ANURAG ENGINEERING COLLEGE

(An Autonomous Institution)
Ananthagiri(V&M) Suryapet(Dt)

Definitions of Key Words:

Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

Course: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these.

Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

Credit Point: It is the product of grade point and number of credits for a course.

Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course.

Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Programme: An educational programme leading to award of a Degree, Diploma or Certificate.

Semester Grade Point Average (SGPA): It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

Semester: Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.

Transcript or Grade Card or Certificate: Based on the grades earned, a grade

certificate shall be issued to all the registered students after every semester. The grade

certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

Types of Courses: The Courses in a programme may be of three kinds: Core, Elective and Foundation.

Core Course:-

There may be a Core Course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

Elective Course:-

Elective course is a course which can be chosen from a pool of papers. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be "Generic Elective" focusing on those courses which add generic proficiency to the students. An elective may be "Discipline centric" or may be chosen from an unrelated discipline. It may be called an "Open Elective."

Foundation Course:-

The Foundation Courses may be of two kinds: Compulsory Foundation and Elective foundation. "Compulsory Foundation" courses are the courses based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines. Elective Foundation courses are value-based and are aimed at man-making education.

ACADEMIC REGULATIONS FOR B. TECH. (REGULAR)

Applicable for the students of B.Tech.(Regular) from the Academic Year 2015-16 onwards

1. Title and Duration of the Progamme.

1.1 The programme shall be called the degree programme in Bachelor of Technology, abbreviated as B.Tech.

1.2 The programme shall be of four academic years duration divided into eight semesters, each semester having duration of minimum 16 weeks of instruction.

1.3 The calendar of events in respect of the programme shall be fixed by the College from time to time.

1.4 The external examination in all the courses (subjects) shall be conducted at the end of each semester for all the eight semesters.

1.5 Students joining the B.Tech. Programme shall have to complete the programme within a stipulated time frame of 8 years from the year of joining and Students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme within a stipulated time frame of 6 years from the year of joining. Otherwise, they shall forfeit their seat in B.Tech Programme and their admission shall stand cancelled.

2. Admission Procedure

2.1 Admissions will be done as per the norms prescribed by the Government of Telangana State.

2.2 The Government orders in vogue shall prevail.

2.3 The candidate should have passed the prescribed qualifying examination on the date of admission.

3. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic requirements:

3.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight academic years.

3.2 The candidate shall register for 192 credits and secure all the 192 credits by securing a minimum CGPA of 5.0.

3.3 The students, who fail to fulfill the academic requirements for the award of the degree within eight academic years from the year of admission, shall forfeit their seats in B.Tech. Programme.

4. Courses of Study

The following B. Tech. Programmes are offered at present:

Branch	Branch Code
Civil Engineering	01
Electrical and Electronics Engineering	02
Mechanical Engineering	03
Electronics and Communication Engineering	04
Computer Science and Engineering	05

and any other course as approved by the Authorities from time to time.

5. Credits

	Semester	
	Contact Periods / week	**Credits**
Theory	04	04
	03	03
	02	02
Practical	03	02
Drawing	00+04	02
	02+02	03
	00+06	03
Mini project	--	02
Comprehensive Viva Voce	--	02
Seminar	6	02
Project	15	10

***Note on Tutorials:- No Credits for < 2 periods /week**

6. **Distribution and Weight age of Marks**

6.1 The performance of a student in a semester shall be evaluated course-wise for a maximum of 100 marks each for a theory and practical course. In addition, industry-oriented mini-project, seminar, Comprehensive Viva-Voce and Project work shall be evaluated for 100, 100, 100 and 200 marks respectively.

6.2 For theory courses the distribution shall be 25 marks for Continuous Internal Evaluation (CIE) and 75 marks for the Semester End- Examination (SEE).

6.3 For theory courses, during the semester there shall be 2 midterm examinations. Each mid term examination consists of Part-A (Short Answers) for 5 marks and Part-B (Long Answers) for 15 marks with duration of 90 Minutes and an assignment carrying 5 marks.

Part-B shall contain 3 questions with internal choice, each carries 5 marks. First mid term examination shall be conducted for 2.5 units of syllabus and second mid term examination shall be conducted for remaining 2.5 units. First Assignment should be submitted before the conduct of the first mid term exam, and the second assignment should be submitted before the conduct of the second mid term exam.

The total marks secured by the student in each mid term examination for 25 marks is considered and the average of the two mid term examinations shall be taken as the final marks secured by each student**.** If he/she is absent for any test / assignment, he/she is awarded zero marks for that test / assignment.

6.4 The Semester End Examination will be conducted for 75 marks which consist of two parts viz. i). Part-A for 25 marks, ii). Part –B for 50 marks.

6.5 Part-A is compulsory, which consists of ten questions (numbered from 1 to 10) two from each unit carrying 2 / 3 marks each.

6.6 Part-B consists of five questions (numbered from 11 to 15) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an “either” “or” choice (that means there will be two questions from each unit and the student should answer any one question).

6.7 For practical courses, there shall be a continuous internal evaluation during a semester for 25 sessional (internal) marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and midterm practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. Semester End Examinations carries 75 marks.

6.8 The practical Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed by the Principal from the panel of examiners recommended by Chairman, Board of Studies in respective branches.

6.9 For the courses having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be

25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for midterm examination) and 75 marks for end examination. There shall be two midterm examinations in a semester and the average of the two shall be considered for the award of marks for midterm examinations.

6.10 There shall be an industry-oriented mini-Project, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated in IV year I Semester. The industry oriented mini project shall be submitted in report form and should be presented before the committee, which shall be evaluated for 100 marks. The committee consists of an external examiner, Head of the Department, the Supervisor of Mini Project and a Senior Faculty member of the department. There shall be no internal marks for industry oriented mini project.

6.11 There shall be a seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, Supervisor of Seminar and a Senior Faculty member of the department. The seminar report shall be evaluated for 100 marks. There shall be no external examination for the seminar.

6.12 There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a committee consisting of Head of the Department and two Senior Faculty members of the department. The Comprehensive Viva-Voce is intended to assess the students understanding of the courses he studied during the B. Tech. course of study. The Comprehensive Viva-Voce shall be evaluated for 100 marks. There are no external marks for the Comprehensive Viva-Voce.

6.13 Out of a total of 200 marks for the Project work, 50 marks shall be for Internal Evaluation and 150 marks for the Semester End Examination. The Semester End Examination (viva-voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department, the Supervisor of Project and a Senior Faculty member of the department. The topics for industry oriented mini project, seminar and project work shall be different from each other. The evaluation of Project work shall be conducted at the end of the IV year II Semester. The internal evaluation shall be on the basis of two seminars given by each student on the topic of his project.

6.14 The Laboratory marks and the sessional marks awarded by the faculty are subject to scrutiny and scaling by the Institution whenever/wherever necessary. In such cases, the sessional and laboratory marks awarded by the teacher will be referred to a College Standing Committee/ Academic Committee. The Committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved as per the University rules and

produced before the Committees of the University as and when asked for.

6.15 Candidates shall be permitted to apply for recounting/revaluation of SEE scripts within the stipulated period with payment of prescribed fee.

7. Attendance Requirements

7.1 A student is eligible to write the Semester End Examinations only if he / she acquires a minimum of 75% of attendance in aggregate of all the courses.

7.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical grounds with a documentary evidence approved by the Academic Council.

7.3 A stipulated fee shall be payable towards condonation of shortage of attendance.

7.4 Shortage of attendance below 65% in aggregate shall not be condoned under any circumstances.

7.5 Students whose shortage of attendance is not condoned are not eligible to write Semester End Examinations of that semester. Such students are detained and their registration for examination stands cancelled.

7.6 A student detained due to shortage of attendance in a semester may seek re-admission into that semester, as and when offered, within four weeks from the date of the commencement of class work with the academic regulations of the batch into which he/she gets admitted.

7.7 A student will be promoted to the next semester if he/she satisfies the attendance requirement of the present semester and shall not be eligible for readmission into the same semester.

7.8 For all mandatory, non-credit courses offered in a semester, a “Satisfactory Participation Certificate” shall be issued to the student, only after securing minimum 75% of attendance in such a course. No marks or Letter Grade shall be allotted for these activities.

8. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7.

8.1 A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical/design/drawing course/project and secured not less 35% marks in Semester End Examination (SEE), and minimum 40% marks when the total of the internal evaluation and semester end examinations taken together.

8.2 The student has to pass the failed course by appearing the supplementary examination as per the requirement for the award of degree.

8.3 Students who fail to earn 192 credits as indicated in the course structure within eight academic years from the year of their admission, shall forfeit their seat in B. Tech. Programme and their admission stands cancelled.

8.4 A student shall be promoted from I Year to II Year only if he/she fulfills the academic requirements of securing 50% of average credits (24 credits out of 48 credits) upto I year II Semester, from all the examinations, whether or not the candidate takes the examinations.

8.5 A student shall be promoted from II Year to III Year only if he/she fulfills the academic requirements of securing 50% of average credits (36 credits out of 72 credits) up to II year I semester, from all the examinations, whether or not the candidate takes the examinations.

8.6 A student shall be promoted from III year to IV year only if he/she fulfills the academic requirements of securing 50% of average credits (60 credits out of 120 credits) up to III year I semester, from all the examinations, whether or not the candidate takes the examinations.

8.7 A student shall register and put up minimum attendance in all 192 credits and earn all 192 credits for the award of degree.

8.8 When a Student is detained due to shortage of attendance in any semester, no Grade Allotments or SGPA/CGPA calculations will be done for that entire Semester in which he got detained.

8.9 When a Student is detained due to lack of Credits in any year, he may be readmitted after fulfillment of the Academic Requirements, with the Academic Regulations of the Batch into which he gets readmitted subject to 3.3.

8.10 For readmitted candidates, if there are any Professional Electives / Open Electives, the same may also be re-registered if offered. However, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Courses offered under that category.

8.11 After securing the necessary 192 Credits as specified for the successful completion of the entire UGP, an exemption of 8 secured Credits (in terms of two of their corresponding Courses (Subjects)) may be permitted for optional drop out from these 192 Credits earned; resulting in 184 Credits for UGP performance evaluation, i.e., the performance of the Student in these 184 Credits shall alone be taken into account for the calculation of 'the final CGPA (at the end of UGP, which takes the SGPA of the IV Year II Semester into account)' , and shall be indicated in the Grade Card of IV Year II Semester; however, the Student's Performances in the earlier individual Semesters, with the corresponding SGPA and CGPA for which already Grade Cards are given, will not be altered. Further, optional drop out for such 8 secured Credits shall not be allowed for Courses listed as … i) Laboratories/ Practicals, ii) Industrial Training/ Mini-Project, iii) Seminar, iv) Comprehensive Viva Voce v) Major Project.

8.12 If a Student registers for some more 'extra courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed courses totalling to 192 Credits as specified in the Course Structure of his Department, the performances in those 'extra courses' (although evaluated and graded using the same procedure as that of the required 192 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra courses' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the

Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.11 above.

9 Program Structure

S. No.	Classification		Course Work - Subject Area	Range of Total Credits (%)	
	AICTE	UGC		Min	Max
1	HS	Foundation Courses	Humanities and Social Sciences including Management; (HS),	5	10
2	BS		Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology;	15	20
3	ES		Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/ Electronics/ Mechanical/Computer Engineering Instrumentation;	15	20
4	PC	Core Courses	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required ;)	30	40
5	PW		Project Work, Seminar and/or Internship in Industry or elsewhere.	10	15
6	PE	Elective Courses	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	10	15
7	OE		Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	5	10

10 Course pattern

10.1 The entire course of study is for four academic years in semester pattern.

10.2 A student eligible to appear for Semester End Examinations in a course, but absent from it or failed in that examination, may write the exam in that course during supplementary exams.

10.3 A student eligible to appear in the Semester End Examination in any Course, but absent at it or failed (thereby failing to secure P Grade or above), may

reappear for that Course at the supplementary examination as and when conducted. In such cases, his Continuous Internal Evaluation (CIE) marks assessed earlier for that Course will be carried over, and added to the marks to be obtained in the supplementary examinations, for evaluating his performance in that course.

11 Minimum Instruction Days

The minimum instruction days for each semester shall be 90 days.

12 Grade Points

12.1 Marks will be awarded to indicate the performance of each student in each theory course, or Lab/Practical's, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % of marks obtained in CIE+SEE(Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

12.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed.

Letter Grade	Grade Points	% of marks Secured (Class Intervals)
O (Out Standing)	10	80% and above (≥80%, ≤100%)
A+ (Excellent)	9	Below 80% but not less than 70% (≥70%, <80%)
A (Very Good)	8	Below 70% but not less than 60% (≥60%, < 70%)
B+ (Good)	7	Below 60% but not less than 55% (≥55%, < 60%)
B (Above Average)	6	Below 55% but not less than 50% (≥50%, < 55%)
C (Average)	5	Below 50% but not less than 45% (≥45%, < 50%)

P (Pass)	4	Below 45% but not less than 40% (≥40%, < 45%)
F (Fail)	0	Below 40% (< 40%)
Ab (Absent)	0	--

12.3 A student obtaining F Grade in any Course shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases; his Continuous Internal Evaluation (CIE) marks in those Course(s) will remain same as those he obtained earlier.

12.4 A Letter Grade does not imply any specific % of Marks.

12.5 In general, a student shall not be permitted to repeat any Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Courses pertaining to that Semester, when he is detained (as listed in items 8.10 - 8.11).

12.6 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Course. **Credit Points (CP) = Grade Point (GP) x Credits of that Course.**

12.7 The Student passes the Course only when he gets GP ≥ 4 (P Grade or above).

13 Registration/Dropping

13.1 Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely necessary for the student to register for courses in time.

13.2 The student has to register for a minimum of 20 credits and may register up to a maximum of 28 credits based on the advice of the Faculty Advisor. On an average, a student is expected to register for 24 credits.

13.3 A student at the end of II year II semester either having the CGPA of ≥ 7.0 or having passed all previous courses in first attempt with a minimum CGPA ≥ 5.0 is allowed to register an additional course / credits from the offered open electives. However mandatory non credit courses can be register during the course of study with the consent of the faculty advisor.

13.4 Open Electives are offered to students in IV year I semester and II semester, which can be registered by the students during III year and IV year I semester. Prior permission for registration of Open Electives as additional course is compulsory.

