

AFFILIATED INSTITUTIONS

REGULATIONS 2017

CHOICE BASED CREDIT SYSTEM

Common to all B.E. / B.Tech. Full-Time Programmes

(For the students admitted to B.E. / B.Tech. Programme at various Affiliated Institutions)

DEGREE OF BACHELOR OF ENGINEERING / BACHELOR OF TECHNOLOGY

This Regulations is applicable to the students admitted to B.E./B.Tech. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2017-2018 onwards.

1. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- I) “**Programme**” means Degree Programme, that is B.E./B.Tech. Degree Programme.
- II) “**Discipline**” means specialization or branch of B.E./B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.
- III) “**Course**” means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.
- IV) “**Director, Academic Courses**” means the authority of the University who is responsible for all academic activities of the Academic Programmes for implementation of relevant rules of this Regulations pertaining to the Academic Programmes.
- V) “**Chairman**” means the Head of the Faculty.
- VI) “**Head of the Institution**” means the Principal of the College.
- VII) “**Head of the Department**” means head of the Department concerned.
- VIII) “**Controller of Examinations**” means the authority of the University who is responsible for all activities of the University Examinations.
- IX) “**University**” means ANNA UNIVERSITY, CHENNAI.


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2. ADMISSION

2.1 Candidates seeking admission to the first semester of the eight semester B.E. / B.Tech. Degree Programme:

Should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

2.2 Lateral entry admission

(i) The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

(OR)

(ii) The candidates who possess the Degree in Science (B.Sc.) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech.

Such candidates shall undergo two additional Engineering subject(s) in the **third and fourth semesters** as prescribed by the University.

3. PROGRAMMES OFFERED

B.E. / B.Tech. Programmes under the Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology.

4. STRUCTURE OF PROGRAMMES

4.1 Categorization of Courses

Every B.E. / B. Tech. Programme will have a curriculum with syllabi consisting of theory and practical courses that shall be categorized as follows:

- i. **Humanities and Social Sciences (HS)** courses include Technical English, Engineering Ethics and Human Values, Communication skills, Environmental Science and Engineering.
- ii. **Basic Sciences (BS)** courses include Mathematics, Physics, Chemistry, Biology, etc.
- iii. **Engineering Sciences (ES)** courses include Engineering practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering, Instrumentation etc.
- iv. **Professional Core (PC)** courses include the core courses relevant to the chosen specialization/branch.
- v. **Professional Elective (PE)** courses include the elective courses relevant to the chosen specialization/ branch.

- vi. **Open Elective (OE)** courses include the courses from other branches which a student can choose from the list specified in the curriculum of the students B.E. / B. Tech. / B. Arch. Programmes.
- vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

4.2 Personality and Character Development

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC/NSS/NSO/YRC) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

National Cadet Corps (NCC) will have about 20 parades.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

National Sports Organization (NSO) will have sports, Games, Drills and Physical exercises.

Youth Red Cross (YRC) will have activities related to social services in and around College/Institutions.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

4.3 Number of courses per semester

Each semester curriculum shall normally have a blend of lecture courses not exceeding **7** and Laboratory courses and Employability Enhancement Course(s) not exceeding **4**. Each Employability Enhancement Course may have credits assigned as per clause 4.4. However, the total number of courses per semester shall not exceed 10.

4.4 Credit Assignment

Each course is assigned certain number of credits based on the following:

Contact period per week	CREDITS
1 Lecture Period	1
2 Tutorial Periods	1
2 Laboratory Periods (also for EEC courses like / Seminar / Project Work / Case study / etc.)	1

The Contact Periods per week for Tutorials and Practical can only be in multiples of 2.

4.5. Industrial Training / Internship

The students may undergo Industrial training for a period as specified in the Curriculum during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

4.6 Industrial Visit

Every student is required to go for at least one Industrial Visit every year starting from the second year of the Programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

4.7 Value Added Courses

The Students may optionally undergo Value Added Courses and the credits earned through the Value Added Courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. One / Two credit courses shall be offered by a Department **of an institution with the prior approval from the Head of the Institution.** The details of the syllabus, time table and faculty may be sent to the Centre for Academic Courses and the Controller of Examinations after approval from the **Head of the Institution** concerned atleast one month before the course is offered. **Students can take a maximum of two one credit courses / one two credit course** during the entire duration of the Programme.

4.8 Online Courses

4.8.1 Students may be permitted to credit only one online course of 3 credits with the approval of **Head of the Institution** and Centre for Academic Courses.

4.8.2 Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Controller of Examinations, Anna University. The details regarding online courses taken up by students should be sent to the Controller of Examinations, Anna University and Centre for Academic Courses one month before the commencement of End Semester Examination.

4.9 The students satisfying the following conditions shall be permitted to carry out their final semester Project work for six months in industry/research organizations.

The student should not have current arrears and shall have CGPA of 7.50 and above.

The student shall undergo the eighth semester courses in the sixth and seventh semesters. The Head of Department, in consultation with the faculty handling the said courses shall forward the proposal recommended by the Head of Institution to the Controller of Examinations through the Director, Centre for Academic courses for approval at least 4 weeks before the commencement of the sixth semester of the programme for approval.

4.10 Medium of Instruction

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports except for the programmes offered in Tamil Medium.

5. DURATION OF THE PROGRAMME

5.1 A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (four academic years) but in any case not more than 14 Semesters for HSC (or equivalent) candidates and not more than 12 semesters for Lateral Entry Candidates.

5.1.1 A student is ordinarily expected to complete the B.E. Mechanical Engineering (Sandwich) Programme in 10 semesters (five academic years) but in any case not more than 18 Semesters for HSC (or equivalent) candidates.

5.2 Each semester shall normally consist of 75 working days or 540 periods of 50 minutes each. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

5.3 The Head of the Institution may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the specified periods. But for the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 6) by the students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{(\text{No. of periods / week as prescribed in the curriculum}) \times 15 \text{ taken together for all courses of the semester}} \times 100$$

The University Examination will ordinarily follow immediately after the last working day of the semester commencing from I semester as per the academic schedule prescribed from time to time.

5.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18) in order that he/she may be eligible for the award of the degree (vide clause 16).

6. COURSE REGISTRATION

6.1 The Institution is responsible for registering the courses that each student is proposing to undergo in the ensuing semester. Each student has to register for all courses to be undergone in the curriculum of a particular semester (with the facility to drop courses to a maximum of 6 credits (vide clause 6.2)). The student can also register for courses for which the student has failed in the earlier semesters.

The registration details of the candidates may be approved by the Head of the Institution and forwarded to the Controller of Examinations. This registration is for undergoing the course as well as for writing the End Semester Examinations. No Elective course shall be offered by any department of any institution unless a minimum 10 students register for the course. However, if the students admitted in the associated Branch and Semester is less than 10, this minimum will not be applicable.

The courses that a student registers in a particular semester may include

- i. Courses of the current semester.
- ii. The core (Theory/Lab /EEC) courses that the student has not cleared in the previous semesters.
- iii. Elective courses which the student failed (either the same elective or a different elective instead).

6.2 Flexibility to Drop courses

- 6.2.1 A student has to earn the total number of credits specified in the curriculum of the respective Programme of study in order to be eligible to obtain the degree.
- 6.2.2 From the III to final semesters, the student has the option of dropping existing courses in a semester during registration. Total number of credits of such courses cannot exceed 6.
- 6.2.3 The student shall register for the project work in the final semester only.

7. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

- 7.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

Ideally every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes.

Therefore, he/she shall **secure not less than 75%** (after rounding off to the nearest integer) of overall attendance as calculated as per clause 5.3.

- 7.2 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.
- 7.3 Candidates who **secure less than 65% overall attendance and candidates who do not satisfy the clause 7.1 and 7.2** shall not be permitted to write the University examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

8. CLASS ADVISOR

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the HoD of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

9. CLASS COMMITTEE

- 9.1. Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include
 - Solving problems experienced by students in the class room and in the laboratories.

- **Clarifying the regulations of the degree programme and the details of rules therein particularly (clause 5 and 7) which should be displayed on college Notice-Board.**
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

9.2 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.

9.3 The class committee shall be constituted within the first week of each semester.

9.4 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

9.5 The Chairperson of the class committee may invite the Class adviser(s) and the Head of the Department to the class committee meeting.

9.6 The Head of the Institution may participate in any class committee of the institution.

9.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Management by the Head of the Institution.

9.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. **The Class Committee Chairman shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation.** During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the course committee may also prepare a common question paper for the internal assessment test(s).

11. SYSTEM OF EXAMINATION

11.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) University examination at the end of the semester.

11.2 Each course, both theory and practical (including project work & viva voce Examinations) shall be evaluated for a maximum of 100 marks.

For all theory and practical courses including project work, the continuous internal assessment will carry **20 marks** while the End - Semester University examination will carry **80 marks**.

11.3 Industrial training and seminar shall carry 100 marks and shall be evaluated through internal assessment only.

11.4 The University examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.

11.5 The University examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.

11.6 For the University examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

12. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

For all theory and practical courses (including project work) the continuous assessment shall be for a maximum of 20 marks. The above continuous assessment shall be awarded as per the procedure given below:

12.1 THEORY COURSES

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

12.2 LABORATORY COURSES

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

12.3 THEORY COURSES WITH LABORATORY COMPONENT

If there is a theory course with Laboratory component, there shall be three tests: the first two tests (each 100 marks) will be from theory portions and the third test (maximum mark 100) will be for laboratory component. The sum of marks of first two tests shall be reduced to 60 marks and the third test mark shall be reduced to 40 marks. The sum of these 100 marks may then be arrived at for 20 and rounded to the nearest integer.

12.4 PROJECT WORK

Project work may be allotted to a single student or to a group of students not exceeding 4 per group.

The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be **reduced for 20 marks** and rounded to the nearest integer (as per the scheme given in 12.4.1).

- 12.4.1 The project report shall carry a maximum 30 marks. The project report shall be submitted as per the approved guidelines as given by Director, Academic Courses. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

Review I	Review II	Review III	End semester Examinations				
			Thesis Submission (30)		Viva-Voce (50)		
5	7.5	7.5	Internal	External	Internal	External	Supervisor
			15	15	15	20	15

- 12.4.2 If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-register for the same in a subsequent semester.

12.5 OTHER EMPLOYABILITY ENHANCEMENT COURSES

- (a) The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).
- (b) The Industrial / Practical Training, Summer Project, Internship, shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. The certificates (issued by the organization) submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examinations.

12.6 ASSESSMENT FOR VALUE ADDED COURSE

The one / two credit course shall carry 100 marks and shall be evaluated through **continuous assessments only**. Two Assessments shall be conducted during the semester by the Department concerned. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer. A committee consisting of the Head of the Department, staff handling the course and a senior Faculty member nominated by the Head of the Institution shall monitor the evaluation process. The list of students along with the marks and the grades earned may be forwarded to the Controller of Examinations for appropriate action at least one month before the commencement of End Semester Examinations.

12.7 ASSESSMENT FOR ONLINE COURSES

Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. **This online course of 3 credits can be considered instead of one elective course.** The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Anna University. **The course shall be evaluated through the End Semester Examination only conducted by Controller of Examinations, Anna University.**

12.8. Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.

12.9 Attendance Record

Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years). The University or any inspection team appointed by the University may verify the records of attendance and assessment of both current and previous semesters.

13. REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A candidate shall normally be permitted to appear for the University Examinations for all the courses registered in the current semester (vide clause 6) if he/she has satisfied the semester completion requirements (subject to Clause 7).

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades.

14. PASSING REQUIREMENTS

14.1 A candidate who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End semester University Examinations] with a minimum of 45% of the marks prescribed for the end-semester University Examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and practical courses (including project work).

14.2 If a student fails to secure a pass in theory courses in the current semester examination, he/she is allowed to write arrear examinations for the next three consecutive semesters and their internal marks shall be carried over for the above mentioned period of three consecutive semesters. If a student fails to secure a pass in a course even after three consecutive arrear attempts, the student has to redo the course in the semester in which it is offered along with regular students.

That is, the students should have successfully completed the courses of (n minus 4)th semester to register for courses in nth semester.

Based on the above, the following prerequisites shall be followed for completing the degree programme:

- i. To enter into Semester V, the student should have no arrear in Semester I. Failing which the student shall redo the Semester I course/courses along with the regular students.

- ii. To enter into Semester VI, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.
- iii. To enter into Semester VII, the student should have no arrear in Semester III. Failing which the student shall redo the Semester III course/courses along with the regular students.
- iv. To enter into Semester VIII, the student should have no arrear in Semester IV. Failing which the student shall redo the Semester IV course/courses along with the regular students.

In case, if he/she has not successfully completed all the courses of semester V at the end of semester VIII, he/she shall redo the Semester V courses along with regular students. For the subsequent semesters of VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

Note:

- The students who are admitted in **2017-2018 and 2018 – 2019** are permitted to appear for arrears upto VI semesters and will be allowed to move to VII semester only on completion of all the courses in the I semester.

In addition the following prerequisites shall be followed for completing the degree programme.

- i. To enter into Semester VII, the student should have no arrear in Semester I. Failing which the student shall redo the Semester I course/courses along with the regular students.
- ii. To enter into Semester VIII, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.

In case, if he/she has not successfully completed all the courses of semester III at the end of semester VIII, he/she shall redo the Semester III courses along with regular students. For the subsequent semesters of IV, V, VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

- 14.3 If a student fails to secure a pass in a laboratory course, **the student shall register** for the course again, when offered next.
- 14.4 If a student fails to secure a pass in project work, **the student shall register** for the course again, when offered next.
- 14.5 The passing requirement for the courses which are assessed only through purely internal assessments (EEC courses except project work), is 50% of the internal assessment (continuous assessment) marks only.
- 14.6 A student can apply for revaluation of the student's semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee along with prescribed application to the COE through the Head of the Institution. The COE will arrange for the revaluation and the results will be intimated to the student concerned through the Head of the Institution. Revaluation is not permitted for laboratory course and project work.

15. AWARD OF LETTER GRADES

- 15.1 All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter Grade	Grade Points	Marks Range
O (Outstanding)	10	91 - 100
A + (Excellent)	9	81 - 90
A (Very Good)	8	71 - 80
B + (Good)	7	61 - 70
B (Average)	6	50 - 60
RA	0	<50
SA (Shortage of Attendance)	0	
W	0	

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: "O", "A+", "A", "B+", "B".

'SA' denotes shortage of attendance (as per clause 7.3) and hence prevention from writing the end semester examinations. 'SA' will appear only in the result sheet.

"RA" denotes that the student has failed to pass in that course. "W" denotes **withdrawal** from the exam for the particular course. The grades RA and W will figure both in Marks Sheet as well as in Result Sheet). In both cases the student has to earn Continuous Assessment marks and appear for the End Semester Examinations.

If the grade W is given to course, the attendance requirement need not be satisfied.

If the grade RA is given to a core **theory course**, the attendance requirement need not be satisfied, but if the grade RA is given to a **Laboratory Course/ Project work / Seminar and any other EEC course**, the attendance requirements (vide clause 7) should be satisfied.

- 15.2 For the Co-curricular activities such as National Cadet Corps (NCC)/ National Service Scheme (NSS) / NSO / YRC, a satisfactory / not satisfactory grading will appear in the mark sheet. Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year. **A satisfactory grade in the above co-curricular activities is compulsory for the award of degree.**
- 15.3 The grades O, A+, A, B+, B obtained for the one credit course shall figure in the Mark sheet under the title '**Value Added Courses**'. The Courses for which the grades are RA, SA **will not figure in the mark sheet.**

Grade sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied
- The list of courses enrolled during the semester and the grade scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester.

CGPA will be calculated in a similar manner, considering all the courses registered from first semester. RA grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^n C_i GP_i}{\sum_{i=1}^n C_i}$$

where C_i is the number of Credits assigned to the course

GP_i is the point corresponding to the grade obtained for each course

n is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

16 ELIGIBILITY FOR THE AWARD OF THE DEGREE

16.1 A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

- Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.
- Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 8 semesters / (10 Semesters for B.E. Mechanical Engineering (Sandwich)) within a maximum period of 7 years (9 years in case of B.E. Mechanical Engineering (Sandwich) and 6 years in the case of Lateral Entry) reckoned from the commencement of the first (third in the case of Lateral Entry) semester to which the candidate was admitted.
- Successfully passed any additional courses prescribed by the Director, Academic Courses whenever readmitted under regulations R-2017 (vide clause 18.3)
- Successfully completed the NCC / NSS / NSO / YRC requirements.
- No disciplinary action pending against the student.
- The award of Degree must have been approved by the Syndicate of the University.

16.2 CLASSIFICATION OF THE DEGREE AWARDED

16.2.1 FIRST CLASS WITH DISTINCTION

A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (10 Semesters in case of Mechanical (Sandwich) and 6 semesters in the case of Lateral Entry) in the student's First Appearance within **five** years (Six years in the case of Mechanical (Sandwich) and Four years in the case of Lateral Entry). Withdrawal from examination (vide Clause 17) will not be considered as an appearance.
- Should have secured a CGPA of not less than **8.50**.
- One year authorized break of study (if availed of) is included in the five years (Six years in the case of Mechanical (Sandwich) and four years in the case of lateral entry) for award of First class with Distinction.
- Should NOT have been prevented from writing end semester examination due to lack of attendance in any semester.

16.2.2 **FIRST CLASS:**

A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

- Should have passed the examination in all the courses of all eight semesters (10 Semesters in case of Mechanical (Sandwich) and 6 semesters in the case of Lateral Entry) **within Six years**. (Seven years in case of Mechanical (Sandwich) and Five years in the case of Lateral Entry)
- One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of six years (Seven years in case of Mechanical (Sandwich) and five years in the case of lateral entry) for award of First class
- Should have secured a CGPA of not less than **7.00**.

16.2.3 **SECOND CLASS:**

All other students (not covered in clauses 16.2.1 and 16.2.2) who qualify for the award of the degree (vide Clause 16.1) shall be declared to have passed the examination in **Second Class**.

16.3 A candidate who is absent in end semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17 and 18)

16.4 Photocopy / Revaluation

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

16.5 Review

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

- 17.1 A student may, for valid reasons, (medically unfit / unexpected family situations / sports approved by Chairman, sports board and HOD) be granted permission to withdraw from appearing for the end semester examination in any course or courses in **ANY ONE** of the semester examinations during the entire duration of the degree programme. The application shall be sent to Director, Student Affairs through the Head of the Institutions with required documents.
- 17.2 Withdrawal application is valid if the student is otherwise eligible to write the examination (Clause 7) and if it is made within TEN days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.
- 17.2.1 Notwithstanding the requirement of mandatory 10 days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.
- 17.3 In case of withdrawal from a course / courses (Clause 13) the course will figure both in Marks Sheet as well as in Result Sheet. **Withdrawal essentially requires the student to register for the course/courses** The student has to register for the course, fulfill the attendance requirements (vide clause 7), earn continuous assessment marks and attend the end semester examination. However, withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.
- 17.4 Withdrawal is permitted for the end semester examinations in the final semester only if the period of study the student concerned does not exceed 5 years as per clause 16.2.1.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

- 18.1 A student is permitted to go on break of study for a maximum period of one year as a single spell.
- 18.2 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Director, Student Affairs in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme.
- 18.3 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 18.4 The authorized break of study would not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 16.2).
- 18.5 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.
- 18.6 If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 18.1)

19. DISCIPLINE

- 19.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.
- 19.2 If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. MECHATRONICS ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES:

Bachelor of Mechatronics Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

1. Develop innovative and sustainable products with multidisciplinary Engineering expertise.
2. Solve complex engineering problems by applying mechanical, electrical and computer knowledge and engage in lifelong learning in their profession
3. Work or pursue higher education in multicultural, multilingual and multinational environment with competent oral and written communication.
4. Lead and contribute in a team entrusted with professional, social and ethical responsibilities.

2. PROGRAMME OUTCOMES:

- a. Will be able to apply the laws of science and mathematics to provide engineering solutions to solve complex problems.
- b. Will be able to identify and analyze complex problems by modeling with the help of literature survey and validate the solution with experiments.
- c. Will be able to design and develop Mechatronics systems by selecting and integrating, sensors, appropriate materials, mechanics, thermal systems, manufacturing and automation methods.
- d. Will be able to collect, condition monitor and interpret data to provide engineering solutions.
- e. Will be able to create applications, products as well as modernizing the existing systems by using latest tools and technologies.
- f. Will be able to develop solutions for local and global requirements by applying engineering knowledge and professional ethics.
- g. Will have professional values on environmental and energy consumption for sustainability.
- h. Will be able to become a leader and contribute in a team with entrepreneurial qualities.
- i. Will be able to interact effectively in both oral and written format.
- j. Will continuously update their knowledge and skills to meet the ever changing global needs.

3. PEO / PO Mapping

PEO / PO	a	b	c	d	e	f	g	h	i	j
1	✓	✓	✓	✓	✓	✓	✓			
2	✓	✓	✓	✓	✓	✓				✓
3									✓	✓
4							✓	✓	✓	

4. SEMESTER COURSE WISE PO MAPPING

		COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
YEAR 1	SEMESTER 1	Communicative English							✓			
		Engineering Mathematics I	✓	✓	✓						✓	
		Engineering Physics	✓	✓	✓							✓
		Engineering Chemistry				✓						
		Problem Solving and Python Programming					✓					
		Engineering Graphics		✓	✓					✓		
		Problem Solving and Python Programming Laboratory			✓		✓					
	Physics and Chemistry Laboratory			✓								
	SEMESTER 2	Technical English								✓		
		Engineering Mathematics II	✓	✓	✓					✓		✓
		Materials Science										
		Basic Electrical, Electronics and Instrumentation Engineering										
		Environmental Science and Engineering				✓						
		Engineering Mechanics	✓	✓						✓	✓	✓
		Engineering Practices Laboratory			✓							
Basic Electrical, Electronics and Instrumentation Engineering Laboratory				✓								

		Course Title	a	b	c	d	e	f	g	h	i	j	
YEAR II	SEMESTER III	Transforms and Partial Differential Equations	✓	✓		✓	✓	✓					
		Strength of Materials for Mechanical Engineers	✓	✓	✓								
		Fluid Mechanics and Machinery	✓	✓	✓								
		Digital Electronics	✓	✓	✓		✓	✓	✓	✓			
		Electrical Machines and Drives	✓	✓	✓		✓	✓	✓				
		Analog Devices and Circuits	✓	✓	✓		✓						
		Strength of Materials and Fluid Mechanics & Machinery Laboratory	✓	✓	✓								
		Electrical Machines and Drives Laboratory	✓	✓	✓		✓	✓	✓				
	Interpersonal Skills/Listening & Speaking										✓		
	SEMESTER IV	Statistics and Numerical Methods	✓	✓	✓		✓						
		Manufacturing Technology	✓	✓		✓		✓	✓		✓		
		Microprocessors and Microcontrollers	✓	✓	✓	✓	✓	✓					✓
		Kinematics of Machinery	✓	✓	✓		✓						
		Thermodynamics and Heat Transfer	✓		✓					✓			
		Microprocessor and Microcontrollers Laboratory	✓	✓	✓	✓	✓	✓					✓
Manufacturing Technology Laboratory		✓	✓		✓		✓	✓		✓			
Computer Aided Machine Drawing				✓		✓							
		Advanced Reading and Writing									✓		
YEAR III	SEMESTER V	Power Electronics	✓	✓	✓		✓	✓				✓	
		Sensors and Instrumentation	✓	✓	✓	✓	✓	✓			✓	✓	
		Dynamics of Machines	✓	✓	✓		✓						
		Control System Engineering	✓	✓	✓	✓	✓				✓	✓	
		Open Elective - I											
		Power Electronics Laboratory	✓	✓	✓		✓	✓					✓
		Sensors and Instrumentation Laboratory	✓	✓	✓	✓	✓	✓			✓	✓	
		Dynamics Laboratory	✓	✓	✓		✓						
	SEMESTER VI	Applied Hydraulics and Pneumatics	✓		✓	✓	✓	✓	✓	✓	✓		
		Design of Mechatronics System	✓	✓	✓	✓	✓	✓	✓				✓
Design of Machine Elements		✓	✓	✓					✓				

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. MECHATRONICS ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
TOTAL				31	19	0	12	25

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8251	Materials Science	BS	3	3	0	0	3
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
PRACTICALS								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
TOTAL				30	20	2	8	25

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
2.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3
3.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
4.	EC8392	Digital Electronics	ES	3	3	0	0	3
5.	MT8301	Electrical Machines and Drives	ES	3	3	0	0	3
6.	MT8302	Analog Devices and Circuits	PC	3	3	0	0	3
PRACTICALS								
7.	CE8381	Strength of Materials and Fluid Mechanics & Machinery Laboratory	ES	4	0	0	4	2
8.	MT8311	Electrical Machines and Drives Laboratory	ES	4	0	0	4	2
9.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
TOTAL				30	20	0	10	25

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA8452	Statistics and Numerical Methods	BS	4	4	0	0	4
2.	ME8392	Manufacturing Technology	PC	3	3	0	0	3
3.	MT8491	Microprocessors and Microcontrollers	PC	3	3	0	0	3
4.	ME8492	Kinematics of Machinery	PC	3	3	0	0	3
5.	MT8401	Thermodynamics and Heat Transfer	PC	3	3	0	0	3
PRACTICALS								
6.	MT8411	Microprocessor and Microcontrollers Laboratory	PC	4	0	0	4	2
7.	ME8461	Manufacturing Technology Laboratory	PC	4	0	0	4	2
8.	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
TOTAL				30	16	0	14	23

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	EE8552	Power Electronics	ES	3	3	0	0	3
2.	MT8591	Sensors and Instrumentation	PC	3	3	0	0	3
3.	ME8594	Dynamics of Machines	PC	4	4	0	0	4
4.	EC8391	Control Systems Engineering	ES	3	3	0	0	3
5.		Open Elective - I	OE	3	3	0	0	3
PRACTICALS								
6.	MT8511	Power Electronics Laboratory	ES	4	0	0	4	2
7.	MT8512	Sensors and Instrumentation Laboratory	PC	4	0	0	4	2
8.	ME8481	Dynamics Laboratory	PC	4	0	0	4	2
TOTAL				28	16	0	12	22

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	ME8591	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
2.	MT8601	Design of Mechatronics System	PC	3	3	0	0	3
3.	ME8593	Design of Machine Elements	PC	3	3	0	0	3
4.	MT8602	Industrial Automation	PC	3	3	0	0	3
5.	MG8591	Principles of Management	HS	3	3	0	0	3
6.		Professional Elective – I	PE	3	3	0	0	3
PRACTICALS								
7.	MT8611	Applied Hydraulics and Pneumatics Laboratory	PC	4	0	0	4	2
8.	MT8612	Industrial Automation Laboratory	PC	4	0	0	4	2
9.	ME8682	Design and Fabrication Project	EEC	4	0	0	4	2
TOTAL				30	18	0	12	24

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	ME8691	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
2.	MT8701	Robotics and Machine Vision System	PC	3	3	0	0	3
3.	MT8791	Embedded System Design	PC	4	2	0	2	3
4.		Open Elective - II	OE	3	3	0	0	3
5.		Professional Elective – II	PE	3	3	0	0	3
6.		Professional Elective - III	PE	3	3	0	0	3
PRACTICALS								
7.	MT8711	Computer Aided Design and Manufacturing Laboratory	PC	4	0	0	4	2
8.	MT8781	Robotics Laboratory	PC	4	0	0	4	2
TOTAL				27	17	0	10	22

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MT8801	Automotive Electronics	PC	3	3	0	0	3
2.		Professional Elective - IV	PE	3	3	0	0	3
3.		Professional Elective – V	PE	3	3	0	0	3
PRACTICALS								
4.	MT8811	Project Work	EEC	20	0	0	20	10
TOTAL				29	9	0	20	19

TOTAL NO. OF CREDITS:185

HUMANITIES AND SOCIAL SCIENCES (HS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS8151	Communicative English	HS	4	4	0	0	4
2	HS8251	Technical English	HS	4	4	0	0	4
3	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4	MG8591	Principles of Management	HS	3	3	0	0	3

BASIC SCIENCE (BS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2	PH8151	Engineering Physics	BS	3	3	0	0	3
3	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6	PH8251	Materials Science	BS	3	3	0	0	3
7	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
8	MA8452	Statistics and Numerical Methods	BS	4	4	0	0	4

ENGINEERING SCIENCES (ES)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
6.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
8.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3

9.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
10.	CE8395	Strength of Materials and Fluid Mechanics & Machinery Laboratory	ES	4	0	0	4	2
11.	EC8392	Digital Electronics	ES	3	3	0	0	3
12.	MT8301	Electrical Machines and Drives	ES	3	3	0	0	3
13.	MT8311	Electrical Machines and Drives Laboratory	ES	4	0	0	4	2
14.	EE8552	Power Electronics	ES	3	3	0	0	3
15.	EC8391	Control Systems Engineering	ES	3	3	0	0	3
16.	MT8511	Power Electronics Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MT8302	Analog Devices and Circuits	PC	3	3	0	0	3
3	ME8392	Manufacturing Technology	PC	3	3	0	0	3
4	MT8491	Microprocessors and Microcontrollers	PC	3	3	0	0	3
5	ME8492	Kinematics of Machinery	PC	3	3	0	0	3
6	MT8401	Thermodynamics and Heat Transfer	PC	3	3	0	0	3
7	MT8411	Microprocessor and Microcontrollers Laboratory	PC	4	0	0	4	2
8	ME8461	Manufacturing Technology Laboratory	PC	4	0	0	4	2
9	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
10	MT8591	Sensors and Instrumentation	PC	3	3	0	0	3
11	ME8594	Dynamics of Machines	PC	4	4	0	0	4
12	MT8511	Sensors and Instrumentation Laboratory	PC	4	0	0	4	2
13	ME8481	Dynamics Laboratory	PC	4	0	0	4	2
14	ME8591	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
15	MT8601	Design of Mechatronics System	PC	3	3	0	0	3
16	ME8593	Design of Machine Elements	PC	3	3	0	0	3

17	MT8602	Industrial Automation	PC	3	3	0	0	3
18	MT8611	Applied Hydraulics and Pneumatics Laboratory	PC	4	0	0	4	2
19	MT8612	Industrial Automation Laboratory	PC	4	0	0	4	2
20	ME8691	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
21	MT8701	Robotics and Machine Vision System	PC	3	3	0	0	3
22	MT8791	Embedded System Design	PC	4	2	0	2	3
25	MT8711	Computer Aided Design and Manufacturing Laboratory	PC	4	0	0	4	2
26	MT8781	Robotics Laboratory	PC	4	0	0	4	2
27	MT8801	Automotive Electronics	PC	3	3	0	0	3

PROFESSIONAL ELECTIVES (PE)***SEMESTER VI, ELECTIVE I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IT8071	Digital Signal Processing	PE	3	3	0	0	3
2.	MT8001	Object Oriented Programming in C++	PE	3	3	0	0	3
3.	ME8091	Automobile Engineering	PE	3	3	0	0	3
4.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3
5.	GE8073	Fundamentals of Nano Science	PE	3	3	0	0	3

SEMESTER VII, ELECTIVE II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AN8091	Maintenance Engineering	PE	3	3	0	0	3
2.	ME8793	Process Planning and Cost Estimation	PE	3	3	0	0	3
3.	MG8491	Operations Research	PE	3	3	0	0	3
4.	MT8002	Advanced Manufacturing Technology	PE	3	3	0	0	3
5.	AE8751	Avionics	PE	3	3	0	0	3
6.	MF8071	Additive Manufacturing	PE	3	3	0	0	3
7.	GE8077	Total Quality Management	PE	3	3	0	0	3

SEMESTER VII, ELECTIVE III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8093	Digital Image Processing	PE	3	3	0	0	3
2.	MT8003	Medical Mechatronics	PE	3	3	0	0	3
3.	MT8071	Virtual Instrumentation	PE	3	3	0	0	3
4.	IT8075	Software Project Management	PE	3	3	0	0	3
5.	GE8074	Human Rights	PE	3	3	0	0	3
6.	GE8071	Disaster Management	PE	3	3	0	0	3

SEMESTER VIII, ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8691	Artificial Intelligence	PE	3	3	0	0	3
2.	MG8091	Entrepreneurship Development	PE	3	3	0	0	3
3.	RO8791	Modeling and Simulation	PE	3	3	0	0	3
4.	EE8091	Micro Electro Mechanical Systems	PE	3	3	0	0	3

HS8151

COMMUNICATIVE ENGLISH

L	T	P	C
4	0	0	4

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12

Reading- short comprehension passages, practice in skimming-scanning and predicting- Writing-completing sentences- - developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information- Language development- Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development-- prefixes- suffixes- articles.- count/ uncount nouns.

UNIT II GENERAL READING AND FREE WRITING 12

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12

Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison-pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT 12

Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

UNIT V EXTENDED WRITING 12

Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations- fixed and semi-fixed expressions

TOTAL: 60 PERIODS

OUTCOMES: At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES

- 1 Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
- 2 Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
- 3 Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
- 4 Comfort, Jeremy, et al. Speaking Effectively : Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
- 5 Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013

MA8151**ENGINEERING MATHEMATICS – I**

L	T	P	C
4	0	0	4

OBJECTIVES :

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS**12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES**12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS**12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS**12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS**12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

TOTAL : 60 PERIODS**OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.

CY8151**ENGINEERING CHEMISTRY****L T P C
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT**9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

UNIT II SURFACE CHEMISTRY AND CATALYSIS**9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

UNIT III ALLOYS AND PHASE RULE**9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

UNIT IV FUELS AND COMBUSTION**9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture

of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING

L T P C
3 0 0 3

OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures -- lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

OUTCOMES:

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING

7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE

6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS

5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

TOTAL: 90 PERIODS**OUTCOMES:**

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING
LABORATORY****L T P C
0 0 4 2****OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort

7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

BS8161

PHYSICS AND CHEMISTRY LABORATORY
(Common to all branches of B.E. / B.Tech Programmes)

L	T	P	C
0	0	4	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
 (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
 - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
 2. Determination of total, temporary & permanent hardness of water by EDTA method.
 3. Determination of DO content of water sample by Winkler's method.
 4. Determination of chloride content of water sample by argentometric method.
 5. Estimation of copper content of the given solution by Iodometry.
 6. Determination of strength of given hydrochloric acid using pH meter.
 7. Determination of strength of acids in a mixture of acids using conductivity meter.
 8. Estimation of iron content of the given solution using potentiometer.
 9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
 10. Estimation of sodium and potassium present in water using flame photometer.
 11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
 12. Pseudo first order kinetics-ester hydrolysis.
 13. Corrosion experiment-weight loss method.
 14. Determination of CMC.
 15. Phase change in a solid.
 16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8TH edition, 2014)

HS8251

TECHNICAL ENGLISH

L T P C
4 0 0 4

OBJECTIVES:

The Course prepares second semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary Language Development –subject verb agreement - compound words.

UNIT II READING AND STUDY SKILLS 12

Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR 12

Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV REPORT WRITING 12

Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations- Reading – reading for detailed comprehension- Writing- email etiquette- job application – cover letter –Résumé preparation(via email and hard copy)- analytical essays and issue based essays-- Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- if conditionals.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12

Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey- Vocabulary Development- verbal analogies Language Development- reported speech

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCES

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251

ENGINEERING MATHEMATICS – II

L T P C
4 0 0 4

OBJECTIVES :

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modeling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES

12

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS

12

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS

12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION

12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT V LAPLACE TRANSFORMS

12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES :

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

	MATERIALS SCIENCE	L	T	P	C
PH8251	(Common to courses offered in Faculty of Mechanical Engineering Except B.E. Materials Science and Engineering)	3	0	0	3

OBJECTIVES:

- To introduce the essential principles of materials science for mechanical and related engineering applications.

UNIT I PHASE DIAGRAMS

9

Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

OBJECTIVES:

To impart knowledge on

- Electric circuit laws, single and three phase circuits and wiring
- Working principles of Electrical Machines
- Working principle of Various electronic devices and measuring instruments

UNIT I ELECTRICAL CIRCUITS**9**

Basic circuit components \rightarrow Ohms Law - Kirchoff's Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevinin's Theorem, Norton's Theorem, Maximum Power transfer theorem- Linearity and Superposition Theorem.