13.5 A student would be allowed to register in an additional course only if he/she satisfies the prerequisites.

13.6 Departments will notify at the time of registration about the minimum number of students to be enrolled for a particular open elective to be offered.

13.7 Any student may be barred from registering for any course for specific reasons like disciplinary reasons, non- payment of fees, etc.

13.8 Dropping of Courses: Within four weeks after the commencement of the semester, the student may, in consultation with his / her faculty advisor, can drop one or more courses without prejudice to the minimum number of credits as

specified in 13.2. The dropped courses are not recorded in the Grade Card.

13.9 After Dropping, minimum credits registered shall be 20.

14 Earning of Credit

A student shall be considered to have completed a Course successfully and earned the credits if he/she secures an acceptable letter grade in the range 'O' to 'P'. Letter grade 'F' in any Course implies failure of the student in that Course and no credits earned.

15 Passing Standards:

15.1 A student shall be declared successful or 'passed' in a Semester, only when he/she gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when he/she gets a CGPA ≥ 5.00; subject to the condition that he/she secures a GP ≥ 4 (P Grade or above) in every registered Course in each Semester (during the entire UGP) for the award of Degree, as required.

15.2 In spite of securing P Grade or above in some (or all) Courses in any Semester, if a Student receives a SGPA < 5.00 and/ or CGPA < 5.00 at the end of such a Semester, then he 'may be allowed' (on the 'specific recommendations' of the Head of the Department and subsequent approval from the Principal) –

(i) to go into the next subsequent Semester (subject to fulfilling all other attendance and

academic requirements as listed under Items 7-8);

(ii) to 'improve his SGPA of such a Semester (and hence CGPA) to 5.00 or above', by reappearing for ONE or MORE (as per Student's choice) of the same Course(s) in which he has secured P Grade(s) in that Semester, at the Supplementary Examinations to be held in the next subsequent Semester(s). In such cases, his Continuous Internal Evaluation Marks (CIE Marks) in those Course(s) will remain same as those he obtained earlier.

In these considerations, the newly secured Letter Grades will be recorded and taken

into account for calculation of SGPA and CGPA, only if there is an improvement.

15.3 A Student shall be declared successful or 'passed' in any Non-Credit Course, if he secures a 'Satisfactory Participation Certificate' for that Mandatory Course.

15.4 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) *(are all theses 3 are same?)* shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

16 Vertical Progression

It shall also be necessary to lay down uniform minimum standards for SGPA and CGPA together with the minimum number of *credits* to be earned in a semester for the *vertical progression* of students. This shall be used in facilitating the mobility of students from one College to another and also in avoiding any confusion among the students. The

a) Minimum Standard for SGPA =5.0;

b) Minimum Standard for CGPA =5.0; (at the end of each semester)

However, failure to secure a minimum CGPA = 5.0 at the end of any semester for the first time, shall **attract a warning** before approval of the student to continue in the following semester and will be required to register for courses having a GPA of 4.0 to improve the SGPA to 5.0 or above

17 Eligibility for Award of B.Tech. Degree

A student shall be eligible for award of the B.Tech degree if he/she fulfils all the following conditions;

17.1 Registered and successfully completed all the components prescribed in the Programme of study (*Course of study* mentioned in all earlier occasions) to which

he/she is admitted,

17.2 Obtained CGPA greater than or equal to 5.0 (Minimum requirements for Pass),

17.3 Has no dues to the College, hostels, Libraries, NCC / NSS etc., and

17.4 No disciplinary action is pending against him/her.

18 Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

CGPA	Class Awarded	
≥8.00	First Class with Distinction	**From the CGPA secured from 192 credits**
≥6.50 - <8.00	First Class	
≥5.50 - <6.50	Second Class	
≥5.00 - <5.50	Pass Class	

18.1 The marks obtained in Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) will not be shown in the memorandum of marks.

18.2 For the purpose of awarding First Class with Distinction (CGPA ≥ 8.0), the student must obtain the minimum required CGPA within 4 academic years or within 3 academic years in case of Lateral Entry candidates by clearing all the courses.

18.3 Candidates detained / prevented from writing the Semester End Examinations due to any reason in any semester are not eligible for the award of First Class with Distinction. Such candidate's even if the CGPA ≥ 8.0, shall be placed in first class.

18.4 For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of Programme shall be considered as per the regulations.

18.5 A student with final CGPA < 5.00 (at the end of the UGP) will not be eligible for the Award of the Degree.

18.6 The CGPA can be converted to equivalent percentage of marks by using the following equation:

(CGPA - 0.5) X 10

19 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidates will be issued after completion of the four years B. Tech Programme.

20 Withholding of Results

If the student has not paid the dues, if any, to the College or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases the matter will be referred to the Academic Council. The decision of the Academic Council is final.

21 Transitory Regulations

21.1 Discontinued, detained, or failed candidates are eligible for readmission as and when next offered as per the college admission procedure.

21.2 Students on transfer shall complete the prescribed courses of the concerned

programme not covered earlier and however he/she should take the remaining programme along with others.

21.3 There shall be no branch transfers after the cutoff date of admissions in the academic year.

22 Transcripts

After successful completion of the total Programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee.

23 Supplementary Examinations

In addition to the Regular Final Examinations held at the end of each semester, Supplementary Final Examinations will be conducted during the academic year. Candidates taking the Regular / Supplementary examinations as Supplementary candidates may have to take more than one Semester End Examination per day. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However the maximum stipulated period cannot be relaxed under any circumstances.

24 Graduation Ceremony

24.1 The College shall have its own annual Graduation Ceremony for the award of degree to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

24.2 The College shall institute Prizes and Awards to meritorious students, for being given away annually at the Graduation Ceremony.

25 Termination from the Program

The admission of a student to the program may be terminated and the student asked to leave the College in the following circumstances:

25.1 The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

25.2 The student fails to satisfy the norms of discipline specified by the College from time to time.

26 Non-Credit Courses (Mandatory Courses)

26.1 All the courses designated as mandatory course is a compulsory requirement for all students for the award of degree.

26.2 These activities carry no credits and are evaluated as Satisfactory/ Unsatisfactory.

26.3 Minimum attendance requirement as per the regulations is compulsory for completing the mandatory courses.

27 Amendments

The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

28 General

28.1 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

28.2 The academic regulation should be read as a whole for the purpose of any interpretation.

28.3 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

ACADEMIC REGULATIONS FOR B. TECH. (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. (Lateral Entry Scheme) from the Academic Year 2016-17 and onwards

1. **Eligibility for award of B. Tech. Degree (LES)**

1.1 The LES candidates shall pursue a course of study for not less than three academic. years and not more than six academic years.

1.2 The candidate shall register for 144 credits and secure 144 credits by securing a minimum CGPA of 5.0 from II to IV year B.Tech. Program (LES) for the award of B.Tech. degree.

1.3 The students, who fail to fulfill the requirement for the award of the degree in **six** academic years from the year of admission, shall forfeit their seats.

1.4 The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech.(LES).

2. **Promotion Rule**

A student shall be eligible for promotion in B.Tech programme, if he/she acquires the minimum number of credits as given below:

2.1 A student shall be promoted from II Year to III Year only if he/she fulfills the academic requirements of securing 50% of average credits (12 credits out of 24 credits) up to II year I semester, from all the examinations, whether or not the candidate takes the examinations.

2.2 A student shall be promoted from III year to IV year only if he/she fulfills the academic requirements of securing 50% of average credits (36 credits out of 72 credits) up to III year I semester, from all the examinations, whether or not the candidate takes the examinations.

2.3 A student shall register and put up minimum attendance in all 144 credits and earn all 144 credits to be eligible for award of degree.

2.4 Students who fail to earn 144 credits as indicated in the course structure within six

academic years, shall forfeit their seat in B.Tech. Programme and their admission stands cancelled.

3. **Award of Class**

After a	**Class Awarded**	**From the CGPA secured from 144 credits**
≥8.00	First Class with Distinction	
≥6.50 - <8.00	First Class	
≥5.50 - <6.50	Second Class	
≥5.00 - <5.50	Pass Class	

4. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B.Tech. (Lateral Entry Scheme).

--*

ANNEXURE - I

1 Grade Point Average

1.1 **SGPA and CGPA**

The *credit index* can be used further for calculating the Semester Grade Point Average *(SGPA)* and the Cumulative Grade Point Average *(CGPA),* both of which being important performance indices of the student. While *SGPA* is equal to the *credit index* for a semester divided by the total number of *credits* registered by the student in that semester, *CGPA* gives the sum total of *credit indices* of all the previous semesters divided by the total number of *credits* registered in all these semesters. Thus,

The Grade Point Average (GPA) will be calculated according to the formula:

$$GPA = \frac{\sum ciGi}{\sum ci}$$

Where Ci = number of credits for the course i,

Gi = grade points obtained by the student in the course.

1.2 Semester Grade Point Average (SGPA) is awarded to candidates considering all the courses of the semester. Zero grade points are also included in this computation. SGPA is rounded off to TWO Decimal Places.

SGPA will be computed as follows:

$$\frac{\sum [(\text{Course } \textit{credits}) \text{ X } (\textit{Grade points})] \text{ (for all Courses passed in that semester)}}{\sum [(\text{Course } \textit{credits})] \text{ (for all courses registered in that semester)}}$$

1.3 To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time. CGPA is rounded off to TWO Decimal Places.

CGPA will be computed as follows:

$$\frac{\sum [(\text{Course } \textit{credits}) \text{ X } (\textit{Grade points})] \text{ (for all Courses passed upto that semester)}}{\sum [(\text{Course } \textit{credits})] \text{ (for all Courses registered until that semester)}}$$

CGPA is thus computed from the I Year First Semester onwards, at the end of each

Semester, as per the above formula. However, the SGPA of I year I Semester itself

may be taken as the CGPA, as there are no cumulative effects

1.4 **Illustrative Example**

An illustrative example given in below Table below indicates the use of the above two equations in calculating SGPA and CGPA, both of which facilitate the declaration of academic performance of a student, at the end of a semester and at the end of successive semesters respectively . Both of them shall be normally calculated up to the second decimal position, so that the *CGPA,* in particular, can be made use of in rank ordering the student's performance in a class. If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* But, if it is not resolved even at this stage, the number of times a student has obtained higher grades like O, A, B etc shall be taken into account in rank ordering of the students in a class.

Year and Semester	Course No.	Credits	Grade	Grade Points	Credit Points
I Year I sem	XX101	5	A	8	40
I Year I sem	XX102	4	F	0	00
I Year I sem	XX103	3	A+	9	27
I Year I sem	XX104	4	F	0	00
I Year I sem	XX105	5	C	5	25
I Year I sem	XX106	5	P	4	20
Total		**26 (18*)**			**112**

SGPA = 112/26 = 4.31			CGPA = 4.31		
I Year II Sem	XX107	5	B+	7	35
I Year II Sem	XX108	4	A	8	32
I Year II Sem	XX109	3	C	5	15
I Year II Sem	XX110	5	P	4	20
I Year II Sem	XX111	4	A+	9	36
I Year II Sem	XX112	2	F	0	00
I Year II Sem	Xx113	2	A	8	16
Total		**25 (23*)**			**154**
SGPA = 154/25 = 6.16		**CGPA = 266/51 = 5.22**			

* Total No. of credits excluding those with 'F'; this is particularly important to keep track of the number of credits earned by a student up to any semester:

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course (subject) of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that course (subject) only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered

	exam hall in respect of any matter.	against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all END examinations. The continuation of the course by the candidate is course to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all END examinations. The continuation of the Programme by the candidate is subject to the academic regulations in connection with forfeiture of

		seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6.	Refuses to obey the orders of the Chief Controllerof Exams/Chief Superintendent / Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all END examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in	Expulsion from the examination hall and

	the examination hall.	cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the PRINCIPAL for further action to award suitable punishment.	

ANURAG ENGINEERING COLLEGE

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Department Of Mechanical Engineering

COURSE STRUCTURE (R15)

I B.Tech (ME) I Semester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A51001	English-I	H.S	2	0	2	25	75	100
2	A51002	Mathematics-I	B.S	3	1	3	25	75	100
3	A51003	Engineering Physics-I	B.S	2	1	2	25	75	100
4	A51004	Applied Chemistry-I	B.S	2	1	2	25	75	100
5	A51005	Computer Programming-I	E.S	3	1	3	25	75	100
6	A51006	Engineering Graphics-I	E.S	0	4	2	25	75	100
7	A51007	Engineering Mechanics-I	E.S	2	1	2	25	75	100
8	A51209	Computer Programming Lab-I	E.S	0	3	2	25	75	100
9	A51210	English Language Communication Skills Lab-I	H.S	0	3	2	25	75	100
10	A51211	Engineering Physics and Applied Chemistry Lab-I	B.S	0	3	2	25	75	100
11	A51212	Engineering Workshop-I	E.S	0	3	2	25	75	100
		Total		14	21	24	275	825	1100

T-Tutorial **P-Practical** **D-Drawing**

I B.Tech (ME) IISemester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A52001	English-II	H.S	2	0	2	25	75	100
2	A52002	Mathematics-II	B.S	3	1	3	25	75	100
3	A52003	Engineering Physics-II	B.S	2	1	2	25	75	100
4	A52004	Applied Chemistry-II	B.S	2	1	2	25	75	100
5	A52005	Computer Programming-II	E.S	3	1	3	25	75	100
6	A52006	Engineering Graphics-II	E.S	0	4	2	25	75	100
7	A52007	Engineering Mechanics-II	E.S	2	1	2	25	75	100
8	A52209	Computer Programming Lab-II	E.S	0	3	2	25	75	100
9	A52210	English Language Communication Skills Lab-II	H.S	0	3	2	25	75	100
10	A52211	Engineering Physics and Applied Chemistry Lab-II	B.S	0	3	2	25	75	100
11	A52212	Engineering Workshop-II&I.T Workshop	E.S	0	3	2	25	75	100
		Total		14	21	24	275	825	1100

T-Tutorial **P-Practical** **D-Drawing**

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COURSE STRUCTURE (R15)

II B.Tech (ME) I Semester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A53013	Mechanics of Solids	E.S	4	1	4	25	75	100
2	A53014	Thermodynamics	P.C	4	1	4	25	75	100
3	A53015	Metallurgy & Material Science	E.S	3	1	3	25	75	100
4	A53016	Environmental Studies	E.S	3	1	3	25	75	100
5	A53001	Mathematics-III	B.S	3	1	3	25	75	100
6	A53017	Electrical and Electronics Engineering	E.S	3	1	3	25	75	100
7	A53207	Electrical and Electronics Engineering Lab	E.S	-	3	2	25	75	100
8	A53208	Metallurgy and Mechanics of Solids Lab	E.S	-	3	2	25	75	100
9	A53209	Gender Sensitization	M.C	-	3	-	25	75	100
		Total		20	15	24	225	675	900

T-Tutorial **P-Practical** **D-Drawing**

II B.Tech (ME) II Semester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A54012	Production Technology	P.C	3	1	3	25	75	100
2	A54013	Kinematics of machinery	P.C	4	1	4	25	75	100
3	A54014	Thermal Engineering-I	P.C	4	1	4	25	75	100
4	A54015	Mechanics of Fluids and Hydraulic Machines	P.C	3	1	3	25	75	100
5	A54016	Machine Drawing	P.C	_	6	3	25	75	100
6	A54001	Probability & Statistics	B.S	3	1	3	25	75	100
7	A54207	Production Technology Lab	P.C	_	3	2	25	75	100
8	A54208	Mechanics of Fluids and Hydraulic Machines Lab	P.C	_	3	2	25	75	100
9	A54209	Human Values and Professional Ethics	M.C	3	-	-	25	75	100
		Total		20	17	24	225	675	900

T-Tutorial **P-Practical** **D-Drawing**

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COURSE STRUCTURE (R15)

III B.Tech (ME) I Semester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A55017	Machine Tools &Metrology	P.C	3	1	3	25	75	100
2	A55018	Dynamics Of Machinery	P.C	3	1	3	25	75	100
3	A55019	Design Of Machine Members-I	P.C	4	1	4	25	75	100
4	A55020	Thermal Engineering-II	P.C	4	1	4	25	75	100
5	A55021	Managerial Economics and Financial Analysis	H.S	3	1	3	25	75	100
6		PE-I							
	A55022	Automobile Engineering	PE	3	1	3	25	75	100
	A55023	Welding Technology							
	A55024	Turbo Machinery							
7	A55205	Metrology &Machine Tools Lab	P.C	-	3	2	25	75	100
8	A55206	Thermal Engineering Lab	P.C	-	3	2	25	75	100
		Total		20	12	24	200	600	800

T-Tutorial **P-Practical** **D-Drawing**

III B.Tech (ME) II Semester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A56015	Design Of Machine Members-II	P.C	3	1	3	25	75	100
2	A56016	Heat Transfer	P.C	4	1	4	25	75	100
3	A56017	Refrigeration & Air Conditioning	P.C	4	1	4	25	75	100
4	A56018	Operation Research	P.C	3	1	3	25	75	100
5		**P E II:**							
	A56019	Industrial Management	P.E	3	1	3	25	75	100
	A56020	Nano Technology							
	A56021	Tribology							
6		**O E I**							
			O.E	3	1	3	25	50	75
7	A56205	Heat Transfer Lab	P.C	-	3	2	25	75	100
8	A56206	Advanced English Communication Skills Lab	P.C	-	3	2	25	75	100
		Total		20	12	24	200	600	800

T-Tutorial **P-Practical** **D-Drawing**

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COURSE STRUCTURE (R15)

IV B.Tech (ME) I Semester

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1	A57019	CAD/CAM	P.C	4	1	4	25	75	100
2	A57020	Instrumentation & Control Systems	P.C	3	1	3	25	75	100
3	A57021	Finite Element Analysis	P.C	3	1	3	25	75	100
4		**P E III:**							
	A57022	Power Plant Engineering	P.E	3	1	3	25	75	100
	A57023	CNC Technologies							
	A57024	Unconventional Machining Process							
5		**P E IV:**							
	A57025	Automation in Manufacturing Systems	P.E	3	1	3	25	75	100
	A57026	Plant Layout &Material handling							
	A57027	Computational Fluid Dynamics							
6		**O.E II:**	O,E	3	1	3	25	75	100
7	A57207	Computer Aided Design & Computer Aided manufacturing Lab	P.C		3	2	25	75	100
8	A57208	PDP &Instrumentation Lab	P.C		3	2	25	75	100
9	A57209	Mini Project	PW		-	2	-	100	100
		Total		19	12	25	200	700	900

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COURSE STRUCTURE (R15)

IV B.Tech (ME) II Semester:

S.No.	Course Code	Course	Course Category	Lectures	T / P / D	Credits	Internal Marks	External Marks	Total Marks
1		**P.E V:**							
	A58013	Industrial Robotics	P.E	3	1	3	25	75	100
	A58014	Mechatronics							
	A58015	Composite Materials							
2		**P.E VI:**							
	A58016	Production Planning and Control	P.E	3	1	3	25	75	100
	A58017	Mechanical vibrations							
	A58018	Flexible Manufacturing Systems							
3		**O.E III:**							
			O.E	3	1	3	25	75	100
4	A58207	Seminar	PW	-	6	2	100	-	100
5	A58208	Project work	PW	-	15	10	50	150	200
6	A58209	Comprehensive viva	PW	-	-	2	100	-	100
		Total		09	24	23	325	375	700

T-Tutorial **P-Practical** **D-Drawing**

ANURAG ENGINEERING COLLEGE

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LIST OF OPEN ELECTIVE SUBJECTS:

OPEN ELECTIVE- I			
S.No	**Course code**	**Subject**	**Offering Department**
1	A56301	Construction Materials	Civil Engineering
2	A56302	Waste Management	
3	A56303	Solar Photovoltaic Systems	Electrical & Electronics Engineering
4	A56304	Maintenance of Electrical Systems	
5	A56305	Advanced Engineering Materials	Mechanical Engineering
6	A56306	Mechatronics	
7	A56307	Principles of Communication Systems	Electronics & Communication Engineering
8	A56308	Electronic Measuring Instruments	
9	A56309	Java Programming	Computer Science & Engineering
10	A56310	Computer Networks	

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OPEN ELECTIVE- II			
S.No.	**Course code**	**Subject**	**Offering Department**
1	A57301	Disaster Management and Mitigation	Civil Engineering
2	A57003	Geological Information System & Remote Sensing	
3	A57302	Energy Storage Systems	Electrical & Electronics Engineering
4	A57303	Electrical Engineering Materials	
5	A57022	Power Plant Engineering	Mechanical Engineering
6	A57304	Industrial Robotics	
7	A57305	Computer Organization	Electronics & Communication Engineering
8	A57306	Principles of Signal Processing	
9	A57307	Database Management Systems	Computer Science & Engineering
10	A57308	Web Technologies	

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OPEN ELECTIVE- III			
S.No	**Course code**	**Subject**	**Offering Department**
1	A58301	Construction Technology and Project Management	Civil Engineering
2	A58302	Safety Engineering	
3	A58303	Energy conservation and Audit	Electrical & Electronics Engineering
4	A58304	Artificial Neural Networks	
5	A58305	Renewable Energy Sources	Mechanical Engineering
6	A58306	Automobile Engineering	
7	A58307	Nano Technology	Electronics & Communication Engineering
8	A58308	Biometric System	
9	A58309	Game Theory with Engineering Applications	Computer Science & Engineering
10	A58310	Software Engineering	

ANURAG ENGINEERING COLLEGE
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I Year B.Tech. ME – I Sem	L	T/P/D	C
	2	0	2

(A51001) English-I

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc. The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.*

2. OBJECTIVES:

a. To improve the language proficiency of the students in English with emphasis on LSRW skills.

b. To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.

c. To develop the study skills and communication skills in formal and informal situations.

LEARNING OUTCOMES:

1. Usage of English Language, written and spoken.

2. Enrichment of comprehension and fluency

3. Gaining confidence in using language in verbal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation

2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

• Listening for general content

• Listening to fill up information

• Intensive listening

• Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.

2. To enable students to express themselves fluently and appropriately in social and professional contexts.

• Oral practice

• Describing objects/situations/people

• Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: ***Skills Annexe - Functional English for Success)***

• Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.

2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

• Skimming the text

• Understanding the gist of an argument

• Identifying the topic sentence

• Inferring lexical and contextual meaning

• Understanding discourse features

• Scanning

• Recognizing coherence/sequencing of sentences

NOTE : The students will be trained in reading skills using the prescribed text for detailed study.

They will be examined in reading and answering questions using 'unseen' passages which may be taken from

authentic texts, such as magazines/newspaper articles.

Writing Skills:

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill

2. To equip them with the components of different forms of writing, beginning with the lower order ones.

• Writing sentences

• Use of appropriate vocabulary

• Paragraph writing

• Coherence and cohesiveness

• Narration / description

• Note Making

• Formal and informal letter writing

• Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED:

For Detailed study:

First Textbook: ***"Skills Annexe -Functional English for Success***", Published by Orient Black Swan, Hyderabad

For Non-detailed study:

Second text book *"Epitome of Wisdom",* Published by Maruthi Publications, Guntur

UNIT –I

Chapter 1: **'Wit and Humour'** from 'Skills Annexe' -Functional English for Success, Published by Orient Black Swan, Hyderabad

2 hrs

L-Listening For Sounds, Stress and Intonation 1

S-Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations) 1

R- Reading for Subject/ Theme 1

W- Writing Paragraphs 1

UNIT –II

Chapter 2:**'Mokshagundam Visvesvaraya'** from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad.

3 hrs

G-Types of Nouns and Pronouns 1

V- Homonyms, homophones synonyms, antonyms 2

UNIT-III

Chapter 3: **"Cyber Age"** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad.

2 hrs

L – Listening for themes and facts 1

S – Apologizing, interrupting, requesting and making polite conversation 1

R- For theme and gist 1

W- Describing People, Places, Objects, Events 1

UNIT-IV

Chapter 4:**'Three Days To See'** from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad G- Verb forms V- noun, verb, adjective and adverb 2hrs

UNIT-V

Chapter 5**'Risk Management'** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad 2hrs

L – for main points and sub-points for note taking 1

S – giving instructions and directions; Speaking of hypothetical situations 1

R – reading for details 1

W – note-making, information transfer, punctuation 1

REFERENCES:

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2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.

3. English Grammar Practice, Raj N Bakshi, Orient Longman.

4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.

5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson

6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw – Hill.

7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.

8. Technical Communication, Meenakshi Raman, Oxford University Press

9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education

10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.

11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.

12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,

13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.

14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education

15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.

16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO

17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education

18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,

19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers.

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(A51002) MATHEMATICS-I

(Calculus and Matrices)

Course Objectives:

1. Able to know the Mean value theorems and determine the maxima and minima for function of several variables.
2. Concepts of matrix algebra, methods of solving system of linear equations.
3. Determine eigen values and eigen vectors of a matrix, cayeley hamilton theorem and inverse by cayley Hamilton theorem
4. Develop a strategy for finding a solution of given arbitrary differential equation, using different methods.
5. Understand the sol of higher order differential equations, application of ODE in Bending of beams, electrical circuits and simple harmonic motion.

UNIT-I: Functions of Single Variable and Functions of several variables

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) – Geometrical interpretation of Mean value theorems. Functions of several variables – Partial Differentiation and total differentiation - Functional dependence-Jacobian Determinent-Maxima and Minima of functions of two variables with constraints and without constraints.

UNIT-II: Matrices and Linear System of Equations

Matrices and Linear systems of equations: Real matrices – Symmetric, skew - symmetric, orthogonal, Linear Transformation – Orthogonal Transformation. Complex matrices: Hermitian, Skew – Hermitian and Unitary. Elementary row transformations-Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods (Gauss Elimination, Gauss Jordan).

UNIT-III: Eigen Values and Eigen Vectors

Eigen values, Eigen vectors – properties, Cayley-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonolization of matrix.

UNIT-IV: Differential Equations of first order and their Applications

Differential equations of first order and first degree: exact, linear and Bernoulli, Applications to Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT-V: Higher Order Linear Differential Equations and their Applications

Linear differential equations of second and higher order with constant coefficients, RHS term of the type f(X) $= e^{ax}, \sin ax, \cos ax \; and \; x^k, e^{ax}V(x), x^kV(x)$. Method of variation of parameters. Applications - Bending of beams, Electrical circuits, simple harmonic motion.

Course Outcomes:

1. Understand Rolle's and the Mean value theorems and to verify the Mean value theorems
2. Apply partial derivatives to study maxima and minima of functions of two variables
3. Define rank and elementary transformations of a matrix.
4. Discuss Non homogeneous and homogeneous system of equations.
5. Compute eigen values and corresponding eigen vectors of a square matrix.
6. Specify standard methods for solving differential equations and their applications in geometrical and physical problems.
7. Identify different types of higher order differential equations and their applications in engineering problem solving.

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Engineering Mathematics Vol - I, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
2. Shahanaz Bathul (2007), Engineering Mathematics-I, 3rd Edition, Hyderabad, Right Publishers.
3. Ramana B.V (2010), Engineering Mathematics, New Delhi, Tata McGraw Hill Publishing Co. Limited
4. Mathematical Methods: S.R.K. Iyengar and R.K. Jain, Narosa Publishing House. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh E

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	2	1	2

(A51003) ENGINEERING PHYSICS – I

Course objectives:

1. To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.
2. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
3. To provide the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials in a variety of engineering disciplines.
4. To equip the students with the required fundamentals of engineering chemistry to carry out in the interdisciplinary research such that the findings benefit the common man.
5. After the completion of the course, the student would understand about the important chemistry of water, electrochemistry, batteries and surface chemistry.

UNIT- I

INTERFERENCE AND DIFFRACTION:

Superposition principle, resultant amplitude, coherence, methods to obtain coherent sources, interference, Young's double slit experiment (Qualitative), interference in thin films by reflection, Newton's rings Experiment, Distinction between Fraunhofer and Fresnel diffraction, Diffraction at single slit, Diffraction grating (Qualitative), Introduction to polarization, Brewster's law and Double refraction.

UNIT - II

CRYSTAL STRUCTURES:

Space lattice – Unit cell – Lattice parameter – Crystal systems – Bravais lattices, Atomic radius – Co-ordination number - Structures d Packaning fractions of Simple Cubic – Body Centered Cubic – Face Centered Cubic crystals.