UNIT II AC CIRCUITS**9**

Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

UNIT III ELECTRICAL MACHINES**9**

Principles of operation and characteristics of ; DC machines, Transformers (single and three phase) , Synchronous machines , three phase and single phase induction motors.

UNIT IV ELECTRONIC DEVICES & CIRCUITS**9**

Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics —Field Effect Transistors – Transistor Biasing –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .

UNIT V MEASUREMENTS & INSTRUMENTATION**9**

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements– instrument transformers (CT and PT)

TOTAL : 45 PERIODS**OUTCOMES:**

Ability to

- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

TEXT BOOKS

1. Leonard S Bobrow, “ Foundations of Electrical Engineering”, Oxford University Press, 2013
2. D P Kothari and I.J Nagarath, ”Electrical Machines “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
3. Thereja .B.L., “Fundamentals of Electrical Engineering and Electronics”, S. Chand & Co. Ltd., 2008

REFERENCES

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
3. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
5. A.E.Fitzgerald, David E Higginbotham and Arvin Gabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
6. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016

GE8291

ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P C
3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION

8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case

studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

OBJECTIVES:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I STATICS OF PARTICLES**9+6**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES**9+6**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS**9+6**

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES**9+6**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS**9+6**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 45+30=75 PERIODS**OUTCOMES:**

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:

- Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
- Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

GE8261

ENGINEERING PRACTICES LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

13

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

18

Welding:

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:

- (b) Model making – Trays and funnels.
- (c) Different type of joints.

Machine assembly practice:

- (a) Study of centrifugal pump
- (b) Study of air conditioner

Demonstration on:

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 16

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

- | | |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench) | 15 Nos. |
| 3. Standard woodworking tools | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |
| 5. Power Tools: (a) Rotary Hammer | 2 Nos |

(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

OBJECTIVE:

- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:

- Load test on separately excited DC generator
- Load test on Single phase Transformer
- Load test on Induction motor
- Verification of Circuit Laws
- Verification of Circuit Theorems
- Measurement of three phase power
- Load test on DC shunt motor.
- Diode based application circuits
- Transistor based application circuits
- Study of CRO and measurement of AC signals
- Characteristics of LVDT
- Calibration of Rotometer
- RTD and Thermistor

Minimum of 10 Experiments to be carried out :-

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	D. C. Motor Generator Set	2
2	D.C. Shunt Motor	2
3	Single Phase Transformer	2
4	Single Phase Induction Motor	2
5	Ammeter A.C and D.C	20
6	Voltmeters A.C and D.C	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12
 Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12
 Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12
 Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12
 Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12
 Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

CE8395**STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS**9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

TOTAL: 45 PERIODS**OUTCOMES:**

Students will be able to

- Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

REFERENCES:

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

CE8394**FLUID MECHANICS AND MACHINERY****L T P C
4 0 0 4****OBJECTIVES:**

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS**12**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS**12**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor-Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS**12**

Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS**12**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps – classification.

UNIT V TURBINES**12**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: 60 PERIODS**OUTCOMES:**

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

REFERENCES:

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

EC8392**DIGITAL ELECTRONICS****L T P C
3 0 0 3****OBJECTIVES:**

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

UNIT I DIGITAL FUNDAMENTALS**9**

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II COMBINATIONAL CIRCUIT DESIGN**9**

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS**9**

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS**9**

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS**9**

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS

TOTAL: 45 PERIODS**OUTCOMES:****At the end of the course:**

- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

TEXT BOOK:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.

REFERENCES

1. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
3. S.Salivahanan and S.Arivazhagan"Digital Electronics", 1st Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini "Digital Electronics", Wiley, 2014.
5. A.Anand Kumar "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal " Digital Electronics", McGraw Hill Education Private Limited, 2016.

OBJECTIVES:

- To understand the working principle and performance characteristics of DC Generator and DC Motor.
- To understand the working principle of induction motor and synchronous machines.
- To provide knowledge in the area of special electrical machines and drives.

UNIT I ELECTRICAL CIRCUITS AND TRANSFORMERS 6

D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchhoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, – power factor – complex power – basic operation of transformers – simple problems.

UNIT II ELECTRICAL MOTORS 12

Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

UNIT III SPEED CONTROL AND STARTING 9

Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.

UNIT IV ELECTRICAL DRIVES 9

Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

UNIT V SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY) 9

Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.

TOTAL 45 PERIODS

OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Get the basic knowledge about the Electric circuits and transformers.

CO2: Understand the various types of electrical motors.

CO3: Know about speed control and starting methods DC and induction motors

CO4: Understand about various types of electrical drives

CO5: Get exposure with solid state drives

TEXT BOOKS:

1. De. N.K., & Sen. P.K "Electric Drives", Prentice Hall India Pvt Limited 2002.
2. Vedam Subramaniam. "Electric Drives", Tata McGraw Hill , New Delhi , 2007.
3. Vukosavic, "Digital Control of Electrical Drives", Springer, Indian Reprint, 2010.

REFERENCES:

1. Bhattacharya S.K. & Brinjinder Singh , "Control of Electrical Machines", New Age International Publishers, 2002.
2. Crowder, "Electric Drives and Electromechanical Systems", Elsevier, Indian Reprint,2009.
3. Dubey.G.K. "Fundamental Electrical Drives" 2nd Edition, Narosa Publications, 2002
4. Metha. V.K. & Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co .2006.

MT8302

ANALOG DEVICES AND CIRCUITS

L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic principle of switching devices
- To study various types of amplifiers.
- To understand the various functionalities of ICs and Waveform generators.
- To study the characteristics of various electronic devices.

UNIT I ANALOG ELECTRONICS

9

Switching Devices: SCR, TRIAC, JFET, MOSFET - Rectifiers and Filters - Regulated Power Supply – Switching Power Supplies, Thermal Considerations - Feedback and power amplifiers - Oscillators: Colpitts oscillator, Hartley oscillator and Wien bridge oscillator

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS

9

Operational amplifiers – Principles, Specifications, characteristics and applications-. Arithmetic Operations, Integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, A/D & D/A converters

UNIT III WAVEFORM GENERATORS AND ICs

9

Triangular, Saw tooth and Sine wave generators - Multivibrators - Function generator ICs – Timer ICs – Voltage regulator ICs: fixed, Adjustable and General purpose - V/F and F/V convertors – Optocouplers

UNIT IV TEST AND MEASURING INSTRUMENTS

9

Measurement of voltage, current ,frequency and power using Multi meters , oscilloscopes, recorders, data loggers, signal sources, counters, analyzers and printers.

UNIT V DISPLAY DEVICES

9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Photo transistor, Solar cell, CCD

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- CO1: Apply the various switching devices in electronic circuits.
CO2: Work with various applications of amplifiers
CO3: Design various circuits using ICs.
CO4: Test and measure different parameters available in electronic circuits.
CO5: Explain the principles of various display devices.

TEXT BOOKS:

1. Donald A Neaman, “Semiconductor Physics and Devices”, Fourth Edition, Tata Mc Graw Hill Inc. 2012.
2. Roy Chowdhury D. and Jain Shail B., Linear Integrated Circuits, New Age Int. Pub., 5th edition, 2018.
3. Salivahanan S., Suresh kumar N. and Vallavaraj A., Electronic Devices and Circuits, Tata Mc Graw Hill publishing company, New Delhi, 3rd edition, 2012

REFERENCES

1. Albert Malvino and Bates J., Electronic Principles, Tata McGraw- Hill Pub. Company Ltd., 7th edition, 2013.
2. Millman J., Halkias C.C. and Satyabrata Jit, Electronic Devices and Circuits, Tata McGraw Hill, New Delhi, 3rd edition, 2010.
3. Thomas L. Floyd, Electronic Devices, Pearson Education Asia, 9th edition, 2010.

OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

STRENGTH OF MATERIALS**30****LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
 - (i) Unhardened specimen
 - (ii) Quenched Specimen and
 - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
 - (i) Hardened samples and
 - (ii) Hardened and tempered samples.

OUTCOME:

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

FLUID MECHANICS AND MACHINES LABORATORY**30****LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.

4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

MT8311

ELECTRICAL MACHINES AND DRIVES LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To familiarize the basic concepts of electrical circuits and associated theorems.
- To understand the fundamentals of DC shunt motors and induction motors.
- To understand the load test and performance characteristics of DC shunt motor, stepper motor and induction motors.

LIST OF EXPERIMENTS

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne's test.
4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three – phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors.
9. Performance characteristics of Stepper motor.
10. Performance characteristics of single phase transformer.

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Test and assess the performances of the DC motors and single phase AC motor for varying load.

CO2: Control the speed of AC and DC motor.

CO3: Analyze and present the findings of experimental observations in both written and oral format.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO	NAME OF THE EQUIPMENT	Qty
1	Shunt motor 5HP	3
2	Single phase Induction Motor 2HP	2
3	Three phase induction Motor 5HP	2
4	Single phase transformer 2KVA	1
5	Three phase auto transformer	2
6	Single phase auto transformer	2
7	3 point starter	3
8	DPST, TPST Each	2
9	DC source 300v, 100A	1
10	Ammeter(0-5A),(0-10A)MC Each	2
11	Ammeter(0-5A),(0-10A)MI Each	2
12	Voltmeter(0-300V) MC	3
13	Voltmeter(0-150V),(0-300V),(0-600V)MI Each	2
14	Wattmeter 150/300V, 5/10A UPF	2
15	Wattmeter 300/600V,5/10A UPF	2
16	Wattmeter 150/300V,5/10A LPF	2
17	Wattmeter 300/600V,5/10A LPF	2
18	Stepper motor 5Kg	1
19	Synchronous motor 5KW	1
20	Rheostat 360 ohm/1.2A	3
21	Tachometer	5
22	Rheostat 50 ohm/5A	3

HS8381	INTERPERSONAL SKILLS/LISTENING & SPEAKING	L	T	P	C
		0	0	2	1

OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS 12

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods : Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods : Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

TOTAL : 60 PERIODS**OUTCOMES :**

Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS :

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES :

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

ME8392**MANUFACTURING TECHNOLOGY****L T P C
3 0 0 3****OBJECTIVE:**

- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

UNIT I CASTING**8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO₂ moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING**8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT III MACHINING**13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT IV FORMING AND SHAPING OF PLASTICS**7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

UNIT V METAL FORMING AND POWDER METALLURGY**9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

TOTAL: 45 PERIODS**OUTCOME:**

- The Students can able to use different manufacturing process and use this in industry for component production

TEXT BOOKS

1. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., “Elements of Manufacturing Processes”, Prentice-Hall of India Private Limited, 2007.

REFERENCES

1. Adithan. M and Gupta. A.B., “Manufacturing Technology”, New Age, 2006.
2. “H.M.T. Production Technology – Handbook”, Tata McGraw-Hill, 2000.
3. Jain. R.K. and S.C. Gupta, “Production Technology”, Khanna Publishers. 16th Edition,2001.
4. Roy. A. Linberg, “Process and Materials of Manufacture”, PHI, 2000.
5. Serope Kalpajian, Steven R.Schmid, “Manufacturing Processes for Engineering Materials”, Fourth Edition, Pearson Education, Inc. 2007.

MT8491**MICROPROCESSORS AND MICROCONTROLLERS**

L	T	P	C
3	0	0	3

OBJECTIVES:

Through the use of assembly language, by the end of the course students will become thoroughly familiar with the elements of microprocessor and microcontroller software and hardware. They will be able to:

- Understand fundamental operating concepts behind microprocessors and microcontrollers.
- Emphasis on the hardware features of Microprocessor 8085, 8086 and Microcontroller 8051 with their functions
- Understand commonly used peripheral / interfacing

UNIT I 8085 PROCESSOR**9**

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II	PROGRAMMING OF 8085 PROCESSOR	9
Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.		
UNIT III	8051 MICRO CONTROLLER	9
Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Serial Communication – Interrupts-Introduction to Arduino.		
UNIT IV	PERIPHERAL INTERFACING	9
Introduction on Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279 ,- A/D and D/A converters.		
UNIT V	MICRO CONTROLLER PROGRAMMING & APPLICATIONS	9
Data Transfer, Manipulation, Control Algorithms & I/O instructions – Simple programming exercises- key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.		

TOTAL :45 PERIODS

OUTCOMES:

On the successful completion of the course, students will be able to

- CO1: Distinguish the feature of the 8085 microprocessor, Hardware Architecture and PIN diagram.
- CO2: Demonstrate programming proficiency using the various addressing modes and data transfer instructions of 8085 microprocessor
- CO3: Acquaint the knowledge on architecture and programming of Microcontroller 8051.
- CO4: Illustrate the interrupts handling and demonstrate peripherals applications in different IC and Know about A/D and D/A converters.
- CO5: Apply the programming concepts to interface the hardware units with microprocessor and Microcontroller

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
3. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013

REFERENCES:

1. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford, 2013.
2. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.
3. Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler’s criterion – Grashof’s Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involute and cycloidal tooth profiles – Spur Gear terminology and definitions – Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TOTAL: 45 PERIODS**OUTCOMES:****Upon the completion of this course the students will be able to**

- CO1 Discuss the basics of mechanism
- CO2 Calculate velocity and acceleration in simple mechanisms
- CO3 Develop CAM profiles
- CO4 Solve problems on gears and gear trains
- CO5 Examine friction in machine elements

TEXT BOOKS:

1. F.B. Sayyad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4 Edition, Oxford University Press, 2014.

REFERENCES:

1. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

MT8401**THERMODYNAMICS AND HEAT TRANSFER**

L	T	P	C
3	0	0	3

OBJECTIVE:

To acquire knowledge on laws of thermodynamics, types of I.C engines, refrigeration techniques, air conditioning system and heat transfer concepts, principles and mechanism for physical systems.

UNIT I FIRST LAW OF THERMODYNAMICS 8

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities C_V and C_P – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 8

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem.

UNIT III INTERNAL COMBUSTION ENGINES(Qualitative Treatment Only) 12

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 8

Principles of refrigeration, refrigerator & heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 9

Heat transfer through conduction and convection, Fourier's law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

TOTAL	45 PERIODS
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OUTCOMES:

Upon completion of this course, the students can able to

CO1: Understand the basic concepts associated first law of thermodynamics

CO2: Understand basic concepts associated with second law of thermodynamics

CO3: Describing the working of I.C engines and to determine its performance parameters

CO4: Basic principles of refrigeration, air conditioning and psychometric chart

CO5: Distinguishing the various modes of heat transfer and its applications

TEXT BOOK:

1. Nag P. K, 'Engineering Thermodynamics' Tata McGraw-Hill, 6thEdition, 2017.

REFERENCES:

1. Holman.J.P., "Thermodynamics", 4th Edition. McGraw-Hill, 1988.
2. Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, Reprint 2004.
3. Kothandaraman. C.P., "Heat and Mass Transfer", New Age International (P) Publishers, 4thEdition Reprint 2015.
4. Michael A. Boles, Yunus A. Cengel, YunusCengel, "Thermodynamics", 8th Edition, Mc Graw-Hill India, 2017.

MT8411	MICROPROCESSOR AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To focus on the implementation of arithmetic operations using microprocessors and microcontroller.
- To simulate assembly language programs.
- To implement various on-chip and off-chip interfacing and algorithms

LIST OF EXPERIMENTS

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions
 - (i) Ascending / Descending order, Maximum / Minimum of numbers
 - (ii) Programs using Rotate instructions.
 - (iii) Hex / ASCII / BCD code conversions
3. Interface Experiments: with 8085
 - (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
 - i) Conditional jumps, looping
 - ii) Calling subroutines
9. Programming I/O Port 8051
 - i) study on interface with A/D & D/A
 - ii) study on interface with DC & AC motor
10. Mini project development with processors

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Solve the arithmetic operations using microcontrollers and various on-chip and off-chip interfacing and algorithms.

CO2: Design the digital and analog hardware interface for microcontroller-based systems

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	NAME OF THE EQUIPMENT	Qty
1	8085 Microprocessor Trainer with Power Supply	15
2	8051 Micro Controller Trainer Kit with power supply	15
3	8255 Interface board	5
4	8251 Interface board	5
5	8259 Interface board	5
6	8279 Keyboard / Display Interface board	5
7	8254 timer counter	5
8	ADC and DAC card	5
19	AC & DC motor with Controller	5
10	Traffic Light Control System	5

ME8461**MANUFACTURING TECHNOLOGY LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVE:

- Demonstration and study of the VARIOUS machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

UNIT I LATHE PRACTICE

- Plain Turning
- Taper Turning
- Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

- Drilling
- Tapping
- Reaming.

UNIT III MILLING

- Surface Milling.
- Gear Cutting.
- Contour Milling.

UNIT IV PLANNING AND SHAPING

- Cutting Key Ways.
- Dovetail machining.

TOTAL: 60 PERIODS**OUTCOMES:**

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty
1	Lathe	15 Nos.
2	Drilling Machine	1 No
3	Milling Machine	2 Nos.
4	Planing Machine	1 No
5	Shaping Machine	2 Nos.

ME8381

COMPUTER AIDED MACHINE DRAWING

L T P C
0 0 4 2

OBJECTIVES:

- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES 12

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.

UNIT II INTRODUCTION TO 2D DRAFTING 16

- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY 32

Sketcher - Datum planes – Protrusion – Holes - Part modeling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet - Pattern – Chamfer - Round - Mirror – Section - Assembly

- Couplings – Flange, Universal, Oldham's, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump

TOTAL:60 PERIODS

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 Follow the drawing standards, Fits and Tolerances
- CO2 Re-create part drawings, sectional views and assembly drawings as per standards

TEXT BOOK:

1. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

REFERENCES:

1. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
2. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers, 2013
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata Mc GrawHill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

HS8461**ADVANCED READING AND WRITING**

L	T	P	C
0	0	2	1

OBJECTIVES:

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

UNIT I

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV

Reading- Genre and Organization of Ideas- Writing- Email writing- resumes – Job application- project writing-writing convincing proposals.

UNIT V

Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011

REFERENCES

1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

EE8552

POWER ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I

POWER SEMI-CONDUCTOR DEVICES

9

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II

PHASE-CONTROLLED CONVERTERS

9

2-pulse, 3-pulse and 6-pulse converters— performance parameters –Effect of source inductance— Firing Schemes for converter—Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

UNIT III

DC TO DC CONVERTERS

9

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

UNIT IV INVERTERS**9**

Single phase and three phase voltage source inverters (both 120° mode and 180° mode)–Voltage & harmonic control–PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

UNIT V AC TO AC CONVERTERS**9**

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters –Introduction to Matrix converters, Applications –welding .

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

REFERENCES

1. Joseph Vithayathil, 'Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7. JP Agarwal, "Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

MT8591**SENSORS AND INSTRUMENTATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of measurement technology.
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I INTRODUCTION**9**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9
Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 7
Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 11
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 9
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course the students will be able to

- CO1: Familiar with various calibration techniques and signal types for sensors.
- CO2: Apply the various sensors in the Automotive and Mechatronics applications
- CO3: Describe the working principle and characteristics of force, magnetic and heading sensors.
- CO4: Understand the basic principles of various pressure and temperature, smart sensors.
- CO5: Ability to implement the DAQ systems with different sensors for real time applications.

TEXT BOOKS:

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw-Hill, 2009
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCES

1. C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001
2. Hans Kurt Tönshoff (Editor), Ichiro, “Sensors in Manufacturing” Volume 1, Wiley-VCH April 2001.
3. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.
4. Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2011.
5. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015

OBJECTIVES:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I FORCE ANALYSIS**12**

Dynamic force analysis – Inertia force and Inertia torque– D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses- Dynamics of Cam- follower mechanism.

UNIT II BALANCING**12**

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.

UNIT III FREE VIBRATION**12**

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration– Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

UNIT IV FORCED VIBRATION**12**

Response of one degree freedom systems to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT V MECHANISM FOR CONTROL**12**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL : 60 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Calculate static and dynamic forces of mechanisms.
- CO2 Calculate the balancing masses and their locations of reciprocating and rotating masses.
- CO3 Compute the frequency of free vibration.
- CO4 Compute the frequency of forced vibration and damping coefficient.
- CO5 Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

TEXT BOOKS:

1. F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, 2014.

REFERENCES:

1. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
3. Khurmi, R.S., "Theory of Machines", 14th Edition, S Chand Publications, 2005.
4. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
5. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
6. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.

EC8391**CONTROL SYSTEMS ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros -Multivariable control system

UNIT II TIME REPOSE ANALYSIS 9

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD,PI,PID control systems

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

TEXT BOOK:

1. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

REFERENCES:

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.

MT8511

POWER ELECTRONICS LABORATORY

**L T P C
0 0 4 2**

OBJECTIVES:

- To introduce the students different power electronics components and use of them in electronic circuits.
- To study characteristic of different power electronics of components.

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	Study of three phase AC regulator module	1
8	Speed control of DC shunt motor using three phase fully controlled converter module	1
9	SCR single phase cyclo converter module	1
10	SCR series and parallel inverters module	1
11	IGBT chopper module	1
12	IGBT based PWM inverter (single phase) module	1
13	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	15
14	Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter	16
15	CRO ,Transformer 1KVA, 1:1, 230V	Each 3

MT8512

SENSORS AND INSTRUMENTATION LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To provide knowledge about sensors and actuators
- To provide hands on experience to measure different signal using sensor and processing them in required form.

LIST OF EXPERIMENTS

1. Design and testing of Digital Comparator
2. Design and testing of Voltage to frequency converter and frequency to voltage converter.
3. Design and testing of sample and hold circuit.
4. Design and testing of Flash type Analog to Digital Converters.
5. Design and testing of instrumentation amplifier using OP-AMP.
6. Displacement measurement using potentiometer and LVDT and plotting the characteristic curves.
7. Study of Characteristics and calibration of strain gauge and Load Cell
 - a. Measurement of strain using resistive type strain gauges with temperature compensation and various bridge configurations.
8. Temperature measurement using Thermocouple, Thermistor and RTD and comparing the characteristics.
9. Comparison of capacitive and resistive type transducer for humidity measurement with their characteristics.
10. Measurement of sound using microphones and sound level meter.
11. Conversation of time domain audio signal into frequency domain signal (FFT).
12. Measurements of 3 phase power and power factor.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course the students will be able to:

- CO1:** Generate appropriate design procedure, suitable for signal conversion to interface with computer.
- CO2:** Design appropriate circuits by using conventional formulas used in signal conditioning and conversion.
- CO3:** Implement their design in bread board and test it.
- CO4:** Generate appropriate design procedure to obtain a required measurement data for temperature, force, humidity, displacement and sound.
- CO5:** Log the data in computer using LABVIEW/ MATLAB/PSILAB.
- CO6:** Present data in a clear and meaningful manner.
- CO7:** Use transducers to create simple Mechatronics applications using data logging software.

EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty
1	Digital Signal Oscilloscope	6
2	Function Generator	5
3	Breadboard	10
4	Regulated Power supply	6
5	LVDT	1
6	Thermistor	1
7	Thermocouple	1
8	RTD	1
9	Load cell setup	1
10	4 Channel data acquisition system for strain gauge	1
11	Sound level meter	1
12	Computer with LABVIEW/ MATLAB/SCILAB	1
13	Prony brake dynamometer	1
14	Hygrometer	1

ME8481

DYNAMICS LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS

1. a) Study of gear parameters.
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.

5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems. - Undamped and Damped Natural frequencies. b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
c) Determination of transmissibility ratio using vibrating table.

TOTAL : 60 PERIODS

OUTCOMES

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.
8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever b) Free-Free beam c) Simply supported beam.	1 No.

OBJECTIVE:

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems

UNIT II HYDRAULIC ACTUATORS AND VALVES 9

Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning - Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves-Types, Construction and Operation- Servo and Proportional valves - Applications – Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols - Problems

UNIT III HYDRAULIC SYSTEMS 9

Accumulators, Intensifiers, Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNIT IV PNEUMATIC SYSTEMS 9

Properties of air– Perfect Gas Laws - Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Design of pneumatic circuit cascade method- Electro pneumatic circuits, Introduction to Fluidics, Pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling in a CNC machine. - Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

TOTAL: 45 PERIODS**OUTCOMES:**

- Understanding operating principles and constructional features of hydraulic and pneumatic systems.
- Knowledge with selection of hydraulic / pneumatic components
- understanding of designing and layout of Hydraulic Power package and trouble shooting.

TEXT BOOK:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.

REFERENCES:

1. Shanmugasundaram.K, “Hydraulic and Pneumatic Controls”, Chand & Co, 2006.
2. Majumdar, S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata Mc Graw Hill, 2001
3. Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata Mc Graw Hill, 2007.
4. Dudelyt, A Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
5. Srinivasan.R, “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.
6. Joji.P, “Pneumatic Controls”, John Wiley & Sons India, 2008

MT8601

DESIGN OF MECHATRONICS SYSTEM

L T P C
3 0 0 3

OBJECTIVES:

- Mechatronics system design and simulation, ergonomics and safety
- Theoretical and practical aspects of computer interfacing, real time data acquisition and control
- Design of motion control, motion converter and temperature control.

UNIT I INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM 9

Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design – Introduction to industrial design, modelling, simulation and analysis – Ergonomics and safety.

UNIT II BASIC SYSTEM MODELLING 9

Introduction – model categories – model development – Simulation using softwares – verification and validation – Mathematical modelling : Basic system modelling – mechanical electrical, fluid and thermal.

UNIT III MECHATRONIC SYSTEM MODELLING 7

Engineering systems: Rotational – translational, electro-mechanical, pneumatic-mechanical, hydraulic-mechanical, micro electro mechanical system – Dynamic responses of system: first order, second order system – Performance measures

UNIT IV REAL TIME INTERFACING 11

Introduction – Selection of interfacing standards- elements of data acquisition and control systems – Overview of I/O process – general purpose I/O cards and its installation – Data conversion process – Application softwares – Man machine interface

UNIT V CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM 9

Motion control using DC Motor, AC Motor and Servomotor - Temperature control of hot/cold reservoir – Pick and place robot – Car parking barriers – Motion and temperature control of washing machine – Auto focus camera, exposure control

TOTAL : 45 PERIODS

OUTCOMES

Students will be able to understand the mechatronics design

CO1: Understand the basics and key elements of Mechatronics design process

CO2: Familiar with basic system modelling

CO3: Understand the concepts of engineering system and dynamic response of the system

CO4: Realize the concepts of real time interfacing and data acquisition

CO5: Understanding the concepts of design of Mechatronics system through case studies

TEXT BOOKS:

1. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2011.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL's, John wiley and sons Ltd, 2003.

REFERENCES

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.

ME8593

DESIGN OF MACHINE ELEMENTS

L	T	P	C
3	0	0	3

OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
(Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 Explain the influence of steady and variable stresses in machine component design.
- CO2 Apply the concepts of design to shafts, keys and couplings.
- CO3 Apply the concepts of design to temporary and permanent joints.
- CO4 Apply the concepts of design to energy absorbing members, bearings and connecting rod.
- CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

1. Bhandari V, “Design of Machine Elements”, 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 9th Edition, Tata McGraw-Hill, 2011.

REFERENCES:

1. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010

2. Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2015.

MT8602

INDUSTRIAL AUTOMATION

L T P C
3 0 0 3

OBJECTIVES:

- To understand the construction, operation and installation of PLCs.
- To provide the knowledge on interfacing the PLCs and field devices with communication protocols.
- To understand the concepts of DCS and SCADA systems.

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules, CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram into ladder diagram. PLC programming- Simple instructions – Manually operated switches – Mechanically operated switches - Latching relays.

UNIT II APPLICATIONS OF PLC 9

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Motor start and stop, Simple materials handling applications, Automatic water level controller, Automatic lubrication of supplier Conveyor belt, Automatic car washing machine, Bottle label detection and process control application.

UNIT III SCADA SYSTEM & ARCHITECTURE 9

Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries - SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA/HMI Systems Various SCADA architectures, advantages and disadvantages of each system

UNIT IV DISTRIBUTED CONTROL SYSTEM 9

Introduction to DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies – Sugar industry and Power plant

UNIT V INDUSTRIAL PROCESS CONTROL 9

Study of Advanced Process control blocks: Statistical Process Control, Model Predictive Control, Fuzzy Logic Based Control, Neural-Network Based Control, PID Control

TOTAL : 45 PERIODS

OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Choose appropriate PLC and explain the architecture, installation procedures and trouble shooting.

CO2: Develop PLC programs using various functions of PLCs for a given application.

CO3: Explain the application development procedures in SCADA and manage data, alarm and storage.

CO4: Distinguish DCS, SCADA and PLC and explain the architecture of DCS

CO5: Describe the controller elements and program methods.

TEXT BOOKS:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", 3rd India edition, Cengage Learning, 2007
2. John Webb, "Programmable Logic Controllers: Principles and Applications", 5th edition Prentice Hall of India, 2012.
3. Krishna Kant "Computer Based Process Control", Prentice Hall of India, 2004.
4. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986

REFERENCES

1. B. G. Liptak "Instrument Engineer's Handbook – Process Software and Digital Network", 3rd edition, CRC Press, 2002.
2. Jose A. Romagnoli, Ahmet Palazoglu, "Introduction to Process control", CRC Taylor and Francisgroup, 2005.
3. Richard Cox, "Programmable Controllers", Delmer Thomson learning, 2001.
4. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015.
5. William T. Shaw, Cybersecurity for SCADA systems, Penn Well Books, 2006

MG8591

PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING**9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING**9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING**9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS**OUTCOME:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have some basic knowledge on international aspect of management

TEXT BOOKS:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Harold Koontz & Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management”, 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

MT8611	APPLIED HYDRAULICS AND PNEUMATICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

To design and test the hydraulic and pneumatic circuits using MATLAB/LABVIEW software and simulate the circuits using Automation studio software.

LIST OF EXPERIMENTS

1. Design and testing of hydraulic circuits such as
 - Pressure control
 - Flow control
 - Direction control
 - Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits such as
 - Pressure control
 - Flow control
 - Direction control
 - Circuits with logic controls
 - Circuits with timers
 - Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
 - Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB/LABVIEW software.
3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Select the actuators and valves for the design of fluid power circuits.

CO2: Design and simulate the fluid power circuits using software tool.

CO3: Test the simulated output by constructing the fluid power circuits using suitable actuators and valves.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	Name of the Equipment	Qty
Hydraulic equipments		
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	1
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with pump and pressure relief valve	1
11	PLC	1
Pneumatics equipments		
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push button	1
2	Pneumatic training kit with FRL unit, Double acting cylinder, manually actuated DCV	1
3	Pneumatic trainer kit with FRL unit, Double acting cylinder, Pilot actuated DCV	1
4	Pneumatic trainer kit with FRL unit Double acting cylinder, Double solenoid actuated DCV, DCV with sensor / magnetic reed switches	1
5	PLC with interface card	1
6	LABVIEW software	1
7	Automation studio software	1

OBJECTIVES:

- To identify the differences between various PLCs.
- To provide the skills to install and trouble shoot PLC systems.
- To provide working experience in various programming techniques.
- To control some process parameters and test PID algorithm.
- To use the VFD to control the speed of AC motor.

LIST OF EXPERIMENTS

1. Study of different PLCs and their specification
2. Study of installations and troubleshooting of PLC.
3. Development of Ladder Diagram (LD) and Structured Text (ST) programming in PLC for simple applications.
4. Development of an application by using timer and counter of PLC.
5. Solving simple problems using Functional Block Diagram (FBD) programming in PLC
6. Interfacing between PLC and Process loop (temperature)
7. Interfacing between PLC and Process loop (level)
8. Interfacing between PLC and Process loop (flow)
9. Verification and testing of PID controller in a process loop.
10. Develop one application using SCADA system.
11. AC motor speed control using PLC and VFD

TOTAL: 60 PERIODS**OUTCOMES:****Upon Completion of the course, the students will be able to:**

CO1: Carryout wiring connections and troubleshoot in different PLCs.

CO2: Develop simple applications using LD, ST and FBD mode of programming.

CO3: Use timers and counter functions of PLC to construct simple applications.

CO4: Integrate and control process station with PLC.

CO5: Develop SCADA application using open source software.

CO6: Perform speed control on AC motor using VFD and PLC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the Equipment	Qty
Hardware:		
1	PLC panel board kit with power supply Any three PLCs from the following list can be used but not limited to 1.Allen Bradley (Micro Logix 1200) 2. Siemens (SIMATIC S7 200) PLC 3. DELTA (DVP-SS Series) PLC 4. Schneider Modicon (M238 series) PLC 5. Mitsubishi Nexgenie (1000 series)	7
2	PLC panel board kit with power supply Any three PLCs from the following list can be used but not limited to 1.Allen Bradley (Micro Logix 1200) 2. Siemens (SIMATIC S7) PLC 3. DELTA (DVP-SS Series) PLC 4. Schneider Modicon (M238 series) PLC	7

	5. Mitsubishi Nexgenie (1000 series)	
3	Process control station	1
4	½ HP AC motor	1
5	VFD to control ½ HP AC motor	1
Software:		
1	Delta PLC software – free ware and corresponding PLC programming software.	1
2	Open source SCADA software such as Free SCADA, Open SCADA, Indigo SCADACodeSys Open source for PLC programming and interfacing with real time PLC.	1

ME8682

DESIGN AND FABRICATION PROJECT

L T P C
0 0 4 2

OBJECTIVE:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 60 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 design and Fabricate the machine element or the mechanical product.
CO2 demonstrate the working model of the machine element or the mechanical product.

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION**9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM –CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

UNIT II GEOMETRIC MODELING**9**

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III CAD STANDARDS**9**

Standards for computer graphics- **Graphical Kernel System (GKS)** - standards for exchange images- **Open Graphics Library (OpenGL)** - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT IV FUNDAMENTAL OF CNC AND PART PROGRAMMING**9**

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming (FANUC) on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS)**9**

Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control–Quantitative analysis in FMS

TOTAL : 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
- CO2 Explain the fundamentals of parametric curves, surfaces and Solids
- CO3 Summarize the different types of Standard systems used in CAD
- CO4 Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines
- CO5 Summarize the different types of techniques used in Cellular Manufacturing and FMS

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill PublishingCo.2007
2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
3. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

REFERENCES:

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker "Computer Graphics". Prentice Hall, Inc,1992.
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003
4. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.

MT8701

ROBOTICS AND MACHINE VISION SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVE:

Students will learn about basics of robots, programming and machine vision applications in robots

UNIT I BASICS OF ROBOTICS

9

Introduction- Basic components of robot-Laws of robotics- classification of robot-work space-accuracy-resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives – gear system - belt drives.

UNIT II ROBOT END EFFECTORS

9

Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

UNIT III ROBOT MECHANICS

10

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT IV ROBOT PROGRAMMING

8

Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

UNIT V MACHINE VISION FUNDAMENTALS

9

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to

CO1: Express the basic concepts, laws, components and parameters of robots

CO2: Explain the types of grippers and its functions.

CO3: Evaluate the kinematic calculations and apply Lagrangian and Newton-Euler methods to analyze dynamic characteristics of robots

CO4: Describing the various programming techniques used in industrial robots

CO5: Basis of machine vision and apply the concept of image processing

TEXT BOOK:

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited 2ndEdition, 2012

REFERENCES:

1. John.J.Craig, " Introduction to Robotics: Mechanics & control" Pearson Publication, Fourth edition, 2018.
2. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, 2nd Edition, 2010
3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, First Edition, 1987.
4. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.

MT8791

EMBEDDED SYSTEM DESIGN

LT P C
2 0 2 3

OBJECTIVES:

- To provide the overview of embedded system design principles
- To understand the concepts of real time operating systems
- To provide exposure to embedded system development tools with hands on experience in using basic programming techniques.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS

7

Overview of embedded systems, embedded system design process, challenges - common design metrics and optimizing them. Hardware - Software codesign embedded product development.

UNIT II REAL TIME OPERATING SYSTEM

7

Real time operating systems Architecture - Tasks and Task states - Tasks and Data - Semaphore and shared data - Message queues, mail boxes and pipes - Encapsulating semaphores and queues - interrupt routines in an RTOS Environment. Introduction to Vx works, R_T Linux.