DIRECTIONS, PLANES AND X-RAY DIFFRACTION:

Miller Indices for Crystal planes and directions – Inter planar spacing of orthogonal crystal systems –Diffraction of X-rays by crystal planes and Bragg's law–Powder method – Applications of X-ray diffraction.

UNIT - III

ELEMENTS OF STATISTICAL MECHANICS:

Introduction, Phase space, Definition of Ensembles, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics – Photon gas –Planck's law of black body radiation – Deduction of Wien's law and Rayleigh-Jeans law from Plank's law.

UNIT – IV

MAGNETIC PROPERTIES :

Introduction – Basic definitions - Origin of magnetic moment, Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro)- Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials – properties of Anti ferro and Ferri magnetic materials .

SUPERCONDUCTIVITY: Introduction, Meissner effect – Critical fields, Type I and Type II superconductors-Applications of super conductors.

UNIT - V

DIELECTRIC PROPERTIES:

Electric dipole, Dipole moment, Dielectric constant – Parallel plate Capacitor, Electronic, Ionic and Orientation Polarization – Calculation of Polarizibilities – Internal fields – Claussius – Mossotti equation – Basic concepts of Piezo, Pyro and Ferro electricity.

Course Outcomes:

1. Finally the students may be familiar with the topics of crystals, dielectrics, optics etc… which will be useful in various branches of technology.
2. There will be a chance for them use the subject as a mathematical tool to solve their real life problems.

TEXT BOOKS:

(1) Modern Engineering Physics by, Dr.K. Vijay Kumar & Dr.S.Chandralingam:S .Chand.Co

(2) Eengineering Physics by P K Palanisamy :Scietech publication
(3) Solid State Physics by M Armugam; Anuradha Publications

REFERENCE BOOKS:

(1) Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons
(2) Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons
(3) Engineering Physics by V Rajendran; McGraw hill education private ltd.
(4) A Text book of Engineering Physics by M N Avadhanulu, P G Kshirsagar; S Chand
(5) Engineering Physics by K Malik, A K Singh; Tata Mc Graw hill book publishers
(6) Engineering Physics by M.R.Srinivasan, New Age Publishers.

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	2	1	2

(A51004) APPLIED CHEMISTRY – I

Course objectives:

1. To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.
2. To enable students to apply the knowledge acquired in improving the properties of Engineering materials.
3. To provide the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials in a variety of engineering disciplines.
4. To equip the students with the required fundamentals of engineering chemistry to carry out in the interdisciplinary research such that the findings benefit the common man.
5. After the completion of the course, the student would understand about the important chemistry of water, electrochemistry, batteries and surface chemistry.

UNIT I : WATER TECHNOLOGY

Hardness of water, expression of hardness, units and types of hardness. Estimation of temporary & permanent hardness of water by EDTA method. Numerical problems. Potable water, characteristics, treatment of water for domestic supply. Desalination of brackish water :reverse osmosis. Alkalinity of water. Boiler troubles:-priming and foaming, boiler corrosion, scales, sludges and caustic embrittlement. Boiler feed water and its treatment: Internal treatment :colloidal, phosphate calgon conditioning . External treatment: zeolite process and ion –exchange process. Numerical problems.

UNIT II: ELECTROCHEMISTRY

Conductance-types (electronic and electrolytic), Types of electrolytic conductance: specific, equivalent and molar conductance, Kolrausch's law and its applications. Electrode, electrode potential, galvonic cell, cell reactions and cell notation, cell EMF, electrochemical series & is applications, types of electrodes (Normal Hydrogen Electrode, calomel electrode, glass electrode and quinhydrone electrode), Nernest equation and its applications, numerical problems. Potentiometric titrations. Concentration cells, classification with examples.

UNIT III: BATTERIES

Introduction to cell and battery, characteristics of a cell. Primary (dry cell and lithium cell) and secondary cells, (lead-Acid cell, Ni-Cd cell and Lithium ion cells,). Engineering applications of batteries, Solar battery, Fuel cells – Hydrogen – Oxygen fuel cell, Methanol -Oxygen fuel cell and advantages and engineering applications of fuel cells.

UNIT IV: CORROSION AND ITS CONTROL:

Corrosion and its types:chemical and electrochemical corrosion, mechanism of chemical and electrochemical corrosion , galvanic , water line and pitting corrosion, factors affecting the rate of corrosion : nature of the metal , galvanic series, purity of metal, nature of corrosion product , nature of environment : effect of temperature, effect of pH, humidity. Corrosion control methods: Cathodic protection:
sacrificial anode method and impressed current cathode method. Protective coatings : metallic coatings , anodic and cathodic , methods of application on metals , hot dipping (galvanizing,), cladding, cementation, electroplating (of copper), electroless plating (of nickel) Organic coatings – paints, its constituents and their functions.

UNIT V: SURFACE CHEMISTRY

Adsorption , types - physical and chemical adsorption, Longmuir adsorption isotherm, application of adsorption, Colloids, classification of colloids, Electrical, mechanical & optical properties of colloids applications of colloids in industry. Micelles- Introduction, formation, structure, critical micellar concentration, uses.
Nano materials: Introduction, basic methods of preparation (co-precipitation method, chemical vapour deposition method and sol gel method) and applications of nano meterials.

Course Outcomes:

1. Industrious Students and health conscious ones remain inquisitive on potable water its parameter and usage.
2. Dynamic students indeed capable of explaining the various aspects of electro chemistry work out numerical problems.
3. Thorough with cells and solar, fuel cells
4. Gets augmented to the caliber in knowing corrosion and causes going around and capable of suggesting periodical maintenance.
5. Archetypal students comprehend the applications of colloids in various fields in exhort their immense significance.

Text Books:

1. Engineering Chemistry by NYS.Murthy, Pearson, India.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company

Reference Books:

1. Text Book of Engineering Chemistry by Shasi Chawla, Dhantpat Rai publishing Company,
2.Engineering Chemistry by C.Daniel Yesudian , Anuradha publications

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(A51005) COMPUTER PROGRAMMING - I

Course Objectives:

1. To explain representation of numbers, alphabets and other characters in computer system
2. To understand the basic concepts in C Programming Language
3. To explain software development tools like algorithm, pseudo codes and programming structure.
4. To explain selection and repetition statements in 'C' Language
5. To explain arrays to solve problems
6. To explain strings and string operations
7. To learn how to write modular programming in 'C' Language.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, operating system functions, language processor concepts.

Overview of C Language : Program structure and simple programs using scanf and printf functions.

Data representations- Binary, octal, hexa number systems, ASCII and EBCDIC, data types, Identifiers, Variables, Constants, declarations.

UNIT - II

Operators, Expressions, Precedence and Associativity, evaluation of expressions, sample programs using expressions, Type conversions, unformatted I/O.

Algorithms- control structure – grouping, selectors, repetitions.

Step wise refinement, flowchart.

UNIT - III

Statements- Selection Statements – if and switch statements, algorithm and program example using selectors

Repetition statements (loops)-while, for, do-while statements, algorithm development using repetition and programs using repetition, break, continue, goto, exit, Simple C Program examples.

UNIT - IV

Arrays – Introduction, declaration, reading and printing arrays , programs using arrays, two – dimensional arrays,

Multidimensional arrays, C program examples.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, C program examples.

UNIT – V

Functions- procedural abstraction, function declarations, function calls and parameter passing, Standard functions, Storage classes- recursion- recursive functions, example C programs.

Course Outcomes:

Upon completion of this course the students will have an:

1. Ability to design algorithmic solutions to problem
2. Ability to convert algorithms to C-Programs
3. Ability to write, compile and debug programs in C Language
4. Ability to write Programs using selection and repetition statements
5. Ability to write programs using Arrays and Strings
6. Ability to design structured programming.

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.

2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.

3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.

4. Programming in C, Ajay Mittal, Pearson.

5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.

6. Problem solving with C, M.T.Somasekhara, PHI

7. Programming with C, R.S.Bickar, Universities Press.

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	0	**-/4/-**	**2**

(A51006) ENGINEERING GRAPHICS - I

Course Objectives:

1. To visualize and communicate geometrical elements like Polygons,Curves,Conic Sections, Cycloids and Involutes
2. To understand the fundamentals of geometry like Plane, Diagonal and Vernier Scales and its applications in design and manufacturing of various engineering components.
3. To understand the fundamentals of geometry like Polygons and Involutes and its applications in design and manufacturing of various engineering components.
4. To understand the fundamentals of geometry like Planes and its applications in design and manufacturing of various engineering components.
5. To understand the fundamentals of geometry like Solids and its applications in design and manufacturing of various engineering components.

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning.
Construction of polygons Practice only.
Curves used in Engineering Practice and their Constructions.
Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola - General method only.
Cycloidal curves - Cycloid, Epicycloid and Hypocycloid

UNIT – II

Introduction to Scales: Construction of Plain, Diagonal, and Vernier Scales.
Involutes of Circle & Regular Polygons.

UNIT – III

Drawing of Projections or Views (Orthographic Projection in First Angle Projection Only): Principles of Orthographic Projections – Conventions – First and Third Angle Projections, Projection of Points, Projection of Lines - inclined to both planes, True lengths. (**Traces, Mid points** can be removed)

UNIT – IV

Projections of Planes: Projections of regular Planes, traces, Projections of Planes on Auxiliary planes.

UNIT –V

Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, Axis inclined to both planes – Change of position and Auxiliary plane method.

Course Outcomes:

1. To know the importance of Engineering Graphics and to represent the various Curves, Conic Sections, and Cycloids used in Engineering Graphics.
2. To Draw and understand the Construction of Plane, Diagonal and Vernier Scales used in Engineering Graphics and also represent the Construction of Polygons and Involutes.
3. To Draw and understand the Principles involved in Orthographic Projections and to represent the Principles involved in Points, Lines and Traces.
4. To Draw and understand the construction Principles involved in Planes.
5. To Draw and understand the construction Principles involved in Solids.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Scietech publishers.

REFERENCES:

1. Engineering Drawing, K.Venugopal/G.Sreekanjana, New Age International Publishers.
2. Engineering Drawing, Basant Agarwal, TMH

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(A51007) ENGINEERING MECHANICS – I

Course Objectives:

1. To apply the knowledge of mechanics for engineering problems
2. To develop an understanding of the principles of statics bodies.
3. To analyse the bodies with applications of friction.
4. To develop the geometric shapes for composite sections
5. To develop the moment of inertia of the geometric shapes for composite sections

UNIT-I

Introduction to Engineering Mechanics - Basic Concepts
System of Forces: Coplanar Concurrent Forces - Components in Space - Resultant - Moment of Force and its Application - Couples and Resultant of Force Systems.

UNIT-II

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar and Spatial System of forces. Lame's Theorem.

UNIT-III

Friction*:* Basic concepts, Types of Friction, cone of friction,
Applications of Friction: Wedge friction, Screw friction and Belt friction

UNIT-IV

Centroid: Centroids of simple figures (from basic principles) Centroids of Composite Figures.

Centre of Gravity: CG of simple bodies (from basic principles), CG of composite bodies, Pappus theorem.

UNIT - V

Area Moment of Inertia: Definition - Polar Moment of Inertia, Transfer Theorem, MI of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: MI of Masses, Transfer Formula for MMI, MMI of composite bodies.

Course Outcomes:

1. To introduce the basic principles of mechanics applicable to rigid bodies in equilibrium.
2. Construct free body diagrams and develop appropriate equilibrium equations.
3. Analyse the systems with friction.
4. Determine the centriod and centre of gravity for composite areas.

TEXT BOOKS:

1. Engineering Mechanics by Ferdinand. L. Singer
2. Engineering Mechanics by S.S.Bhavikatti J.G.Rajasekharappa.

REFERENCE BOOKS:

1. Engineering Mechanics by Timoshenko & Young.
2. Engineering Mechanics by Meriam and Kraize
3. Engineering Mechanics by K.L.Kumar / Tata McGraw Hill.
4. Engineering Mechanics by A. K. Tayal.

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	0	-/3/-	2

(A51209) COMPUTER PROGRAMMING – I LAB

Course Objectives:

1. To make the student learn Linux commands
2. To make the student learn a programming language
3. To teach the student to write programs in C to solve the problems
4. To make the student to write the programs using control statements
5. To make the student to use arrays for solving the problems
6. To make the student to write modular programming

Week 1:

1. Familiarity with Linux Commands – Login, Wild Chars, ls, cp, mv, mkdir, wc, chdir.
2. Creation of text files using vi editor.

Week 2:

Using vi editor – perform operations of pattern search, insertion, deletion and substitution operations

Week 3:

Write simple programs using scanf and printf functions and familiarity with format strings.

Week 4 & 5:

Write programs to illustrate the Assignment Operators

Week 6:

Write programs to illustrate the Logical Operators

Week 7:

Write programs to illustrate the Relational Operators

Week 8:

Write programs using If Statement

Week 9:

Write programs using while, do-while loops

Week 10:

Write programs using for loop

Week 11:

Write programs to illustrate one dimensional arrays

Week 12:

Write programs to illustrate two dimensional arrays

Week 13:

Write programs to illustrate String concepts.

Week 14:

Write programs using functions

Week 15:

Review

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	0	-/3/-	2

(A51210) English Language Communication Skills Lab-I

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

1. To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
2. To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
4. To improve the fluency in spoken English and neutralize mother tongue influence
5. To train students to use language appropriately for interviews, group discussion and public speaking

Learning Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking with clarity and confidence thereby enhancing employability skills of the students

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

The following course content is prescribed for the English Language Communication Skills Lab:

Exercise-I

CALL Lab: Introduction to Sounds of English Language
Speech Sounds
Vowels and Consonants

Exercise-II

ICS Lab: Ice-Breaking activity and Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise-III

CALL Lab: Structure of Syllables

Past Tense Marker and Plural Marker
Weak Forms and Strong Forms
Consonant Clusters.

Exercise-IV

ICS Lab: Situational Dialogues -Role-Play- (Self-introduction and introducing others- Greetings- Apologies- Requests), JAM Session.

Exercise-V

ICS Lab: Social and Professional Etiquette and Telephone Etiquette-Tenses-Non-Verbal Communications.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab: the Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners. **System Requirement (Hardware component):**

(computers with suitable configuration as per the purchased software demands)

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
a) Speed – 2.8 GHZ
b) RAM – 512 MB Minimum
c) Hard Disk – 80 GB
ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation
2. **Strengthen Your Steps -** Dr. M. Hari Prasad and others, Maruthi Publications
3. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
4. Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill
5. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

6. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.
7. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP
8. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP
9. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi: Foundation

10. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan

11. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
12. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
13. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)

14. **Lab Manual:** A Manual entitled "**English Language Communication Skills (ELCS) Lab Manual- cum- Work Book**", published by Cengage Learning India Pvt. Ltd, New Delhi. 2013

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(A51211) ENGINEERING PHYSICS AND APPLIED CHEMISTRY LAB - I

Engineering Physics Lab:

Any Five Experiments from the following:

1. Torsional Pendulum Expt. to determine the rigidity modulus of material of a wire
2. Melde's experiment
3. Newton's Rings
4. Dispersive Power of the material of a Prism using Spectrometer
5. Stewart & Gee's experiment
6. LED Characteristics
7. LASER Characteristics
8. Diffraction Grating with laser source

APPLIED CHEMISTRY LAB – I:

Course objectives:

1 To impart fundamental knowledge in handling the equipment /glassware and chemicals in the

chemistry laboratory .

2. To offer hands on experience on the basic equipment related to engineering chemistry.

3. For practical understanding of theoretical concepts of chemistry.

Number of periods = 3 periods in two weeks per batch

Perform any seven experiments:

1. Fundamentals of volumetric analysis : Determination of strength of an acid (HCl)
2. Estimation of ferrous iron by dichrometry
3. Estimation of hardness of water by EDTA method.
4. Determination of iron by permanganometry.
5. Determination Surface Tension of lubricants.
6. Determination of alkalinity of water.
7. Determination of total dissolved solids in water.
8. Determination of free chlorine or chlorides in water.
9. Determination of reactivity of given metals
10. Determination of the rate constant of acid catalyzed hydrolysis of methyl acetate.

Course Outcomes:

1. As commences with fundamentals which indeed takes the individual students to be more conversant with apparatus and allied.
2. Gets equipped with the technical importance of knowing the extent of hardness and consciousness of units.
3. Students gets augmented the adroitness and keep aware of some industrial determination techniques

TEXT BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis
2. Essentials of experimental engineering chemistry , Shashi Chawla, Dhanpat Rai & Co
3. Laboratory manual of engineering chemistry, S.K.Bhasin and Sudha Rani , Dhanpat Rai & Co.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.
2. A text book on experiments and calculations . S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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	0	-/3/-	2

(A51212) ENGINEERING WORKSHOP – I

Course Objectives:

1. To impart the knowledge regarding the various techniques, skills and tools necessary for engineering workshop practice.
2. To provide the students with hands on experience on different trades of engineering workshop like black smithy, foundry and welding.
3. To learn about the machines in view of constructions details, different operations to be performed on the machines and different tools.
4. To enhance the practical approach towards machine tools.
5. To introduce the concepts of power tools in constructions , wood working, electrical engineering and mechanical engineering in manufacturing applications

1. TRADES FOR EXERCISES:

At least THREE exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-smithy and development of jobs carried out and soldering.
4. House-wiring

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine shop

Course Outcomes:

1. To make a lap joint
2. To make a dovetail- joint
3. To make a T-briddle joint
4. To prepare a flat filing
5. To prepare a step cutting
6. To prepare a angular cutting
7. To prepare a open scoop
8. To prepare a rectangular tray
9. To prepare a square tin

10. To understand and to give the connections for one light point control by one single pole switch .
11. To understand and to give the connections for one light point control by two-two way switchs (parallel connections)
12. To understand and to give the connections for to-connect a electrical bell by using bell push
13. To understand and to give the connections for two light point controlled by one single pole switch.
14. To prepair a pipe joint , tap- connections by using pluming
15. To apply different operations to be performed on the lathe machines.

TEXT BOOKS:

1. Work shop manual - P.Kannaiah/K.L Narayana/scitech publishers.
2. Workshop manual by Venkat Reddy

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	2	0	2

(A52001)English – II

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc. The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for

example, from newspaper articles, advertisements, promotional material etc.. However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.

2. OBJECTIVES:

1. To improve the language proficiency of the students in English with emphasis on LSRW skills.
2. To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.
3. To develop the study skills and communication skills in formal and informal situations.

LEARNING OUTCOMES:

1. Usage of English Language, written and spoken.
2. Enrichment of comprehension and fluency
3. Gaining confidence in using language in verbal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions.
   Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

   i. Listening for general content
   ii. Listening to fill up information
   iii. Intensive listening
   iv. Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.
   - Oral practice
   - Describing objects/situations/people
   - Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: **Skills Annexe - Functional English for Success)**
   - Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.
    - Skimming the text
    - Understanding the gist of an argument
    - Identifying the topic sentence
    - Inferring lexical and contextual meaning
    - Understanding discourse features
    - Scanning
    - Recognizing coherence/sequencing of sentences

NOTE : The students will be trained in reading skills using the prescribed text for detailed study.

They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill

2. To equip them with the components of different forms of writing, beginning with the lower

order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED:

For Detailed study:

First Textbook: "Skills Annexe -Functional English for Success", Published by Orient Black Swan, Hyderabad

For Non-detailed study:

Second text book "Epitome of Wisdom", Published by Maruthi Publications, Guntur

UNIT-I

Chapter 1:**'Leela's Friend'** by R.K. Narayan from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad 2 hrs

G – Present Tense 2

V – Synonyms and Antonyms 2

UNIT-II

Chapter 2: **'Human Values and Professional Ethics'** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad
2 hrs

L -Listening for specific details and information 1

S- Narrating, expressing opinions and telephone interactions 1

R -Reading for specific details and information 1

W- Writing formal letters and CVs 1

UNIT-III

Chapter 3: **'The Convocation Speech'** by N.R. Narayanmurthy' from "Epitome of Wisdom", Published by Maruthi Publications, Hyderabad
2 hrs

G- Past and future tenses 2

V- Vocabulary - idioms and Phrasal verbs
2

UNIT-IV

Chapter 4: **'Sports and Health'** from "Skills Annexe -Functional English for Success" Published by Orient Black Swan, Hyderabad
2 hrs

L- Critical Listening and Listening for speaker's tone/ attitude 1

S- Group discussion and Making presentations 1

R- Critical reading, reading for reference 1

W-Project proposals; Technical reports, Project Reports and Research Papers

1

UNIT-V

Chapter5: '**The Secret of Work'** from "Epitome of Wisdom", Published by Maruthi Publications Hyderabad. 2 hrs

G- Adjectives, Prepositions and Concord 2

V- Collocations and Technical Vocabulary 2

REFERENCES:

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan

   Publishers, New Delhi.2010.

2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.

3. English Grammar Practice, Raj N Bakshi, Orient Longman.

4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.

5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao**,** P Sreehari, Published by Pearson

6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.

7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.

8. Technical Communication, Meenakshi Raman, Oxford University Press

9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education

10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.

11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.

12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,

13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.

14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education

15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.

16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan, Frank Bros & CO

17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education

18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,

19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers.

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	3	1/-/-	3

(A52002)MATHEMATICS-II

(Mathematical Techniques)

Course Objectives:

1. To introduce some special functions like Gamma, Beta and learn how to evaluate definite integrals with the help of special functions.
2. Able to know the Laplace , Inverse Laplace transform and sol of ODE by using Laplace transforms
3. Evaluate the multiple integrals and analyze the DEL properties.
4. Apply the theorems by using line, surface and volume integrals
5. Determine the Fourier coefficients of a given function. Analyze the characteristics and properties of Fourier transforms

UNIT-I: Laplace transform and its applications to Ordinary differential equations

Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms – Application of Laplace transforms to ordinary differential equations.

UNIT-II: Gamma and Beta Functions:

Gamma and Beta Functions-Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.

UNIT – III: Multiple Integrals

Multiple integrals - double and triple integrals – change of order of integration- change of variables. Gradient- Divergence- Curl and their related properties - Potential function - Laplacian and second order operators.

UNIT-IV: Vector Calculus

Line integral – work done —- Surface integrals - Flux of a vector valued function. Vector integrals theorems: Green's – Stoke's and Gauss's Divergence Theorems (Only Statements & their Verifications).

UNIT-V: Fourier Series:

Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Course Outcomes:

1. Apply Beta and Gamma functions to evaluate many integrals which cannot be expressed in terms of elementary functions.
2. Apply Laplace transform to solve differential equations which will be converted to algebraic
3. Evaluate double integrals by changing variables , changing order and triple integration Calculate line integrals along piecewise smooth paths, interpret such quantities as work done by a force
4. Apply Green's theorem to evaluate line integrals along simple closed contours on the plane, Stoke's theorem to give physical interpretation of the curl of a vector field and Divergence theorem to give physical interpretation of the divergence of a vector field
5. Develop Fourier series of periodic functions.

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Engineering Mathematics Vol - I, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Shahanaz Bathul (2007), Mathematical Methods, 3rd Edition, Hyderabad, Right Publishers.
2. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
3. Dass H.K. and Rajnish Verma Er (2007), Higher Engineering Mathematics, First Edition, New Delhi, S. Chand & Company Limited.
4. Integral Transforms by A.R.Vasista
5. Schaum's outline series on Vector Analysis; Linear Algebra.
6. Larry C. Andrews and Bhimsen K. Shivamoggi, Integral Transforms for Engineers, Prentice – Hall of India Private Limited, New Delhi.
7. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

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	2	**1**	**2**

(A52003)ENGINEERING PHYSICS – II

Course Objectives:

1. To impart the knowledge of mathematics and science to determine the working of semiconductor devices .
2. Emphasize the study of Quantum mechanics to apply it to solve problems of micro & macro particles.
3. To have the knowledge of laser technology to know about the working & applications of laser.
4. To inculcate the importance of nanotechnology which has the world wide importance.

UNIT- I PRINCIPLES OF QUANTUM MECHANICS: 08

Waves and particles – De Broglie hypothesis - Matter waves - Davisson and Germer experiment – Schrodinger Wave Equation – Wave function and its Physical Significance - Particle in one dimensional potential box(wave functions, probability densities and energy states).

UNIT- II FREE ELECTRON THEORY OF METALS: 06

Classical Theory, Electrical Conductivity and Ohm's Law – Drawbacks, Sommerfield theory (Qualitative), Density of States, Effect of temperature on the Fermi-Dirac distribution.

BAND THEORY OF SOLIDS: 06

Electron in a periodic potential – Bloch Theorem - Kronig-Penney model (Qualitative) – Origin of energy band formation in solids – Classification of materials into conductors, semiconductors & Insulators - Concept of effective mass of an electron.

UNIT- III SEMICONDUCTOR PHYSICS: 08

Fermi level in Intrinsic and Extrinsic semiconductors - Intrinsic semiconductor and carrier concentration – Extrinsic semiconductor and carrier concentration – Characteristics of p-n junction diode - Hall effect, LED, Photodiode.

FIBRE OPTICS 04

Basic principle of optical fibre, Acceptance angle, Acceptance cone, numerical aperture (Quantitative), Types of optical fibre, applications of optical fibre.

UNIT IV LASERS: 06

Characteristics of Lasers – Spontaneous and Stimulated Emission of radiation, meta stable state, population inversion, lasing action, Einstein's coefficients and relation between them — Ruby Laser – Helium-Neon Laser –Semiconductor Laser – Applications of lasers.

UNIT V BASIC PRINCIPLES OF NANO SCIENCE:

Introduction, surface to volume ratio, quantum confinement – Fabrication of nano materials- Top down fabrication, Bottom up fabrication: sol-gel Technique, CVD method– Characterization (XRD & TEM) - Applications of nanomaterials.

Course Outcomes:

1. Having the knowledge of semiconductors & fiber optics, there will be a chance to know their applications.
2. There will be a chance for them to use the subject as a mathematical tool to solve their real life problems.
3. The students will be able to know the working of different lasers & their real life applications.

TEXT BOOKS:

1. Engineering Physics by P K palanisamy :Scietech publication
2. Solid State Physics by M Armugam; Anuradha Publications

REFERENCE BOOKS:

1. Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons
2. Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons
3. Engineering Physics by V Rajendran; McGraw hill education private ltd.
4. A Text book of Engineering Physics by M N Avadhanulu, P G Kshirsagar; S Chand
5. Engineering Physics by K Malik, A K Singh; Tata Mc Graw hill book publishers
6. Engineering Physics by M.R.Srinivasan, New Age Publishers

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	2	1	2

(A52004)APPLIED CHEMISTRY – II

Course objectives:

1. To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.
2. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
3. To provide the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials in a variety of engineering disciplines.
4. To equip the students with the required fundamentals of engineering chemistry to carry out in the interdisciplinary research such that the findings benefit the common man.
5. After the completion of the course, the student would understand about the important chemistry of polymers ,corrosion and its control , material chemistry , phase rule and energy sources.

UNIT-I: POLYMER CHEMISTRY:

Introduction, classification of polymer, Types of polymerization (addition and condensation, *mechanisms not included*). Plastics, types of plastics -Thermoplastics and thermosetting plastics. Compounding and moulding of plastics. Preparation, properties and engineering applications of PVC, Teflon and Bakelite. Fibers: Nylon 6, 6 and terelene (Dacron). Elastomers , natural rubber, structure, vulcanization. Synthetic rubbers : Buna-S , butyl rubber , Thikol rubber. Conducting polymers: Classification, mechanism of conduction, Poly acetylene - preparation and effects of doping on conduction. Applications of conducting polymers.

UNIT II: MATERIALS CHEMISTRY: Cement: composition of Portland cement, manufacture of Port land cement, setting & hardening of cement (reactions). Admixtures for cement.

Refractories: Classification, Properties of refractory materials.(refractoriness, RUL test, spalling, dimensional stability and porosity). Characteristics of a good refractory.

Lubricants: Classification of lubricants, mechanisms of lubrication, properties of lubricants: Viscosity and viscosity index, cloud point, pour point, flash & fire point,

Insulators : Classification of insulators, characteristics of thermal & electrical insulators and applications.

UNIT III: PHASE RULE and ALLOYS : Definitions - phase, component, degree of freedom, and phase rule equation. Phase diagrams - one component system: water system. Two component system: lead- silver system. Alloys: classification preparation and objectives in alloy making.