UNIT III PIC MICROCONTROLLER

9

Architecture - Instruction set - Addressing modes - Timers - Interrupt logic - CCP modules - ADC.

UNIT IV EMBEDDED NETWORKING

7

Introduction - CAN BUS - I²C - GSM - GPRS - Zig bee.

UNIT V EMBEDDED PROGRAMMING LABORATORY : LIST OF EXPERIMENTS

30

I/O Programming
Interrupts and Timer application
Interfacing Keypad
Interfacing LCD
Interfacing ADC/DAC

TOTAL : 60 PERIODS

OUTCOMES:

- CO1. Explain the need of embedded systems and their development procedures.
CO2. Summarize the concepts involved in Real time operating systems.
CO3. Use various tools for developing embedded applications.
CO4. Explain the construction, addressing modes and instructions sets of PIC micro controller.
CO5. Conduct experiments with I/O systems used in embedded systems.

TEXT BOOKS:

1. Frank Vahid, Tony John Givargis, Embedded System Design: A Unified Hardware/ Software Introduction - Wiley & Sons, Inc.2002 .
2. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata Mc Graw Hill, 2011
3. John B. Peatman, "Design with PIC Microcontrollers" Prentice Hall, 2003.

REFERENCES

1. Steve Heath, 'Embedded System Design', II edition, Elsevier, 2003.
2. David E. Simon, "An embedded software primer", Addison – Wesley, Indian Edition Reprint (2009).
3. Robert Foludi "Building Wireless Sensor Networks", O'Reilly, 2011.

MT8711 COMPUTER AIDED DESIGN AND MANUFACTURING LABORATORY **L T P C**
0 0 4 2

OBJECTIVES:

- To understand and interpret drawings of machine components for the preparation of assembly drawings using standard CAD packages.
- To gain practical experience in handling 3D modelling software systems.
- To learn basic principles of finite element analysis procedure and enable the students to formulate the design problems into FEA.
- To understand and interpret program codes for manufacturing different machine components using standard CAM packages.

LIST OF EXPERIMENTS

1. Modelling of a part using any CAD package.
2. Modelling and assembling of the mechanical assembly using any CAD package.
3. Structural analysis using FEA software – any analysis package.
4. Beam deflection analysis using FEA software – any analysis package.
5. Modelling and tool path simulation – turning using any CAM package.
6. Modelling and tool path simulation – milling using any CAM package.
7. NC code generation for milling using any CAM package.
8. NC code generation for turning using any CAM package.

TOTAL: 60 PERIODS

EQUIPMENTS FOR A BATCH OF 30 STUDENTS

NOTE - Any solid modelling and analysis using suitable software packages can be used for exercise.
CNC lathe – 1 no
CNC milling machine – 1 no

OUTCOMES:

Upon Completion of the course, the students will be able to:

- CO1: Model and assemble a given three dimensional engineering components
CO2: Perform various analyses on simple structures for the application of different loads.
CO3: Generate CNC programs for a given components to work with CNC machines

MT8781

ROBOTICS LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To introduce different types of robotics and demonstrate them to identify different parts and components.
- To write programming for simple operations.

LIST OF EXPERIMENTS

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Colour identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

TOTAL: 60 PERIODS

OUTCOME:

Upon Completion of the course, the students will be able to:

CO1:Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots

LIST OF EQUIPMENTS BATCH OF 30 STUDENTS:

- ROS (Robotic Operating System)
- 30 Systems with server
- Verification of direct kinematics equations and inverse kinematics equations of 1DOF “R-configuration” robot.
- Verification of direct kinematics equations and inverse kinematics equations of 2DOF “R-R-configuration” robot.

MT8801

AUTOMOTIVE ELECTRONICS

L T P C
3 0 0 3

OBJECTIVES:

- The intention and purpose of this course is to study the basics of electronics, emission controls and its Importance in automobiles.
- To study the various sensors and actuators used in automobiles for improving fuel economy and emission control.
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.

UNIT I INTRODUCTION

8

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II IGNITION AND INJECTION SYSTEMS 10
Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III SENSOR AND ACTUATORS IN AUTOMOTIVES 7
Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 10
Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 10
Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL : 45 PERIODS

OUTCOMES:

After successful completion of this course, the students should be able to

- CO1:** Know the importance of emission standards in automobiles.
- CO2:** Understand the electronic fuel injection/ignition components and their function.
- CO3:** Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.
- CO4:** Diagnose electronic engine control systems problems with appropriate diagnostic tools.
- CO5:** Analyses the chassis and vehicle safety system.

TEXT BOOK:

1. Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier, Indian Reprint, 2013

REFERENCES

1. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
2. Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 2000.
3. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.
4. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.

MT8811

PROJECT WORK

L	T	P	C
0	0	20	10

OBJECTIVES:

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Students in the form of group, not exceeding 3 members in a group to carry out their main project. It should be a Mechatronics project. However, special considerations can be given for interdisciplinary measurement and computer based simulation projects. This exception should be recorded and approved by the department committee. Management related projects will not be allowed. The interdisciplinary projects will carry more weight age. It is mandatory to publish their main project in national/international level conferences to appear in the viva-voce exam.

TOTAL: 300 PERIODS

OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Design, analyze, realize / simulate a physical system by using the technology they learnt during the program.

CO2: Integrate various systems into one Mechatronics product.

CO3: Work in a team with confined time duration.

CO4: Disseminate his work both in oral and written format.

IT8071	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique
- To realize the concept and usage of DSP in various engineering fields.

UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9

Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals–Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems–Discrete Convolution: Linear and Circular–Correlation.

UNIT II ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS 9

Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.

UNIT III INFINITE IMPULSE RESPONSE FILTERS 9

Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method–Design of digital IIR filters (LPF, HPF, BPF, and BRFF) using various transformation techniques.

UNIT IV FINITE IMPULSE RESPONSE FILTERS 9

Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRFF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.

UNIT V APPLICATIONS OF DSP 9

Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal –Processing of Audio and Radar signal.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Perform mathematical operations on signals.
- Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- Transform the time domain signal into frequency domain signal and vice-versa.
- Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.

TEXT BOOK:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

REFERENCES

1. Richard G. Lyons, "Understanding Digital Signal Processing". Second Edition, Pearson Education.
2. A.V. Oppenheim, R.W. Schaffer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
3. Emmanuel C. Ifeachor, & Barrie.W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
4. William D. Stanley, "Digital Signal Processing", Second Edition, Reston Publications.

MT8001

OBJECT ORIENTED PROGRAMMING IN C++

L T P C
3 0 0 3

OBJECTIVE:

- To introduce the C++ programming and its use in object oriented environment

UNIT I OOP PARADIGM

9

Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Reusability – Security – Object oriented programming fundamental – Abstraction – Encapsulation – Derivation – Object oriented languages and packages – Applications of OOP – A simple C++ program – More C++ statements – Structure of C++ Program

UNIT II INTRODUCTION TO C++

10

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators – Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading

UNIT III CLASSES AND OBJECTS

9

Specifying a class – Defining member functions – Private member functions – Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments – Friendly functions – Returning objects. Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors – Destructors

UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM 10
 Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions

UNIT V CASE STUDIES 7
 Over view of typical object oriented systems – Case studies- Applications

TOTAL : 45 PERIODS

OUTCOMES:

On the successful completion of the course, students will be able to

- CO1:** Distinguish between Structured and Object Oriented problem solving approaches and apply them based on the problem given
- CO2:** Define the fundamental concepts in programming with C++.
- CO3:** Identify classes and objects from the given problem description and able to create classes and objects using C++
- CO4:** Achieve code reusability and extensibility by means of Inheritance and Polymorphism.
- CO5:** Translate the informal description of an algorithm to solutions for problems in engineering, science and text processing using Object Oriented Programming.

TEXT BOOKS:

1. Balagurusamy E, —Object Oriented Programing with C++|Tata McGraw Hill *Education Pvt.Ltd* , Fourth Edition 2010.

REFERENCES:

1. Baarkakati. N., ‘Object Oriented Programming in C++’, Prentice Hall of India, 1997.
2. Bjanne Stroustrup, “The C++ Programming Language”, 4th Edition, Addison Wesley,2013.
3. Herbert Schildt, “C++ The Complete Reference”, Tata Mc Graw Hill Edition, 2003
4. Stanley, B.Lippman, JoveLagrie, “C++Primer”, 3rd Edition, Addison Wesley,1998

ME8091	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS**9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS**9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES**9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 recognize the various parts of the automobile and their functions and materials.
- CO2 discuss the engine auxiliary systems and engine emission control.
- CO3 distinguish the working of different types of transmission systems.
- CO4 explain the Steering, Brakes and Suspension Systems.
- CO5 predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:

1. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

REFERENCES:

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

GE8075**INTELLECTUAL PROPERTY RIGHTS**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION**9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10
International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9
Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

GE8073

FUNDAMENTALS OF NANOSCIENCE

L T P C
3 0 0 3

OBJECTIVE:

To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS**12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO₂,MgO, ZrO₂, NiO, nanoalumina, CaO, AgTiO₂, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES**9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS**7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS**OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

AN8091**MAINTENANCE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I	PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING	9
Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTRR and MWT – Factors of availability – Maintenance organization – Maintenance economics.		
UNIT II	MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE	9
Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.		
UNIT III	CONDITION MONITORING	9
Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear- debris analysis		
UNIT IV	REPAIR METHODS FOR BASIC MACHINE ELEMENTS	10
Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.		
UNIT V	REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT	8
Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance		

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities
- To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

TEXT BOOKS:

1. Srivastava S.K., “Industrial Maintenance Management”, S. Chand and Co., 1981
2. Venkataraman .K “Maintenance Engineering and Management”, PHI Learning, Pvt.Ltd., 2007

REFERENCES:

1. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
2. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995
3. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.
4. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.
5. Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1988.
6. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979
7. “Advances in Plant Engineering and Management”, Seminar Proceedings - IPE, 1996.

ME8793	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I	INTRODUCTION TO PROCESS PLANNING	9
Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection		
UNIT II	PROCESS PLANNING ACTIVITIES	9
Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies		
UNIT III	INTRODUCTION TO COST ESTIMATION	9
Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost		
UNIT IV	PRODUCTION COST ESTIMATION	9
Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop		
UNIT V	MACHINING TIME CALCULATION	9
Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.		

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 select the process, equipment and tools for various industrial products.
- CO2 prepare process planning activity chart.
- CO3 explain the concept of cost estimation.
- CO4 compute the job order cost for different type of shop floor.
- CO5 calculate the machining time for various machining operations.

TEXT BOOKS:

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Sinha B.P, “Mechanical Estimating and Costing”, Tata-McGraw Hill publishing co, 1995.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley, 1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”, Pearson Education 2001.
5. K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”,Khanna Publishers 1990.

OBJECTIVE:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS**15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS**8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS**6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS**6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS**10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS**OUTCOME:**

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOKS:

- Hillier and Libeberman, "Operations Research", Holden Day, 2005
- Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

- Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.
- Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
- Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
- Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
- Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

MT8002

ADVANCED MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of forming and sheet metal working of metals with its different types of operations and simultaneously to know about various non-traditional machining processes, surface finishing and surface hardening processes with its types and various applications.
- To understand the work and tool holding devices with its principles and its industrial applications

UNIT I SHEET METAL WORKING OF METALS 8

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming electro hydraulic forming-electromagnetic forming

UNIT II NON TRADITIONAL MACHINING 9

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications

UNIT III SURFACE FINISHING AND SURFACE HARDENING PROCESS 10

Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating (PVD, CVD).

UNIT IV EDM AND ECM 10

Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate-applications-EDWC - process principles – equipments - applications. Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate -accuracy and surface finish obtained. Electro Chemical grinding (ECG) – Chemical machining-electro chemical grinding equipment-application-electro chemical deburring - honing applications.

UNIT V JIGS AND FIXTURES 8

Jigs-Locating and Clamping devices-principles-elements-mechanical-pneumatic and hydraulic actuation-types of Jigs-general consideration in Jig design-jig bushing, types- methods of construction. Fixtures-types of fixtures- fixture for machine tools –lathe, milling, boring, broaching, grinding-assembly inspection of welding fixture design.

TOTAL : 45 PERIODS

OUTCOMES:

- CO1: Understand the basics and working principles of various sheet metal working and forming processes
- CO2: Knowledge on various non-traditional machining processes with its applications
- CO3: Understand the various type of surface finishing and surface hardening process
- CO4: Understand the concept of EDM and ECM with its characteristics and application
- CO5: Understand the work and tool holding devices used for different machine tools

TEXT BOOKS:

1. Rao P.N., "Manufacturing Technology, Metal cutting and Machine Tools", Tata McGraw Hill, 2013
2. Sharma .P.C., "A text book of Production Technology- vol I &II ", S.Chand & Company Ltd, New Delhi, 2014

REFERENCES

1. Donaldson. C. "Tool design", Tata McGraw Hill Co. Ltd.,2003
2. HajraChoudhary.S.K. and Hajra Choudhary.A.K, "workshop Technology", Vol-I&Vol-II", Media Publishers 2008
3. H.M.T Bangalore "Production Technology" Tata McGraw Hill, 2016.

AE8751**AVIONICS****L T P C
3 0 0 3****OBJECTIVES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

UNIT I INTRODUCTION TO AVIONICS**9**

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

UNIT II DIGITAL AVIONICS ARCHITECTURE**9**

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

UNIT III FLIGHT DECKS AND COCKPITS**9**

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS**9**

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

UNIT V AIR DATA SYSTEMS AND AUTO PILOT**9**

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system.
- Integrate avionics systems using data buses.
- Analyze the performance of various cockpit display technologies.
- Design autopilot for small aircrafts using MATLAB

TEXT BOOKS:

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.

REFERENCES:

1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.
4. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000

MF8071

ADDITIVE MANUFACTURING

**L T P C
3 0 0 3**

OBJECTIVES:

- To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

UNIT I INTRODUCTION

9

Overview – Need - Development of Additive Manufacturing Technology -Principle – AM Process Chain- Classification –Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Applications- Benefits – Case studies.

UNIT II DESIGN FOR ADDITIVE MANUFACTURING

9

Design tools: Data processing - CAD model preparation – Part orientation and support structure generation – Model slicing –Tool path generation- Design for Additive Manufacturing: Concepts and objectives- AM unique capabilities – DFAM for part quality improvement- Customised design and fabrication for medical applications.

UNIT III PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES

9

Photo polymerization: SLA-Photo curable materials – Process - Advantages and Applications. Powder Bed Fusion: SLS-Process description – powder fusion mechanism – Process Parameters – Typical Materials and Application. Electron Beam Melting.

UNIT IV EXTRUSION BASED AND SHEET LAMINATION PROCESSES

9

Extrusion Based System: FDM-Introduction – Basic Principle – Materials – Applications and Limitations – Bioextrusion. Sheet Lamination Process:LOM- Gluing or Adhesive bonding – Thermal bonding.

UNIT V PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES

9

Droplet formation technologies – Continuous mode – Drop on Demand mode – Three Dimensional Printing – Advantages – Bioplotter - Beam Deposition Process:LENS- Process description – Material delivery – Process parameters – Materials – Benefits – Applications.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of this course, students will learn about a working principle and construction of Additive Manufacturing technologies, their potential to support design and manufacturing, modern development in additive manufacturing process and case studies relevant to mass customized manufacturing.

TEXT BOOKS:

- 1 Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third edition, World Scientific Publishers, 2010.
- 2 Ian Gibson, David W. Rosen, Brent Stucker "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing" Springer, 2010.

REFERENCES:

- 1 Andreas Gebhardt "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing" Hanser Gardner Publication 2011.
- 2 Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
- 3 Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications :A tool box for prototype development", CRC Press, 2007.
- 4 Tom Page "Design for Additive Manufacturing" LAP Lambert Academic Publishing, 2012.

GE8077**TOTAL QUALITY MANAGEMENT****L T P C****3 0 0 3****OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES**9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I**9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II**9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM**9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

EC8093**DIGITAL IMAGE PROCESSING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS**9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT**9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION**9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION**9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION**9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL :45 PERIODS**OUTCOMES:****At the end of the course, the students should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.

REFERENCES

1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3. D.E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

MT8003**MEDICAL MECHATRONICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand how to measure biochemical parameters and various physiological information.
- To study the need and technique of electrical safety in Hospitals.
- To study the use of radiation for diagnostic and therapy.
- To study about recorders and advanced equipment in medicine

UNIT I INTRODUCTION**9**

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION**9**

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY 9

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp- electrometer amplifier, carrier Amplifier – instrument power supply. Oscillographic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIT IV MEDICAL SUPPORT 10

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC– defibrillator patient safety - electrical shock hazards. Centralized patient monitoring system.

UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION 8

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

TOTAL : 45 PERIODS

OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Explain different measurement techniques used in physiological parameters measurement.

CO2: Describe the sensors and signal conditioning circuits used in biomedical engineering.

CO3: Understand about various amplifiers, recording and display devices.

CO4: Differentiate the working of recorders and explain the advanced systems used in medicine

CO5: Understand about various Bio- medical diagnostics instrumentation.

TEXT BOOKS:

1. Arumugam M., “Bio Medical Instrumentation”, Anuradha agencies Pub., 2003
2. Cromwell, Weibell and Pfeiffer, “Biomedical Instrumentation and Measurements”, 2nd Edition, Printice Hall of india , 2012.
3. Siamak Najarian “ Mechatronics in Medicine – A Bio medical engg approach” , McGraw – Hill Education , 2011.

REFERENCES

1. Geddes L.A., and Baker, L.E., “Principles of Applied Bio-medical Instrumentation”, 3rd Edition, John Wiley and Sons, 2010
2. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TMH, 2009.
3. Tompkins W.J., “Biomedical Digital Signal Processing”, Prentice Hall of India, 1998

MT8071

VIRTUAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVE:

- Introduce the principle, programming technique with instrument interfaces and applications of virtual instruments and to understand the basics of data acquisition are introduced in mechatronics systems.

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data -flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES 9
 VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISITION BASICS 9
 AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation

UNIT IV COMMON INSTRUMENT INTERFACES 9
 Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office & Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS 9
 Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

TOTAL : 45 PERIODS

OUTCOMES:

- CO1: Understand the evolution, advantages, techniques, architecture and applications of visual instrumentation
- CO2: Acquiring knowledge on VI programming techniques
- CO3: Study about the basics of data acquisition
- CO4: Understanding the concept of common instrument interfaces with industrial applications
- CO5: Study about the use of analysis tools with various applications.

TEXT BOOK:

1. Gupta ,” Virtual Instrumentation Using Lab view” 2nd Edition, Tata McGraw-Hill Education, 2010

REFERENCES:

1. Gary Jonson, "Labview Graphical Programming", Fourth Edition, McGraw Hill, New York, 2006
2. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition & Process Control", Second Edition, Instrument Society of America, 1994.
3. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 1998

IT8075

SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization’s strategic goals.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9
 Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TOTAL 45 PERIODS

OUTCOMES:

At the end of the course, the students should be able to:

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES

1. Gopaldaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013.
2. Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
3. Walker Royce: “Software Project Management”- Addison-Wesley, 1998.

GE8074

HUMAN RIGHTS

L T P C
3 0 0 3

OBJECTIVE:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II

9

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III

9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV

9

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME:

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

GE8071

DISASTER MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Process and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

ARTIFICIAL INTELLIGENCE

CS8691

L T P C
3 0 0 3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

UNIT I INTRODUCTION

9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS

9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

UNIT III KNOWLEDGE REPRESENTATION

9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

UNIT IV SOFTWARE AGENTS

9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS

9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence.

TEXT BOOKS:

- 1 S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
- 2 I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
4. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

MG8091**ENTREPRENEURSHIP DEVELOPMENT****L T P C
3 0 0 3****OBJECTIVE:**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP**9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION**9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS**9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING**9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS**9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL: 45 PERIODS**OUTCOME:**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

TEXT BOOKS :

1. Khanka S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entrepreneurship – Theory, Process and Practice", Cengage Learning 9th edition, 2014.

REFERENCES :

1. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers:
2. Entrepreneurship Development", Institute of India, Ahmadabad, 1986.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
4. Mathew J Manimala, Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition, Dream Tech, 2005.
5. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.

RO8791**MODELING AND SIMULATION**

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide an overview of how computers are being used in mechanical component design with the use of various CAD standards and to introduce the concepts of Mathematical Modelling of Engineering Problems using FEM with 2D scalar and vector variables problems respectively.

UNIT I MODELLING AND ASSEMBLY 9

Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking

UNIT II CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards

UNIT III INTRODUCTION TO ANALYSIS 9

Basic concepts of the Finite Element Method - Discretization -Meshing – Mesh refinement- Mesh Enrichment- Natural co-ordinate systems -Types of elements- Special Elements- Crack tip Element- Introduction to Analysis Software.

UNIT IV TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems.

UNIT V TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

TOTAL : 45 PERIODS**OUTCOMES:**

- CO1: To know the basic concepts of modelling and assembly for different mechanical components
 CO2: To know the different types of CAD standards used in modeling of mechanical components
 CO3: To know about basic concepts of FEA and analysis software for analyzing mechanical components
 CO4: To know about different mathematical techniques used in finite element analysis to solve structural and thermal problems

TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007
2. Rao, S.S., "The Finite Element Method in Engineering", 5th Edition, Butterworth Heinemann, 2010

REFERENCES

1. Donald Hearn and M. Pauline Baker "Computer Graphics". Prentice Hall, Inc, 1996.
2. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson, 2nd edition, 1995.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

EE8091

MICRO ELECTRO MECHANICAL SYSTEMS

L T P C
3 0 0 3

OBJECTIVES

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I

INTRODUCTION

9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II

SENSORS AND ACTUATORS-I

9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

UNIT III

SENSORS AND ACTUATORS-II

9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV

MICROMACHINING

9

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS**9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS**OUTCOMES**

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
2. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD,2002
3. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000
4. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer 2012.

CS8492**DATABASE MANAGEMENT SYSTEMS****L T P C
3 0 0 3****OBJECTIVES**

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

UNIT I RELATIONAL DATABASES**10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II DATABASE DESIGN**8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS

9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT IV IMPLEMENTATION TECHNIQUES

9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT V ADVANCED TOPICS

9

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- Classify the modern and futuristic database applications based on size and complexity
- Map ER model to Relational model to perform database design effectively
- Write queries using normalization criteria and optimize queries
- Compare and contrast various indexing strategies in different database systems
- Appraise how advanced databases differ from traditional databases.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2011.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management Systemsll, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,“Database Management Systems”, Tata McGraw Hill, 2011.

MG8892

MARKETING MANAGEMENT

L T P C
3 0 0 3

OBJECTIVE:

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I MARKETING PROCESS

9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9
Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.

TOTAL: 45 PERIODS

OUTCOME:

- The learning skills of Marketing will enhance the knowledge about Marketer's Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

TEXTBOOKS:

1. Philip Kotler & Keller, "Marketing Management", 14th Edition, Prentice Hall of India, 2012.
2. Chandrasekar, K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill – Vijaynicole 2010.

REFERENCES:

1. Adrain palmer, " Introduction to Marketing Theory and practice", Oxford university press IE 2004.
2. Czinkota & Kotabe, "Marketing Management", Thomson learning, Indian edition 2007
3. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India-1997.
4. Graeme Drummond and John Ensor, "Introduction to marketing concepts", Elsevier, Indian Reprint, 2007.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
7. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.

IM8071

PRODUCT DESIGN AND DEVELOPMENT

**L T P C
3 0 0 3**

OBJECTIVE:

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION 9

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.

UNIT II CONCEPT GENERATION AND SELECTION 9

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT III PRODUCT ARCHITECTURE 9

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

UNIT IV INDUSTRIAL DESIGN 9

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

TOTAL: 45 PERIODS

OUTCOME:

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:

1. Kari T.Ulrich and Steven D.Eppinger, "Product Design and Development", McGraw-Hill International Edns. 1999.

REFERENCES:

1. Kemneth Crow, "Concurrent Engg./Integrated Product Development", DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal, "Effective Product Design and Development", Business One Orwin, Home wood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, "Tool Design –Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY.

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS**OUTCOME:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

- Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
- Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

- Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
- John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
- Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
- Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
- World Community Service Centre, 'Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

ANNA UNIVERSITY, CHENNAI
REGULATIONS 2013

(Common to all B.E. / B.Tech. Degree (8 Semesters) Full – Time Programmes of
Affiliated Institutions)

CREDIT SYSTEM

AFFILIATED COLLEGES

DEGREE OF BACHELOR OF ENGINEERING / BACHELOR OF TECHNOLOGY

This Regulations is applicable to the students admitted to B.E./B.Tech. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2013-2014.

1. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- I) **“Programme”** means Degree Programme, that is B.E./B.Tech. Degree Programme.
- II) **“Discipline”** means specialization or branch of B.E./B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.
- III) **“Course”** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.
- IV) **“Director, Academic Courses”** means the authority of the University who is responsible for all academic activities of the Academic Programmes for implementation of relevant rules of this Regulations pertaining to the Academic Programmes.
- V) **“Chairman”** means the Head of the Faculty.
- VI) **“Head of the Institution”** means the Principal of the College.
- VII) **“Head of the Department”** means head of the Department concerned.
- VIII) **“Controller of Examinations”** means the authority of the University who is responsible for all activities of the University Examinations.
- IX) **“University”** means ANNA UNIVERSITY, CHENNAI.

2. ADMISSION

- 2.1 Candidates seeking admission to the first semester of the eight semester B.E. / B.Tech. Degree Programme:

Should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

2.2 **Lateral entry admission**

- (i) The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

(OR)

- (ii) The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech.

Such candidates shall undergo two additional Engineering subject(s) in the third and fourth semesters as prescribed by the University.

3. **PROGRAMMES OFFERED**

B.E. / B.Tech. Programmes under the Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology.

4. **STRUCTURE OF PROGRAMMES**

- 4.1 Every Programme will have curricula with syllabi consisting of theory and practical courses such as:

- (i) General core courses comprising Mathematics, Basic sciences, Engineering sciences, Humanities and Management.
- (ii) Core courses of Engineering/Technology.
- (iii) Elective courses for specialization in related fields.
- (iv) Workshop Practice, Computer Practice, Engineering Graphics, Laboratory work, Industrial Training, Seminar presentation, Project work, Educational tours, Camps etc.
- (v) NCC / NSS / NSO / YRC activities for character development

There shall be a certain minimum number of core courses and sufficient number of elective courses that can be opted by the students. The blend of different courses shall be so designed that the student, at the end of the programme, would have been trained not only in his / her relevant professional field but also would have developed as a socially conscious human being.

- 4.2 Each course is normally assigned a certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical).
- 4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 and practical courses not exceeding 4. However, the total number of courses per semester shall not exceed 10.
- 4.4 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study.
- 4.5 **The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports except for the programmes offered in Tamil Medium.**

5. DURATION OF THE PROGRAMME

- 5.1 A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (four academic years) but in any case not more than 14 Semesters for HSC (or equivalent) candidates and not more than 12 semesters for Lateral Entry Candidates.
- 5.2 Each semester shall normally consist of 90 working days or 450 periods of 50 minutes each. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.
- 5.3 The Head of the Institution may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the specified periods. But for the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 6) by the students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{(\text{No. of periods / week as prescribed in the curriculum}) \times 15 \text{ taken together for all courses of the semester}} \times 100$$

The University Examination will ordinarily follow immediately after the last working day of the semester as per the academic schedule prescribed from time to time.

- 5.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18.4) in order that he/she may be eligible for the award of the degree (vide clause 15).

6. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

- 6.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.
Ideally every student is expected to attend all classes and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes.
Therefore, he/she shall **secure not less than 75%** (after rounding off to the nearest integer) of overall attendance as calculated as per clause 5.3.
- 6.2 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.
- 6.3 Candidates who **secure less than 65% overall attendance and candidates who do not satisfy the clause 6.1 and 6.2** shall not be permitted to write the University examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

7. CLASS ADVISOR

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the HoD of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

8. CLASS COMMITTEE

8.1. Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- **Clarifying the regulations of the degree programme and the details of rules therein particularly (clause 5 and 6) which should be displayed on college Notice-Board.**
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

8.2 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.

8.3 The class committee shall be constituted within the first week of each semester.

8.4 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

8.5 The Chairperson of the class committee may invite the Class adviser(s) and the Head of the Department to the class committee meeting.

8.6 The Head of the Institution may participate in any class committee of the institution.

8.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Management by the Head of the Institution.

- 8.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. **The Class Committee Chairman shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation.** During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the course committee may also prepare a common question paper for the internal assessment test(s).

10. SYSTEM OF EXAMINATION

- 10.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) University examination at the end of the semester.
- 10.2 Each course, both theory and practical (including project work & viva voce Examinations) shall be evaluated for a maximum of 100 marks.
- For all theory and practical courses including project work, the continuous internal assessment will carry **20 marks** while the End - Semester University examination will carry **80 marks**.
- 10.3 Industrial training and seminar shall carry 100 marks and shall be evaluated through internal assessment only.
- 10.4 The University examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.
- 10.5 The University examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.
- 10.6 For the University examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

For all theory and practical courses (including project work) the continuous assessment shall be for a maximum of 20 marks. The above continuous assessment shall be awarded as per the procedure given below:

11.1(a) Theory Courses

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

(b) Practical Courses:

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

(c) Theory Courses with Laboratory Component:

If there is a theory course with Laboratory component, there shall be three tests: the first two tests (each 100 marks) will be from theory portions and the third test (maximum mark 100) will be for laboratory component. The sum of marks of first two tests shall be reduced to 60 marks and the third test mark shall be reduced to 40 marks. The sum of these 100 marks may then be arrived at for 20 and rounded to the nearest integer.

11.2(a) The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

(b) The Industrial / Practical Training, Summer Project, Internship shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. The certificates (issued by the organization) submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examinations.

11.3 Project Work:

Project work may be allotted to a single student or to a group of students not exceeding 4 per group.

The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be **reduced for 20 marks** and rounded to the nearest integer (as per the scheme given in 11.3.1).

11.3.1 The project report shall carry a maximum 30 marks. The project report shall be submitted as per the approved guidelines as given by Director, Academic Courses. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

Review I	Review II	Review III	End semester Examinations				
			Thesis Submission (30)		Viva-Voce (50)		
			Internal	External	Internal	External	Supervisor
5	7.5	7.5	15	15	15	20	15

11.3.2 If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

11.4 Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.

11.5 Attendance Record

Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years). The University or any inspection team appointed by the University may verify the records of attendance and assessment of both current and previous semesters.

12. REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A candidate shall normally be permitted to appear for the University Examinations of the current semester if he/she has satisfied the semester completion requirements (subject to Clause 6) and has registered for examination in all courses of the semester. Registration is mandatory for current semester examinations as well as arrear examinations, failing which the candidate will not be permitted to move to the higher semester.

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades.

13. PASSING REQUIREMENTS

13.1 A candidate who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End semester University Examinations] with a minimum of 45% of the marks prescribed for the end-semester University Examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and practical courses (including project work).

13.2 If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the subsequent semester when examination is conducted in that course; he/she should continue to register and reappear for the examinations in the failed subjects till he / she secures a pass.

13.3 The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass. However, from the third attempt onwards if a candidate fails to obtain pass marks (IA + End Semester Examination) as per clause 13.1, then the candidate shall be declared to have passed the examination if he/she secure a minimum of 50% marks prescribed for the university end semester examinations alone.

14. AWARD OF LETTER GRADES

14.1.1 All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter grade	Grade Points	Marks Range
S	10	91 – 100
A	9	81 – 90
B	8	71 – 80
C	7	61 – 70
D	6	57 – 60
E	5	50 – 56
U	0	< 50
W	0	(or 50 but not satisfying clause 13.1)

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: “S”, “A”, “B”, “C”, “D”, “E”.

‘SA’ denotes shortage of attendance (as per clause 6.3) and hence prevention from writing the end semester examination. ‘SA’ will appear only in the result sheet.

“U” denotes **Reappearance** (RA) is required for the examination in the course. “W” denotes **withdrawal** from the exam for the particular course. (The grades U and W will figure both in Marks Sheet as well as in Result Sheet)

Grade sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied
- The list of courses enrolled during the semester and the grade scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester.

CGPA will be calculated in a similar manner, considering all the courses registered from first semester. “U”, and “W” grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^n C_i \text{ GP}_i}{\sum_{i=1}^n C_i}$$

where C_i is the number of Credits assigned to the course

GP_i is the point corresponding to the grade obtained for each course

n is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

15. ELIGIBILITY FOR THE AWARD OF THE DEGREE

15.1 A student shall be declared to be eligible for the award of the Degree if he/she has

- Successfully gained the required number of total credits as specified in the Curriculum corresponding to his/her Programme within the stipulated time.

- No disciplinary action is pending against him/her.
- The award of the degree must be approved by the Syndicate.
- Successfully completed any additional courses prescribed by the Director, Academic Courses, whenever any candidate is readmitted under Regulations other than R – 2013 (clause 18.2).

16. CLASSIFICATION OF THE DEGREE AWARDED

16.1 FIRST CLASS WITH DISTINCTION

A candidate who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction.

- Should have passed the End semester examination in all the courses of all the eight semesters (six semesters in the case of lateral entry) in his/her First Appearance within four years (three years in the case of lateral entry). Withdrawal from examination (vide Clause 17) will not be considered as an appearance. One year authorized break of study (if availed of) is permitted in addition to four years (three years in the case of lateral entry) for award of First class with Distinction.
- Should have secured a CGPA of not less than 8.50.

16.2 FIRST CLASS

A candidate who satisfies the following conditions shall be declared to have passed the examination in First class.

- Should have passed the End semester examination in all the courses of all the eight semesters (six semesters in the case of lateral entry) within five years (four years in the case of lateral entry). One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of five years (four years in the case of lateral entry) for award of First class.
- Should have secured a CGPA of not less than 6.50.

16.3 SECOND CLASS

All other candidates (not covered in clauses 16.1 and 16.2) who qualify for the award of the degree (vide Clause 15) shall be declared to have passed the examination in **Second Class**.

16.4 A candidate who is absent in semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17 and 18)

16.5 Photocopy / Revaluation

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

16.6 Review

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

- 17.1 A candidate, may for valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.
- 17.2 Such withdrawal shall be permitted **only once during the entire period** of study of the degree programme.
- 17.3 Withdrawal application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.
- 17.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.
- 17.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.
- 17.5 Withdrawal from the End Semester Examination is **NOT** applicable to arrears subjects of previous semesters.
- 17.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.
- 17.7 Withdrawal shall not be permitted in the final semester examinations.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

- 18.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Director, Student Affairs in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme.
- 18.2 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 18.3 The authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 16.1).
- 18.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

18.5 If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 18.1)

19. INDUSTRIAL VISIT

Every student is required to undergo one Industrial visit for every theory course offered, starting from the third semester of the Programme. Every teacher shall take the students at least for one industrial visit in a semester.

20. PERSONALITY AND CHARACTER DEVELOPMENT

All students shall enroll, on admission, in any one of the personality and character development programmes (the NCC / NSS / NSO / YRC) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

National Cadet Corps (NCC) will have about 20 parades.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

National Sports Organization (NSO) will have sports, Games, Drills and Physical exercises.

Youth Red Cross (YRC) will have activities related to social services in and around college / institutions.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year.

21. DISCIPLINE

21.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.

21.2 If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

22. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2013

B.E. MECHATRONICS ENGINEERING

I – VIII SEMESTERS CURRICULUM AND SYLLABUS

HS6151

TECHNICAL ENGLISH – I

L T P C

3 1 0 4

OBJECTIVES:

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I

9+3

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

9+3

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

9+3

Listening - Listening to specific task - focused audio tracks; Speaking - Role- play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV

9+3

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of

essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Learners should be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C

3 1 0 4

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUENCES AND SERIES

9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.