Unit IV: FUELS: Classification, advantages and disadvantages of solid, liquid and gaseous fuels. Solid fuels - coal – classification , analysis - proximate and ultimate analyses and their significance Liquid fuels - petroleum -refining of petroleum , cracking : moving bed catalytic cracking. Knocking- octane number and cetane number. synthetic petrol - Fischer Tropsch's process; Gaseous fuels – LPG and CNG , Combustion , quantity of air required for combustion of the fuel, calorific value of fuel - HCV, LCV, determination of calorific value of a gaseous fuel by Junkers calorie meter. Numerical problems. Flue gas and its analysis by Orsat apparatus.

UNIT V: ADVANCED ENGINEERING MATERIALS: Biodegradable polymers, types , examples: Polyhydroxy butyrate (PHB) ,Poly-Hydroxybutyrate-co-b-Hydroxy valerate (PHBV) ,Polyglycolic acid (PGA) , Polylactic acid (PLA) ,Poly (Î-caprolactone) (PCL). Applications of biodegradable polymers.
Composite materials: Constituents of composite materials. Types of composite materials. Advantages and engineering applications of composite materials.
Biofuels – Biodiesel, general methods of preparation and advantages.

Course Outcomes:

1. Conscientious Students Expatiate And realize the immense importance of polymers and their applicability.
2. All the students under ambit no doubt derive the ins and outs of the construction items their properties and present drive.
3. The abstract phenomenon and the allied industrial applications got in bibed as well transfer to the industry.
4. Engineering minded students well realized the present demand of energy resources in all forms and try to be frugal.
5. Scintillating category students ardent enough in familiarizing the engineering materials on obvious reasons and pass it on.

TEXT BOOKS:

1. Engineering chemistry –II, by NYS.Murthy, Pearson, India.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).

REFERENCE BOOKS:

1. Text Book of Engineering Chemistry by Shasi Chawla, Dhantpat Rai publishing Company, New Delhi (2008).
2. Engineering Chemistry by B. Siva Shankar, Mc.Graw Hill Publishing Company Limited , New Delhi -2006.

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	3	1/-/-	3

(A52005)COMPUTER PROGRAMMING - II

Course Objectives:

1. To explain various sorting and searching techniques
2. To explain structures, unions, and enumeration types and operations on them
3. To understand dynamic memory management using pointers.
4. To introduce basic data structures such as stacks, queues and linked lists.
5. To explain various types of files in 'C' Language.

UNIT - I

Searching and Sorting – Sorting- selection sort, bubble sort, Insertion sort, Quick Sort, Merge sort, Searching-linear and binary search methods.

UNIT - II

Structures - Declaration, initialization, accessing structures, operations on structures,nested structures, arrays of structures, Unions, Enumerated types, Type Definition(typedef), C programming examples.

UNIT - III

Pointers – Concepts, declarations, usage, pointers to pointers, pointer expressions, Arrays and Pointers, array of pointers,parameter passing of pointers, pointers to void, pointers to functions, structures through pointers, self referential structures, C programming examples

UNIT - IV

Lists- Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Push and Pop Operations, Queues- Enqueue and Dequeue operations.

UNIT - V

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files,State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling),Positioning functions, command –line arguments, C program examples.

Course Out Comes:

1. Upon completion of this course the students will have an:
2. Ability to design various sorting and searching techniques
3. Ability to design user defined data types to solve real world problems
4. Ability to manage heap memory
5. Ability to implement and use data structures like stacks, queues and linked lists
6. Ability to create and use various types of files in 'C' Language.

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.
3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
4. Programming in C, Ajay Mittal, Pearson.
5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
6. Problem solving with C, M.T.Somasekhara, PHI
7. Programming with C, R.S.Bickar, Universities Press.
8. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.

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	0	-/4/-	2

(A52006)ENGINEERING GRAPHICS - II

Course Objectives:

1. To visualize and communicate geometrical elements like Sections of Solids, Development of Surfaces and intersections of similar Solids and its applications in design and manufacturing of various engineering components.
2. To understand the fundamentals of geometry like Isometric Projections and its applications in design and manufacturing of various engineering components.
3. To understand the fundamentals of geometry like Conversion of Orthographic Views to Isometric Views and its applications in design and manufacturing of various engineering components.
4. To understand the fundamentals of geometry like Perspective Projections and its applications in design and manufacturing of various engineering components.
5. To understand the fundamentals of geometry like Computer Aided drafting and its applications in design and manufacturing of various engineering components.

UNIT – I

Sections of Solids: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views

UNIT – II

Development of Surfaces: Development of Surfaces of Right Regular Solids – Prisms, Cylinders, Pyramids, Cones and their parts.

Intersection of Similar Solids: Line method - Intersection of Prism Vs Prism, Cylinders Vs Cylinder Simple treatment only. **(Dissimilar category- this part can be removed.)**

UNIT –III

Isometric Projections/views: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines.

UNIT –IV

Transformation of Projections: Conversion of Orthographic Views to Isometric Views and Isometric views to orthographic views.

UNIT –V

Perspective Projection: Principle, Perspective elements, Perspective View of Points, Lines, Plane Figures and Simple Solids; Vanishing Point Method, Visual Ray Method.

Course Outcomes:

1. To Draw and understand about the Sections of Solids, Development of Surfaces and intersections of similar Solids used in Engineering Graphics.
2. To Draw and understand the construction Principles involved in Isometric Projections.
3. To Draw and understand about Conversion of Orthographic Views to Isometric Views and also represent it's Transformation of Projections.
4. To Draw and understand about the construction Principles involved in Perspective Projections.
5. To Draw and understand about the Computer Aided Drafting used in Engineering Graphics

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Scietech publishers.

REFERENCES:

1. Engineering graphics with Auto CAD- R.B Choudary / Anuradha Publishes
2. Engineering Drawing, K.Venugopal/G.Sreekanjana, New Age International Publishers.
3. Engineering Drawing, Basant Agarwal, TMH
4. Engineering Drawing, R. K. Dhawan, S.Chand Publishers.

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I Year B.Tech. ME – II Sem	L	T/P/D	C
	2	1/-/-	2

(A52007)ENGINEERING MECHANICS – II

Course Objectives:

1. To develop the analysis of frames with application
2. To teach the basic principles of mechanics applicable to the motion of particles and rigid bodies.
3. To introduce with mathematical description of the plane motion of rigid bodies.
4. To develop the work-energy equation for translations.
5. To develop the equilibrium conditions in terms of virtual work.

UNIT-I

Analysis of perfect frames (Analytical Method) – Types of Frames – Assumptions for forces in members of a perfect frame, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

UNIT-II

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body –Types and their Analysis in Planar Motion.

UNIT-III

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion –
Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

UNIT-IV

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

UNIT-V

Principle of virtual work: Equilibrium of Ideal systems, efficiency of simple machines, stable and unstable equilibriums.

Course Outcomes:

1. Determine the axial forces in the members of trusses.
2. Determine the kinematic relations of particles & rigid body motion.
3. Apply equations of kinetics motions to particle and rigid body motion.
4. Analyze motion of particles & rigid bodies using the principle of work-energy.
5. Determine the equilibrium conditions(FBD) in terms of virtual work

TEXT BOOKS:

1. Engineering Mechanics by Ferdinand. L. Singer
2. Engineering Mechanics by S.S.Bhavikatti J.G.Rajasekharappa.

REFERENCE BOOKS:

1. Engineering Mechanics by Timoshenko & Young.
2. Engineering Mechanics by Meriam and Kraize
3. Engineering Mechanics by K.L.Kumar / Tata McGraw Hill.
4. Engineering Mechanics by A. K. Tayal.

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	0	-/3/-	2

(A52209) COMPUTER PROGRAMMING II LAB

Course Objectives:

1. To make the student to implement various sorting and searching techniques
2. To introduce the student to structures, unions, and enumeration types and operations on them
3. To introduce the student dynamic memory management using pointers.
4. To introduce basic data structures such as stacks, queues and linked lists.
5. To make the student to create various types of files in 'C' Language.

Week 1:

Review of Arrays and functions.

Week 2:

Write programs to illustrate the implementation of Bubble Sort and Selection Sort

Week 3:

Write programs to illustrate the implementation of Insertion Sort and Quick Sort

Week 4:

Write programs to illustrate the implementation of Merge Sort.

Week 5:

Write programs to illustrate the implementation of Binary Search and Linear Search.

Week 6 & 7:

Write programs to illustrate the various concepts of structures

Week 8:

Write programs to illustrate the concepts of accessing variables using pointers

Week 9:

Write programs to illustrate the implementation of call by reference

Week 10:

Write programs to illustrate the implementation of arrays using pointers

Week 11:

Write programs to implement structures using pointers

Week 12:

Write program to illustrate the implementation of Single Linked List

Week 13:

Write programs to illustrate Stack operations using arrays and pointers

Week 14:

Write programs to illustrate Queue operations using arrays and pointers

Week 15:

Write programs to illustrate the various concepts of files.

Week 16:

Review

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	0	-/3/-	2

(A52210)English Language Communication Skills Lab-II

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

1. To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
2. To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
4. To improve the fluency in spoken English and neutralize mother tongue influence
5. To train students to use language appropriately for interviews, group discussion and public speaking

Learning Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking with clarity and confidence thereby enhancing employability skills of the students

Syllabus: English Language Communication Skills Lab shall have two parts:

1. **Computer Assisted Language Learning (CALL) Lab**
2. **Interactive Communication Skills (ICS) Lab**

The following course content is prescribed for the English Language Communication Skills Lab

Exercise-I

CALL Lab: Minimal Pairs
Word accent and Stress Shifts
Listening Comprehension

Exercise-II

ICS Lab: Descriptions- Narrations- Giving Directions and Guidelines

Question Tags and One-Word Substitutes

Concord (Subject in agreement with verb) and Words often misspelt- confused/misused

Exercise-III

CALL Lab: Intonation and Common Errors in Pronunciation.-Neutralization of Mother Tongue Influence and Conversation Practice.

Exercise-IV

ICS Lab: Extempore - Oral Presentation Skills

Active and Passive Voice,

Common Errors in English,

Idioms and Phrases

Exercise-V

ICS Lab: Information Transfer

Public Speaking

Reading Comprehension

Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

(computers with suitable configuration as per the purchased software demands)

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation

2. Strengthen Your Steps - Dr. M. Hari Prasad and others, Maruthi Publications

3. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011.

Macmillan Publishers India Ltd. Delhi.

4. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata

McGraw Hill

5. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

6. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.

7. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP

8. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP

9. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New

Delhi: Foundation

10. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan

11. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.

12. A textbook of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)

13. Lab Manual: A Manual entitled “English Language Communication Skills (ELCS) Lab Manual- cum- Work Book”, published by Cengage Learning India Pvt. Ltd, New Delhi. 2013.

ANURAG ENGINEERING COLLEGE
(An Autonomous Institution)

I Year B.Tech. ME – II Sem	L	T/P/D	C
	0	-/3/-	2

(A52211) ENGINEERING PHYSICS AND APPLIED CHEMISTRY LAB - II

ENGINEERING PHYSICS:

Any Five Experiments from the following:

1. Energy gap of a semiconductor material
2. Decay of charge - R C circuit and time constant
3. L C R Series circuits
4. Diffraction Grating with sodium vapor lamp
5. Single Slit with laser source
6. Numerical Aperture of an Optical Fibre
7. Bending losses of an Optical Fibre
8. Seebeck Effect

APPLIED CHEMISTRY LAB – II:

Course objectives:

1. To impart fundamental knowledge in handling the equipment /glassware and chemicals in the chemistry laboratory .

2. To offer hands on experience on the basic equipment related to engineering chemistry.

3. For practical understanding of theoretical concepts of chemistry.

Number of periods = 3 in two weeks.

(Any **seven** experiments out of the following ten experiments should be performed)

1. Estimation of HCl by conductometry using standard NaOH solution.
2. Estimation of HCl by potentiometry using standard NaOH solution.
3. Determination of strength of an acid by pH metry
4. Determination of cloud point and pour point of a lubricant
5. Synthesis of phenol – formaldehyde and urea formaldehyde resins .
6. Preparation of Biodiesel from Waste Vegetable Oil (WVO).
7. Determination of viscosity of sample oil .
8. Estimation of Copper by Colorimetric method.
9. Preparation of thikol rubber and nylon 6:6
10. Determination of carbon residue /flash point –fire point of a lubricant

Course Outcomes:

1. Awareness in obtaining some important products with enough yield.

2. gets familiar with synthesis of thermosetting plastics.

TEXT BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis
2. Essentials of experimental engineering chemistry , Shashi Chawla, Dhanpat Rai & Co
3. Laboratory manual of engineering chemistry, S.K.Bhasin and Sudha Rani , Dhanpat Rai & Co.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel.
2. A text book on experiments and calculations. S.S. Dara.

3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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I Year B.Tech. ME – II Sem	L	T/P/D	C
	0	-/3/-	2

(A52212) ENGINEERING WORKSHOP – II AND IT WORKSHOP

Course Objectives:

1. To impart the knowledge regarding the various techniques, skills and tools necessary for engineering workshop practice.
2. To provide the students with hands on experience on different trades of engineering workshop like black smithy, foundry and welding.
3. To learn about the machines in view of constructions details, different operations to be performed on the machines and different tools.
4. To enhance the practical approach towards machine tools.
5. To introduce the concepts of power tools in constructions, wood working, electrical engineering and mechanical engineering in manufacturing applications.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Black smithy
2. Foundry
3. Welding

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine shop
3. Power tools in construction, wood working, electrical engineering and mechanical engineering.

Course Outcomes:

1. To prepair a various shape of (S-shape, T- shape, Z- shape)
2. To prepare a single piece and double piece pattern by using casting process
3. To make a lap-joint, but-joint and angular joint.
4. To prepair a pipe joint , tap- connections by using pluming.
5. To apply different operations to be performed on the lathe machines.
6. To prepare a switch boards , wood drilling and threading different various sizes.

IT WORKSHOP:-

Objectives:

The IT Workshop for engineers is a training lab course spread over 40 hours. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, and Power Point.

1. **IT Workshop-I:** Computer hardware, identification of parts, disassembly, assembly of computer to working condition, sample diagnostic exercises.
2. **IT Workshop-II:** Installation of operating system windows and Linux simple diagnostic exercises.