PH6151

ENGINEERING PHYSICS – I

L T P C

3 0 0 3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS**9**

Elasticity- Hooke's law - Relationship between three moduli of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders

Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III QUANTUM PHYSICS**9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS**9**

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS**9**

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO₂, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL: 45 PERIODS**OUTCOMES:**

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:

1. Arumugam M. Engineering Physics. Anuradha publishers, 2010
2. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
3. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I POLYMER CHEMISTRY**9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T_g, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II CHEMICAL THERMODYNAMICS**9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY**9**

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

UNIT IV PHASE RULE AND ALLOYS**9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

UNIT V NANO CHEMISTRY**9**

Basics - distinction between molecules, nanoparticles and bulk materials; size -dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

TOTAL :45 PERIODS**OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES:

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

GE6151**COMPUTER PROGRAMMING****L T P C
3 0 0 3****OBJECTIVES:****The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION**8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS**10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS**9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS**9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications.

TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

GE6152

ENGINEERING GRAPHICS

L T P C

2 0 3 4

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING

5+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

5+9

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **5+9**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **5+9**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **6+9**
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

COMPUTER AIDED DRAFTING (Demonstration Only) **3**
Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

REFERENCES:

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE6161

COMPUTER PRACTICES LABORATORY

**L T P C
0 0 3 2**

OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)**I CIVIL ENGINEERING PRACTICE 9 Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE**13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

Basic Machining:

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

Sheet Metal Work:

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

Machine assembly practice:

- (a) Study of centrifugal pump
- (b) Study of air conditioner

Demonstration on:

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE** **10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
 2. Fluorescent lamp wiring.
 3. Stair case wiring
 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

 5. Measurement of energy using single phase energy meter.
 6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE** **13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
 2. Study of logic gates AND, OR, EOR and NOT.
 3. Generation of Clock Signal.
 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
 5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapooan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas PUBLISHING House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

- | | |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench) | 15 Nos. |
| 3. Standard woodworking tools | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |
| 5. Power Tools: (a) Rotary Hammer | 2 Nos |
| (b) Demolition Hammer | 2 Nos |
| (c) Circular Saw | 2 Nos |
| (d) Planer | 2 Nos |
| (e) Hand Drilling Machine | 2 Nos |
| (f) Jigsaw | 2 Nos |

MECHANICAL

- | | |
|---|-----------|
| 1. Arc welding transformer with cables and holders | 5 Nos. |
| 2. Welding booth with exhaust facility | 5 Nos. |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets. |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. | 2 Nos. |
| 5. Centre lathe | 2 Nos. |
| 6. Hearth furnace, anvil and smithy tools | 2 Sets. |
| 7. Moulding table, foundry tools | 2 Sets. |
| 8. Power Tool: Angle Grinder | 2 Nos |
| 9. Study-purpose items: centrifugal pump, air-conditioner | One each. |

ELECTRICAL

- | | |
|---|---------|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Electrical measuring instruments | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each |
| 4. Megger (250V/500V) | 1 No. |
| 5. Power Tools: (a) Range Finder | 2 Nos |
| (b) Digital Live-wire detector | 2 Nos |

ELECTRONICS

- | | |
|---|---------|
| 1. Soldering guns | 10 Nos. |
| 2. Assorted electronic components for making circuits | 50 Nos. |
| 3. Small PCBs | 10 Nos. |
| 4. Multimeters | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply | |

GE6163

PHYSICS AND CHEMISTRY LABORATORY – I

L T P C

0 0 2 1

PHYSICS LABORATORY – I

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS

(Any FIVE Experiments)

- (a) Determination of Wavelength, and particle size using Laser
(b) Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of Young's modulus by Non uniform bending method
- Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

OUTCOMES:

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS

(Any FIVE Experiments)

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method.
- 3 Determination of strength of given hydrochloric acid using pH meter.
- 4 Determination of strength of acids in a mixture using conductivity meter.
- 5 Estimation of iron content of the water sample using spectrophotometer.
(1,10- phenanthroline / thiocyanate method).
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 7 Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Iodine flask	-	30 Nos
2. pH meter	-	5 Nos
3. Conductivity meter	-	5 Nos
4. Spectrophotometer	-	5 Nos
5. Ostwald Viscometer	-	10 Nos

Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)

OBJECTIVES:

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I**9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II**9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III**9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV**9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, - asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on

Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V

9+3

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

Websites

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

End Semester Examination: 80%

MA6251

MATHEMATICS – II

L T P C

3 1 0 4

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS

9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM 9+3

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz , $1/z$, z^2 , e^z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 9+3

Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics” Volume II, Second Edition, PEARSON Publishing, 2011.

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

TOTAL: 45 PERIODS**OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

- Arumugam M., Materials Science. Anuradha publishers, 2010
- Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

REFERENCES:

- Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
- Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
- Mani P. Engineering Physics II. Dhanam Publications, 2011
- Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER TECHNOLOGY**9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION**9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III ENERGY SOURCES**9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion-solar cells- wind energy. Batteries and fuel cells:Types of batteries - alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H₂ -O₂ fuel cell- applications.

UNIT IV ENGINEERING MATERIALS**9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION**9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS

OUTCOMES:

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

1. Vairam S, Kalyani P and SubaRamesh., "Engineering Chemistry"., Wiley India PvtLtd., New Delhi., 2011
2. DaraS.S, UmareS.S. "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

REFERENCES:

- 1 Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
- 4 Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

GE6252**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING****L T P C****4 0 0 4****OBJECTIVES:**

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS**12**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS**12**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS**12**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS**12**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING**12**

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS**OUTCOMES:**

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

1. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, 2003.

GE6253**ENGINEERING MECHANICS****L T P C****3 1 0 4****OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I BASICS AND STATICS OF PARTICLES**12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES**12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS**12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES**12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS**OUTCOMES:**

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY**L T P C****0 1 2 2****OBJECTIVES:**

- To develop skill to use software to create 2D and 3D models.

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.

8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

GE6262

PHYSICS AND CHEMISTRY LABORATORY – II

L T P C

0 0 2 1

PHYSICS LABORATORY – II

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS

(Any FIVE Experiments)

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS

(Any FIVE Experiments)

- 1 Determination of alkalinity in water sample
- 2 Determination of total, temporary & permanent hardness of water by EDTA method
- 3 Estimation of copper content of the given solution by EDTA method
- 4 Estimation of iron content of the given solution using potentiometer
- 5 Estimation of sodium present in water using flame photometer
- 6 Corrosion experiment – weight loss method
- 7 Conductometric precipitation titration using BaCl_2 and Na_2SO_4
- 8 Determination of CaO in Cement.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
 2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
 3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
 4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- | | | |
|-----------------------|---|-------|
| 1. Potentiometer | - | 5 Nos |
| 2. Flame photo meter | - | 5 Nos |
| 3. Weighing Balance | - | 5 Nos |
| 4. Conductivity meter | - | 5 Nos |

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS**9 + 3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES**9 + 3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**9 + 3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS**9 + 3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS**9 + 3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL (L:45+T:15): 60 PERIODS**OUTCOMES:**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay. T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES:

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, NewDelhi, 2008.

3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

CE6306

STRENGTH OF MATERIALS

L T P C

3 1 0 4

OBJECTIVES:

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION

9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS

9

Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS

9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lamé’s theorem.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.

CE6451**FLUID MECHANICS AND MACHINERY****L T P C****3 0 0 3****OBJECTIVES:**

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 8

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT V TURBINES 10

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: 45 PERIODS**OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

REFERENCES:

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

EC6302**DIGITAL ELECTRONICS****L T P C****3 0 0 3****OBJECTIVES:**

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES 9 **Minimization Techniques:** Boolean postulates and laws – De-Morgan’s Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don’t care conditions – Quine - Mc Cluskey method of minimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

UNIT II COMBINATIONAL CIRCUITS**9**

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS**9**

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps- Circuit implementation - Modulo–n counter, Registers – shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

UNIT IV MEMORY DEVICES**9**

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

UNIT V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS**9**

Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG.

TOTAL: 45 PERIODS**OUTCOMES:****Students will be able to:**

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Write simple HDL codes for the circuits.

TEXT BOOK:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003.

EE6358**ELECTRICAL MACHINES AND DRIVES****L T P C****3 0 0 3****OBJECTIVES:**

- The students will learn basic principle ,A.C , D.C Circuits, Transformers, Characteristics , starting methods, of D.C. and A.C. motors ,induction motor. and controlling the speed of D.C. and A.C. motors using solid state devices.

UNIT I ELECTRICAL CIRCUITS AND TRANSFORMERS**6**

D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchhoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, – power factor – complex power – basic operation of transformers – simple problems.

UNIT II	ELECTRICAL MOTORS	12
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.		
UNIT III	SPEED CONTROL AND STRATING	9
Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.		
UNIT IV	ELECTRICAL DRIVES	9
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.		
UNIT V	SOLID STATE DRIVES(QUALITATIVE TREATMENT ONLY)	9
Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.		
		TOTAL: 45 PERIODS

OUTCOMES:

- Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

TEXT BOOKS:

1. Vukosavic, "Digital Control of Electrical Drives", Springer, Indian Reprint, 2010.
2. Vedam Subramaniam. "Electric Drives", Tata McGraw Hill , New Delhi , 2007.
3. De. N.K., & Sen. P.K "Electric Drives", Prentice Hall India Pvt Limited 2002.

REFERENCES:

1. Crowder, "Electric Drives and Electromechanical Systems", Elsevier, Indian Reprint, 2009
2. Metha. V.K. & Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co .2006.
3. Dubey.G.K. "Fundamental Electrical Drives" 2nd Edition, Narosa Publications, 2002
4. Bhattacharya S.K. & Brinjinder Singh , "Control of Electrical Machines", New Age International Publishers, 2002.

ME6401

KINEMATICS OF MACHINERY

L T P C

3 0 0 3

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system/ machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I **BASICS OF MECHANISMS**

9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler’s criterion – Grashof’s Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle –

Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involute and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
5. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
6. Rao.J.S. and Dukupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.
9. Khurmi, R.S., "Theory of Machines", 14th Edition, S Chand Publications, 2005
10. Sadhu Sigh : Theory of Machines, "Kinematics of Machine", Third Edition, Pearson Education, 2012

OBJECTIVES:

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

OBJECTIVES:

- To expose the students the operation of electric drives to gain hands on experience.

LIST OF EXPERIMENTS

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne's test.

4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three – phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors.
9. Performance characteristics of Stepper motor.
10. Performance characteristics of single phase transformer.

TOTAL: 45 PERIODS

OUTCOMES

- Ability to perform load test on D.C. shunt motor
- Ability to perform speed control test
- Ability to do characteristics of different electrical motors

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	NAME OF THE EQUIPMENT	Qty
1	Shunt motor 5HP	3
2	Single phase Induction Motor 2HP	2
3	Three phase induction Motor 5HP	2
4	Single phase transformer 2KVA	1
5	Three phase auto transformer	2
6	Single phase auto transformer	2
7	3 point starter	3
8	DPST, TPST Each	2
9	DC source 300v, 100A	1
10	Ammeter(0-5A),(0-10A)MC Each	2
11	Ammeter(0-5A),(0-10A)MI Each	2
12	Voltmeter(0-300V) MC	3
13	Voltmeter(0-150V),(0-300V),(0-600V)MI Each	2
14	Wattmeter 150/300V, 5/10A UPF	2
15	Wattmeter 300/600V,5/10A UPF	2
16	Wattmeter 150/300V,5/10A LPF	2
17	Wattmeter 300/600V,5/10A LPF	2
18	Stepper motor 5Kg	1
19	Synchronous motor 5KW	1
20	Rheostat 360 ohm/1.2A	3
21	Tachometer	5
22	Rheostat 50 ohm/5A	3

MT6311

COMPUTER AIDED MACHINE DRAWING

L T P C

0 0 3 2

OBJECTIVES

3. To introduce the students the Indian standard code of practice for engineering drawing and general symbols and abbreviation used on the drawing.
4. To provide hands on experience to develop 2D and 3D models of engineering components.
5. To provide knowledge to use Drawing/Modeling software.

UNIT I **9**
Indian standard code of practice for engineering drawing – general principles of Presentation. Conventional representations of threaded parts, springs, gear and Common features. Abbreviations and symbols for use on technical drawings. Conventions for sectioning and dimensioning.

UNIT II **9**
Tolerances – types – representation of tolerances on drawing, fits – types – selection of Fits – allowance. Geometric tolerances – form and positional tolerances – datum, datum Features. Maximum material principle – symbols and methods of indicating it on drawing Surface finish symbols – welding symbols and methods of indicating it on drawing.

UNIT III DRAFTING WORK USING MINI DRAFTER **9**
Preparation of part and assembly drawings of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper, stuffing box, piston & connecting rod universal joint)

UNIT IV **9**
Introduction to the use of any drafting software – creation of simple geometric bodies using primitives (line, arc, circle etc.,) and editing for the drawing, Dimensioning and text writing, concept of layer creation and setting, line types.

UNIT V **9**
Preparation of 2-D drawings using CAD software for components and assemblies of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper. Introduction to 3-D modeling solid and frame modeling.

TOTAL: 45 PERIODS

OUTCOMES

- Ability to develop engineering drawing for the industrial component using Indian Standard code of practice.
- Ability to develop 2D and 3D models of the component using manual/software.

TEXT BOOKS:

1. Sadhu Singh & P.L. Sah, "Fundamentals of Machine Dynamics", Prentice Hall of India 2003
2. Rao. P.N., "CAD/CAM Principles and Applications", Tata McGraw – Hill 2003.

REFERENCE:

1. Venugopal. K., "Engineering Graphics AutoCAD", John Wiley & Sons, 2002

MA6452 **STATISTICS AND NUMERICAL METHODS** **L T P C**
3 1 0 4

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

UNIT I **TESTING OF HYPOTHESIS** **9+3**

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t, χ^2 and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS**9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**9+3**

Newton Raphson method – Gauss elimination method – pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**9+3**

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Milne's predictor corrector methods for solving first order equations – Finite difference methods for solving second order equations.

TOTAL (L:45+T:15): 60 PERIODS**OUTCOMES:**

- It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS

1. Johnson. R.A., and Gupta. C.B., "Miller and Freund's "Probability and Statistics for Engineers", 11th Edition, Pearson Education, Asia, 2011.
2. Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.

REFERENCES

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
3. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 5th Edition, Tata McGraw Hill, New Delhi, 2007.
4. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.

ME6505**DYNAMICS OF MACHINES****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I	FORCE ANALYSIS	9
Dynamic force analysis – Inertia force and Inertia torque– D Alembert’s principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses- Dynamics of Cam-follower mechanism.		
UNIT II	BALANCING	9
Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V- engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.		
UNIT III	SINGLE DEGREE FREE VIBRATION	9
Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.		
UNIT IV	FORCED VIBRATION	9
Response of one degree freedom systems to periodic forcing – Harmonic disturbances –Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.		
UNIT V	MECHANISM FOR CONTROL	9
Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.		

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem

TEXT BOOK:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms” ,3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, “Theory of Machines”, 3rd Edition, Tata McGraw-Hill, 2009

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2005
3. Benson H. Tongue, "Principles of Vibrations", Oxford University Press, 2nd Edition, 2007
4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Allen S. Hall Jr., “Kinematics and Linkage Design”, Prentice Hall, 1961
6. Ghosh. A and Mallick, A.K., “Theory of Mechanisms and Machines”, Affiliated East-West Pvt. Ltd., New Delhi, 1988.
7. Rao.J.S. and Dukkupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
8. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
9. Grover. G.T., “Mechanical Vibrations”, Nem Chand and Bros., 1996
10. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, “Theory of Vibration with Application”, 5th edition, Pearson Education, 2011
11. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
12. Khurmi, R.S.,”Theory of Machines”, 14th Edition, S Chand Publications, 2005.

OBJECTIVES:

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems
- To introduce the state variable analysis method

UNIT I CONTROL SYSTEM MODELING**9**

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

UNIT II TIME RESPONSE ANALYSIS**9**

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

UNIT III FREQUENCY RESPONSE ANALYSIS**9**

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

UNIT IV STABILITY ANALYSIS**9**

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB

UNIT V STATE VARIABLE ANALYSIS**9**

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sampler & Hold – Open loop & Closed loop sampled data systems.

TOTAL: 45 PERIODS**OUTCOMES:****Upon completion of the course, students will be able to:**

- Perform time domain and frequency domain analysis of control systems required for stability analysis.
- Design the compensation technique that can be used to stabilize control systems.

TEXTBOOK:

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

REFERENCES:

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.
3. Schaum's Outline Series, "Feed back and Control Systems" Tata Mc Graw-Hill, 2007.
4. John J.D'Azzo & Constantine H.Houpis, "Linear Control System Analysis and Design", Tata Mc Graw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

OBJECTIVES:

- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

UNIT I CASTING**8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO₂ moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING**8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

UNIT III MACHINING**13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

UNIT IV FORMING AND SHAPING OF PLASTICS**7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

UNIT V METAL FORMING AND POWDER METALLURGY**9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

TOTAL: 45 PERIODS**OUTCOMES:**

- The Students can able to use different manufacturing process and use this in industry for component production

TEXT BOOKS:

- Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
- Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

REFERENCES:

1. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4th Edition, Pearson Education, Inc. 2007.
2. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16th Edition, 2001.
3. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Adithan. M and A.B. Gupta, "Manufacturing Technology", New Age, 2006.

ME6504

METROLOGY AND MEASUREMENTS

L T P C

3 0 0 3

OBJETCTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I .BASICS OF METROLOGY

5

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS

10

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY

12

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT

10

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE

8

Force, torque, power - mechanical , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components

TEXT BOOKS:

1. Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.

REFERENCES:

1. Shot bolt, "Metrology for Engineers", McGraw Hill, 1990.
2. Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2006.

MT6401**MICROPROCESSORS AND APPLICATIONS****L T P C****3 0 0 3****OBJECTIVES:**

- Most of the Mechatronics systems control is based on Microprocessor or Microcontroller. The students will be exposed to the knowledge of Microprocessor , Microcontrollers and design of mechatronics using them.systems.

UNIT I INTRODUCTION**10**

Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes – instruction machine cycles with states and timing diagram.- 8085 assembly language programming- Examples.

UNIT II INTERFACING TECHNIQUES**9**

Need for Interfacing - Memory Interfacing, address space partitioning – address map – Address decoding – Designing decoders circuit. I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts. DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 system – serial data transfer.

UNIT III INTERFACING DEVICES**9**

Programmable peripheral device (8255) – programmable interval timer (8353) – Programmable communication interface (8251) (USART) – Programmable interrupt controller – Programmable DMA Controller (8257)- Programmable Keyboard/display controllers.(8279)

UNIT IV DESIGN USING PERIPHERAL DEVICES**9**

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 with 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 - Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

UNIT V MICROPROCESSOR APPLICATIONS**8**

Temperature monitoring system – Automotive applications – Closed loop process control – Stepper motor control.

TOTAL: 45 PERIODS**OUTCOMES:**

- At the end of the course the students will be able to design microprocessor based systems.

TEXT BOOKS:

1. Rafiquzzaman, "Microprocessors and Microcomputer-Based System Design" 2nd Edition, Taylor & Francis, Indian Reprint, 2009
2. Ramesh Gonakar, "Microprocessor Architecture. Programming and Applications with the 8085" 5th edition – Penram International Publishing (India) Private Limited. 2005.

REFERENCES:

1. Aditya P Mathur , "Introduction to Microprocessor" 3rd Edition, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2003.
2. Douglas V. Hall. "Microprocessors and Interfacing, Programming and Hardware" Tata McGraw – Hill Publishing Company Ltd., New Delhi, 1997.

MT6411**MICROPROCESSOR LABORATORY****L T P C****0 0 3 2****OBJECTIVES:**

- To expose the students to microprocessor and trvia them to perform simple programming
- To provide knowledge on interfacing

LIST OF EXPERIMENTS.**I PROGRAMMING****30**

1. Addition of two 8 – bit numbers, sum of 8 – bits and 16 bits.
2. Decimal addition of two 8 – bit numbers Sum: 16 bits.
3. 8 - bit subtraction.
4. 8 – bit decimal subtraction.
5. Additional of two 16 – bit numbers, Sum: 16 bits or more.
6. Multibyte subtraction.
7. To arrange a series of numbers in Ascending order.
8. To arrange a series of numbers in Descending order.
9. 8 – bit Multiplication.
10. 8 – bit Division.
11. Decimal to hexadecimal conversion and hexadecimal to decimal number conversion.

II. INTERFACING**15**

1. Analog to digital conversion.
2. Digital to analog conversion.
3. Steeper motor controller.
4. Temperature controller.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to use the microprocessor to perform simple programmes like addition, subtraction, multiplication, division etc.,
- Ability to use the microprocessor for interfacing for conversion of signals.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	8085 Microprocessor trainer kits	15
2	ADC interface card	3
3	DAC interface card	3
4	Stepper motor interfacing card with stepper motor	3
5	Temperature controller with sensors(thermocouple)	3

OBJECTIVES:

- Demonstration and study of the VARIOUS machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

LIST OF EXPERIMENTS**UNIT I LATHE PRACTICE**

- Plain Turning
 - Taper Turning
 - Thread Cutting
- Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

- Drilling
- Tapping
- Reaming.

UNIT III MILLING

- Surface Milling.
- Gear Cutting.
- Contour Milling.

UNIT IV PLANNING AND SHAPING

- Cutting Key Ways.
- Dove tail machining.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	. Lathe -	15 Nos.
2	Drilling Machine -	1 No
3	Milling Machine -	2 Nos.
4	Planning Machine -	1 No
5	Shaping Machine -	2 Nos.

OBJECTIVES:

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS

1. a) Study of gear parameters.
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.
b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.-Undamped and Damped Natural frequencies.
b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
c) Determination of transmissibility ratio using vibrating table.

TOTAL : 45 PERIODS

OUTCOME

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.
8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever b) Free-Free beam c) Simply supported beam.	1 No.

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
(Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS**10**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS**8**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines – crankshafts - Rigid and flexible couplings

UNIT III TEMPORARY AND PERMANENT JOINTS**9**

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS**9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS**9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS**OUTCOMES:**

- Upon completion of this course, the students can able to successfully design engine components

TEXT BOOKS:

1. Bhandari V, “Design of Machine Elements”, 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Sundararajamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4th Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010

4. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw-Hill Book Co., 2006.
5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Prentice Hall, 2003.

EE6503

POWER ELECTRONICS

L T P C

3 0 0 3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES

9

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II PHASE-CONTROLLED CONVERTERS

9

2-pulse, 3-pulse and 6-pulse converters – performance parameters – Effect of source inductance – Gate Circuit Schemes for Phase Control – Dual converters.

UNIT III DC TO DC CONVERTER

9

Step-down and step-up chopper-control strategy – Forced commutated chopper – Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck-boost converter, Introduction to Resonant Converters.

UNIT IV INVERTERS

9

Single phase and three phase voltage source inverters (both 120^o mode and 180^o mode) – Voltage & harmonic control – PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation – Current source inverter.

UNIT V AC TO AC CONVERTERS

9

Single phase and Three phase AC voltage controllers – Control strategy- Power Factor Control – Multistage sequence control - single phase and three phase cyclo converters – Introduction to Matrix converters.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S. Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.

3. L. Umanand, " Power Electronics Essentials and Applications", Wiley, 2010.

REFERENCES:

1. Joseph Vithayathil, ' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins, ' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3rd Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

MT6501

SENSORS AND SIGNAL PROCESSING

L T P C

3 0 0 3

OBJECTIVES:

- Students will be exposed to basics of sensors and the methods of processing their signals.

UNIT I SCIENCE OF MEASUREMENT

9

Units and Standards – Calibration techniques –Errors in Measurements – Generalized Measurement System – Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Response of transducers to different time varying inputs – Classification of transducers

UNIT II MECHANICAL MEASUREMENTS

9

Temperature: Filled thermometer – Bimetallic thermometer – monometers – elastic transducers – bourdon gauge – bellows – diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge, flow measurement: orifice, venturi, nozzle, pilot tube, turbine flow meter, hot wire anemometer.'

UNIT III ELECTRICAL MEASUREMENTS

9

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

UNIT IV SMART SENSORS

9

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

UNIT V SIGNAL CONDITIONING AND DATA ACQUISITION

9

Amplification – Filtering – Sample and Hold circuits –Data Acquisition: Single channel and multi channel data acquisition – Data logging.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to use Sensors, various electrical and mechanical instruments in industries.

TEXT BOOKS:

1. Doebelin. E. O., "Measurement Systems – Applications and Design", Tata McGraw Hill, 1992
2. Patranabis. D, "Sensors and Transducers", 2nd Edition PHI, New Delhi, 2003.

REFERENCES:

1. Ian Sinclair .R "Sensors and transducers", Newnes ,Elaiver Indian print 2011.
2. Beckwith, Marangoni and Lienhard, "Mechanical Measurements", Addison Wesley, 2000..
3. Venkatesan. S.P, "Mechanical Measurements", Ane Books Pvt Ltd, India 2008.

GE6351**ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C
3 0 0 3****OBJECTIVES:**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION**10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; - Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NO_x, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

10

Forest resources: Use and over-exploitation, deforestation, case studies - timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd Edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. Trivedi R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

OBJECTIVES:

Upon completion of this subject, student will be able to:

- Understand evolution and principle of CNC machine tools
- Describe constructional features of CNC machine tools
- Explain drives and positional transducers used in CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe tooling and work holding devices for CNC machine tools

UNIT I INTRODUCTION TO CNC MACHINE TOOLS 6

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection

UNIT II STRUCTURE OF CNC MACHINE TOOL 10

CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.

UNIT III DRIVES AND CONTROLS 9

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer.

UNIT IV CNC PROGRAMMING 11

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

UNIT V TOOLING AND WORK HOLDING DEVICES 9

Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification- PMK, NSH, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course the student and can to provide knowledge on principle, constructional features, programming, tooling and workholding devices in CNC machine tools

TEXT BOOKS:

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Warren S.Seamers, "Computer Numeric Control", Fourth Edition – Thomson Delmar, 2002.

REFERENCES:

1. James Madison, "CNC Machining Hand Book", Industrial Press Inc., 1996.
2. Ken Evans, John Polywka & Stanley Gabrel, "Programming of CNC Machines", Second Edition – Industrial Press Inc, New York, 2002
3. Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000

4. Berry Leathan – Jones, “Introduction to Computer Numerical Control”, Pitman, London, 1987.
5. Radhakrishnan P “Computer Numerical Control Machines”, New Central Book Agency, 2002.
6. Rao P.N., "CAD/CAM", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.

MT6502 THERMODYNAMICS PRINCIPLES AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES:

- The laws of thermodynamics are introduced. Types of I.C engines ,air conditioning and refrigeration techniques and heat transfer methods are introduced.

UNIT I FIRST LAW OF THERMODYNAMICS 8

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities CV and CP – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 8

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem

UNIT III INTERNAL COMBUSTION ENGINES 12

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 8

Principles of refrigeration, refrigerator& heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 9

Heat transfer through conduction and convection, Fourier’s law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to apply the thermodynamics laws in the design of I.C engines , air conditioning and refrigeration equipments.

TEXT BOOK:

1. Nag P. K, ‘Engineering Thermodynamics’ Tata McGraw-Hill, 2005.

REFERENCES:

1. Michael A. Boles, Yunus A. Cengel, YunusCengel, "Thermodynamics", 2nd Edition, Mc Graw-Hill India, 2006.
2. Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, 2000.
3. Kothandaraman. C.P., "Heat and Mass Transfer", New Age International (P) Publishers, 2002.
4. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2000.

MT6511**POWER ELECTRONICS LABORATORY****L T P C****0 0 3 2****OBJECTIVES:**

- To introduce the students different power electronics components and use of them in electronic circuits.
- To study characteristic of different power electronics components.

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	Study of three phase AC regulator module	1
8	Speed control of DC shunt motor using three phase fully controlled converter module	1
9	SCR single phase cyclo converter module	1
10	SCR series and parallel inverters module	1
11	IGBT chopper module	1
12	IGBT based PWM inverter (single phase) module	1

13	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	15
14	Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter	16
15	CRO ,Transformer 1KVA, 1:1, 230V	Each 3

MT6512

SENSORS AND SIGNAL PROCESSING LABORATORY

L T P C

0 0 3 2

OBJECTIVES:

- To provide knowledge sensors and signal processing
- To provide hand experience to measure different signal using sensor and processing them in required form.

LIST OF EXPERIMENTS

1. Measurement of temperature using thermocouple, thermistor and RTD
2. Measurement of displacement using POT, LVDT & Capacitive transducer
3. Torque measurement using torque measuring devices
4. Strain Measurement using strain gauge
5. Servomotor position control using photo electric pickup
6. Wave Shaping circuit
7. Analog to Digital Converters
8. Digital Comparator
9. Voltage to frequency converter
10. Frequency to Voltage Converter
11. Position and velocity measurement using encoders
12. Study on the application of data acquisition system for industrial purposes.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use the sensors for the measurement of different signals and use of signal processing techniques to convert them to useful signal.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Cathode Ray Oscilloscope	5
2	Function Generator	5
3	Regulated power supply	7
4	Displacement Measurement Trainer using LVDT	1
5	Capacitive pickup trainer module	1
6	Position and Velocity measurement using encoder kit	1
7	Servomotor Position control kit	1
8	Speed measurement and closed loop control of DC	1
9	Motor using photo electric pickup kit	1
10	RTD module	1
11	Thermistor module	1
12	Thermocouple module	1
13	Absolute encoder	1
14	Potentiometer trainer pickup	1
15	Strain gauge module	1
16	Load cell module	1

MT6513

CNC LABORATORY

L T P C

0 0 3 2

OBJECTIVES:

- To train the students in manual and computer assisted part programming, tool path generation and control, operation and control of CNC machines tools.

LIST OF EXPERIMENTS

1. Manual part programming using G and M codes for Turning, step turning, Taper turning, thread cutting and radius turning on cylindrical components.
2. Programming and Simulation of machining using the following features.
 - (i) Linear and Circular interpolation
 - (ii) Pocket milling, slotting, peck drilling and other fixed canned cycles.
3. Given a component drawing to write the manual part programming and execute on CNC Lathe and Milling Machine.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to write manual part programming using G code and M code for simple components
- Ability to operate CNC controlled machine tools

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. CNC Lathe with Fanuc control
2. CNC Milling Machine with Fanuc control
3. Master CAM software
4. Computer nodes

MG6851

PRINCIPLES OF MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING

9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING

9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING **9**
Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING **9**
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have some basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, , 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999

MT6601 **MICROCONTROLLER AND PLC** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the basic features, programming methods and applications of Micro controllers
.The design of systems using PLC is introduced in detail.

UNIT I INTRODUCTION TO MICROCONTROLLER **9**
8051 Architecture:– Memory map - Addressing modes, I/O Ports –Counters and Timers – Serial data - I/O – Interrupts –Instruction set,, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions , Assembly Language Programming tools.

UNIT II MICROCONTROLLER PROGRAMMING **9**
8051 Assembly Language Programming- Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques

UNIT III MICROCONTROLLER APPLICATIONS **8**
Interfacing of Keyboards – Interfacing of Display Devices – Pulse measurement – Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Serial Data Communication – Network Configuration.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 9

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules , CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays,

UNIT V APPLICATIONS OF PROGRAMMABLE LOGIC CONTROLLERS. 9

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will learn the theory, programming and application of microcontroller And design of systems using Programmable Logic Controllers

TEXT BOOKS:

1. Muhammad Ali Mazdi ,J.G.Mazdi & R.D.McKinlay “The 8051 Microcontroller& Embedded systems Using assembly & C “ 2nd Edition Pearson Education , Inc ,2006
2. Udayasankara.v & Mallikarjunaswamy .M.S ,’8051 Microcontroller, Hardware, Software & Applications ,Tata McGraw Hill Education Pvt Limited. New Delhi ,2009.
3. Gary Dunning , ‘Introduction to Programmable Logic Controllers” Thomson Learning, 2001.

REFERENCES:

1. Singh. B.P., "Microprocessors and Microcontrollers", Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.
2. Parr, "Programmable Controllers: An Engineers Guide", 3rd Edition, Elsevier, Indian Reprint, 2013
3. Valdes-Perez, Microcontrollers: Fundamentals and Applications with PIC, Taylor & Francis, Indian Reprint, 2013.
4. Bolton , "Programmable Logic Controllers” 5th Edition Newnes, ,2009

MT6602

APPLIED HYDRAULICS AND PNEUMATICS

L T P C

3 0 0 3

OBJECTIVES:

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems

UNIT II SYSTEM MODELLING **9**
Introduction-model categories-fields of application-model development-model verification-model validation-model simulation-design of mixed systems-electro mechanics design-model transformation-domain-independent description forms-simulator coupling.

UNIT III REAL TIME INTERFACING **9**
Introduction-selection of interfacing standards Elements of Data Acquisition & control Systems- Over view of I/O process, General purpose I/O card and its installation, Data conversion process, Application Software- Lab view Environment and its applications, Vim-Sim Environment & its applications -Man machine interface.

UNIT IV CASE STUDIES ON MECHATRONIC SYSTEM **9**
Introduction –Fuzzy based Washing machine – pH control system – Autofocus Camera, exposure control– Motion control using D.C.Motor& Solenoids – Engine management systems.– Controlling temperature of a hot/cold reservoir using PID- Control of pick and place robot – Part identification and tracking using RFID – Online surface measurement using image processing

UNIT V MICRO MECHATRONIC SYSTEM **9**
Introduction- System principle - Component design – System design – Scaling laws – Micro actuation – Micro robot – Micro pump – Applications of micro mechatronic components.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to design systems in mechatronics approach using modern software packages.

TEXT BOOKS:

1. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition ,Cengage Learning 2011.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL's, John wiley and sons Ltd, 2003

REFERENCES:

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013

MT6604 OBJECT ORIENTED PROGRAMMING IN C++ **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the C++ programming and its use in object oriented environment.

UNIT I OOP PARADIGM : **9**
Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Reusability – Security – Object oriented programming fundamental – Abstraction – Encapsulation – Derivation – Object oriented languages and packages–Applications of OOP – A simple C++ program – More C++ statements – Structure of C++ Program.

UNIT II INTRODUCTION TO C++: 10

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators– Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading.

UNIT III CLASSES AND OBJECTS : 9

Specifying a class – Defining member functions – Private member functions –Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments –Friendly functions – Returning objects. Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors– Destructors.

UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM 10

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions.

UNIT V CASE STUDIES 7

Over view of typical object oriented systems – Case studies- Applications

TOTAL:45 PERIODS

OUTCOMES:

- The students will be able to develop C++ programs for object oriented systems and test the systems

TEXT BOOK:

1. Balagurusamy. E., "Object Oriented Programing with C++", Tata McGraw Hill,1997.

REFERENCES:

1. Herbert Schildt,"C++ The Complete Reference", Tata Mc Graw Hill Edition, 2003
2. Bjanne Stroustrup, "The C++ Programming Language",3rd Edition, Addison Wesley, 2000
3. Stanley, B.Lippman,JoveLagrie,"C++Primer",3rd Edition, Addison Wesley,1998
4. Baarkakati. N., 'Object Oriented Programming in C++', Prentice Hall of India, 1997.

**MT6611 MICRO CONTROLLER AND PLC LABORATORY L T P C
0 0 3 2**

OBJECTIVES:

- To introduce and train the students to use microcontroller and PLC for actuation, control of speed.

LIST OF EXPERIMENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.

6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to use microcontroller and PLC to control different motor/equipment.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Regulated power supply	7
2	Pulse generator	1
3	Function generator	5
4	Cathode ray oscilloscope	5
5	8051 MicroController Kit	5
6	stepper Motor	2
7	stepper motor interfacing board	2
8	PLC trainer kit and related software	2
9	Hydraulic cylinder	1
10	Pneumatic cylinder	1
11	LED/LCD interface units	1
12	SCR/Triac/Power MOSFET interface unit	1

MT6612

OBJECT ORIENTED PROGRAMMING LABORATORY

L T P C

0 0 3 2

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

LIST OF EXPERIMENTS:

C++:

1. program using functions
 - functions with default arguments
 - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
 - classes with primitive data members,
 - classes with arrays as data members
 - classes with pointers as data members
 - classes with constant data members
 - classes with static member functions
3. compile time polymorphism

- operator overloading
 - function overloading
4. run time polymorphism
- inheritance
 - virtual functions
 - virtual base classes
 - templates
5. file handling
- sequential access
 - random access

TOTAL :45 PERIODS

OUTCOMES

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Standalone desktops with C++ complier (or) Server with C++ compiler supporting 30 terminals or more.	30 Nos.