TEXT BOOKS:

1. Work shop manual - P.Kannaiah/K.L Narayana/scitech publishers.
2. Workshop manual by Venkat Reddy

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(A53013)MECHANICS OF SOLIDS

Objectives

1. To develop an understanding of the relationship between external loads applied to a deformable body and the internal stresses, strains and deformation induced in the body.
2. To develop analytical & graphical problem solving skills.
3. To provide students with an understanding of advanced topics concerning the response of materials and structural elements to applied forces and deformations.

UNIT – I

Simple Stresses & Strains : Introduction – Types of stresses & strains- Hook's law – stress – strain diagram for mild steel – Working stress – Factory of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic module & the relationship between them. Problems on Bars of varying section & composite bars – Temperature stresses, Strain energy – Resilience – problems on Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force And Bending Moment: Introduction– Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported, fixed and overhanging beams subjected to different types of loads, point of contra flexure.

UNIT – III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of pure bending equation. Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (solid and hollow), I, T, L and channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – shear stress distribution across various beams sections like rectangular, circular, triangular I, T angle sections.

UNIT – IV

Deflection Of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L, uniformly varying load, Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

UNIT – V

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

Thick cylinders – lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

Learning Outcomes:

1. Calculate stress, strain, and deformation for basic geometries subjected to axial loading and thermal effects.
2. Calculate bending and shear stresses from shear force and bending moment diagram for cantilever, simply supported and over hanging beams of transverse loading.
3. Calculate shear stresses for torsional loading and identify the location of shear centers for the various sections of beams.
4. Calculate analytically and graphically (Mohr's Circle) the maximum and minimum normal and shear stresses and the orientations at which they occur for an arbitrary two-dimensional stress/strain state for combined loading conditions.
5. Calculate Circumferential Stress, Longitudinal And Volumetric Strain.

TEXT BOOKS

1. Strength of Materials – A.Ramamrutham/Dinnu sobi publisher/1st edition, Chennai -600109, India.
2. Mechanics of Materials by Dr.B.C.Punmia/publisher firewall Media, 2002/ 1st edition.
3. Strength of Materials – by Jindal, Umesh Publications.

REFERENCES

1. Analysis of structures by Vazirani and Ratwani.
2. Mechanics of structures Vol-III, by S.B. Junnarkar.
3. Strength of materials by S. Timshenko.
4. Strength of Material – S.S.Rattan/ TMH Publications.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(A53014)THERMODYNAMICS

Objectives:

1. To make students familiar with the basic concepts of thermodynamics and need of energy conservation.
2. To develop an understanding of the concepts underlying first and second laws.
3. To provide basic understanding of pure substance behavior.

UNIT – I

Basic concepts: Introduction**-S**ystem, Control volume, Surrounding boundaries, Universe, Types of systems, Macroscopic and Microscopic view points, Concept of Continuum, Thermodynamics Equilibrium, state, Property, Process, Cycle – Reversibility – Quasi – static Process irreversible process, Causes of irreversibility – Energy in state and Transition, Types , Work and heat, Point and path function. Zeroth Law of Thermodynamics – Concept of quality of temperature – Principles of Thermometry – Reference points – Const. Volume gas thermometer – Scales of temperature, Ideal gas scale

UNIT – II

PMM I,Joule's experiments – First law of thermodynamics – Corollaries – First law applied to a process – applied to a flow system – Steady flow energy equation. Limitations of the first law – Thermal Reservoir, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvinplanck and Clausius Statements and their Equivalence/ Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialities, Thermodynamic scale of temperature, Clausius inequality, Entropy, Principle of Entropy increase – Energy equation, Availability and irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz functions, Maxwell Relations – Elementary Treatment of the third law of thermodynamics.

UNIT – III

Pure Substances: p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables, Mollier charts – Various thermodynamic processes and energy transfer – Steam calorimetry.

UNIT –IV

Perfect Gas Laws: Equation of State, specific and universal Gas constants – various Non-flow processes, properties, end states, Heat and work Transfer, changes in internal energy – Throttling and free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander walls Equation of State – Compressibility charts – variable specific Heats – Gas tables.

Mixtures Of Perfect Gases: Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases

UNIT – V

Power Cycles : Otto Diesel, Dual combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Learning Outcomes:

1. Understand The Fundamentals Of Thermodynamics
2. Apply mass and energy balances (First Law) to a variety of simple processes
3. Determine the properties of a pure substance using thermodynamic tables
4. Analyze Rankine's ideal power cycle
5. Analyze and apply knowledge on power cycle

TEXT BOOKS

1. Engineering Thermodynamics / PK Nag/TMH Publications, 3rd Edition.
2. Applied Thermodynamics /D.S.Kumar/S.K.Kataria,2010/ 2nd Edition.

REFERENCES:

1. An introduction to Thermodynamics – YVS Rao / University press
2. Solution Manual to introduction to Thermodynamics, YVC Rao, University press
3. Engineering Thermodynamics – Jones & Dugan.
4. Thermodynamics – Robert Balmer, Jaico pub.
5. Thermodynamics – J.P Holman, McGrawHill
6. Engineering Thermodynamics – K.Ramakrishna, Anuradha publishers.
7. Fundamentals of thermodynamics – Sonntag, Borgnakke and van wylen, John wiley & sons (ASIA) Pte Ltd.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A53015)METALLURGY AND MATERIAL SCIENCE

Objectives:

1. To introduce the basic concepts concerning the materials in the world.
2. To explain the structure and properties of crystalline and non-crystalline materials, the symmetry and defects of crystal structures, physical properties, mechanical properties and changes in structure.
3. To explain the different heat treatment approaches and technologies which have led to our understanding of materials' structure and properties.
4. To provide sufficient background material to enable students to continue with more specialized courses, such as Nano Science and other physical science subjects.

UNIT – I

Structure of Metals: Crystallogrphy, miller's indices, packing Efficiency, Density calculations. Grains and grain boundaries. Effect of grain size on the properties.Determination of grain size by different methods.

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT – II

Phase Diagrams: Construction and interpretation of phase diagrams, phase rule. Binary phase diagrams, isomophous, Eutectic and Eutectoid transformations with examples. relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Si and Fe-Fe_3C.

UNIT – III

Heat Treatment of Alloys: : Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, Hardening, TTT diagrams, Tempering, Hardenability, surface – hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – IV

Cast Irons and steels- Structure and properties of White Cast iron, Malleable cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steel

UNIT – V

Ceramic Materials: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials – definition, properties and applications of the above.

Composite materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.

Learning Outcomes:

1. Acquire an understanding of the main concepts related to the structure and properties of materials
2. Understand about phase rules and Iron-Iron Carbon equilibrium diagram, TTT diagrams
3. Understand the basic concepts of Heat treatment processes
4. Understand the micro structure of ferrous and non-ferrous materials
5. Understand the basic methods of manufacturing various types of composite materials.

TEXT BOOKS

1. Introduction to Physical Metallurgy / Sidney H. Avener
2. Material science and Metallurgy / Kodgire/Everest Publishing House/31st Edition.
3. Materials Science and Engineering / William and callister

REFERENCES

1. Elements of material science / V. Raghavan/PHI learning pvt.Ltd, 2004/5thEdition.
2. Science of Engineering Materials / Agarwal
3. Essential of Materials science and engineering / Donald R. Askeland/ Thomson
4. Material Science & Material / C.D Yesudian & harris Samuel.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A53016) ENVIRONMENTAL STUDIES

(COMMON FOR ALL BRANCHES)

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance.

(a) Ecosystems: Concept of an ecosystem – Classification, structure and function of Forest, Pond, Grass Land ecosystems - Producers, consumers and decomposers. - Energy flow in the ecosystem - Food chains, food webs and ecological pyramids- Ecological succession.

(b) Biodiversity and its conservation: Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. ICUN categories of biodiversity and RED DATA book - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - II

Natural Resources : Renewable and non-renewable – Natural resources and associated problems Forest resources – Use and over – exploitation, deforestation,– Timber extraction, mining, dams and other effects on forest 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. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. 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.

UNIT – III

(a) Environmental Pollution: Definition, Cause, effects and control measures of different kinds of pollution (Air, Water , Soil , Nuclear, e –Waste)

(b) Social Issues and the Environment: From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, and watershed management. -Climate change, global warming, ozone layer depletion, nuclear accidents and holocaust.

UNIT – IV:

(a) Waste management technology: Solid waste Management: Causes, effects and control measures of Solid and Biomedical wastes. Disaster management: floods, earthquake, cyclone and landslides.

Waste water treatment technology: Sewage Water and Effluent Water- primary, secondary and tertiary treatments. Brief account on Bioremediation and Phyto-remediation, R.O technology. Application of GIS and GPS system in environment.

(b) Environmental policy, Rules and regulations. EIA (Environmental Impact Assessment) –Definition, Baseline Data acquisition, Impacts Assessment, EIS(Environment Impact Statement) & EMP (Environment Management Plan) – Environment Protection Act-1986, - Air (Prevention and Control of Pollution) Act- 1981, -Water (Prevention and control of Pollution) Act-1974, -Wildlife Protection Act-1974, – Forest Conservation Act.

UNIT – V

(a) Towards sustainable future: concept of sustainable development, threats of sustainability, population and its explosion, over exploitation of resources, strategies for achieving sustainable development. Environmental education, Conservation of resources. Urban sprawl, sustainable cities and sustainable communities, human health. Environmental ethics, concept of green building, Basic principles of Green engineering, clean development mechanism (CDM), Low carbon life cycle, Polluters-pay principle.

(b) Field work: Visit to a local area to document environmental assets River/forest grassland/hill/ mountain Visit to a local polluted site-Urban/Rural/industrial/

Agricultural Study of common plants, insects, birds, Visit to effluent treatment

plant/sewage treatment plant Study of simple eco systems pond, river, hill slopes, etc.

Mini projects by students which is mandatory

TEXT BOOK:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, University Press.
2. Environmental studies, From Crisis to cure by R.Rajagopalan,2005

REFERENCES:

1. Environmental Science: towards a sustainable future by Richard T.Wright.2008 PHL Learning Private Ltd .New Delhi
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P.Ela.2008 PHI Learning Pvt. Ltd.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A53001) MATHEMATICS-III

UNIT-I: Solution of Non- linear Equations and Linear System of Equations.

Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.Solving system of non-homogeneous equations by L-U Decomposition method(Crout's Method)Jacobi's and Gauss-Seidel Iteration method.

UNIT-II: Interpolation:

Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols- Difference Equations - Differences of a polynomial-Newton's formulae for interpolation – Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

UNIT-III: Numerical Differentiation, Numerical Integration & Curve fitting

Numerical Diferentiation, Generalized Quadrature (Newton's Cote's formula), Trapezoidal, Simson's and Weddle's rules and problems. Curve fitting: Fitting a straight line – Second degree curve – exponentional curve-power curve by method of least squares.

UNIT – IV: Numerical solution of IVP's in ODE

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods – Predictor-Corrector Methods- Adams-Bashforth Method-Milne Thamson Method.

UNIT-V: Partial differential equations

Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (Standard type) equations, Charpits Method, Method of separation of Variables for second order equations. Classification of general second order partial differential equations. Applications of Partial Differential Equations-One dimensional wave equation, Heat equation.

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Introductory Methods of Numerical Analysis. S.S. Sastry, Prentice Hall.
3. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Numerical Analysis (Paper IV), First Edition 2010, Telugu Akademi, Hyderabad.
2. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A53017) ELECTRICAL AND ELECTRONICS ENGINEERING

Objective:

This course facilitates to study Basic Electrical Engineering and DC,AC machines concepts. Basic Electronics Engineering.

UNIT-I: Electrical Circuits

Basic definitions, types of elements, ohms law, Kirchhoff' laws, resistive networks, inductive networks, capacitive networks, series, parallel circuits and star –delta transformations.

UNIT-II: DC Machines

DC generators: Construction, basic principle, EMF equation, types of dc generators, losses & efficiency, applications.

DC Motors: Basic principle, types of dc motors, torque equation, necessity of starters,3-point starter, characteristics, speed control of dc shunt motor, losses & efficiency, applications.

UNIT-III: AC Machines

Transformers: Principle of operation of 1-phase transformers, construction, oc & sc tests, losses, efficiency & regulation, applications.

Induction machines: Principle of operation of 3-phase induction machines, torque-slip characteristics. Losses and efficiency and applications.

UNIT-IV: Diode and Transistor

Diode: p-n junction diode, symbol, V-I characteristics, Diode Application, Rectifier-Half wave, Full wave and Bridge rectifier.

Transistor: PNP and NPN junction transistor, Transistor as an amplifier,

UNIT-V: Cathode Ray Oscilloscope

Principles of CRT (Cathode Ray Tube), Deflection, sensitivity, Electroscopic and Magnetic deflection, Application of CRO-voltage, Current and frequency measurements.

Course Outcomes:

After going through this course the student gets knowledge on

- Introduction of Electrical Elements, Electrical circuits and applications of KVL, KCL, and Ohm's Law.
- DC machines and their applications.
- AC machines and their applications.
- Electronic devices like Diode, Transistors and their applications.
- Working principle of CRO and its internal parts.

TEXT BOOKS:

1. Principles of Electrical and Electronics Engineering -V.K.Mehta, 2nd edition, S.Chand & Co, 2008.
2. Introduction to Electrical Engineering - Kothari and Nagarath, 2nd edition, TMH Publications.
3. Fundamentals of Electrical Engineering and Electronics - J.B. Gupta, S.K. Kataria & sons Publications, 2002.

REFERENCE BOOKS:

1. Basic Electrical Engineering - Kothari and Nagarath, TMH Publications, 2nd edition
2. Electrical and Electronics Technology - Hughes – Pearson education

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(A53207) ELECTRICAL AND ELECTRONICS ENGINEERING LAB

PART-A

Electrical Engineering

The following 4 experiments are compulsory:

1. Swinburne's test on DC shunt machine.
2. OC & SC tests on single phase transformer.
3. Brake test on 3-phase induction motor.
4. Regulation of Three phases Alternator by Synchronous Impedance Method.

In addition to the above 4 experiments any one of the experiments has to be conducted.

1. Brake test on DC shunt motor.
2. Speed control of DC Shunt Motor by

   a) Armature voltage control b) field flux control method.

PART-B

Electronics Engineering

Any 5 of the experiments has to be conducted from the following.