MT6613

APPLIED HYDRAULICS AND PNEUMATIC LABORATORY

L T P C

0 0 3 2

OBJECTIVES:

- To introduce and provide hand on experience to students to design and test hydraulic circuit to control press, flow etc.,
- To provide hands on experience to design and test the pneumatic circuit to perform basic operations
- To introduce the MAT Lan/ LABVIEW software to simulate hydraulic, pneumatic and electrical circuit.

LIST OF EXPERIMENTS

1. Design and testing of hydraulic circuits such as

- i) Pressure control
- ii) Flow control
- iii) Direction control
- iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits such as

- i. Pressure control
- ii. Flow control
- iii. Direction control
- iv. Circuits with logic controls

- v. Circuits with timers
- vi. Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using

MATLAB/LABVIEW software.

- 6. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.
- TOTAL : 45 PERIODS**

OUTCOMES:

- Ability to design and test hydraulic, pneumatic circuits
- Use of MATLAB/LABVIEW software for simulation of hydraulic, pneumatic and electrical circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	NAME OF THE EQUIPMENT	Qty
Hydraulic equipment		
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	2
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
11	PLC	1
Pneumatics equipment		
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push buttons	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder, manually actuated DCV	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV, DCV with sensors/ magnetic reed switches	1
5	PLC with Interface card	1
6	LABVIEW Software	1
7	Automation studio software	1

MT6701

MEDICAL MECHATRONICS

L T P C

3 0 0 3

OBJECTIVES:

- The students will be exposed to sensors and actuators used in biomedical system design

UNIT I INTRODUCTION

9

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION 9

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY 9

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply. Oscillagrophic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIT IV MEDICAL SUPPORT 10

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC- defibrillator patient safety - electrical shock hazards. Centralized patient monitoring system.

UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION 8

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

TOTAL :45 PERIODS

OUTCOMES:

- The students will be able to design , use and maintain various medical equipments

TEXT BOOKS:

1. Siamak Najarian “ Mechatronics in Medicine – A Bio medical engg approach” , McGraw – Hill Education , 2011
2. Cromwell, Weibell and Pfeiffer, “Biomedical Instrumentation and Measurements”, 2nd Edition, Printice Hall of india , 1999
3. Arumugam M., “Bio Medical Instrumentation”, Anuradha agencies Pub., 2002

REFERENCES:

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TMH, 1989.
2. Geddes L.A., and Baker, L.E., “Principles of Applied Bio-medical Instrumentation”, 3rd Edition, John Wiley and Sons, 1995.
3. Tompkins W.J., “Biomedical Digital Signal Processing”, Prentice Hall of India, 1998

MT6702

MODELLING AND SIMULATION

L T P C

3 0 0 3

OBJECTIVES:

- To provide an exposure on how to simulate a system or a process or an activity for detailed analysis, optimization and decision making which is essential to reduce the product design and development cost and time.

UNIT I SYSTEM AND SYSTEM ENVIRONMENT 9

Component of a System – Continuous and discrete systems– Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queues – inventory system.

UNIT IV MACHINE VISION FUNDAMENTALS 9
 Machine vision: image acquisition, digital images-sampling and quantization-levels of computation
 Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary
 morphology - grey morphology

UNIT V ROBOT PROGRAMMING 8
 Robot programming: Robot Languages- Classification of robot language-Computer control and robot
 software-Val system and Languages- application of robots.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited, 2008

REFERENCES:

1. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Sixth edition, Tata McGraw-Hill Publication, 2003.
2. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, 1987.
3. John.J.Craig, "Introduction to Robotics: Mechanics & control", Second edition, 2002.
4. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, Indian Reprint, 2010

ME6602 AUTOMOBILE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES 9
 Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9
 Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9
 Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES 9
Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Standard Publishers, Seventh Edition, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:

1. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers, 1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle, "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA, 1978.
4. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
5. Ganesan V. "Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill, 2007.

MT6711 COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING LABORATORY

**L T P C
0 0 3 2**

OBJECTIVES:

- To provide an overview of how computers are being used in design

LIST OF EXPERIMENTS:

1. Modelling of a part using Pro-E / CATIA / UNIGRAPHICS.
2. Modelling of a component using Pro-E / CATIA / UNIGRAPHICS.
3. Modelling and assembling of the mechanical assembly using Pro-E / CATIA / UNIGRAPHICS.
4. Structural analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
5. Beam deflection analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
6. Thermal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
7. Vibration or modal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
8. Modelling and tool path simulation using Master CAM (MILL) or any CAM package.
9. Modelling and tool path simulation using Master CAM (Lathe) or any CAM package.
10. NC code generation for milling using Master CAM (MILL) or any CAM package.
11. NC code generation for turning using Master CAM (Lathe) or any CAM package.

TOTAL : 45 PERIODS

EQUIPMENTS FOR A BATCH OF 30 STUDENTS

NOTE - Any solid modelling or suitable software packages can be used for exercise.

OUTCOMES:

- The students can able to apply the students can able to apply mathematical knowledge in modeling and assembly of parts

MT6712

ROBOTICS LABORATORY

L T P C

0 0 3 2

OBJECTIVES:

- To introduce different types of robotics and demonstrate them to identify different parts and components.
- To write programming for simple operations like pick and place, rotation etc.,

LIST OF EXPERIMENTS:

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

TOTAL: 45 PERIODS

OUTCOMES:

- Use of Adam's software and MAT Lab software to model the different types of robots and calculate work volume for different robots.

EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Adam's software and Mat lab software packages are to be used to carry out the listed experiments

MT6713

DESIGN AND FABRICATION PROJECT

L T P C

0 0 4 2

OBJECTIVES:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based

on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 60 PERIODS

OUTCOMES:

- Use of design principles and develop conceptual and engineering design of any components.
- Ability to fabricate any components using different manufacturing tools.

MT6801

AUTOMOTIVE ELECTRONICS

L T P C

3 0 0 3

OBJECTIVES:

- Students will be exposed to application of electronics in automotives systems

UNIT I INTRODUCTION

8

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II IGNITION AND INJECTION. SYSTEMS

10

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III SENSOR AND ACTUATORS

7

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS

10

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS

10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to use advanced sensors and actuators in the upgradation of automobiles.

TEXT BOOKS:

1. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint, 2013

REFERENCES:

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.

2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
3. Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 2000.
4. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.

MT6811

PROJECT WORK

L T P C

0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

MT6001

ADVANCED MANUFACTURING TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I SHEET METAL WORKING OF METALS

8

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming electro hydraulic forming-electromagnetic forming

UNIT II NON TRADITIONAL MACHINING

9

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)- Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications and limitations.

UNIT III SURFACE FINISHING AND SURFACE HARDENING PROCESS 10

Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating(PVD, CVD).

UNIT IV EDM AND ECM 10

Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate- applications-EDWC - process principles – equipments - applications.Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate - accuracy and surface finish obtained. Electro Chemical grinding (ECG) – Chemical machining-electro chemical grinding equipment-application-electro chemical deburring-honingapplications

UNIT V JIGS AND FIXTURES 8

Jigs-Locating and Clamping devices-principles-elements-mechanical-pneumatic and hydraulicactuation-types of Jigs-general consideration in Jig design-jig bushing, types- methods of construction. Fixtures-types of fixtures- fixture for machine tools –lathe, milling, boring, broaching, grinding-assembly inspection of welding fixture design.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use different manufacturing process and use this in industry for component production

TEXTBOOKS:

1. Rao P.N., "Manufacturing Technology, Metal cutting and Machine Tools", Tata McGraw Hill, 2000.
2. Sharma .P.C., "A text book of Production Technology- vol I &II ", S.Chand & Company Ltd, New Delhi, 1996.

REFERENCES:

1. HajraChoudhary.S.K. and Hajra Choudhary.A.K, "workshop Technology", Vol-I &Vol-II", Media Publishers 1986.
2. Donaldson. C. "Tool design", Tata McGraw Hill Co. Ltd.,1985.
3. H.M.T Bangalore "Production Technology" Tata McGraw Hill, 2001

GE6757

TOTAL QUALITY MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES :

- The principles and techniques used in TQM and various quality control systems are introduced.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II	TQM PRINCIPLES	9
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal- Continuous process improvement - PDSA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.		
UNIT III	TQM TOOLS AND TECHNIQUES I	9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.		
UNIT IV	TQM TOOLS AND TECHNIQUES II	9
Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.		
UNIT V	QUALITY SYSTEMS	9
Need for ISO 9000 - ISO 9000-2000 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM Implementation in manufacturing and service sectors including IT.		

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to implement various quality control procedures in manufacturing and service sectors including IT.

TEXT BOOK:

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

IT6502	DIGITAL SIGNAL PROCESSING	L T P C
		3 1 0 4

OBJECTIVES:

- To introduce discrete Fourier transform and its applications.
- To teach the design of infinite and finite impulse response filters for filtering undesired signals.
- To introduce signal processing concepts in systems having more than one sampling frequency.

UNIT I	SIGNALS AND SYSTEMS	9
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Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution – Correlation.

UNIT II	FREQUENCY TRANSFORMATIONS	9
Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms - Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.		
UNIT III	IIR FILTER DESIGN	9
Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.		
UNIT IV	FIR FILTER DESIGN	9
Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques		
UNIT V	FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS	9
Binary fixed point and floating point number representations – Comparison - Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.		
		TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to:

- Perform frequency transforms for the signals.
- Design IIR and FIR filters.
- Finite word length effects in digital filters

TEXT BOOK:

1. John G. Proakis and Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education, Prentice Hall, 2007.

REFERENCES:

1. Emmanuel C.Ifeachor, and Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson Education, Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Third Edition, Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw Hill, 2006.

IE6011	PRODUCT DESIGN AND DEVELOPMENT	L T P C
		3 0 0 3

OBJECTIVES:

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I	INTRODUCTION	5
Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.		

UNIT I	DEFECTS AND FAILURE ANALYSIS	9
Maintenance Concept, Maintenance objective, Challenges in maintenance. Defect generation - Types of failures - Defect reporting and recording - Defect analysis -Failure analysis -Equipment down time analysis - Breakdown analysis - FTA - FMEA - FMECA.		
UNIT II	MAINTENANCE SYSTEMS	9
Planned and unplanned maintenance - Breakdown maintenance - corrective maintenance- Opportunistic maintenance - Routine maintenance - Preventive maintenance – Predictive Maintenance - Condition based maintenance system - Design out maintenance – Maintenance by objectives – Selection of maintenance system		
UNIT III	SYSTEMATIC MAINTENANCE	9
Codification and Cataloguing - instruction manual and operating manual - Maintenance manual and departmental manual - Maintenance time standard - Maintenance work order and work permit - job monitoring – Feedback and control – Maintenance records and documentation. Introduction to Total Productive Maintenance (TPM).		
UNIT IV	COMPUTER MANAGED MAINTENANCE SYSTEM	9
Selection and scope of computerization – Equipment classification – Codification of breakdown,material and facilities - Job sequencing - Material management module – Captive engineering module. Decision making in maintenance.Economic aspects of maintenance.		
UNIT V	CONDITION MONITORING	9
Condition monitoring techniques – Visual monitoring – Temperature monitoring – Vibration monitoring – Lubricant monitoring – Cracks monitoring – Thickness monitoring - Noise and sound monitoring – Condition monitoring of hydraulic system. Machine diagnostics – Objectives - Monitoring strategies – Examples of monitoring and diagnostics - Control structures for machine diagnosis.		
		TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to analyze the defects and rectify the faults. Also they will be able to monitor and maintain the equipment..

TEXTBOOK:

1. Sushil Kumar Srivastava, “Industrial Maintenance Management”, S.Chand & Company Ltd, New Delhi, 1998.

REFERENCES:

1. Manfred, H. "Bibring, Handbook of Machine Tools", Vol.3, John Wiley & Sons
2. Mishra R.C., Pathak K. "Maintenance Engineering and Management", Prentice Hall of India Private Ltd., New Delhi, 2002

MG6072	MARKETING MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES:

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I	MARKETING PROCESS	9
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.		
UNIT II	BUYING BEHAVIOUR AND MARKET SEGMENTATION	9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.		
UNIT III	PRODUCT PRICING AND MARKETING RESEARCH	9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.		
UNIT IV	MARKETING PLANNING AND STRATEGY FORMULATION	9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.		
UNIT V	ADVERTISING, SALES PROMOTION AND DISTRIBUTION	9
Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.		

TOTAL: 45 PERIODS

OUTCOMES :

- The learning skills of Marketing will enhance the knowledge about Marketer's Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

TEXTBOOKS:

1. Philip Kotler & Keller, "Marketing Management", 14th edition, Prentice Hall of India, 2012.
2. Chandrasekar. K.S., "Marketing Management Text and Cases", 1st Edition, Tata McGraw Hill – Vijaynicole, 2010.

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to Marketing Theory and Practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, "Introduction to marketing concepts", Elsevier, Indian Reprint, 2007.

MT6003	ENGINEERING ECONOMICS AND COST ANALYSIS	L T P C
		3 0 0 3

OBJECTIVES:

- Basics of economic analysis and cost analysis are introduced. Method adopted For capital budgeting and depreciation estimation are introduced.

UNIT I DEMAND AND SUPPLY ANALYSIS 9

Nature and scope of engineering economics – definition and scope of study- importance of economic analysis in business. Demand and supply analysis – demand determinants- Law of demand – elasticity of demand – demand forecasting. Law of supply – elasticity of supply – market price

UNIT II COST ANALYSIS 9

Types of cost - Fixed cost, variable cost, marginal cost. Cost output relationship in short and long run. Pricing decisions – situations demanding pricing decisions, pricing techniques in practice – full cost pricing, marginal cost pricing, going rate pricing, bid pricing, price fixing for a rate of return. Statutory requirements.

UNIT III MONEY AND BANKING 9

Value of money – inflation – deflation, banking- commercial bank and its functions, central bank and its functions. New economic environment – globalization, liberalization and privatization.

UNIT IV CAPITAL BUDGETING 9

Need for capital budgeting – method of appraising project profitability – rate of return method, payback period method, present value comparisons method, cost benefit analysis. Preparation of feasibility report, appraisal process, economic and commercial feasibility, financial feasibility, technical feasibility.

UNIT V DEPRECIATION AND COST ANALYSIS 9

Causes of depreciation, objectives, methods of computing depreciation, simple problems. Breakeven analysis, breakeven point – assumptions, breakeven chart, uses of breakeven analysis, simple problems. Financial statements – cash flow statement, profit and loss account, balance sheet and evaluation of projected financial statements.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to carryout cost analysis for capital subjecting based on depreciation, money available , supply of material and demand of products.in their management profession.

TEXTBOOK:

1. James L Riggs, David D. Bedworth, "Engineering Economics", Tata McGraw Hill, 1998

REFERENCES:

1. Varshney R Lnd Maheswari K L, "Managerial Economics", S.Chand& Co, 1993
2. Samuelson P A and Nordhaus W D, "Economics", Tata McGraw Hill, 2001
3. Prasanna Chandra, "Projects", Tata McGraw Hill, 2003
4. Patel Bhavesh . M, "Project Management, Strategic Financial Planning Evaluation and Control", Vikas Publishing House, New Delhi, 2000

**MT6004 INDUSTRIAL ELECTRONICS AND APPLICATIONS L T P C
3 0 0 3**

OBJECTIVES:

- Students will be exposed to electronics devices and their controls used in industrial environment

UNIT I INTRODUCTION 9

Industrial control classification- motion and process control- feed forward control-interfacing devices- Operational Amplifier-review of thyristor- SCR- TRIAC-Phototransistor

UNIT II CONVERTERS AND INVERTERS 9
Analysis of controlled and fully controlled converters-Dual converters-Analysis of voltage source and current source- current source and series converters

UNIT III INDUSTRIAL MOTOR CONTROL 9
Method of controlling speed- Basic control circuit-DC motor control- AC motor control- Servo motor control- Stepper motor control- micro controller based speed control – solid state motor control-PLL control of a DC motor control

UNIT IV RELAYS, HEATING & WELDING CONTROL 9
Introduction- principle of relays- electromechanical relay- solid state relays- Latching relays timing relays- Induction heating- dielectric heating- resistance welding.

UNIT V PROCESS AND MOTION CONTROL 9
Elements of process control- temperature control- Flow control- Level control- Methods of motion control- feedback control- Direct digital control

TOTAL :45 PERIODS

OUTCOMES:

- The students will be able to design various electronic industrial controllers

TEXT BOOK:

1. Chitode .J.S “ Industrial Electronics “ Technical Publications ,2009

REFERENCES:

1. Terry Baltelt, "Industrial electronics, devices, systems and applications", Delmar publishers, 1997
2. Stephan L.Herman, Walter N.Alerich, "Industrial Motor Control", fourth edition, Delmar publishers, 1998
3. Biswanath Paul, "Industrial Electronics and Control" Prentice Hall India publisher-2004.
4. P.Harrott- "Process Control"- Tata McGraw Hill-1991

ME6501

COMPUTER AIDED DESIGN

L T P C

3 0 0 3

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9
Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II GEOMETRIC MODELING 9
Representation of curves- Hermite curve- Bezier curve- B-spline curves -rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM 9
Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

UNIT IV ASSEMBLY OF PARTS**9**

Assembly modelling – interferences of positions and orientation – tolerance analysis-massproperty calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS**9**

Standards for computer graphics- **Graphical Kernel System (GKS)** - standards for exchangeimages- **Open Graphics Library (OpenGL)** - Data exchange standards - IGES, STEP, CALSetc. - communication standards.

TOTAL : 45 PERIODS**OUTCOMES:**

- Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles”, "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker “Computer Graphics”:. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.

IT6005**DIGITAL IMAGE PROCESSING****L T P C
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

UNIT I DIGITAL IMAGE FUNDAMENTALS**8**

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

UNIT II IMAGE ENHANCEMENT 10 Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform

– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT III IMAGE RESTORATION AND SEGMENTATION 9 Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Morphological processing- erosion and dilation.

UNIT IV WAVELETS AND IMAGE COMPRESSION**9**

Wavelets – Subband coding - Multiresolution expansions - **Compression:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

UNIT V IMAGE REPRESENTATION AND RECOGNITION**9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon successful completion of this course, students will be able to:

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

TEXT BOOK

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
5. <http://eeweb.poly.edu/~onur/lectures/lectures.html>.
6. <http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html>

EE6007**MICRO ELECTRO MECHANICAL SYSTEMS****L T P C****3 0 0 3****OBJECTIVES:**

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION**9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I**9**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

UNIT III SENSORS AND ACTUATORS-II**9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING**9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS**9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Boca Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

OBJECTIVES:

- Generating a good understanding of RP history, its development and applications.. To expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

UNIT I INTRODUCTION**8**

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS**10**

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS**10**

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS**10**

Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING and NEW TECHNOLOGIES**7**

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TOTAL: 45 PERIODS**OUTCOMES:**

- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields

TEXT BOOKS:

1. Rafiq I. Noorani, "Rapid Prototyping – Principles and Applications", Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific, 2003.

REFERENCES:

1. Hopkinson N., R.J.M, Hauge, P M, Dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006
2. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototyping", Wiley, 2006
3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, "Fundamentals of Stereolithography", McGraw Hill 1993.
4. D.t.Pham and S.S. Dimov, "Rapid Manufacturing", Springer Verlag 2001.

MT6005

VIRTUAL INSTRUMENTATION

L T P C

3 0 0 3

OBJECTIVES:

- The principle and applications of virtual instruments are introduced in mechatronics systems.

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data -flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES 9

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISITION BASICS 9

AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation.

UNIT IV COMMON INSTRUMENT INTERFACES 9

Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office &.Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS 9

Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to use virtual instruments to design various mechatronics systems

TEXT BOOK:

1. Gupta ,” Virtual Instrumentation Using Lab view” 2nd Edition, Tata McGraw-Hill Education, 2010

REFERENCES:

- 1 Gary Jonson, "Labview Graphical Programming", Second Edition, McGraw Hill, New York, 1997
2. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 1998.
3. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition & Process Control", Second Edition, Instrument Society of America, 1994.

ME6015

OPERATIONS RESEARCH

L T P C

3 0 0 3

OBJECTIVES:

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I	LINEAR MODELS	15
The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.		
UNIT II	TRANSPORTATION MODELS AND NETWORK MODELS	8
Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.		
UNIT III	INVENTORY MODELS	6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.		
UNIT IV	QUEUEING MODELS	6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.		
UNIT V	DECISION MODELS	10
Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.		
		TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Taha H.A., “Operations Research”, Prentice Hall of India, Sixth Edition, 2003,

REFERENCES:

1. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Hillier and Libeberman, “Operations Research”, Holden Day, 1986
5. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
6. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson – Asia 2002.

MG6071	ENTREPRENEURSHIP DEVELOPMENT	L T P C
		3 0 0 3

OBJECTIVES :

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I	ENTREPRENEURSHIP	9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.		

UNIT II MOTIVATION 9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

TEXTBOOKS :

1. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, “ Entrepreneurship – Theory, Process and Practice”, 9th edition, Cengage Learning, 2014.

REFERENCES :

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, Entrepreneurship theory at cross roads: paradigms and praxis” Dream tech, 2nd edition 2005.
3. Rajeev Roy, ‘Entrepreneurship’ 2nd edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

**GE6075 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3**

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS**9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES**8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS**OUTCOME :**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

OBJECTIVES:

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham- Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

TOTAL : 45 PERIODS**OUTCOMES:**

- At the end of the course the students will be able to practice Project Management principles while developing a software.

TEXTBOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management", Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki "Effective Software Project Management", Wiley Publication, 2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley , 1998.
3. Gopaldaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), Fourteenth Reprint 2013.

OBJECTIVES:

- To expose the students to the fundamentals of Database Management Systems.
- To make the students understand the relational model.
- To familiarize the students with ER diagrams.
- To expose the students to SQL.
- To make the students to understand the fundamentals of Transaction Processing and Query Processing.
- To familiarize the students with the different types of databases.
- To make the students understand the Security Issues in Databases.

UNIT I INTRODUCTION TO DBMS**10**

File Systems Organization - Sequential, Pointer, Indexed, Direct - Purpose of Database System- Database System Terminologies-Database characteristics- Data models – Types of data models – Components of DBMS- Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization – Functional Dependencies, Anomaly- 1NF to 5NF- Domain Key Normal Form – Denormalization

UNIT II SQL & QUERY OPTIMIZATION**8**

SQL Standards - Data types - Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static Vs Dynamic SQL - QUERY OPTIMIZATION: Query Processing and Optimization - Heuristics and Cost Estimates in Query Optimization.

UNIT III TRANSACTION PROCESSING AND CONCURRENCY CONTROL**8**

Introduction-Properties of Transaction- Serializability- Concurrency Control – Locking Mechanisms- Two Phase Commit Protocol-Dead lock.

UNIT IV TRENDS IN DATABASE TECHNOLOGY**10**

Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing - Introduction to Distributed Databases- Client server technology- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Data Warehouse-Mining- Data marts.

UNIT V ADVANCED TOPICS**9**

DATABASE SECURITY: Data Classification-Threats and risks – Database access Control – Types of Privileges –Cryptography- Statistical Databases.- Distributed Databases-Architecture-Transaction Processing-Data Warehousing and Mining-Classification -Association rules-Clustering-Information Retrieval- Relevance ranking-Crawling and Indexing the Web- Object Oriented Databases-XML Databases.

TOTAL: 45 PERIODS**OUTCOMES:**

At the end of the course, the student should be able to:

- Design Databases for applications.
- Use the Relational model, ER diagrams.
- Apply concurrency control and recovery mechanisms for practical problems.
- Design the Query Processor and Transaction Processor.
- Apply security concepts to databases.

TEXT BOOK:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2008.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata Mc Graw Hill, 2011.
2. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4. Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing House Private Limited, New Delhi, 2003.
5. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata Mc Graw Hill, 2010.
6. G.K.Gupta, "Database Management Systems", Tata Mc Graw Hill, 2011.
7. Rob Cornell, "Database Systems Design and Implementation", Cengage Learning, 2011.

CS6551**COMPUTER NETWORKS****L T P C****3 0 0 3****OBJECTIVES:****The student should be made to:**

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

UNIT I FUNDAMENTALS & LINK LAYER**9**

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

UNIT II MEDIA ACCESS & INTERNETWORKING**9**

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)

UNIT III ROUTING**9**

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT IV TRANSPORT LAYER**9**

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V APPLICATION LAYER**9**

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

TEXT BOOK:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
4. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

ANNA UNIVERSITY, CHENNAI
UG (B.E. / B. Tech.) REGULATIONS 2008
CREDIT SYSTEM
AFFILIATED COLLEGES

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

The following Regulations are applicable to all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai.

1. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- I) **“Programme”** means Degree Programme, that is B.E./B.Tech. Degree Programme.
- II) **“Discipline”** means specialization or branch of B.E./B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.
- III) **“Course”** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.
- IV) **“Director, Academic Courses”** means the authority of the University who is responsible for all academic activities of the University Departments for implementation of relevant rules of this Regulations.
- V) **“Head of the Institution”** means the Principal of the Campus.
- VI) **“Chairperson”** means the Head of the Faculty.
- VII) **“Head of the Department”** means head of the Department concerned.
- VIII) **“Controller of Examinations”** means the authority of the University who is responsible for all activities of the University Examinations.
- IX) **“University”** means ANNA UNIVERSITY, CHENNAI.

2. ADMISSION

- 2.1 Candidates seeking admission to the first semester of the eight semester B.E. / B.Tech. Degree Programme:

Should have passed the Higher Secondary Examinations of (10 +2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four courses of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

(OR)

Should possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamil Nadu or any other authority accepted by the Syndicate of the university as equivalent thereto.


Dr. P. MANIARASAN
Principal

Nehru Institute of Engg. & Technology
T.M.Palayam, Coimbatore - 641 105

2.2 Lateral entry admission

- (i) The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

(OR)

- (ii) The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech.

Such candidates shall undergo two additional Engineering subject(s) in the third or fifth and fourth or sixth semesters respectively as prescribed by the respective Faculty. (See [Annexure – I](#)).

3. PROGRAMMES OFFERED

A candidate may be offered a programme in any one of the branches of study approved by the University (See [Annexure - II](#)), and offered by that college where the candidate is admitted.

Programmes offered in Anna University, Chennai are mentioned in Annexure - II.

4. STRUCTURE OF PROGRAMMES

- 4.1 Every Programme will have curricula with syllabi consisting of theory and practicals such as:

- (i) General core courses comprising mathematics, basic sciences, Engineering sciences, humanities and engineering.
- (ii) Core courses of Engineering/Technology.
- (iii) Elective courses for specialization in related fields.
- (iv) Workshop Practice, Computer Practice, Engineering Graphics, Laboratory work, Industrial training, Seminar presentation, Project work, Educational tours, Camps etc.
- (v) NCC / NSS / NSO / YRC activities for character development

There shall be a certain minimum number of core courses and sufficient number of elective courses that can be opted by the student. The blend of different courses shall be so designed that the student, at the end of the programme, would have been trained not only in his / her relevant professional field but also would have developed as a socially conscious human being.

- 4.2 Each course is normally assigned certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical) and **1 credit for 2 weeks, 2 credits for 4 weeks and 3 credits for 6 weeks of industrial training during semester vacations.**
- 4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 and practical courses not exceeding 4. However, the total number of courses per semester shall not exceed 10.
- 4.4 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch.
- 4.5 **The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports except for the programmes offered as Tamil Medium courses.**

5. DURATION OF THE PROGRAMME

- 5.1 A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (four academic years) but in any case not more than 14 Semesters for HSC candidates and not more than 12 semesters for Lateral Entry Diploma / B.Sc. Candidates.
- 5.2 Each semester shall normally consist of 90 working days or 450 periods of 50 minutes each. The principal shall ensure that every teacher imparts instruction as per the number of periods / hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.
- 5.3 The Head of the Institution / Principal may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the Specified periods. But for the purpose of calculation of attendance requirement or writing the end semester examinations (as per clause 6) by the students 450 periods conducted within the specified academic schedule alone shall be taken into account and the overall percentage of attendance shall be calculated accordingly.

The University Examination will ordinarily follow immediately after the last working day of the semester commencing from I semester as per academic schedule prescribed from time to time.

- 5.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18.3) in order that he/she may be eligible for the award of the degree (vide clause 15).

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

- 6.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.
Ideally every student is expected to attend all classes and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports / personal, the student is expected to attend atleast 75% of the classes during **any semester commencing from First semester.**
- 6.1.1 **Therefore**, he/she shall **secure not less than 75%** (after rounding off to the nearest integer) of overall attendance taking into account the total number of **450 periods in a semester within 90 working days** in all courses put together attended by the candidate as against the total number of periods in all courses offered during the **semester** (vide clause 5.3)
- 6.2 However, a candidate who secures overall attendance between 65% and 74% in that current semester due to medical reasons (prolonged hospitalization / accident / specific illness / Participation in Sports events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations, Anna University, Chennai for record purposes.
- 6.3 Candidates who **secure less than 65% of overall attendance** shall not be permitted to write the University examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

7. CLASS ADVISER

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department of the students will attach a certain number of students to a teacher of the Department who shall function as Class Adviser for those students throughout their period of study. Such Class Advisers shall advise the students and monitor the courses undergone by the students, check the attendance and progress of the students attached to him/her and counsel them periodically. If necessary, the Class adviser may also discuss with or inform the parents about the progress of the students.

8. CLASS COMMITTEE

8.1. Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- **Clarifying the regulations of the degree programme and the details of rules therein particularly clause 5 and 6 which should be displayed on college Notice-Board.**
- Informing the student representatives the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

8.2 The class committee for a class under a particular branch is normally constituted by the head of the department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Principal.

8.3 The class committee shall be constituted within the first week of each semester.

8.4 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

8.5 The chairperson of the class committee may invite the Faculty adviser(s) and the Head of the department to the meeting of the class committee.

8.6 The Principal may participate in any class committee of the institution.

8.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Principal within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Management by the Head of the Institution.

- 8.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. **The Class Committee Chairman shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation.** During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department / Principal depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the course committee may also prepare a common question paper for the internal assessment test(s).

10. SYSTEM OF EXAMINATION

- 10.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) University examination at the end of the semester.
- 10.2 Each course, both theory and practical (including project work & Viva voce Examinations) shall be evaluated for a maximum of 100 marks. The project work shall be evaluated for a maximum of 100 marks.
- 10.2.1 For all theory and practical courses including project work, the continuous internal assessment will carry **20 marks** while the End Semester University examination will carry **80 marks**.

Project work may be allotted to a single student or to a group of students not exceeding 4 per group.

- 10.3 The University examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.
- 10.4 The University examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the guide of the project group and an internal examiner.
- 10.5 For the University examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the University.

11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

For all theory and practical courses the continuous assessment shall be for a maximum of 20 marks (consisting of 15 marks for tests/experiments and 5 marks for attendance). The above continuous assessment shall be awarded as per the procedure given below:

11.1.

(a) **Theory Courses**

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 15 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

(b) **Practical Courses:**

Every practical exercise / experiment shall be evaluated based on the exercise / experiment prescribed as per the syllabi and the records of work done maintained. There shall be at least one test during the semester. The criteria for arriving at the internal assessment marks (15 marks) shall be decided based on the recommendation of the class committee and shall be announced at the beginning of every semester by the Principal.

(c) **Internal Assessment for Theory Courses with Laboratory Component:**

The maximum marks for Internal Assessment shall be 15 in case of theory courses with Laboratory component.

If there is a theory course with Laboratory component, there shall be three tests: the first two tests (each 100 marks) will be from theory portions and the third test (maximum mark 100) will be for laboratory component. The sum of marks of first two tests shall be reduced to 30 marks and the third test mark shall be reduced to 30 marks. The sum of these 60 marks (Vide clause 11) may then be arrived at for 15 and rounded to the nearest integer.

11.2 **Project Work:**

The Principal shall constitute a review committee for each branch of study. There shall be three reviews (each 100 Marks) during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be **reduced for 15 marks** and rounded to the nearest integer. (This also implies equal weightage to all the three assessments), **5 marks** shall be given for Attendance (Clause 11.3).

11.2.1 The project report shall carry a maximum 30 marks (same mark shall be awarded for the report submitted to every student within the project group) while the viva-voce examination shall carry 50 marks. (Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination).

Attendance	Review I	Review II	Review III	End semester Examinations				
				Thesis Submission (30)		Viva-Voce (50)		
				Internal	External	Internal	External	Guide
5	5	5	5	15	15	16.66	16.66	16.66

11.3 Attendance

The remaining 5 marks for attendance shall be awarded as given below:

Theory and Practical courses and Project Work

76% to 80% of attendance - 1 mark
81% to 85% of attendance - 2 marks
86% to 90% of attendance - 3 marks
91% to 95% of attendance - 4 marks
96% to 100% of attendance -5 marks

- 11.3 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Principal who will keep this document in safe custody (for five years). The University or any inspection team appointed by the University may inspect the records of attendance and assessment of both current and previous semesters.

12. REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A candidate shall normally be permitted to appear for the University Examinations of any semester commencing from I semester if he/she has satisfied the semester completion requirements (subject to Clause 6) and has registered for examination in all courses of the semester. Registration is mandatory for semester examinations as well as arrear examinations, failing which the candidate will not be permitted to move to the higher semester.

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades / marks.

13. PASSING REQUIREMENTS

- 13.1 A candidate who secures not less than 50% of total marks prescribed for the courses with a minimum of 45% of the marks prescribed for the end-semester University Examination in both theory and practical courses (including Project work), shall be declared to have passed the Examination.

13.1.1 If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the subsequent semester when examination is conducted in that course; he/she should continue to register and reappear for the examinations in the failed subjects till he / she secures a pass.

13.1.2 The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass.

However, from the 3rd attempt onwards if a candidate fails to obtain pass marks (IA + End Semester Examination) as per clause 13.1 then the passing requirement shall be as follows:

The candidate should secure 50% and above the maximum marks prescribed for course in the university examinations alone irrespective of Internal Assessment marks obtained.

14. AWARD OF LETTER GRADES

14.1.1 All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter grade	Grade Points	Marks Range
S	10	91 – 100
A	9	81 – 90
B	8	71 – 80
C	7	61 – 70
D	6	57 – 60
E	5	50 – 56
U	0	< 50
I	0	
W	0	

“U” denotes **Reappearance** is required for the examination in the course. (This grade will figure both in Marks Sheet as well as in Result Sheet)

“W” denotes **withdrawal** from the course.

The Grade “I” denotes inadequate attendance (as per clause 12) and hence prevention from writing the end semester examination.

The Grade “I” and “W” will figure only in the Result Sheets.

Grade sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied
- The list of courses enrolled during the semester and the grade scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester.

$$\text{GPA} = \frac{\text{Sum of [Credits acquired x Grade points]}}{\text{Sum of Credits acquired}}$$

CGPA will be calculated in a similar manner, considering all the courses registered from first semester. “U”, “I” and “W” grades will be excluded for calculating GPA and CGPA.

$$\text{CGPA} = \frac{\sum_{i=1}^n C_i \text{GP}_i}{\sum_{i=1}^n C_i}$$

where C_i – is the Credits assigned to the course

GP_i – is the point corresponding to the grade obtained for each
Course

n – is number of all Courses successfully cleared during the
particular semester in the case of GPA and during all the
semesters in the case of CGPA

14.1.2 Whenever students, having arrear subjects, appear for the end semester examination during which there are no regular batch of students writing the same subjects, then, the letter grades for the arrears subjects shall be awarded based on the range of marks approved by the class committee immediately preceding end semester examination in which regular students wrote.

14.2 REVALUATION

A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Institution. **A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.** The Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institution. Revaluation is not permitted for practical courses, seminars, practical training and for project work.

15. ELIGIBILITY FOR THE AWARD OF THE DEGREE

15.1 A student shall be declared to be eligible for the award of the Degree if he/she has

- Successfully gained the required number of total credits as specified in the Curriculum corresponding to his/her Programme within the stipulated time.
- No disciplinary action is pending against him/her.
- Successfully completed the field visit / industrial training, if any, as prescribed in the curriculum.
- The award of the degree must be approved by the Syndicate.
- Successfully completed any additional courses prescribed by the Director, Academic Courses, whenever any candidate is readmitted under Regulations other than R – 2008 (clause 18.2.).

16. CLASSIFICATION OF THE DEGREE AWARDED

16.1 A candidate who qualifies for the award of the Degree (vide clause 15) having passed the examination in all the courses in his/her first appearance within the specified minimum number of semesters securing a **CGPA of not less than 8.50** shall be declared to have passed the examination in **First Class with Distinction**. For this purpose the withdrawal from examination (vide clause 17.4) will not be construed as an appearance. Further, the authorized break of study (vide clause 18.3) will not be counted for the purpose of classification.

16.2 A candidate who qualifies for the award of the Degree (vide clause 15) having passed the examination in all the courses within the specified minimum number of semesters plus one year (two semesters), securing a **CGPA of not less than 6.50** shall be declared to have passed the examination in **First Class**. Further, the authorized break of study (vide clause 18.3) will not be counted for the purpose of classification.

16.3 All other candidates (not covered in clauses 16.1 and 16.2) who qualify for the award of the degree (vide Clause 15) shall be declared to have passed the examination in **Second Class**.

16.4 A candidate who is absent in semester examination in a course / project work after having enrolled for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17 and 18)

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

17.1 A candidate, may for valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

17.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

17.3 Withdrawal application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.

17.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

17.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during VII semester.

17.5 Withdrawal from the End semester examination is **NOT** applicable to arrears subjects of previous semesters

17.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

18. INDUSTRIAL VISIT

Every student is required to undergo one Industrial visit for every theory course offered, starting from the third semester of the Programme. Every teacher shall take the students at least for one industrial visit in a semester.

19. PROVISION FOR AUTHORISED BREAK OF STUDY

19.1 **Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme.** However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the **Director, Student Affairs in advance**, but not later than the last date for registering for the end semester examination of the semester in question, through the Principal of the Institution stating the reasons therefore and the probable date of rejoining the programme.

19.2 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining.

19.2(i) The students rejoining in any of the semesters are required to gain the stipulated number of credits in order to become eligible for the award of degree, under NEW Regulations.

19.2(ii) If any shortage of credits is observed cumulatively till the semester in which he / she is readmitted, then the Principal / student (through the Principal) shall apply to the Director, Academic Courses for prescribed additional courses, if any, at the beginning of the readmitted semester itself, so as to compensate for the shortage of the credits.

- 19.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (vide Clause 16.1 & 16.2). However, additional break of study granted will be counted for the purpose of classification.
- 19.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18.3) in order that he/she may be eligible for the award of the degree.
- 19.5 If any student is detained for want of required attendance, the period spent in that semester shall not be considered as permitted 'Break of Study' (Clause 18.3) is not applicable for this case.

20. PERSONALITY AND CHARACTER DEVELOPMENT

All students shall enroll, on admission, in any one of the personality and character development programmes (the NCC / NSS / NSO / YRC) and undergo training for about 80 hours and attend a camp of about Seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

National Cadet Corps (NCC) will have about 20 parades.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

National Sports Organization (NSO) will have sports, Games, Drills and Physical exercises.

Youth Red Cross (YRC) will have activities related to social services in and around college / institutions.

While the training activities will normally be during week ends, the camp will normally be during vacation period.

Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Principal may permit a student to complete this requirement in the second year.

21. DISCIPLINE

Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Principal shall constitute a disciplinary committee consisting of Principal, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious in disciplinary action which leads to suspension or Dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by Anna University on getting information from the Head of Institution.

If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the university from time to time.

22. REVISION OF REGULATION AND CURRICULUM

The University may from time to time revise, amend or change the Regulations, scheme of examinations and syllabi if found necessary.

ANNEXURE- I

ADDITIONAL COURSES TO BE STUDIED BY THE B.SC. GRADUATES ADMITTED TO
III SEMESTER B.E. / B.TECH. UNDER LATERAL ENTRY SCHEME.

THE FOLLOWING TWO ADDITIONAL COURSES ARE PRESCRIBED FOR THE B.SC. GRADUATES

- a. The First course to be studied either in their III semester or V semester of study.

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	GE2111	Engineering Graphics	2	3	0	5

- b. The Second course to be studied during the IV or VI semester of their study.

The student can register for any ONE of the following courses as applicable to their Branch of study.

- i. For Non-Circuit Branches: (Any one of the Following)

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ME2151	Engineering Mechanics *	3	1	0	4
2.	GE2151	Basic Electrical & Electronics Engineering*	4	0	0	4

- ii. For Circuit Branches:

- a. For Branches under Electrical Faculty (Any one of the Following)

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EE2151	Circuit Theory * (For branches under Electrical Faculty)	3	1	0	4
2.	GE2152	Basic Civil & Mechanical Engineering *	4	0	0	4

- b. For Branches under I & C Faculty (Any one of the Following)

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EC2151	Electric Circuits and Electron Devices * (For branches under I & C Faculty)	3	1	0	4
2.	GE2152	Basic Civil & Mechanical Engineering *	4	0	0	4

Non-Circuit Branches are:

Civil Engineering, Mechanical Engineering, Aeronautical Engineering, Automobile Engineering, Marine Engineering, Production Engineering, Chemical Engineering, Biotechnology, Polymer Technology, Textile Technology, Textile Technology (Fashion Technology), Petroleum Engineering, Plastics Technology.

Circuit Branches are:

- a. **Electrical Faculty:** Electrical and Electronics Engineering, Electronics and Instrumentation Engineering and Instrumentation and Control Engineering.
- b. **Information and Communication Engineering Faculty:** Computer Science and Engineering, Electronics and Communication Engineering, Information Technology and Biomedical Engineering.

ANNEXURE – II

B.E. Degree Programmes :

B.E. Aeronautical Engineering
B.E. Automobile Engineering
B.E. Civil Engineering
B.E. Computer Science and Engineering
B.E. Electrical and Electronics Engineering
B.E. Electronics and Communication Engineering
B.E. Electronics and Instrumentation Engineering
B.E. Instrumentation and Control Engineering
B.E. Marine Engineering
B.E. Mechanical Engineering
B.E. Production Engineering
B.E. Bio Medical Engineering

B.Tech. Degree Programmes:

B.Tech. Chemical Engineering
B.Tech. Biotechnology
B.Tech. Information Technology
B.Tech. Polymer Technology
B.Tech. Textile Technology
B.Tech. Textile Technology (Fashion Technology)
B.Tech. Petroleum Engineering
B.Tech. Plastics Technology

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2008

I SEMESTER CURRICULA AND SYLLABI

(Common to all B.E. / B.Tech Programmes except B.E. Marine Engineering)

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2111	Technical English - I	3	1	0	4
2.	MA2111	Mathematics - I	3	1	0	4
3.	PH2111	Engineering Physics - I	3	0	0	3
4.	CY2111	Engineering Chemistry - I	3	0	0	3
5.	GE2111	Engineering Graphics	2	3	0	5
6.	GE2112	Fundamentals of Computing and Programming	3	0	0	3
PRACTICAL						
7.	GE2115	Computer Practice Laboratory -I	0	0	3	2
8.	GE2116	Engineering Practices Laboratory	0	0	3	2
9.		* Physics & Chemistry Laboratory I	0	0	3	-
TOTAL : 26 CREDITS						

* Laboratory classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (Including the first semester experiments also).

**AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI**

R-2008

**B.E. MECHATRONICS ENGINEERING
II - VIII SEMESTERS CURRICULA AND SYLLABI**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2161	<u>Technical English – II*</u>	3	1	0	4
2.	MA2161	<u>Mathematics – II*</u>	3	1	0	4
3.	PH2161	<u>Engineering Physics – II*</u>	3	0	0	3
4.	CY2161	<u>Engineering Chemistry – II*</u>	3	0	0	3
5. a	ME2151	<u>Engineering Mechanics</u> (For non-circuit branches)	3	1	0	4
5. b	EE2151	<u>Circuit Theory</u> (For branches under Electrical Faculty)	3	1	0	4
5. c	EC2151	<u>Electric Circuits and Electron Devices</u> (For branches under I & C Faculty)	3	1	0	4
6. a	GE2151	<u>Basic Electrical & Electronics Engineering</u> (For non-circuit branches)	4	0	0	4
6. b	GE2152	<u>Basic Civil & Mechanical Engineering</u> (For circuit branches)	4	0	0	4
PRACTICAL						
7.	GE2155	<u>Computer Practice Laboratory-II*</u>	0	1	2	2
8.	GS2165	<u>Physics & Chemistry Laboratory - II*</u>	0	0	3	2
9. a	ME2155	<u>Computer Aided Drafting and Modeling Laboratory</u> (For non-circuits branches)	0	1	2	2
9. b	EE2155	<u>Electrical Circuits Laboratory</u> (For branches under Electrical Faculty)	0	0	3	2
9. c	EC2155	<u>Circuits and Devices Laboratory</u> (For branches under I & C Faculty)	0	0	3	2
TOTAL : 28 CREDITS						
10.	-	<u>English Language Laboratory</u> ⁺	0	0	2	-

* Common to all B.E. / B.Tech. Programmes

+ Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.

A. CIRCUIT BRANCHES

I Faculty of Electrical Engineering

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I Faculty of Civil Engineering

1. B.E. Civil Engineering

II Faculty of Mechanical Engineering

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
6. B.Tech. Petroleum Engineering
7. B.Tech. Plastics Technology

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
MA 2211	<u>Transforms and Partial Differential Equation</u>	3	1	0	4
CE 3204	<u>Strength of Materials</u>	3	0	0	3
ME 2204	<u>Fluid Mechanics and Machinery</u>	3	1	0	4
EC 3204	<u>Digital Electronics</u>	3	0	0	3
EE 3205	<u>Electrical Machines and Drives</u>	3	0	0	3
ME 3203	<u>Kinematics of Machinery</u>	3	1	0	4
PRACTICALS					
CE 3218	<u>Fluid Mechanics And Machinery Laboratory</u>	0	0	3	2
MT 3208	<u>Electrical Machines And Drives Laboratory</u>	0	0	3	2
MT 3209	<u>Computer Aided Machine Drawing</u>	0	0	3	2
MT 3210	<u>Technical Seminar I</u>	0	0	3	2
TOTAL		18	3	12	29

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
MA 2264	<u>Numerical Methods</u>	3	1	0	4
ME 3212	<u>Dynamics of Machinery</u>	3	1	0	4
EC 3213	<u>Control Systems</u>	3	1	0	4
ME 3214	<u>Manufacturing Technology</u>	3	0	0	3
ME 3221	<u>Engineering Metrology</u>	3	1	0	4
EC 3216	<u>Microprocessors And Applications</u>	3	0	0	3
PRACTICALS					
EC 3217	<u>Microprocessor Laboratory</u>	0	0	3	2
ME 3218	<u>Manufacturing Technology Laboratory</u>	0	0	3	2
MT 3219	<u>Machine Dynamics Laboratory</u>	0	0	3	2
TOTAL		18	4	9	28

SEMESTER V

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
ME 3301	<u>Design of Machine Elements</u>	3	0	0	3
EC 3302	<u>Power Electronics</u>	3	0	0	3
EC 3303	<u>Sensors and Signal Processing</u>	3	0	0	3
EC 3304	<u>Modeling and Simulation</u>	3	0	0	3
ME 3310	<u>CNC Technology</u>	3	0	0	3
ME 3306	<u>Thermodynamics Principles and Applications</u>	3	0	0	3
PRACTICALS					
EC 3307	<u>Power Electronics Laboratory</u>	0	0	3	2
EC 3308	<u>Sensors and Signal Processing Laboratory</u>	0	0	3	2
ME 3309	<u>CNC Laboratory</u>	0	0	3	2
GE3318	<u>Communication Skills Laboratory</u>	0	0	4	2
TOTAL		18	0	13	26

SEMESTER VI

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
MG 3310	<u>Principles of Management</u>	3	0	0	3
ME 3311	<u>Micro controller and PLC</u>	3	0	0	3
ME 2305	<u>Applied Hydraulics and Pneumatics</u>	3	0	0	3
MT 3313	<u>Design of Mechatronics system</u>	3	0	0	3
EC 3314	<u>Object Oriented Programming</u>	3	0	0	3
	Elective – I	3	0	0	3
PRACTICALS					
MT 3315	<u>Micro controller and PLC Laboratory</u>	0	0	3	2
EC 3316	<u>Object Oriented Programming Laboratory</u>	0	0	3	2
ME 3317	<u>Applied Hydraulics and Pneumatics Laboratory</u>	0	0	3	2
MT 3318	<u>Technical Seminar II</u>	0	0	3	2
TOTAL		18	0	12	26

SEMESTER VII

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
MT 3401	<u>Medical Mechatronics</u>	3	0	0	3
MF 3402	<u>Computer Integrated Manufacturing</u>	3	0	0	3
ME 3403	<u>Robotics and Machine Vision System</u>	3	0	0	3
ME 3404	<u>Automobile Engineering</u>	3	0	0	3
	Elective – II	3	0	0	3
	Elective - III	3	0	0	3
PRACTICALS					
ME 3405	<u>Computer Aided Design And Computer Aided Manufacturing Laboratory</u>	0	0	3	2
MT 3406	<u>Robotics Laboratory</u>	0	0	3	2
MT 3407	<u>Design and Fabrication Project</u>	0	0	4	2
TOTAL		18	0	10	24

SEMESTER VIII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MT 3408	<u>Automotive Electronics</u>	3	0	0	3
	Elective - IV	3	0	0	3
	Elective – V	3	0	0	3
PRACTICAL					
MT 3409	Project Work	0	0	12	6
TOTAL		9	0	12	15

LIST OF ELECTIVES FOR MECHATRONICS ENGINEERING ELECTIVE – I

CODE NO	COURSE TITLE	L	T	P	C
MT 3002	<u>Digital Image Processing</u>	3	0	0	3
MT 3004	<u>Diagnostic Techniques</u>	3	0	0	3
ME 3006	<u>Operations Research</u>	3	1	0	4
GE 3008	<u>Professional Ethics and Human values</u>	3	0	0	3

ELECTIVE – II

CODE NO	COURSE TITLE	L	T	P	C
EC 3007	<u>Digital Signal Processing</u>	3	0	0	3
ME 3017	<u>Micro Electro Mechanical Systems</u>	3	0	0	3
ME 3018	<u>Computer Aided Design</u>	3	0	0	3
ME2035	<u>Entrepreneurship Development</u>	3	0	0	3

ELECTIVE – III

CODE NO	COURSE TITLE	L	T	P	C
EC 3014	<u>Computer Networks</u>	3	0	0	3
EC 3015	<u>Virtual Instrumentation</u>	3	0	0	3
EC 3016	<u>Industrial Electronics and Applications</u>	3	0	0	3

ELECTIVE – IV

CODE NO	COURSE TITLE	L	T	P	C
MT 3001	<u>Advanced Manufacturing Technology</u>	3	0	0	3
GE2022	<u>Total Quality Management</u>	3	0	0	3
MG2021	<u>Marketing Management</u>	3	0	0	3
ME 3009	<u>Project Engineering</u>	3	0	0	3
EC 3010	<u>Database Management System</u>	3	0	0	3

ELECTIVE – V

CODE NO.	COURSE TITLE	L	T	P	C
ME 3011	<u>Rapid Prototyping</u>	3	0	0	3
ME 3012	<u>Engineering Economics and Cost Analysis</u>	3	0	0	3
ME 3013	<u>Product Design and Development</u>	3	0	0	3

AIM:

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I**12**

General Vocabulary - changing words from one form to another - Adjectives, comparative adjectives – Adverbs - Active and passive voice – Tenses - simple present, present continuous - Adverb forms – Nouns – compound nouns - Skimming and scanning - Listening and transfer of information – bar chart, flowchart - Paragraph writing, description – Discussing as a group and making an oral report on the points discussed, conversation techniques - convincing others.

Suggested activities:

1. Matching words & meanings - Using words in context – Making sentences.
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form – bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary.
5. Role play, conversation exercises, discussions, oral reporting exercises
Any other related relevant classroom activity.

UNIT II**12**

Vocabulary – prefixes & suffixes – simple past tense - Spelling and punctuation – ‘wh’ Question forms - Scanning, inference - Listening & note-taking - Paragraph writing - comparison and contrast - Creative thinking and speaking.

Suggested Activities:

1. a. Vocabulary activities using prefixes and suffixes.
b. Exercises using questions – asking & answering questions.
2. Scanning the text for specific information
3. Listening guided note-taking - Writing paragraphs using notes, giving suitable headings and subheadings for paragraphs. Using expressions of comparison and contrast.
4. Discussion activities and exploring creative ideas.
Any other related relevant classroom activity

UNIT III**12**

Tenses - simple past, simple future and past perfect - Reading in Context -Listening & note-taking – single line – Definitions – sequencing of sentences – instruction - Persuasive speaking.

Suggested activities:

1. a. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions, instructions
(b) Identifying the discourse links and sequencing jumbled sentences / writing instructions.
4. Speaking exercises, discussions, role play exercises using explaining, convincing and persuasive strategies
Any other related relevant classroom activity

UNIT IV**12**

Modal verbs and Probability – Concord subject verb agreement – Correction of errors - Cause and effect expressions – Extended Definition - Speaking about the future plans.

Suggested activities:

1. a. Making sentences using modal verbs to express probability
b. Gap filling using relevant grammatical form of words.
2. Writing extended definitions
3. Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.
4. Any other related relevant classroom activity

UNIT V**12**

'If' conditionals – Gerunds - Intensive reading - Speaking – Presentation of problems & solutions - Itinerary – planning for an industrial visit - Formal Letter writing – Letter to the editor, invitation letter, accepting, declining letter and permission letter.

Suggested activities:

1. a) Sentence completion exercises using 'If' conditionals.
b) Gap filling exercises using gerunds and present participle forms
2. Reading comprehension exercises.
3. Role play, discussion, debating and speaking activities for stating, discussing problems and suggesting solutions.
4. Planning a tour, Writing a travel itinerary. Writing letters to officials and to the editor in formal/official contexts.
Any other related relevant classroom activity

TOTAL : 60 PERIODS**TEXT BOOK:**

1. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 1 – 4 (Resources, Energy, Computer, Transport)

REFERENCES:

1. Meenakshi Raman and Sangeeta Sharma, 'Technical Communication English skills for Engineers', Oxford University Press, 2008.
2. Andrea, J. Rutherford, 'Basic Communication Skills for Technology', Second Edition, Pearson Education, 2007.

EXTENSIVE READING:

1. A.P.J.Abdul Kalam with Arun Tiwari, 'Wings of Fire' An Autobiography, University Press (India) Pvt. Ltd.,1999, 30th Impression 2007.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2111**MATHEMATICS – I****L T P C**
3 1 0 4**UNIT I MATRICES****12**

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY**12**

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS**12**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES**12**

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS**12**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TOTAL: 60 PERIODS**TEXT BOOK:**

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PH2111**ENGINEERING PHYSICS – I****L T P C
3 0 0 3****UNIT I ULTRASONICS****9**

Introduction – Production – magnetostriction effect - magnetostriction generator- piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications - Sonograms

UNIT II LASERS**9**

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B coefficients - derivation. Types of lasers – He-Ne, CO₂, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) Qualitative Industrial Applications - Lasers in welding, heat treatment, cutting – Medical applications - Holography (construction & reconstruction).

UNIT III FIBER OPTICS & APPLICATIONS**9**

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Double crucible technique of fibre drawing - Splicing, Loss in optical fibre – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) - Light sources - Detectors - Fibre optic sensors – temperature & displacement - Endoscope.

UNIT IV QUANTUM PHYSICS**9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT V CRYSTAL PHYSICS

9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy - Crystal defects – point, line and surface defects- Burger vector.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi(2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.

REFERENCES:

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007)
2. Rajendran, V and Marikani A, 'Engineering Physics' Tata McGraw Hill Publications Ltd, III Edition, New Delhi, (2004).
3. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2007).
4. Jayakumar. S, 'Engineering Physics', R.K. Publishers, Coimbatore, (2003).
5. Chitra Shadrach and Sivakumar Vadivelu, 'Engineering Physics', Pearson Education, New Delhi, (2007).

CY2111

ENGINEERING CHEMISTRY – I

L T P C
3 0 0 3

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.
- Principles of polymer chemistry and engineering applications of polymers
- Industrial applications of surface chemistry
- Conventional and non-conventional energy sources and energy storage devices and Chemistry of engineering materials

UNIT I WATER TECHNOLOGY

9

Characteristics – alkalinity – types of alkalinity and determination – hardness – types and estimation by EDTA method (problems); Domestic water treatment – disinfection methods (Chlorination, ozonation. UV treatment) – Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination and reverse osmosis.

UNIT II POLYMERS AND COMPOSITES 9

Polymers-definition – polymerization – types – addition and condensation polymerization – free radical polymerization mechanism – Plastics, classification – preparation, properties and uses of PVC, Teflon, polycarbonate, polyurethane, nylon-6,6, PET-Rubber -vulcanization of rubber, synthetic rubbers – buty1 rubber, SBR, Composites – definition, types polymer matrix composites – FRP only.

UNIT III SURFACE CHEMISTRY 9

Adsorption – types – adsorption of gases on solids – adsorption isotherms – Freundlich and Langmuir isotherms – adsorption of solutes from solution – role of adsorbents in catalysis, ion-exchange adsorption and pollution abatement.

UNIT IV NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only) – breeder reactor – solar energy conversion – solar cells – wind energy – fuel cells – hydrogen – oxygen fuel cell – batteries – alkaline batteries – lead–acid, nickel–cadmium and lithium batteries.

UNIT V ENGINEERING MATERIALS 9

Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnesite and zirconia bricks, Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrication, liquid lubricants, - properties – viscosity index, flash and fire points, cloud and pour points, oilyness) – solid lubricants – graphite and molybdenum sulphide. Nanomaterials – introduction to nanochemistry – carbon nanotubes and their applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES:

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

AIM

To develop graphic skills in students.

OBJECTIVES

To develop in students graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

Concepts and conventions (Not for Examination)**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING**15****Curves used in engineering practices:**

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Free hand sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**14**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS**15**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES**15**

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**15**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL: 75 PERIODS

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition, (2003).

REFERENCES:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
7. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

AIM :

To provide an awareness to Computing and Programming

OBJECTIVES :

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT I INTRODUCTION TO COMPUTERS **9**

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II COMPUTER SOFTWARE **9**

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE **9**

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV INTRODUCTION TO C **9**

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V FUNCTIONS AND POINTERS **9**

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ashok.N.Kamthane, "Computer Programming", Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:

1. Pradip Dey, Manas Ghoush, "Programming in C", Oxford University Press. (2007).
2. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, "Programming in C", Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education Inc., (2005).
5. E.Balagurusamy, "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, "C for All", Anuradha Publishers, (2008).

LIST OF EXERCISES**a) Word Processing** **15**

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet **15**

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

Simple C Programming * **15**

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

TOTAL: 45 PERIODS

* For programming exercises Flow chart and pseudocode are essential

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS**Hardware**

- . LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
- . Printers – 3 Nos.

Software

- . OS – Windows / UNIX Clone
- . Application Package – Office suite
- . Compiler – C

OBJECTIVES

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)**I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:
 - Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:
 - Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE**13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

Basic Machining:

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

Sheet Metal Work:

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

Machine assembly practice:

- (a) Study of centrifugal pump
- (b) Study of air conditioner

Demonstration on:

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE 10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
 2. Fluorescent lamp wiring.
 3. Stair case wiring
 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
 5. Measurement of energy using single phase energy meter.
 6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE 13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
 2. Study of logic gates AND, OR, EOR and NOT.
 3. Generation of Clock Signal.
 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
 5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

REFERENCES:

1. K.Jeyachandran, S.Natarajan & S, Balasubramanian, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, (2007).
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, “Engineering Practices Lab Manual”, Vikas Pupliching House Pvt.Ltd, (2006)
3. H.S. Bawa, “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, (2007).
4. A.Rajendra Prasad & P.M.M.S. Sarma, “Workshop Practice”, Sree Sai Publication, (2002).
5. P.Kannaiah & K.L.Narayana, “Manual on Workshop Practice”, Scitech Publications, (1999).

SEMESTER EXAMINATION PATTERN

The Laboratory examination is to be conducted for Group A & Group B, allotting 90 minutes for each group, with a break of 15 minutes. Both the examinations are to be taken together in sequence, either in the FN session or in the AN session. The maximum marks for Group A and Group B lab examinations will be 50 each, totaling 100 for the Lab course. The candidates shall answer either I or II under Group A and either III or IV under Group B, based on lots.

Engineering Practices Laboratory

List of equipment and components

(For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
(b) Demolition Hammer 2 Nos
(c) Circular Saw 2 Nos
(d) Planer 2 Nos
(e) Hand Drilling Machine 2 Nos
(f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
(b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
4. Multimeters 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

PHYSICS LABORATORY – I

L T P C
0 0 3 -

LIST OF EXPERIMENTS

1. (a) Particle size determination using Diode Laser
(b) Determination of Laser parameters – Wavelength, and angle of divergence.
(c) Determination of acceptance angle in an optical fiber.
2. Determination of thickness of a thin wire – Air wedge method
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

CHEMISTRY LABORATORY – I

L T P C
0 0 3 -

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA
2. Estimation of Copper in brass by EDTA
3. Determination of DO in water (Winkler's method)
4. Estimation of Chloride in Water sample (Argentometric)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight and degree of polymerization using viscometry.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

AIM:

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I**12**

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading & predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:

Exercises on word formation using the prefix 'self' - Gap filling with preposition.

1. Exercises - Using sequence words.
2. Reading comprehension exercise with questions based on inference – Reading headings and predicting the content – Reading advertisements and interpretation.
4. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II**12**

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:

Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.

1. Listening comprehension exercises to categorise data in tables.
2. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III**12**

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:

Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)

1. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
2. Reading comprehension exercises with critical questions, Multiple choice question.
3. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV**12**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

Rewriting exercises using numerical adjectives.

1. Reading comprehension exercises with analytical questions on content – Evaluation of content.
2. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
3. Speaking - Role play – group discussions – Activities giving oral instructions.
4. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V**9**

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL : 60 PERIODS**TEXT BOOK**

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

EXTENSIVE READING:

1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

NOTE:

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2161**MATHEMATICS – II****L T P C**
3 1 0 4**UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : $w = z + c$, cz , $1/z$, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL : 60 PERIODS**TEXT BOOKS**

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PH2161

ENGINEERING PHYSICS – II

L T P C

3 0 0 3

UNIT I CONDUCTING MATERIALS

9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS

9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect – Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

9

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives. Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS

9

Metallic glasses: preparation, properties and applications.

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.

Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Charles Kittel 'Introduction to Solid State Physics', John Wiley & sons, 7th edition, Singapore (2007)
2. Charles P. Poole and Frank J. Owen, 'Introduction to Nanotechnology', Wiley India (2007) (for Unit V)

REFERENCES

1. Rajendran, V, and Marikani A, 'Materials science' Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications (India) Pvt. LTd., Chennai, second Edition (2007)
4. M. Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).

CY2161

ENGINEERING CHEMISTRY – II

L T P C
3 0 0 3

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY

9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode – Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^+ vs Cl^- titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL

9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III FUELS AND COMBUSTION**9**

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV PHASE RULE AND ALLOYS**9**

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V ANALYTICAL TECHNIQUES**9**

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lamé’s theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton’s law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOK

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

EE2151

CIRCUIT THEORY
(Common to EEE, EIE and ICE Branches)

L T P C
3 1 0 4

UNIT I BASIC CIRCUITS ANALYSIS 12

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS: 12

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 12

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V ANALYSING THREE PHASE CIRCUITS 12

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 60 PERIODS

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).

- Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, (2007).

REFERENCES

- Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
- Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
- Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
- Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

EC2151 ELECTRIC CIRCUITS AND ELECTRON DEVICES L T P C
 (For ECE, CSE, IT and Biomedical Engg. Branches) **3 1 0 4**

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES 12

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV TRANSISTORS 12

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES 12
(QUALITATIVE TREATMENT ONLY)

Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL : 60 PERIODS

TEXT BOOKS

- Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series, Tata McGraw

- Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, (2008).
 3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Edition, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyabranta Jit, "Electronic Devices & Circuits", Tata McGraw Hill, 2nd Edition, 2008.

GE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
 (Common to branches under Civil, Mechanical and Technology faculty) **4 0 0 4**

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 12

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL : 60 PERIODS

TEXT BOOKS

1. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.

REFERENCES

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, (2003).

GE2152

BASIC CIVIL & MECHANICAL ENGINEERING
(Common to branches under Electrical and I & C Faculty)

L T P C
4 0 0 4

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TOTAL : 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 10

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV I C ENGINES 10

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 30 PERIODS

REFERENCES

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, (2000).

GE2155	COMPUTER PRACTICE LABORATORY – II	L T P C
	<u>LIST OF EXPERIMENTS</u>	0 1 2 2

1. UNIX COMMANDS	15
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Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING	15
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Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX	15
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Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

HARDWARE

- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

SOFTWARE

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

GS2165

PHYSICS LABORATORY – II

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
 2. Determination of Band Gap of a semiconductor material.
 3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
 4. Determination of viscosity of liquid – Poiseuille's method.
 5. Spectrometer dispersive power of a prism.
 6. Determination of Young's modulus of the material – uniform bending.
 7. Torsional pendulum – Determination of rigidity modulus.
- A minimum of FIVE experiments shall be offered.
 - Laboratory classes on alternate weeks for Physics and Chemistry.
 - The lab examinations will be held only in the second semester.

GS2165

CHEMISTRY LABORATORY – II

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
 2. Conduct metric titration (Mixture of weak and strong acids)
 3. Conduct metric titration using BaCl_2 vs Na_2SO_4
 4. Potentiometric Titration (Fe^{2+} / KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$)
 5. PH titration (acid & base)
 6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
 7. Estimation of Ferric iron by spectrophotometry.
- A minimum of FIVE experiments shall be offered.
 - Laboratory classes on alternate weeks for Physics and Chemistry.
 - The lab examinations will be held only in the second semester.

ME2155 COMPUTER AIDED DRAFTING AND MODELING LABORATORY**L T P C
0 1 2 2****List of Exercises using software capable of Drafting and Modeling**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

EE2155**ELECTRICAL CIRCUIT LABORATORY**
(Common to EEE, EIE and ICE)**L T P C
0 0 3 2****LIST OF EXPERIMENTS**

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155

CIRCUITS AND DEVICES LABORATORY

L T P C
0 0 3 2

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

TOTAL : 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)

L T P C
0 0 2 -

- 1. LISTENING:** **5**
Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations
- 2. SPEAKING:** **5**
Pronouncing words & sentences correctly – word stress – Conversation practice.
- CLASSROOM SESSION** **20**
1. Speaking: Introducing oneself, Introducing others, Role play, Debate- Presentations:
Body language, gestures, postures. Group Discussions etc
 2. Goal setting – interviews – stress time management – situational reasons

Evaluation

- | | |
|---|------------|
| (1) Lab Session | – 40 marks |
| Listening | – 10 marks |
| Speaking | – 10 marks |
| Reading | – 10 marks |
| Writing | – 10 marks |
| (2) Classroom Session – 60 marks | |
| Role play activities giving real life context | – 30 marks |

Note on Evaluation

1. Examples for role play situations:
 - a. Marketing engineer convincing a customer to buy his product.
 - b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.
2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES

1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

LAB REQUIREMENTS

1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION
(Common to all branches)

L T P C
3 1 0 4

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I FOURIER SERIES**9 + 3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS**9 + 3**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS**9 + 3**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3
Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z-transform.

LECTURES: 45 TUTORIALS : 15 TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

- 1 Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).
4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

CE3204 STRENGTH OF MATERIALS L T P C
3 0 0 3

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 8
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic Constants – Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSEVERSE LOADING ON BEAMS AND STRESSES IN BEAMS 13
Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending - bending formula – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 6
Stresses and deformation in circular and hollows shafts – Stepped shafts – Shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

UNIT IV DEFLECTION OF BEAMS**10**

Double Integration method – Macaulay’s method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam and energy method – Maxwell’s reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS**9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses – deformation in thin cylinders –spherical shells subjected to internal pressure – deformations in spherical shells - Lamé’s theory – application of theories of failure

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Rajput.R.K. “Strength of Materials” S.Chand & co Ltd. New Delhi 1996
2. Jindal U.C. “Strength of Materials” Asian Books Pvt Ltd, New Delhi 2007

REFERENCES

1. Egor.P.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi 1997
2. Subramanian R. “Strength of Materials” Oxford University Press,Oxford Higher Education series ,2007
3. Hibbeler , R.C, “Mechanics of materials”, Pearson Education, Low price Edition,2007

ME2204**FLUID MECHANICS AND MACHINERY****L T P C**

(Common to Aeronautical, Mechanical, Automobile & Production)

3 1 0 4**OBJECTIVES**

- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- The applications of the conservation laws to flow through pipes and hydraulics machines are studied

UNIT I INTRODUCTION**12**

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS**12**

Laminar flow through circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equation. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow through pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS 9
Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV ROTO DYNAMIC MACHINES 16
Homologous units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES 11
Reciprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps. Classification. Working and performance curves.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

EC 3204

DIGITAL ELECTRONICS

L T P C
3 0 0 3

OBJECTIVE

To design Microprocessor / Microcontroller / PLC based Mechatronics system it is essential to have the fundamental knowledge of digital circuits and digital systems. Hence the subject Digital Electronics is offered in which they study the design of Arithmetic circuits, shift registers and counters etc.

UNIT I NUMBER SYSTEM AND BASIC LOGIC 9
Number systems – Binary, Octal, Hexadecimal, BCD, Excess 3, Complements Conversions and Arithmetic. Boolean theorems, Boolean algebra – AND, OR, NOT, NAND & NOR operation, Sum of Product and Product of Sum forms. Minimization – Karnaugh's map, Tabular Minimization Procedures.

UNIT II COMBINATIONAL CIRCUITS 9
Design of Logic gates. Design of Adder, Subtractor, Comparators, Code Converters, Encoders, Decoders, Multiplexers and Demultiplexers. Function realization using Gates & Combinational circuits.

UNIT I	CIRCUITS AND TRANSFORMERS	6
D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchoff’s laws – mesh analysis – A.C. voltage – sinusoidal waves, hasor representation – power factor – complex power – basic idea of transformers – simple problems.		
UNIT II	ELECTRICAL MOTORS	12
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.		
UNIT III	SPEED CONTROL AND STRATING	9
Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.		
UNIT IV	ELECTRICAL DRIVES	9
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.		
UNIT V	SOLID STATE DRIVES(QUALITATIVE TREATMENT ONLY)	9
Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.		

TOTAL: 45 PERIODS

TEXT BOOK

1. N.K.De.,P.K.Sen “Electric Drives”, Prentice Hall, First edition 1999.

REFERENCES

1. I.J.Nagrath, T.P. Kothari., “Basic Engineering”, McGraw – Hill Publishing company Ltd., Second edition, 2002.
2. S.K. Bhattacharya “Electrical Machines”, second edition 1999, Tata McGraw – Hill Pvt. Company Ltd., Second edition, 1999.
3. G.K. Dubey “Fundamental Electrical Drives” second edition 2002, Narosa Publications, Second edition, 2002.
4. Pillai, S.K., “ A Seish course on Electrical Drives”, Wilay Eastern Ltd., New Delhi, 1982.

OBJECTIVES

- To understand the layout of linkages in the assembly of a system/machine.
- To understand the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages in a mechanism.

UNIT I BASIC OF MECHANISMS 7

Terminology and Definitions – Degree of Freedom Mobility – Kutzbach criterion – Grashoff's law – Kinematic Inversions of 4 – bar chain and slider crank chains – Mechanical Advantage – Transmission angle – Description of common Mechanisms – Single, double and offset slider mechanisms – Quick return mechanisms Ratchets and escapements – Indexing Mechanisms – Rocking Mechanisms – Straight line generators – Design of Crank – rocker Mechanisms.

UNIT II KINEMATICS 12

Displacement, velocity and acceleration and analysis in simple mechanisms – Graphical Method velocity and acceleration polygons – Kinematic analysis by Complex Algebra Methods – Vector Approach, Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis Acceleration.

UNIT III KINEMATICS OF CAM 8

Classifications – Displacement diagrams – parabolic Simple harmonic and Cycloidal motions – Layout of plate cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams – Standard cam motion – Pressure angle and undercutting.

UNIT IV GEARS 10

Spur gear Terminology and definitions – Fundamental Law of toothed gearing and involute gearing – Inter changeable gears – gear tooth action – Terminology – Interference and undercutting – Non standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears (Basics only) – Gear trains – Parallel axis gear trains – Epicyclic gear trains – Differentials

UNIT V FRICTION 8

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives, Friction aspects in Brakes – Friction in vehicle propulsion and braking

TUTORIALS 15: TOTAL: 60 PERIODS**TEXT BOOKS**

1. Rattan S.S, "Theory of Machines", Tata McGraw – Hill Publishing Company Ltd., New Delhi, 1998.
2. Shigley J.E and Uicker J.J, "Theory of Machines and Mechanisms", McGraw – Hill, Inc. 1995.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East – West Pvt. Ltd., New Delhi, 1998.

3. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley – Eastern Ltd., New Delhi, 1992.
4. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low – Prices Student Edition, 1999.

CE3218 FLUIDS MECHANICS AND MACHINERY LABORATORY L T P C
0 0 3 2

AIM:

To perform experiments on various types of pumps and turbines to understand their characteristics.

OBJECTIVES:

- To understand the concepts flow through different cross sections.
- To understand and draw characteristics of various pumps.
- To understand and draw performance characteristics of different turbines.

UNIT I FLOW MEASUREMENT

Calibration of Flow Measuring instruments – venturimeter, orificemeter, rotometer, Calibration of flows in open channels – weirs and notches. Estimation of friction factor in flow through pipes.

UNIT II PUMPS

Determination of performance characteristics of pumps – centrifugal pumps, submersible pumps, turbine pumps and positive displacement pumps – reciprocating and gear pumps.

UNIT III TURBINES

Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

TOTAL : 45 PERIODS

REFERENCE

1. CWR, Hydraulics Laboratory Manual, 2004

MT3208 ELECTRICAL MACHINES AND DRIVES LABORATORY L T P C
0 0 3 2

OBJECTIVE

To expose the students the operation of electric drives and give them hands on experience.

LIST OF EXPERIMENTS

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne's test.

4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three – phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors.
9. Performance characteristics of Stepper motor.
10. Performance characteristics of single phase transformer.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

S.No	Equipments	Qty
1	Shunt motor 5HP	3
2	Single phase Induction Motor 2HP	2
3	Three phase induction Motor 5HP	2
4	Single phase transformer 2KVA	1
5	Three phase quto transformer	2
6	Single phase auto transformer	2
7	3 point starter	3
8	DPST, TPST	Each 2
9	DC source 300v, 100A	1
10	Ammeter(0-5A),(0-10A)MC	Each 2
11	Ammeter(0-5A),(0-10A)MI	Each 2
12	Voltmeter(0-300V) MC	3
13	Voltmeter(0-150V),(0-300V),(0-600V)MI	Each 2
14	Wattmeter 150/300V, 5/10A UPF	2
15	Wattmeter 300/600V,5/10A UPF	2
16	Wattmeter 150/300V,5/10A LPF	2
17	Wattmeter 300/600V,5/10A LPF	2
18	Stepper motor 5Kg	1
19	Synchronous motor 5KW	1
20	Rheostat 360 ohm/1.2A	3
21	Rheostat 50 ohm/5A	3
22	Tachometer	5

MT 3209

COMPUTER AIDED MACHINE DRAWING

L T P C

0 0 3 2

9

UNIT I

Indian standard code of practice for engineering drawing – general principles of Presentation. Conventional representations of threaded parts, springs, gear and Common features. Abbreviations and symbols for use on technical drawings. Conventions for sectioning and dimensioning.

UNIT II

9

Tolerances – types – representation of tolerances on drawing, fits – types – selection of Fits – allowance. Geometric tolerances – form and positional tolerances – datum, datum Features. Maximum material principle – symbols and methods of indicating it on drawing Surface finish symbols – welding symbols and methods of indicating it on drawing.

UNIT III (DRAFTING WORK USING MINI DRAFTER) 9

Preparation of part and assembly drawings of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper, stuffing box, piston & connecting rod universal join)

UNIT IV 9

Introduction to the use of any drafting software – creation of simple geometric bodies using primitives (line, arc, circle etc.,) and editing for the drawing, Dimensioning and text writing, concept of layer creation and setting, line types.

UNIT V 9

Preparation of 2-D drawings using CAD software for components and assemblies of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper. Introduction to 3-D modeling solid and frame modeling.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Sadhu Singh & P.L. Sah, Fundamentals of Machine Dynamics, Prentice Hall of India Pct Ltd, 2003.
2. P.N. Rao, CAD/CAM Principles and Applications, Tata McGraw – Hill 2003.

REFERNCES

1. K.Venugopal, Engineering Graphics AutoCAD, John Wiley& Sons, 2002.

LIST OF EQUIPMENT AND SOFTWARE REQUIRED

(for a batch of 30 students)

- | | |
|--|----|
| 1. Computer System | 30 |
| VGA Color Monitor, Pentium IV Processor, 20 GB HDD, 256 MB RAM | |
| 2. Laser Printer | 01 |
| 3. Plotter(A2 size) | 01 |
| 4. Software: AutoCAD or Mechanical Desktop or Pro/E or CATIA or IDEAS 30 Licenses or solidworks | |
| 5. Drawing Boards and Tables in Drawing Hall Nos. | 30 |

MT 3210

TECHNICAL SEMINAR I

L T P C

0 0 3 2

OBJECTIVE

During the seminar session each student is exposed to prepare and pressure a topic on engineering/technology, for a duration of about 8 to 10 minutes. In a session of three periods per weeks, 15 students are expected to present of the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

MA2264

NUMERICAL METHODS

L T P C
3 1 0 4

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

- At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:
- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
- The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
- Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

9

Solution of equation –Fixed point iteration: $x=g(x)$ method - Newton’s method – Solution of linear system by Gaussian elimination and Gauss-Jordon method– Iterative method - Gauss-Seidel method - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method and by Jacobi method for symmetric matrix.

UNIT II INTERPOLATION AND APPROXIMATION

9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton’s forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

9

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson’s 1/3 and 3/8 rules – Romberg’s method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpsons’s rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

9

Single step methods: Taylor series method – Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

L = 45 , T = 15, TOTAL: 60 PERIODS

TEXT BOOKS

1. Veerarjan, T and Ramachandran, T. 'Numerical methods with programming in 'C' Second Edition, Tata McGraw-Hill Publishing.Co.Ltd. (2007).
2. Sankara Rao K, 'Numerical Methods for Scientists and Engineers' – 3rd edition Printice Hall of India Private Ltd, New Delhi, (2007).

REFERENCES

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004

ME3212

DYNAMICS OF MACHINERY

**L T P C
3 1 0 4**

OBJECTIVES

- To understand the force-motion relationship in components subjected to External Forces.
- To understand the force-motion analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of dynamics of Undesirable Vibrations.

- To understand the principles in mechanisms used for governing of machines.

UNIT I	FORCE ANALYSIS	10
Rigid Body dynamics in general plane motion – Equations of motion- Dynamic force analysis – Inertia force and Inertia torque – D. Alemberts principle – The principle of superposition – Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses – Bearing loads – Crank shaft Torque – Turning moment diagrams – Fly wheels.		
UNIT II	BALANCING	9
Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder Engine Balancing Multi – cylinder Engines – Partial balancing in locomotive Engines – Balancing linkages.		
UNIT III	FREE VIBRATION	10
Basic features of vibratory systems – Degrees of freedom – Single degree a freedom – Free vibration – Equations of motion – natural frequency – Types of Damping – Damped vibration critical speeds of simple shaft – Torsional systems; Natural frequency of two and three rotor systems.		
UNIT IV	FORCE VIBRATION	6
Response to periodic forcing – Harmonic Forcing – Forcing caused by unbalance – Support motion – Force transmissibility and amplitude transmissibility vibration isolation.		
UNIT V	MECHANISM FOR CONTROL	10
Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling Force other governor mechanisms. Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes.		

TOTAL: 60 PERIODS

TEXT BOOK

1. Rattan S.S., “Theory of Machines”, Tata McGraw – Hill Publishing Company Ltd., New Delhi, 1994.

REFERENCES

1. Thomas Bevan, “Theory of Machines”, CBS Publishers and distributors, 1984.
2. Ghosh A. and Mallick A.K., “Theory of Mechanisms and Machines”, Affiliated East- West Press Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., “Theory of Machines and Machanisms“, McGraw – Hill, Inc., 1995.
4. Rao J.S. and Dukkupati R.V., “Mechanism of Machine Theory”, Wiley – Eastern Limited, New Delhi, 1992.
5. John Hannah and Stephens R.C., “Mechanics of Machines”, Viva low – Priced Student Edition, 1999.
6. Sadhu Singh “Theory of a Machines”, Pearson Education, 2002.

OBJECTIVE

To study the response and stability of mechanical and electrical systems so as to design for stable operation.

UNIT I BASIC CONCEPTS AND SYSTEM REPRESENTATION 12

Basic elements in control systems – Open and closed loop systems with example – Mathematical model of Translational, Rotational & Electrical systems – Transfer function – Block diagram reduction techniques – Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS 12

Introduction – Time domain specifications – Types of test inputs – I and II order system response – Steady state error – Error coefficients – Generalized error series – P, PI, PD, PID Controlled characteristics.

UNIT III FREQUENCY RESPONSE ANALYSIS AND DESIGN 12

Introduction – Frequency domain specifications – Bode plots and polar plots – Constant M and N circles and Nichols chart – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY OF CONTROL SYSTEMS 12

Characteristics equation – Location of roots in s-plane for stability – Routh Hurwitz criterion – Root locus construction – Gain margin and phase margin – Nyquist stability criterion.

UNIT V COMPENSATION DESIGN 12

Realization of basis compensation – Lag, Lead and Lag – lead networks – Compensator design using Bode plots.

MATLAB applications: Partial Fraction expansion, Transformation of a Mathematical models, Transient response analysis, Root locus, Bode diagrams, Nyquist plots, analysis of compensator design problems.

TOTAL= 60 PERIODS**REFERENCES**

1. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition, Pearson Education 2003.
2. I.J.Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
3. B.C.Kuo, "Automatic control systems", Prentice Hall of India Ltd, New Delhi 1995.
4. Dorf R.C. and Bishop R.H., "Modern Control systems", Addison – Wesley, 1995 (MATLAB reference).
5. Leonard N.E. and William Levine, "Using MATLAB to Analyze and Design Control Systems," Addison Wesley, 1995.

OBJECTIVE

For understanding the principle of Dimensional metrology and applying principles, techniques and devices used for quality control in modern Industrial environment.

UNIT I BASIC CONCEPTS AND COMPARATORS 12

Basic concept – Legal metrology – Precision – Accuracy – Types of errors – standards of measurement – traceability – interchangeability and selective assembly, gauge blocks, limit gauges – tailors principle of gauge design. Comparators: Mechanical, Electronic, optical and Pneumatic – Automatic gauging.

UNIT II ANGULAR MEASUREMENT AND SURFACE FINISH MEASUREMENT 12

Angular measurement : sine bar – Autocollimator, optical projectors: profile projectors – toolmakers microscope, measurement of surface finish: Terminology – roughness – waviness – analysis of surface finish – stylus probe instrument – Talysurf.

UNIT III SCREW THREAD AND GEAR METROLOGY 12

Screw thread metrology: errors in thread – pitch error – drunkenness – measurement of various elements thread – two and three wire method – best wire size – Thread gauges – floating carriage micrometer. Measurement of gears – Terminology – measurement of various elements of gear – tooth thickness – constant chord and base tangent method – Parkinson Gear Tester.

UNIT IV LASER METROLOGY 12

Laser Metrology: LASER interferometer – constructional features, sources of error, measurement of positional error, straightness and flatness of machine tools – LASER Alignment Telescope – LASER Micrometer – LASER Triangulation technique – in process and on line measurement.

UNIT V ADVANCES IN METROLOGY 12

Coordinate measuring machine (CMM): Constructional features – types, applications, Applications of Image Processing in measurement – computer aided inspection.

TOTAL= 60 PERIODS**REFERENCES**

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 1994.
2. Gupta I.C , "Engineering Metrology", Dhanpat rai Publications, fifth edition, 1998.
3. Connie Dotson, et al., "Fundamentals of Dimensional Metrology", Thomas Asia, Singapore, First print, 2003.
4. Doebelin E.O., "measurement system applications and design" First Edition, 1990.
5. Groover M.P., "Automation, production system and computer integrated manufacturing ", Prentice – Hall, New Delhi, 2003.

OBJECTIVE

Most of the Mechatronics systems control is based on Microprocessor or Microcontroller. So it is necessary to include this subject in the syllabus so that students will be exposed to the knowledge of Microprocessor based systems and design of these systems.

UNIT I INTRODUCTION 10

Organization of Micro Computers – Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes – instruction and machine cycles with states and timing diagram. Methods of 8085 programs and 8085 assembly language.

UNIT II INTERFACING AND I/O DEVICES 9

Need for Interfacing - /Memory Interfacing: address space partitioning – address map – Address decoding – Designing decoders circuit for the given address map – Bus connection and Z – line Control – Access Time Computations.

I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts.

DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 system – serial data transfer.

UNIT III INTERFACING DEVICES 9

Programmable peripheral device – programmable interval timer (8253) – Programmable communication interface (USART) – Programmable interrupt controller – Programmable DMA Controller (8257)- Programmable Keyboard/display controllers.

UNIT IV DESIGN USING PERIPHERAL DEVICES 9

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 using 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 - Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

UNIT V MICROPROCESSOR APPLICATIONS 8

Temperature monitoring system – Automotive applications – Closed loop process control – Stepper motor control.

TOTAL= 45 PERIODS**TEXT BOOK**

1. Introduction to Microprocessor – Third Edition – Aditya P Mathur Tata McGraw – Hill Publishing Company Ltd., New Delhi 3rd Edition 2003.

REFERENCES

1. Microprocessor Architecture. Programming and Applications with the 8085 Ramesh Goankar, fifth edition – Penram International Publishing (India) Private Limited.

2. "Microprocessors and Interfacing, Programming and Hardware" Douglas V. Hall. Tata McGraw – Hill Publishing Company Ltd., New Delhi, 1997.

EC3217

MICROPROCESSOR LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS

I. PROGRAMMING

30

1. Addition of two 8 – bit numbers, sum of 8 – bits and 16 bits.
2. Decimal addition of two 8 – bit numbers Sum: 16 bits.
3. 8 - bit subtraction.
4. 8 – bit decimal subtraction.
5. Additional of two 16 – bit numbers, Sum: 16 bits or more.
6. Multibyte subtraction.
7. To arrange a series of numbers in Ascending order.
8. To arrange a series of numbers in Descending order.
9. 8 – bit Multiplication.
10. 8 – bit Division.
11. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion.

II. INTERFACING

15

1. Analog to digital conversion.
2. Digital to analog conversion.
3. Steeper motor controller.
4. Temperature controller.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS (for a batch of 30 students)

S.No	Equipments	Qty
1	8085 Microprocessor trainer kits	15
2	ADC interface card	3
3	DAC interface card	3
4	Stepper motor interfacing card with stepper motor	3
5	Temperature controller with sensors like	3

ME3218

MANUFACTURING TECHNOLOGY LABORATORY

L T P C
0 0 3 2

OBJECTIVE

Demonstration and study of the following machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

LIST OF EXPERIMENTS

UNIT I LATHE PRACTICE

- a. Plain Turning
- b. Taper Turning
- c. Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

- a. Drilling
- b. Tapping
- c. Reaming.

UNIT III MILLING

- a. Surface Milling.
- b. Gear Cutting.
- c. Contour Milling.

UNIT IV PLANNING AND SHAPING

- a. Cutting Key Ways.
- b. Dove tail machining.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

- 1. Lathe -15 Nos.
- 2. Drilling Machine -1 Nos.
- 3. Milling Machine -2 Nos.
- 4. Planning Machine -1 Nos.

5. Shaping Machine -2 Nos.

MT3219

MACHINE DYNAMICS LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Governor – Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors.
2. Cam – Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope – Verification of law's – Determination of gyroscopic couple.
4. Whirling of shaft – Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system Spring mass – system – Determination of damping co – efficient of single degree of freedom system.
9. Determination of influence co – efficient for multidegree freedom suspension system.
10. Determination of transmissibility ratio – vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel – system with lumped Moment of inertia.
12. Transverse vibration – free – Beam. Determination of natural frequency and deflection of beam.

TOTAL:45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

- | | |
|---|---------|
| 1. Cam analyzer | -1 Nos. |
| 2. Motorised gyroscope | -1 Nos. |
| 3. Governor apparatus – watt, porter, proell and hartnell governor. | -1 Nos. |
| 4. Whirling of shaft apparatus. | -1 NoS. |
| 5. Dynamic balancing machine. | -1 Nos. |
| 6. Static dynamic balancing machine. | -1 Nos. |
| 7. Vibration test facilities apparatus. | -1 Nos. |

ME3301

DESIGN OF MACHINE ELEMENTS

(Note: Approved Design Data Book is permitted in the examination)

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3 0 0 3

UNIT I	DESIGN FUNDAMENTALS	9
Design Process - Computer aided design - Optimum design - Mechanical properties of materials - Types of loads - Stresses - Static, varying, thermal, impact and residual - Factors of safety - Theories of failure – Stress concentration factors.		
UNIT II	DESIGN OF SHAFTS, KEYS AND COUPLINGS	9
Design of Solid and Hollow shafts – Based on strength, rigidity and deflection- Torsional rigidity – Lateral rigidity- Material constants - Design of Keys – Types – Keyways – Design of rigid and flexible couplings		
UNIT III	GEARS	9
Principles of gear tooth action - Gear correction - Gear tooth failure modes - Stresses and loads – Component design of spur, helical, bevel and worm gears. Design of speed reducers		
UNIT IV	BRAKES AND CLUTCHES	9
Dynamic and thermal aspects of braking – Design of brakes - Design of clutches- Single plate – Multi plate – Conical clutch		
UNIT V	BEARINGS AND SPRINGS	9
Design of Bearings – Sliding contact – Rolling contact – Design of Journal Bearings – Calculation of Bearing dimensions – Design of helical and leaf springs.		

TOTAL = 45 PERIODS

REFERENCES

1. Joseph Edward Shigley and Charles R.Mischke, Mechanical Engineering Design, 6th Edition, McGraw-Hill International Edition, 2004.
2. Kulkarni.S.G., Machine Design - Solved Problems, Tata McGraw-Hill, New Delhi, 2003.
3. William Orthwein, Machine Component Design (Vol. I & II), M/s. Jaico Publishing house, Mumbai, 2003.
4. Maitra.G.M., and Prasad.LN., Hand Book of Mechanical Design, 2nd Edition, Tata McGraw Hill, New Delhi, 2005.

UNIT I	POWER SEMI CONDUCTOR DEVICES	9
Principle of operation – Characteristics of power diodes, SCR, TRIAC, GTO, Power BJT, Power MOSFET and IGBT – Thyristor protection circuits.		
UNIT II	PHASE CONTROLLED CONVERTERS	9
Uncontrolled and controlled converters – Single phase semi and full converters, 3 phase half converter and 3 phase full converter – effect of source inductance – Thyristor triggering circuits.		
UNIT III	DC TO DC CHOPPERS	9
DC Chopper – control strategies – Principle of operation – step up and step down chopper – quadrant operation – Forced commutation – different techniques – voltage, current and load commutated choppers – triggering circuits.		
UNIT IV	INVERTERS	9
Voltage source inverters – series, parallel and bridge inverters – PWM techniques – sinusoidal PWM, modified sinusoidal PWM, multiple PWM – current source inverters.		
UNIT V	AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS	9
Single phase AC voltage controller – on - off control and phase control – multistage sequence control – step up and step down cycloconverters – three phase to single phase and three phase cycloconverters.		
		TOTAL = 45 PERIODS

REFERENCES

1. Reshid, M.H., "Power Electronics – Circuits Devices and Application" Prentice Hall International, New Delhi, 3rd Edition, 2004.
2. Lander, W., "Power Electronics" McGraw-Hill and Company, 3rd Edition, 1993.
3. Singh, M.D., Khanchandani, K.B., "Power Electronics", Tata McGraw-Hill, 1998.
4. Dubey, G.K., Doradia, S.R., Joshi, A. and Singh, R.M., "Thyristorised Power Controllers", Wiley Eastern Limited, 1986.
5. Mohan Undeland and Robbins, "Power Electronics", John Wilry and Sons, New York, 1995.

UNIT I SCIENCE OF MEASUREMENT**9**

Units and Standards – Calibration techniques –Errors in Measurements – Generalized Measurement System – Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Response of transducers to different time varying inputs – Classification of transducers

UNIT II MECHANICAL MEASUREMENTS**9**

Temperature: Filled thermometer – Bimetallic thermometer – monometers – elastic transducers – bourdon gauge – bellows – diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge, flow measurement: orifice, venturi, nozzle, pilot tube, turbine flow meter, hot wire anemometer.

UNIT III ELECTRICAL MEASUREMENTS**9**

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

UNIT IV SMART SENSORS**9**

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

UNIT V SIGNAL CONDITIONING AND DATA ACQUISITION**9**

Amplification – Filtering – Sample and Hold circuits –Data Acquisition: Single channel and multi channel data acquisition – Data logging.

TOTAL = 45 PERIODS**REFERENCES**

1. E. O. Doebelin, 'Measurement Systems – Applications and Design', Tata McGraw Hill, edition 1992.
2. A. K. Sawhney, 'A course in Electrical and Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd, 2004.
3. Beckwith, Marangoni and Lienhard, 'Mechanical Measurements', Addison – Wesley, 5th Edition, 2000.
4. D. Roy Choudry, Sheil Jain, 'Linear Integrated Circuits', New Age International Pvt. Ltd., 2000.
5. Patranabis. D, "Sensors and Transducers", 2nd edition PHI, New Delhi, 2003.

OBJECTIVE

To provide an exposure on how to simulate a system or a process or an activity for detailed analysis, optimization and decision making which is essential to reduce the product design and development cost and time.

UNIT I**9**

System and System Environment: Component of a System – Continuous and discrete systems – Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queues – inventory system.

UNIT II**9**

Random number generation: Properties of random numbers – Generation of Pseudo – random numbers – techniques of generating pseudo random numbers; Test for random numbers: the Chisquare test-the kolmogrov Smirnov test – Runs test – Gap test – poker test.

UNIT III**9**

Random – Variate Generation: Inverse transform technique for Exponential, Uniform, triangular, weibull, empirical, uniform and discrete distribution, Acceptance rejection method for Poisson and gamma distribution; Direct Transformation for normal distribution.

UNIT IV**9**

Analysis of simulated Data – Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

UNIT V**9**

Concepts of System Identification – Identification using normal operating records (Integration method) – Identifiability conditions – System order determination

TOTAL : 45 PERIODS**TEXT BOOK**

1. Banks J., Carson J.S. and Nelson B.L., “Discrete – Event System Simulation”, 3rd Edition, Pearson Education, Inc 2004 (ISBN 81-7808-505-4).

REFERENCES

1. Geoffrey Gorden, “System Simulation”, Prentice Hall of India, 2003.
2. Narsingh Deo., “System Simulation with Digital Computer”, Prentice Hall of India, 2003.

WEB SITES REFERENCES

1. www.arenasimulation.com
2. www.gpss.co.uk
3. www.caciasl.com
4. Other useful sites can be found in the text book recommended for this course.

OBJECTIVE

Now a day's industries are having lot of changes because of technological developments and the same creates better environment to manufacture components. CNC machining is one of the widely accepted machining methods, which provides lesser manufacturing lead-time and accuracy to the components. Therefore studying the fundamentals, construction details and other controls are very much essential for the Mechatronics engineering students.

UNIT I FUNDAMENTALS OF CNC MACHINES 9

Introduction to Computer Numerical Control: CNC Systems – An Overview of Fundamental aspects of machine control, Different types of CNC machines – Advantages and disadvantages of CNC machines.

UNIT II CONSTRUCTIONAL FEATURES OF CNC MACHINES AND RETROFITTING 10

Features of CNC Machines: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Timing belts and pulleys, Spindle bearing – Arrangement and installation. Slide ways. Re - circulating ball screws – Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors. Retrofitting of Conventional Machine Tools: Modification to be carried out on conventional machines for retrofitting.

UNIT III CONTROL SYSTEMS, FEED BACK DEVICES AND TOOLING 10

Description of a simple CNC control system. Interpolation systems. Features available in a CNC system – introduction to some widely used CNC control systems. Types of measuring systems in CNC machines – Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation. Qualified and pre-set tooling – Principles of location – Principles of clamping – Work holding devices.

UNIT IV CNC PART PROGRAMMING 9

Part Program Terminology-G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming – Computer Assisted part programming – APT language – CNC part programming using CAD/CAM-Introduction to Computer Automated Part Programming.

UNIT V ECONOMICS AND MAINTENANCE 7

Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements.

TOTAL : 45 PERIODS**TEXT BOOK**

1. Yoreur Koren, "Computer Control of Manufacturing Systems", Pitman, London, 1987.

REFERENCES:

1. Radhakrishnan P., Computer Numerical Control Machines, New Central Book Agency, 1992.
2. BERRY LEATHAM – JONES, Computer Numerical Control, Pitman, London, 1987.
3. STEAVE KRAR and ARTHUR GILL, CNC Technology and Programming, McGraw–Hill Publishing Company, 1990.

4. HANS B.KIEF and T.FREDERICK WATERS, Computer Numerical Control Macmillan/McGraw-Hill, 1992.
5. G.E.THYER, Computer Numerical Control of Machine Tools. Second Edition, B/H NEWNES, 1993.
6. GROOVER, M.P., Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall, 1998.
7. MIKE MATTSON, "CNC Programming Thomson Learning, 2003.

ME3306 THERMODYNAMICS PRINCIPLES AND APPLICATIONS L T P C
 (Approved Heat and Mass Transfer Data Book is Allowed) **3 0 0 3**

UNIT I FIRST LAW OF THERMODYNAMICS 8

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities C_V and C_P – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 8

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem

UNIT III INTERNAL COMBUSTION ENGINES 11

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 8

Principles of refrigeration, refrigerator & heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 10

Heat transfer through conduction and convection, Fourier's law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

TOTAL: 45 PERIODS

REFERENCES

1. Nag P. K, 'Engineering Thermodynamics' Tata McGraw-Hill, 2005.
2. Michael A. Boles, Yunus A. Cengel, Yunus Cengel, "Thermodynamics", 2nd Edition, McGraw-Hill India, 2006.
3. Dr. C.P. Kothandaraman, S.Domkundwar & A.V.Domkundwar, "A course in Thermal

- Engineering” DHANPATRAI & CO (P) LTD, Fifth edition, 2000.
4. Dr. C.P.Kothandaraman, “Heat and Mass Transfer”, New Age International (P) Publishers, 2002.
 5. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2000.

EC 3307

POWER ELECTRONICS LABORATORY

**L T P C
0 0 3 2**

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

TOTAL = 45 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

S.No	Equipments	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	Study of three phase AC regulator module	1
8	Speed control of DC shunt motor using three phase fully controlled converter module	1
9	SCR single phase cyclo converter module	1
10	SCR series and parallel inverters module	1
11	IGBT chopper module	1
12	IGBT based PWM inverter (single phase) module	1
13	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	
14	Voltmeter (0-300V) MC, (0-600V) MC,	

15	(0-300V) MI, (0-600V) MI, Multimeter	Each 3
16	CRO Transformer 1KVA, 1:1, 230V	6 5

EC3308

SENSORS AND SIGNAL PROCESSING LABORATORY

L T P C

0 0 3 2

LIST OF EXPERIMENTS

1. Measurement of temperature using thermocouple, thermistor and RTD
2. Measurement of displacement using POT, LVDT & Capacitive transducer
3. Torque measurement using torque measuring devices
4. Strain Measurement using strain gauge
5. Servomotor position control using photo electric pickup
6. Wave Shaping circuit
7. Analog to Digital Converters
8. Digital Comparator
9. Voltage to frequency converter
10. Frequency to Voltage Converter
11. Position and velocity measurement using encoders
12. Study on the application of data acquisition system for industrial purposes

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	EQUIPMENT	QTY
1	Cathode Ray Oscilloscope	5
2	Function Generator	5
3	Regulated power supply	7
4	Displacement Measurement Trainer using LVDT	1
5	Capacitive pickup trainer module	1
6	Position and Velocity measurement using encoder kit	1
7	Servomotor Position control kit	1
8	Speed measurement and closed loop control of DC Motor using photo electric pickup kit	1
9	RTD module	1
10	Thermistor module	1
11	Thermocouple module	1
12	Absolute encoder	1
13	Potentiometer trainer pickup	1
14	Strain gauge module	1
15	Loadcell module	1

ME3309

CNC LABORATORY

L T P C

OBJECTIVE

To train the students in manual and computer assisted part programming, tool path generation and control, operation and control of CNC machines tools.

LIST OF EXPERIMENTS

1. Manual part programming using G and M codes for Turning, step turning, Taper turning, thread cutting and radius turning on cylindrical components.
2. Programming and Simulation of machining using the following features.
 - (i) Linear and Circular interpolation
 - (ii) Pocket milling, slotting, peck drilling and other fixed canned cycles.
3. Given a component drawing to write the manual part programming and execute on CNC Lathe and Milling Machine.

LIST OF FACILITIES REQUIRED

1. CNC Lathe with Fanuc control
2. CNC Milling Machine with Fanuc control
3. Master CAM software
4. Computer nodes

TOTAL = 45 PERIODS

GE3318 COMMUNICATION SKILLS LABORATORY

L T P C
0 0 4 2

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session	(Weightage 40%)	24 periods
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A. ENGLISH LANGUAGE LAB

(18 Periods)

1. LISTENING COMPREHENSION:

(6)

Listening and typing – Listening and sequencing of sentences – Filling in the blanks -Listening and answering questions.

2. READING COMPREHENSION:

(6)

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING:

(6)

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS

(6 PERIODS)

(Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING

(1)

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS:

(1)

Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS:

(2)

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION:

(1)

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. INTERVIEW SKILLS:

(1)

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

II. Practice Session	(Weightage – 60%)	24 periods
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1. **Resume / Report Preparation / Letter writing:** Students prepare their own resume and report. (2)

2. **Presentation Skills:** Students make presentations on given topics. (8)

3. **Group Discussion:** Students participate in group discussions. (6)

4. Interview Skills: Students participate in Mock Interviews

(8)

TEXT BOOKS

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.

REFERENCES

1. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
2. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
3. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
4. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

LAB REQUIREMENT

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Requirement for a batch of 60 students

Sl.No.	Description of Equipment	Quantity required
1.	Server	1 No.
	o PIV system	
	o 1 GB RAM / 40 GB HDD	
	o OS: Win 2000 server	
	o Audio card with headphones (with mike)	
o JRE 1.3		
2.	Client Systems	60 No.
	o PIII or above	
	o 256 or 512 MB RAM / 40 GB HDD	
	o OS: Win 2000	
	o Audio card with headphones (with mike)	
o JRE 1.3		
3.	Handicam Video Camera (with video lights and mic input)	1 No.

4.	Television - 29"	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - Desirable	1 No.

MG3310

PRINCIPLES OF MANAGEMENT

L T P C
3 0 0 3

UNIT I BASICS OF GLOBAL MANAGEMENT

9

Definition of Management – Science or Art – Management thought and Patterns of management analysis – System approach to the Management process – Functions of Manager – Responsibilities of Manager – Ethics in managing – International management and multinational corporations.

UNIT II PLANNING

9

Types of Plans – Steps involved in Planning – Objectives – Setting Objectives – Benefits and weaknesses of Management by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

UNIT III ORGANISING

9

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV LEADING

9

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING

9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL = 45 PERIODS

REFERENCES

1. Harold Kooritz & Heinz Wehrich "Essentials of Management", Tata McGraw-Hill, 1998

2. Joseph L Massie “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.
3. Tripathy PC And Reddy PN, “Principles of Management”, Tata McGraw-Hill, 1999.
4. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
5. Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.

ME3311	MICRO CONTROLLER AND PLC	L T P C
		3 0 0 3
UNIT I		9

8051 Architecture: Microcontroller Hardware – I/O Pins, Ports – External memory – Counters and Timers – Serial data I/O – Interrupts – 8051 Assembly Language Programming: Instruction set of 8051, Addressing modes, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, interrupts and returns interrupts and returns interrupt handling.

UNIT II		9
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8051 Microcontroller Design: 8051 Microcontroller Specification 8051 – Microcontroller System Design – Testing the Design, Timing Subroutines, Look up Tables – Serial Data Transmission.

UNIT III		9
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8051 Microcontroller Applications: Interfacing of Keyboards – Interfacing of Display Devices – Pulse measurement – Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Multiple interrupts – Serial Data Communication – Network Configuration.

UNIT IV		9
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Programmable Logic Controllers: Introduction – Parts of PLC – Principles of operation – PLC sizes – PLC hardware components – I/O section Analog I/O Section Analog I/O modules – digital I/O modules CPU processor memory module – Programming devices – PLC programming Simple instructions – Manually operated switches – Mechanically operated and Proximity switches - Output control devices - Latching relays PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram.

UNIT V		9
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Timer instructions ON DELAY, OFF DELAY and RETENTIVE Timers, UP COUNTER, DOWN COUNTER and UP DOWN COUNTERS, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Kenneth J. Ayala. The 8051 Microcontroller Architecture, Programming and Applications, Penram International Publishing (India), Second Edition, Mumbai.
2. Frank D. Petruzella. “Programmable Logic Controllers”, McGraw–Hill Book, Company, 1989.

REFERENCES

1. B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.
2. Embedded Controller Hand book, Intel Corporation, USA.
3. Microcontroller Hand Book, INTEL, 1984.

ME2305

APPLIED HYDRAULICS AND PNEUMATICS

**L T P C
3 0 0 3**

OBJECTIVES:

- To know the advantages and applications of Fluid Power Engineering and Power Transmission System.
- To learn the Applications of Fluid Power System in automation of Machine Tools and others Equipments.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components : Directional control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

REFERENCES:

1. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
2. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
5. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.
6. 1976.
7. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
8. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

MT3313	DESIGN OF MECHATRONICS SYSTEM	L T P C
		3 0 0 3
UNIT I	FUNDAMENTALS	9
Introduction to Mechatronics system – Key elements – Mechatronics Design process – Types of Design –Design Parameter– Traditional and Mechatronics designs – Advanced approaches in Mechatronics - Industrial design and ergonomics, safety.		
UNIT II	SYSTEM MODELLING	9
Introduction-model categories-fields of application-model development-model verification-model validation-model simulation-design of mixed systems-electro mechanics design-model transformation-domain-independent description forms-simulator coupling.		
UNIT III	SYSTEM INTERFACING	9
Introduction-selection of interface cards-DAQ card-single channel-multichannel-RS232/422/485 communication- IEEE 488 standard interface-GUI card-GPIB-Ethernet switch -Man machine interface.		
UNIT IV	CASE STUDIES ON MECHATRONIC SYSTEM	9
Introduction –Fuzzy based Washing machine – pH control system – Autofocus Camera, exposure control– Motion control using D.C.Motor & Solenoids – Engine management systems. – Controlling temperature of a hot/cold reservoir using PID- Control of pick and place robot – Part identification and tracking using RFID – Online surface measurement using image processing		
UNIT V	MICRO MECHATRONIC SYSTEM	9
Introduction- System principle - Component design – System design – Scaling laws – Micro actuation – Micro robot – Micro pump – Applications of micro mechatronic components.		

TOTAL = 45 PERIODS

REFERENCES

1. Georg pelz, Mechatronic Systems: Modeling and simulation with HDL's, John wiley and sons Ltd, 2003
2. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", Thomson Learning Publishing Company, Vikas publishing house, 2001.
3. Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
4. Bishop, Robert H, Mechatronics Hand book, CRC Press, 2002.
5. Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.

EC3314

OBJECT ORIENTED PROGRAMMING

L T P C

3 0 0 3

UNIT I OOP PARADIGM

9

Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Reusability – Security – Object oriented programming fundamental – Abstraction – Encapsulation – Derivation – Object oriented languages and packages–Applications of OOP - What is C++? – A simple C++ program – More C++ statements – Structure of C++ Program.

UNIT II INTRODUCTION TO C++

10

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators – Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading.

UNIT III CLASSES AND OBJECTS

9

Specifying a class – Defining member functions – Private member functions –Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments –Friendly functions – Returning objects. Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors – Destructors.

UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM

10

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions.

UNIT V CASE STUDIES

7

Over view of typical object oriented systems – Case studies - Applications.

TOTAL : 45 PERIODS

REFERENCES

1. E.Balagurusamy, "Object Oriented Programing wih C++", Tata McGraw Hill,1997.
2. Herbert Schildt,"C++ The Complete Reference", Tata McGrawHill Edition, 2003
3. Bjanne Stroustrup,"The C++ Programming Language",3rd Edition, Addison Wesley, 2000

4. Stanley, B.Lippman, Jove Lagrie, "C++Primer", 3rd Edition, Addison Wesley, 1998
5. Baarkakati. N., 'Object Oriented Programming in C++', Prentice Hall of India, 1997.

MT3315

MICRO CONTROLLER AND PLC LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

TOTAL : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Equipments	Qty
1	Regulated power supply	7
2	Pulse generator	1
3	Function generator	5
4	Cathode ray oscilloscope	5
5	8051 MicroController Kit	5
6	stepper Motor	2
7	stepper motor interfacing board	2
8	PLC trainer kit and related software	2
9	Hydraulic cylinder	1
10	Pneumatic cylinder	1
11	LED/LCD interface units	1
12	SCR/Triac/Power MOSFET interface unit	1

EC3316 OBJECT ORIENTED PROGRAMMING LABORATORY
LIST OF EXPERIMENTS

L T P C
0 0 3 2

1. Programs Using Functions
 - Functions with default arguments
 - Implementation of Call by Value, Call by Address and Call by Reference
2. Simple Classes for understanding objects, member functions and Constructors
 - Classes with primitive data members
 - Classes with arrays as data members
 - Classes with pointers as data members – String Class
 - Classes with constant data members
 - Classes with static member functions
3. Compile time Polymorphism
 - Operator Overloading including Unary and Binary Operators.
 - Function Overloading
4. Runtime Polymorphism
 - Inheritance
 - Virtual functions
 - Virtual Base Classes
 - Templates
5. File Handling
 - Sequential access
 - Random access

TOTAL : 45 PERIODS

ME3317 APPLIED HYDRAULICS AND PNEUMATIC LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS

- 1. Design and testing of hydraulic circuits such as**
 - i) Pressure control**
 - ii) Flow control**
 - iii) Direction control**
 - iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.**
- 2. Design and testing of pneumatic circuits such as**
 - i) Pressure control**
 - ii) Flow control**

- iii) Direction control
 - iv) Circuits with logic controls
 - v) Circuits with timers
 - vi) Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
3. Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using **MATLAB/LABVIEW** software.
 4. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

TOTAL : 45 PERIODS

LIST OF EQUIPMENT

(for a batch of 30 students)

S.No	Equipments	Qty
	Hydraulic equipments	
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	2
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
11	PLC	1
	Pneumatics equipment	
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push buttons	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder, manually actuated DCV	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV, DCV with sensors/ magnetic reed switches	1
5	PLC with Interface card	1
6	LABVIEW Software	1
7	Automation studio software	1

MT3318

TECHNICAL SEMINAR II

L T P C
0 0 3 2

During technical seminar hour students are encouraged to use various teaching aids like O.H.P., PPT and demonstration models. This will enable them to gain confidence in facing the placement interviews.

MT3401

MEDICAL MECHATRONICS

L T P C
3 0 0 3

UNIT I INTRODUCTION

9

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION

9

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY

9

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply. Oscillagrophic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIT IV MEDICAL SUPPORT

10

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC – defibrillator patient safety - electrical shock hazards. Centralized patient monitoring system.

UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION

8

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

TOTAL = 45 PERIODS

REFERENCES

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, 1989.
2. Arumugam M., "Bio Medical Instrumentation", Anuradha agencies Pub., 2002.
3. Geddes L.A., and Baker, L.E., "Principles of Applied Bio-medical Instrumentation", 3rd Edition, John Wiley and Sons, 1995.

ME3403	ROBOTICS AND MACHINE VISION SYSTEM	L T P C
		3 0 0 3
UNIT I	BASICS OF ROBOTICS	9
Introduction- Basic components of robot-Laws of robotics- classification of robot-work space-accuracy-resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives		
UNIT II	ROBOT END EFFECTORS	9
Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.		
UNIT III	ROBOT MECHANICS	10
Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation		
UNIT IV	MACHINE VISION FUNDAMENTALS	9
Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology		
UNIT V	ROBOT PROGRAMMING	8
Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.		

TOTAL = 45 PERIODS

REFERENCES

1. Sathya Ranjan Deb, robotics Technology & flexible Automation Sixth edition, Tata Mcgraw-Hill Publication, 2003.
2. Gordon M.Dair, Industrial Robotics, PHI 1988.
3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, Robotics: Sensing, Vision& Intelligence, Tata Mcgraw-Hill Publication, 1987.
4. John.J.Craig, Introduction to Robotics: Mechanics & control, Second edition-2002.
5. M.P.Groover, Industrial robotics- Technology, programming and Applications, McGraw-Hill, 1986

ME3404

AUTOMOBILE ENGINEERING

L T P C
3 0 0 3

UNIT I INTRODUCTION

9

Engine Terminology – Types of engines: Petrol& Diesel - 2 Stroke & 4 Stroke - – Engine components: Cylinder block – Cylinder head – Sump – manifolds – Gaskets – Cylinder - Piston – Rings – Connecting rod – Piston pins – Crank shaft – bearings – valves – Mufflers. Engine cooling and Lubrication.

UNIT II TRANSMISSION SYSTEMS

9

Clutch – Types and Construction – Clutch operation: Electromagnetic – Mechanical – Hydraulic – Vacuum. Gear Boxes: Manual and Automatic – Simple Floor Mounted Shift Mechanism – Over Drives – Transfer Box - Fluid flywheel - Torque converters – Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive.

UNIT III STEERING, BRAKES AND SUSPENSION

9

Steering: Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry - Types of steering gear box – Davis and Ackermann steering mechanism - Power Steering – Types of Front Axle. Suspension systems: Types of suspension springs – Plastic, Air and Independent suspension system – Shock absorbers. Braking Systems: Types and Construction – Hydraulic brakes - Diagonal Braking System – Antilock Braking System

UNIT IV BATTERY AND LIGHTING SYSTEM

9

Types of batteries - Construction, Operation and Maintenance. Electrical systems: Lighting – wiring circuit - Head lights – Switches – Indicating lights – trouble shooting. Accessories: Direction indicators – windscreen wiper – Horn – Speedometer – Heaters – Air conditioner.

UNIT V ALTERNATE ENERGY SOURCES

9

Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells.

TOTAL = 45 PERIODS

REFERENCES

1. Kirpal Singh “Automobile Engineering Vol. 1& 2”, Standard Publishers, New Delhi.
2. Sethi H.M, “Automobile Technology”, Tata McGraw-Hill-2003
3. Crouse and Anglin “Automotive Mechanism”, 9th Edition. Tata McGraw-Hill, 2003.
4. Newton, Steeds and Garet, “Motor vehicles”, Butterworth Publishers, 1989.
5. Joseph Heitner, “Automotive Mechanics”, 2nd edition, East-West Press, 1999.

ME3405

**COMPUTER AIDED DESIGN AND COMPUTER AIDED
MANUFACTURING LABORATORY**

**L T P C
0 0 3 2**

LIST OF EXPERIMENTS

1. Modelling of a part using Pro-E / CATIA / UNIGRAPHICS.
2. Modelling of a component using Pro-E / CATIA / UNIGRAPHICS.
3. Modelling and assembling of the mechanical assembly using Pro-E / CATIA / UNIGRAPHICS.
4. Structural analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
5. Beam deflection analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
6. Thermal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
7. Vibration or modal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
8. Modelling and tool path simulation using Master CAM (MILL) or any CAM package.
9. Modelling and tool path simulation using Master CAM (Lathe) or any CAM package.
10. NC code generation for milling using Master CAM (MILL) or any CAM package.
11. NC code generation for turning using Master CAM (Lathe) or any CAM package.

TOTAL = 45 PERIODS

NOTE - Any solid modelling or suitable software packages can be used for exercise.

MT3406

ROBOTICS LABORATORY

**L T P C
0 0 3 2**

LIST OF EXPERIMENTS

1. **Study of different types of robots based on** configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
5. Estimation of accuracy, repeatability and resolution.
6. Robot programming exercises

(Point-to-point and continuous path programming)

TOTAL = 45 PERIODS

MT3407	DESIGN AND FABRICATION PROJECT	L T P C
		0 0 4 2

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution and if possible with an industry guide also.

The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

TOTAL: 60 PERIODS

MT 3408	AUTOMOTIVE ELECTRONICS	L T P C
		3 0 0 3

UNIT I	INTRODUCTION	8
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Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II	IGNITION AND INJECTION. SYSTEMS	10
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Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III	SENSOR AND ACTUATORS	7
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Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 10

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL = 45 PERIODS

REFERENCES

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.
2. William B. Ribbens, "Understanding Automotive Electronics", 5th edition, Newnes Publishing, 2000.
3. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
4. "Fuel System and Emission controls", Check Chart Publication, 2000.
5. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.

**MT 3002 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3**

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Introduction – Examples of fields that use Digital image processing, Fundamental steps in Digital Image Processing systems, Components of an image processing systems, Light and EM spectrum, Image sensing and acquisition, Image sampling and quantization- Concepts, image representation, Spatial and gray level resolution, Aliasing and Morie patterns, Some basic relationships between pixels

UNIT II IMAGE ENHANCEMENT IN SPATIAL DOMAIN 9

Background, Gray level transformation- Image negatives, Log transformations, Power law transformations, Piecewise-Linear transformation functions, Histogram processing- Histogram equalization, Histogram matching(Specifications), Enhancement using ALU

UNIT III IMAGE ENHANCEMENT IN FREQUENCY DOMAIN 9

Introduction to the Fourier transform and the frequency domain – 1-D Fourier transform and its inverse, 2-D Fourier transform and its inverse, Smoothing frequency domain filters- Ideal, Butterworth, Gaussian low pass filters, Sharpening frequency domain filters- Ideal, Butterworth, Gaussian high pass filters

UNIT IV COLOR IMAGE PROCESSING AND WAVELETS 9
 Color fundamentals, Color models- RGB color model, CMY and CMYK color model, HIS color model.

Wavelets- Background- Image pyramids, sub band coding, Haar transform, Wavelet transform in 1-D- Wavelet series expansion, discrete wavelet transform, Continuous wavelet transform.

UNIT V IMAGE COMPRESSION AND SEGMENTATION 9
 Fundamentals – Image compression models, Error-free compression – Lossy compression- Lossy predictive coding, Transform coding, JPEG 2000 – Detection of discontinuities – Edge linking and boundary detection

TOTAL = 45 PERIODS

REFERENCES

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education Asia / Addison Wesley publishing company, Sixth Indian Reprint 2001.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall of India, New Delhi, 2001.
3. Maher A. Sid-Ahmed, “Image Processing Theory, Algorithms and architectures”, McGraw-Hill, 1995.
4. William K. Pratt, “Digital Image Processing”, Wiley-Inter Science Publication, 2nd Edition, 1991.
5. Arthur K Wrecks, “Fundamentals of Electronics Image Processing”, Prentice-Hall of India, New Delhi, 2001

MT3004 DIAGNOSTIC TECHNIQUES L T P C
3 0 0 3

UNIT I DEFECTS AND FAILURE ANALYSIS 9
 Maintenance Concept, Maintenance objective, Challenges in maintenance. Defect generation - Types of failures - Defect reporting and recording - Defect analysis -Failure analysis - Equipment down time analysis - Breakdown analysis - FTA - FMEA - FMECA.

UNIT II MAINTENANCE SYSTEMS 9
 Planned and unplanned maintenance - Breakdown maintenance - corrective maintenance- Opportunistic maintenance - Routine maintenance - Preventive maintenance - Predictive Maintenance - Condition based maintenance system - Design out maintenance – Maintenance by objectives – Selection of maintenance system

UNIT III SYSTEMATIC MAINTENANCE 9
 Codification and Cataloguing - instruction manual and operating manual - Maintenance manual and departmental manual - Maintenance time standard - Maintenance work order and work

permit - job monitoring – Feedback and control – Maintenance records and documentation.
Introduction to Total Productive Maintenance (TPM).

UNIT IV COMPUTER MANAGED MAINTENANCE SYSTEM 9

Selection and scope of computerization – Equipment classification – Codification of breakdown, material and facilities - Job sequencing - Material management module – Captive engineering module. Decision making in maintenance. Economic aspects of maintenance.

UNIT V CONDITION MONITORING 9

Condition monitoring techniques – Visual monitoring – Temperature monitoring – Vibration monitoring – Lubricant monitoring – Cracks monitoring – Thickness monitoring - Noise and sound monitoring – Condition monitoring of hydraulic system. Machine diagnostics – Objectives - Monitoring strategies – Examples of monitoring and diagnostics - Control structures for machine diagnosis.

TOTAL = 45 PERIODS

REFERENCES

1. Sushil Kumar Srivastava, "Industrial Maintenance Management", S.Chand & Company Ltd, New Delhi, 1998.
2. Manfred, H. Bibring, Handbook of Machine Tools, Vol.3, John Wiley & Sons
3. Mishra R.C., Pathak K. Maintenance Engineering and Management, Prentice Hall of India Private Ltd., New Delhi, 2002

ME3006 OPERATIONS RESEARCH L T P C

3 1 0 4

UNIT I LINEAR MODELS 12

The phases of operations research study- Linear programming - Graphical method - Simplex algorithm – Dual Simplex - Transportation problems- Traveling salesmen problems - Assignment models - Applications to problems with discrete variables.

UNIT II NETWORK MODELS 6

Network models - Shortest route - Minimal spanning tree - Maximum flow models - Project network - CPM and PERT networks - Critical path scheduling - Sequencing models.

UNIT III INVENTORY MODELS 6

Inventory models - Economic order quantity models - Quantity discount models - Stochastic Inventory models - Multi product models - Inventory control models in practice.

UNIT IV QUEUING THEORY 9

Queuing models - Queueing systems and structures - Notation - parameter - Single Server and multi server models - Poisson input - Exponential service - Constant rate service - Infinite population - Simulation.

UNIT V DECISION MODELS**12**

Decision models - Game theory - Two person zero sum games - Graphical solution - Algebraic solution – Linear programming solution - Models based on service life - Economic life. Replacement models - Replacement of items that deteriorate with time - value of money changing with time –not changing with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with 3 machines.

TUTORIALS 15 TOTAL = 60 PERIODS**REFERENCES**

1. H.A.Taha, " Operations Research ", Prentice Hall of India, 1999, Sixth Edition.
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2002
3. M.J. Bazara, Jarvis, H. Sherali, " Linear Programming and Network Flows ", John Wiley,1990.
4. Philip and Ravindran, " Operational Research ", John Wiley, 1992.
5. Shennoy, Srivastava, " Operation Research for Management ", Wiley Eastern, 1994.

GE3008 PROFESSIONAL ETHICS AND HUMAN VALUES**L T P C
3 0 0 3****UNIT I HUMAN VALUES****9**

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

UNIT II ENGINEERING ETHICS**9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies.
Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES**9**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE),India, etc.

TOTAL= 45 PERIODS

REFERENCES

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York, 1996.
2. Govindarajan M, Natarajan S, and Senthil Kumar V. S, "Engineering Ethics", Prentice
3. Hall of India, New Delhi, 2004.
4. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)
5. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
6. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

EC3007

DIGITAL SIGNAL PROCESSING

L T P C
3 0 0 3

UNIT I SIGNALS AND SYSTEMS 9

Basic elements of Digital Signal Processing - Concept of frequency in Continuous time and Discrete time signals - Sampling theorem – Discrete time signals. Discrete time systems – Analysis of Linear time invariant systems – Z transform – Convolution and Correlation.

UNIT II FAST FOURIER TRANSFORMS 9

Introduction to Radix 2 FFT 's – Decimation in time FFT algorithm - Decimation in frequency FFT algorithm – Computing inverse DFT using FFT – Mixed radix FFT algorithm – Periodogram technique

UNIT III IIR FILTER DESIGN 9

Structure of IIR – System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives

UNIT IV FIR FILTER DESIGN 9

Symmetric & Antisymmetric FIR filters – Linear phase filter – Windowing technique – Rectangular, Kaiser Windows – Frequency sampling techniques – Structure for FIR systems

UNIT V FINITE WORD LENGTH EFFECTS 9

Effect of Number representation on Quantization – Overflow – Need for scaling – truncation error – coefficient Quantization error – limit cycle oscillations. Multichannel – Multi – dimensional – typical applications of DSP – Introduction to Programmable DSP – Instruction set of TMS 320C50.

TOTAL : 45 PERIODS

REFERENCES

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing, Algorithms and Application", PHI., New Delhi 3rd Edition 2000.
2. S.Salivahanan, A.Vallavaraj and Gnanapriya, "Digital Signal Processing", McGraw-Hill, 2000
3. Sanjith K. Mitra "Digital Signal Processing, A Computer Based approach", Tata McGraw–Hill, New Delhi, 1998.
4. Allan V.Oppenheim & Donald W. Schafer, "Digital Signal Processing", PHI 1989.

6. B.Venkataramani and M.Bhaskar, "Digital Signal Processor"- Architecture Programming and applications, TMH, New Delhi 2002.

ME3017	MICRO ELECTRO MECHANICAL SYSTEMS	L T P C
		3 0 0 3
UNIT I	INTRODUCTION	9
Overview-Microsystems and microelectronics -definition-MEMS materials-scaling laws-scaling in geometry-scaling in rigid body dynamics- scaling in electrostatic forces- scaling in electricity-scaling in fluid mechanics- scaling in heat transfer.		
UNIT II	MICRO SENSORS & ACTUATORS	9
Working principle of Microsystems - micro actuation techniques - micro sensors-types - Microactuators – types – micropump – micromotors – micro – valves – microgrippers -micro accelerometers		
UNIT III	FABRICATION PROCESS	9
Substrates-single crystal silicon wafer formation-Photolithography-Ion implantation-Diffusion – Oxidation-CVD-Physical vapor deposition-Deposition by epitaxy-etching process		
UNIT IV	MICRO SYSTEM MANUFACTURING	9
Bulk Micro manufacturing- surface micro machining –LIGA-SLIGA-Micro system packaging-materials-die level-device level-system level-packaging techniques-die preparation-surface bonding-wire bonding-sealing		
UNIT V	MICRO SYSTEM DESIGN	9
Design considerations-process design-mask layout design- mechanical design-applications of micro system in -automotive industry-bio medical –aero space-telecommunications.		

TOTAL :45 PERIODS

REFERENCES

1. Mohamed Gad-el-Hak, The MEMS Hand book, CRC press 2002.
2. Julian W.Gardner,Vijay K.Varadan,Osama O.Awadel Karim,Microsensors MEMS and Smart Devices, John Wiley & sons Ltd.,2001.
3. S.Fatikow,U.Rembold,Microsystem Technology and Microrobotics,Springer-Verlag Berlin Heidelberg ,1997.
4. Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture, Tata McGraw-Hill,2006.
5. Francis E.H Tay and W.O Choong, Microfluidics and BioMEMS Applications, Springer, 2002.

ME3018

COMPUTER AIDED DESIGN

L T P C
3 0 0 3

UNIT I DESIGN PROCESS 9

The design process Morphology of design - Product cycle - Sequential and concurrent engineering - Role of computers - Computer Aided Engineering - Computer Aided Design - Computer Aided Manufacturing - Benefits of CAD.

UNIT II INTERACTIVE COMPUTER GRAPHICS 9

Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D – Viewing transformation - Clipping - hidden line elimination - Mathematical formulation for graphics - Curve generation techniques.

UNIT III DATA STRUCTURE AND STORAGE 9

Model storages and Data structure - Data structure organisation - Engineering Data Management System. Hierarchical data structure - Network data structure - Relational data structure. Data storage and search methods.

UNIT IV SOLID MODELING 9

Geometric Modeling - Wire frame, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modeling Packages - Parametric and features.

UNIT V DESIGN ANALYSIS USING FINITE ELEMENT METHOD 9

Introduction - Procedures - Element types - Nodal approximation - Element matrices, vectors and equations - Global connectivity - Assembly - Boundary conditions - Solution techniques - Interfaces to CAD – Introduction to CAD packages.

TOTAL = 45 PERIODS

REFERENCES

1. Ibrahim Zeid, CAD - CAM Theory and Practice, Tata McGraw Hill, New Delhi, 2003.
2. Radhakrishnan. P.and Kothandaraman. C.P., Computer Graphics and Design, Dhanpat Rai and Sons, New Delhi, 1998.
3. Dieter.G. E., Engineering Design, Tata McGraw-Hill, New Delhi, 2000.
4. Sadhu Singh, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, 2002.
5. Rogers.D.F. and Adams.J.A., Mathematical Elements in Computer Graphics, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003.

ME2035

ENTREPRENEURSHIP DEVELOPMENT

L T P C
3 0 0 3

OBJECTIVE:

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, “Enterprenuership – Theory, process and practices”, Thomson learning 6th edition.

REFERENCES:

1. Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala, “Enterprenuership theory at cross roads: paradigms and praxis” Dream tech 2nd edition 2006.

3. Rabindra N. Kanungo “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.
4. EDII “ Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development” Institute of India, Ahmadabad, 1986.

EC3014

COMPUTER NETWORKS

L T P C
3 0 0 3

UNIT I DATA COMMUNICATION CONCEPTS 9

Digital & Analog, Parallel & serial, Synchronous & Asynchronous, Simplex, Half duplex & Full duplex. Computer Networks- introduction, Network topology, wired network Vs wireless network. Classification of computer N/w's- LAN, MAN, WAN.

UNIT II N/W REFERENCE MODELS AND PROTOCOL SUITS 9

Need of protocols & their significance in networking, OSI reference model, TCP/IP reference Model, comparison of OSI & TCP/IP Reference models. Networking Hardware: Ethernet cabling The NIC, Repeater, Router, Bridges, Switches, Transceivers, hubs, Cable modems.

UNIT III SWITCHING TECHNOLOGIES AND LAN STANDARDS 9

Circuit switching, message & packet switching, Channel allocation methods – ALOHA protocols – Pure ALOHA – Slotted ALOHA, IEEE standard 802 for LANS Ethernet, CSMA/CD, Token Ring, Token Bus, & their frame format. FDDI.

UNIT IV DATA LINK & NW LAYER 9

Services provided by NW layer, Framing, Data link control: Flow control, Error detection, HDLC & SDLC, Concept of Routing & congestion control. Transport layer Protocols like TCP, UDP, connection oriented transport protocol, TCP services.

UNIT V N/W PROTOCOLS & TRADITIONAL APPLICATION 9

The IP layers and functions – addressing and routing – Internet user services – E-Mail – w.w.w. Telnet, FTP, HTTP. **Broad Band Networks:** ISDN Evolution – structures – Limitation Broad-band ISDN, Asynchronous transfer mode (ATM), SONET.

TOTAL = 45 PERIODS

REFERENCES

1. Forouzan, “Introduction to Data communications and Networking”, Tata McGraw-Hill, 3rd Edition.
2. William Stallings, “Data and Computer communications”, Maxwell Macmillan International Editions, 2nd Edition.
3. Andrew S. Tanenbaum, “Computer Networks”, Prentice Hall of India, 3rd edition, 1998.
4. Balaji Kumar, “Broad band Communication”, McGraw-Hill, 1996.
5. Larry L.Peterson and Bruce S.Davie, “ Computer Networks A system approach”, Elsevier publications, 3rd Edition.

EC3015

VIRTUAL INSTRUMENTATION

L T P C
3 0 0 3

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES 9

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISITION BASICS 9

AOC. OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation.

UNIT IV COMMON INSTRUMENT INTERFACES 9

Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office & Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS 9

Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

TOTAL = 45 PERIODS

REFERENCES

1. Gary Jonson, Labview Graphical Programming, Second Edition, McGraw Hill, New York, 1997
2. Sokoloff; Basic concepts of Labview 4, Prentice Hall Inc., New Jersey 1998.
3. S. Gupta, J.P: Gu.pta, PC interfacing for Data Acquisition & Process Control, Second Edition, Instrument Society of America, 1994.
4. Lis K. wells & Jeffrey Travis, Labview for everyone, Prentice Hall Inc., New Jersey; 1997
5. Labview user manual first and second edition.

EC3016

INDUSTRIAL ELECTRONICS AND APPLICATIONS

L T P C

3 0 0 3

UNIT I INTRODUCTION

9

Industrial control classification- motion and process control- feed forward control-interfacing devices- Operational Amplifier-review of thyristor- SCR- TRIAC-Phototransistor

UNIT II CONVERTERS AND INVERTERS

8

Analysis of controlled and fully controlled converters-Dual converters-Analysis of voltage source and current source- current source and series converters

UNIT III INDUSTRIAL MOTOR CONTROL

10

Method of controlling speed- Basic control circuit-DC motor control- AC motor control- Servo motor control- Stepper motor control- micro controller based speed control – solid state motor control-PLL control of a DC motor control

UNIT IV RELAYS, HEATING & WELDING CONTROL

9

Introduction- principle of relays- electromechanical relay- solid state relays- Latching relays-timing relays- Induction heating- dielectric heating- resistance welding.

UNIT V PROCESS AND MOTION CONTROL

9

Elements of process control- temperature control- Flow control- Level control- Methods of motion control- feed back control- Direct digital control

TOTAL = 45 PERIODS

REFERENCES:

1. Terry Baltelt- Industrial electronics, devices, systems and applications- Delmar publishers- 1997
2. Frank D. Petruzella- Industrial electronics- McGraw Hill-1996
3. Stephan L.Herman, Walter N.Alerich- Industrial motor control- Delmar publishers- fourth edition-1998
4. Biswanath Paul- Industrial electronics and control- prentice Hall India publisher-2001.
5. P.Harrott- process control- Tata McGraw Hill-1991

UNIT I SHEET METAL WORKING OF METALS 8

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming-electro hydraulic forming-electro magnetic forming

UNIT II NON TRADITIONAL MACHINING 9

Ultrasonic machining (USM) – process and description of USM-applications and limitations-Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles-Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications and limitations.

UNIT III SURFACE FINISHING AND SURFACE HARDENING PROCESS 10

Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating(PVD, CVD).

UNIT IV EDM AND ECM 10

Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate-applications-EDWC - process principles – equipments - applications.

Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate -accuracy and surface finish obtained. Electro Chemical grinding (ECG) - Chemical machining-electro chemical grinding equipment-application-electro chemical deburring-honing-applications

UNIT V JIGS AND FIXTURES 8

Jigs-Locating and Clamping devices-principles-elements-mechanical-pneumatic and hydraulic actuation-types of Jigs-general consideration in Jig design-jig bushing, types- methods of construction. Fixtures-types of fixtures- fixture for machine tools –lathe, milling, boring, broaching, grinding-assembly inspection of welding fixture design.

TOTAL = 45 PERIODS**REFERENCES**

1. Rao P.N., "Manufacturing Technology, Metal cutting and Machine Tools", Tata McGraw Hill, 2000.
2. Hajra Choudhary.S.K. and Hajra Choudhary.A.K, "workshop Technology", Vol-I & Vol-II"- Media Publishers 1986.

3. Donaldson. C. "Tool design", Tata McGraw Hill Co. Ltd.,1985.
4. H.M.T. Production Technology-Tata McGraw Hill, 2001
5. Sharma .P.C., "A text book of Production Technology- vol I & II ", S.Chand & Company Ltd, New Delhi, 1996.

GE2022

TOTAL QUALITY MANAGEMENT

**L T P C
3 0 0 3**

UNIT I INTRODUCTION

9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES

9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II

9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS

9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education Asia,Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

OBJECTIVES:

- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kotler, Koshy Jha "Marketing Management", Pearson Education, Indian adapted edition.2007

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota&Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007.

ME3009

PROJECT ENGINEERING

L T P C
3 0 0 3

UNIT I FEASIBILITY ANALYSIS 9

Project Feasibility analysis: Marketing, Technical and financial feasibility, case studies, report preparation.

UNIT II PROJECT PLANNING 9

Project management: nature, scope, PERT, CPM techniques, principles, applications

UNIT III TIME VALUE OF MONEY 9

Internal and time value of money: simple interest, compound interest, present worth uniform series payments, use of interest tables, nominal and effective interest rates, continuous compounding, uniform continuous payment, uniform gradient.

UNIT IV EVALUATION OF ALTERNATIVES 9

Methods of tangible evaluation of alternatives: Equivalent annual worth comparisons, present worth comparisons rate of return comparisons.

Methods of forecasting: Need for forecast – statistical method, time series analysis, method of least squares, moving average method, curvilinear trend, correlation analysis

UNIT V REPLACEMENT AND RISK ANALYSIS 9

Replacement policy: item deteriorating with time and items that fail completely (not accounting for time value of money), accounting time value of money, replacement policy for new and old machine with infinite horizon.

Risk analysis: Risk in economic analysis, measuring risk investment, risk profiles, decision trees, formulation of discounted tree.

TOTAL = 45 PERIODS

REFERENCES

1. Prasanna Chandra, "Projects", Tata McGraw Hill, 2003
2. Patel Bhavesh . M, Project Management, Strategic Financial Planning Evaluation and Control, Vikas Publishing House, New Delhi, 2000
3. James, L. Riggs, "Engineering Economics", Tata Mc Graw Hill, 1998.
4. William G. Sullivan, James A. Bontadelli, Elin M Wicks, Engineering Economy Pearson Education Asia, 2001.
5. Pannirselvam. R, Engineering Economics, PHI, 2006s

EC3010	DATABASE MANAGEMENT SYSTEM	L T P C
		3 0 0 3
UNIT I	INTRODUCTION	9
Introduction to data file and database environment – Database administration – Data dictionary – Basic data modeling concepts.		
UNIT II	PHYSICAL STORAGE ORGANIZATION	9
Database design – Conceptual model – Logical model – Data storage and access methods – Physical Organization – Physical database design – Searching and reporting.		
UNIT III	PROGRAMMING	9
Programming in the database environment – Programming languages – programming language interfaces – Front-end tools – Querying languages – Security and Integrity factors.		
UNIT IV	RECORD BASE MODELS	9
Relational Model: system R architecture, data structure – external level, data manipulation – Hierarchical model: IMS architecture, data structure, external and internal levels – data manipulation – Network model: DBTG architecture, data structure, external level, data manipulation.		
UNIT V	RECENT TRENDS	9
Introduction to distributed databases – Recent trends in database systems – case studies using existing systems – Comparative study of existing commercial systems.		

TOTAL = 45 PERIODS

REFERENCES

1. Abraham Silberschatz, Henry F Korth, S.Sudharshan, "Database System Concepts", McGraw- Hill 1997.
2. Date C.J., "An Introduction to Database Systems", III edition, Vol. I, Narosa Publishing House, 1995.
3. James Martin, "Computer Database Organization" PHI Pvt. Ltd., 2002
4. Gerry M Litton, "Introduction to Database Management – A Practical Approach", S. Chand & Co Ltd., New Delhi, 1992
5. Atre S., "Database: Structured Techniques for design, performance and management", Wiley Interscience Publication, John Wiley and Sons, 1991

ME3011	RAPID PROTOTYPING	L T P C
		3 0 0 3
UNIT I	OVERVIEW OF RAPID PROTOTYPING	9

Definitions, evolution, CAD for RPT, Product design and rapid product development, conceptual design, detail design, prototyping, Fundamentals of RP systems, 3D solid modeling software and their role in RPT, creation of STL file

UNIT II	LIQUID BASED RP PROCESSES	9
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Liquid based RP systems: Stereo lithography (SLA)-principle-process parameters-process details-machine details- applications Solid Ground Curing - Principle- process parameters-process details-machine details, Applications

UNIT III	SOLID BASED RP PROCESSES	9
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Fusion Deposition Modeling - Principle- process parameters-process details-machine details, Applications. Laminated Object Manufacturing - Principle- process parameters-process details-machine details, Applications.

UNIT IV	POWDER BASED RP PROCESSES	9
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Powder based RP systems: Selective Laser Sintering (SLS)- Principle- process parameters-process details-machine details- Applications. 3-Dimensional Printers - Principle- process parameters-process details-machine details, Applications, and other Concept Modelers like Thermo jet printers, Sander's model maker

UNIT V	RAPID TOOLING	10
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Principles and typical process for quick batch production of plastic and metal parts through quick tooling.

Reverse Engineering – 3D scanning-3D digitizing and Data fitting

TOTAL : 45 PERIODS

REFERENCES:

1. Chua C.K. et al., "Rapid Prototyping: principles and applications" Wiley,2003
2. Pham D.T & Dimov.S.S, "Rapid manufacturing" , Springer-Verlag, London, 2001
3. Jacobs P.F., " Stereolithography and other Rapid Prototyping & Manufacturing Technologies", McGrawHill ,New york,1996
4. Hilton P.D., " Rapid Tooling" Marcel Dekkar, 2000
5. Zeid I., " CAD/CAM : Theory & Practice", McGrawHill,Singapore,1991

ME3013	PRODUCT DESIGN AND DEVELOPMENT	L T P C
		3 0 0 3
UNIT I	CREATIVE THINKING AND PRODUCT INNOVATION	9
The product and process design function. Locating ideas for new products. Selecting the product. Qualifications of the production design engineer, Creative thinking curiosity and imagination.		
UNIT II	CRITERIA FOR PRODUCT SUCCESS	9
Areas to be studies preparatory to design market research functional design. The value of appearance - Principles and laws of appearance - Incorporating quality and reliability into the design. Man Machine considerations-Designing for case of maintenance.		
UNIT III	COST AND PRODUCT DEVELOPMENT	9
Sources of funds for development cost - Product costs - Estimating product costs - Kinds of cost procedures - Value Engineering - Cost reduction.		
UNIT IV	PATENTS	9
Classes of exclusive rights - Patents-Combination versus aggregation - Novelty and Utility - Design patents - patent disclosure - patent application steps - Patent office prosecution - Sales of patent rights - Trade marks - Copy rights.		
UNIT V	QUALITY CONTROL AND RELIABILITY	9
Quality Control procedure - Inspection and test equipment - Statistical quality control - Manufacturing Reliability - Probability of tool reliability - Reliability operations - Developing a quality-control and reliability programme.		

TOTAL: 45 PERIODS

REFERENCES

1. Niebel.B.W. and Draper.A.B., Product Design and Process Engineering, McGraw Hill Book Company, New York, 1974.
2. Ulrich Karl.T., Product design and development, 3rd Edition, Tata McGraw Hill, New Delhi, 2005.
3. Kevin Otto and Kristin Wood, Product design: Techniques in reverse engineering and new product development, Pearson education Inc, New Delhi, 2004.
4. Chitale.A.K., Product design and manufacturing, Prentice-Hall of India, New Delhi, 2005.
5. Zaidi.A., SPC Concepts - Methodologies and Tools, Prentice Hall of India Pvt. Ltd., 2003.