1. Transistor CE characteristics.
2. Full wave rectifier with and without filters.
3. CE amplifiers.
4. RC phase shift oscillators.
5. Class-A power amplifier.
6. Microprocessor.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(A53208) METALLURGY AND MECHANICS OF SOLIDS LAB

Objectives:

1. To familiarize the students with the use of stress, strain measuring instruments and to enable the students to acquire the knowledge of flow meters.

(A) METALLURGY LAB:

1. Preparation and study of the Micro Structure of pure metals like iron, Cu and Al.
2. Preparation and study of the Micro Structure of Mild steel, low carbon steels, high – C steels.
3. Study of the Micro Structure of Cast irons.
4. Study of the Micro Structure of Non-Ferrous alloys.
5. Study of the Micro Structure of Heat treated steels.
6. Hardenability of steels by Jominy End Quench test.
7. To find out the hardness of various treated and untreated steels.

(B) MECHANICS OF SOLIDS LAB:

1. To determine the Tensile Strength of specimen.
2. To determine the values of Bending stress and young's modulus or elasticity of a simple supported at the ends and carrying a concentrated load at the centre.
3. To determine the modulus at rigidity of given specimen.
4. To find the Rockwell Hardness of test specimen.
5. To determine the stiffness and modulus at rigidity of spring material.
6. To determine the breaking stress of the given material by testing apparatus.
7. To study the Impact testing machine and perform Charpy Impact test.

NOTE: Any 10 experiments from the above are to be conducted taking at least 4 from each section.

Learning Outcomes:

1. Determine Young's modulus by conducting tensile, torsion tests on mild steel rods, compression test on springs, bricks, concrete, and impact strength of steel.
2. Study of the micro structure of iron, Cu.Al, MS, LCS, HCS.

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B.Tech ME II Year I-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**0**

(A53209) GENDER SENSITIZATION

Course Objectives:

- To develop students sensibility with regard to issues of gender in contemporary India.
- To provide critical perspective or the socialization of men and women.
- To introduce students to information about so0me key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender vigilance.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professions a will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the now laws that provide protection and relief to women, the textbook will empower students to understand respond to gender violence.

Unit-I:-

UNDERSTANDING GENDER:

Gender: Why shoud we Study it? (Towards a world of equals: Unit - 1)

Socialization: Making women, Making Men (Towards a world of equals: Unit – 2)

Introduction. Preparing for Womanhood Growing up male. First lessons in Cases. Different masculinities.

Just Relationships: Being Together as Equals (Towards a world of equals: Unit – 12)

Mary Kom and onles love and Acid just do not Mix. Love Letters, Mothers and Fathers. Furthur Reading: Rose Parks The Brave Heart.

Unit – II:

GENDER AND BIOLOGY:

Missing Women: Sex Selection and its consequences (Towards a world of equals: Unit – 4)Destining Sex Ratio, Demographic Consequences.

Gender Spectrum: Beyond the Binary (Towards a world of Equals unit – 10)Two or Many? Struggles with DiscriminationAdditional reading: Our Bodies, Our Health (Towards a world of equals: Unit – 13)

Unit – III:

GENDER AND LABOUR:

Housework: the Invisible Labour (Towards a world of equals: Unit – 3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (Towards a world of equals: Unit – 7)

Fact and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and Conditions of Work.

Unit – IV:

ISSUES OF VOLENCE:

Sexual Ilarassment: Say Not (Towards a world of equals: Unit – 6)

Sexual Harassment: not Eve teasing Coping with Everyday Harassment Further Reading: "*Chupalu"*.

Domestic Violence: Speaking Out (Towards a world of equals: Unit – 8)

Is home a safe place? – When women unite [Film]. Rebuilding lives Further Reading New Forums for Justice.

Thinking about Sexual Violence (Towards a world of equals: Unit – 11)

Blaming the Victim-"I fought for my life…." – Further Reading: The Caste Face of Violence

Unit – V:

GENDER STUDIES:

Knowledge: Through the Lens of Gender (Towards a world of equals: Unit – 5) Point of view Gender and the structure of knowledge. Further Reading: Unacknowledged women Artists of Telangana.

Whose History? Questions for historians and others (Towards a world of equals: Unit – 9)Reclaiming a Past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Essential Reading: All The Units In the Textbook, " Towards a World of Equals: A Billngual Textbook on Gneder" written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Thanu.

Note: Since it is interdisciplinary course, Resource Persons can be drawn form the fields of English Literature or Sociology or political science or any other qualified faculty who has expertise in this field.

REFERENCE BOOKS:

1. Sen, Amartya. "More than One Million Women are Missing." New York of books 37.20 (20 December 1990). Print. "we Were Making History…" Life Stories of Women in the Telangana People's Struggle. New Delhi: Kall fcr Women. 1989.
2. Tripti Lahiri. "By the Numbers: Where Indian Women Work." Women's Studies Journal (14 November 2012) Availbale online at : http:// blogs.wsj.com/india real time/2J12/11/14/by- The numbers-wehere-Indian-women-work/>
3. K.Satyanaraya and Susie Tharu (Ed.) Steel Nibs Are Sorouting: New Dalit Writing From South India, Dussier 2. Telugu And Khannada http://harpercolling.co.in/BookDetail.aso?BookCodes3732
4. Vimala. "Vartillu (the Kitchen)". Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susic Tharu and K.Lalits. Delhi:Oxford University Press, 1995. 599-601.
5. Shatruguna. Veana At . Women's Work and its Imapact on Child Health and Nutrition Hyderabad, National Institute of Nutrition . India council of research. 1993.
6. Stree Shakti Sangeetana. "We Were Making History … 'Life Stories of women in the Telangana People's Struggle. New Delhi: Kai for Women. 1989.
7. Menon. Nivedita. Seeing Like a Feminist New Delhi: Zubaan-Penguin Books, 2012.
8. Yayaprabha, A. "Chupulu (states)". Women Writing in India: 500BC to the Present. Volume II: The 20th Century Ed. Susie Tharu and K.Lalita Delhi: Oxford University Press. 1995.596-597.
9. Haveed Shayam and Anupam Maruhaar, "Women and Wage Discrimination in India: A Critical Analysis. " I International journal of Humanities and Social Science Invention 2.4(2013)

10. Gautam. Liela and Gita Ramaswamy. “A Conversation between a Daughter and a Mohter. “ Eroadsheet on contemporary Politics. Special Issue on Sexually and Harassment: Gender Politics on Campus Today. Ed. Madhumeeta Sinha and Asma Rasheed. Hyderabad Anveshi Research Center for Women’s Studies. 2014
11. Aodulali Sohaila. “I fought for My Life .. and Won. “ Available online at http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand -won-sohala-abdula/
12. Jeganathan Pradeep. Partha Chattarjee (Ed). “Community, Gender and Violence Subaltern Studies XI”. Parmanert Black and Ravi Dayal Publishers, New Delhi, 2000.
13. Kkapadia. The Violence of Development: The Plitics of Identity, Gender and Social Inequalities in india London: Zed Books. 2002
14. S.benhabib. Situaling the Self Gender, Community ana Postmoderism in Contemporary Ethics. London roullege. 1992
15. Virgnia Woolf. A Room of One’s Own. Oxford Black Swan. 1992
16. T. Banuri and M. Mahmood, Just Development: Beyond Adjustment with a human Face, Karachi Oxford University Press, 1997

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A54012) PRODUCTION TECHNOLOGY

Objectives:

To impart the principles of various fabrication process such as casting, welding and expose the students to various forming processes.

UNIT – I

Casting: Introduction, Steps involved in making a casting – Advantage of casting and its applications, - Patterns and pattern making – Types of patterns, Materials used for patterns, pattern allowances and their construction, principles of Gating, Gating ratio and design of Gating systems.

UNIT – II

Advanced casting process:

Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys, Risers – Types, function and design, casting design considerations, special casting processes 1) centrifugal, 2) Die, 3) investment. Casting defects and methods. Methods of melting: Crucible melting and cupola operation, steel making processes, special.

UNIT – III

Metal joining processes:

a) **Welding:** Classification of welding processes, types of welds& welded joints, characteristics of welding, preparation of welded joints, Gas welding, Arc welding, Forge welding, Resistance welding, Thermit welding and Plasma welding.
b) **Cutting of Metals:** Oxy – Acetylene Gas cutting, water plasma, cutting of ferrous metals.
c) **Inert Gas welding:** TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing, Heat affected zones in welding, welding defects – causes and remedies – Destructive, Non destructive testing of welds.

UNIT – IV

Metal forming and working:

Hot working, cold working, advantages, disadvantages, and limitations, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of cold and Hot worked parts; Rolling fundamentals – theory of rolling, types of rolling mills and forces in rolling and power requirements.

Stamping, forming and other cold working processes, Blanking and piercing – Bending and Forming – Drawing and its types, Deep Drawing – wire drawing and Tube drawing – coining – Hot and cold spinning.

UNIT – V

Extrusion Of Metals: Basic extrusion process and its characteristics, Hot extrusion and cold extrusion – Forward extrusion and backward extrusion – impact extrusion, Hydrostatic extrusion.

Forging Processes: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – Forging defects.

Processing Of Plastics: Types of Plastics, Properties, applications and their Processing methods & Equipment -blow & injection molding.

Learning Outcomes:

1. Understand the technology of the casting processes.
2. Understand the various casting methods.
3. Differentiate the various joining processes with application.
4. Understand the various bulk forming processes.
5. Understand the various extrusion process

TEXT BOOKS:

1. Elements Of Work Shop Technology Volume-1 /media promoters/a.k.hajra choudhury, nirjhar roy / 6th edition.
2. A Text Book of Production Technology / P.C.Sharma/published 2009 by Chand(s) Co Ltd/8th Edition.
3. Manufacturing Technology vol-1 3E/Tata McGraw-Hill Education2009/Rao/6th Edition.

REFERENCES:

1. Production Technology / R.K Jain
2. Process And Materials Of Manufacturing – Lindberg/PE
3. Principles of Metal Castings – Roenthal.
4. Welding Process – Paramar
5. Production Engineering – Suresh Dalela & Ravi Shanker / Galgotia Publications Pvt. Ltd.
6. Manufacturing Engineering and Technology / Kalpakjin. S / Pearson Edu.
7. Manufacturing Processes for Engineering Materials – Serope Kalpakjian and Steven R Schmid, Pearson Publication.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(A54013) KINEMATICS OF MACHINARY

Objectives:

The objectives of this course are to cover the kinematics & synthesis of single degree of-freedom mechanisms and cover the gears, gear trains, cams and also the velocity and acceleration of links in a mechanism.

UNIT – I

Mechanisms: Elements of Links – Classification – Rigid Link, flexiable and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Kinematic chain – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

Straight Line Motion Mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, pantograph.

UNIT – II

Introduction to Velocity and acceleration – Motion of link on machine – Determination of velocity and acceleration using Graphical method – Application of relative velocity method four bar mechanism.

Analysis of Mechanisms: Analysis of slider crank mechanism for displacement, Velocity and acceleration of slider – Acceleration diagram for a given mechanism, Coriolis acceleration.

Plane motion of body: Instantaneous center of rotation, centrods and axodes – Three centres in line theorem.

Steering Mechanisms: Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio.

UNIT – III

Cams : Definition of cam and follower –applications, Types of followers and Cam terminology, Types of follower motions – Uniform velocity -simple harmonic motion-

uniform acceleration and cycloid motion Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Hooke's Joint: Single and double Hooke's joint – applications– problems.

UNIT – IV

Introduction to toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth, cycloidal and involute profiles, sliding of Velocity – phenomena of interferences – Causes of interfererence, Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – introduction of Helical, Bevel and worm gearing.

UNIT – V

Gear Trains: Introduction – Train value – Types – Simple and reverted wheel train – Epicyclic gear train, Methods of finding train value or velocity ratio – Epicyclic gear trains, Differential gear for an automobile.

Belt, Rope and Chain Drives: Introduction, Belt and rope drives, selection of belt drive – types of belt drives, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains -classification of chains, length, angular speed ratio.

Learning Outcomes:

1. Analyze different mechanisms and machines.
2. Calculate position, velocity, and acceleration of linkages.
3. Develop the cam profiles. Calculate velocity, and acceleration of follower.
4. Calculate the length of path of contact, length of arc of contact, contact ratio, no of teeth's required to avoid interference and speed.
5. Calculate the velocity ratio and know the concept of belt, rope & chain drives.

TEXT BOOKS

1. Theory of Machines – Rattan .S.S, TMH, 2009 Edition.
2. Theory of Machines by Thomas Bevan/Pearson/3rd Edition.
3. Theory of Machines – R.K Bansal/Laxmi publications/9thEdition.
4. Theory of Machines / Shigley / Oxford.

REFERENCES:

1. Theory of Machines – PL. Ballaney / kharina publishers,
2. Theory of Machines Sadhu Singh Pearsons Edn
3. Mechanism and Machine Theory / JS Rao and RV Dukkipati / NewAge
4. Theory of Machines R.S Khurmi & J.K Gupta.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

(A54014) THERMAL ENGINEERING – I

Objectives:

This course provides the fundamental thermodynamic operating principles of I.C. engines and Gas turbines and also exposes to the alternative fuels used in I.C Engines

UNIT – I

I.C Engines: Classification – Working principles, Valve and Port Timing Diagrams, Air – Standard, Air-fuel and actual cycles – Engine systems – Fuel, Carburetor, Fuel injection system & its Types, Ignition, Comparison of Air Standard and Actual Cycles, Actual and Fuel-Air Cycles of CI Engines.

UNIT – II

Combustion in S.I Engines: Normal combustion and abnormal combustion – importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

Combustion of C.I Engines: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock – Need for air movement suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – III

Performance and Testing of I.C Engines: Parameters of performance – measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT – IV

Reciprocating & Rotary Compressors: Classification – positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types

Reciprocating: Principle of operation, work required, isothermal efficiency, volumetric efficiency and effect of clearance, stage compression, undercooling, saving of work, minimum work condition for stage compression.

Rotary (Positive displacement type): Roots blower, vane sealed compressor, Lyshoim compressor – mechanical details and principle of working – efficiency considerations

UNIT – V

Centrifugal Compressors: Mechanical details and principle of operation – velocity and pressure variation, Energy transfer, impeller blade shape- losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor – isentropic efficiency – pressure rise calculations – Polytropic efficiency.

Learning Outcomes:

1. Analyze air standard cycles used in I.C. Engines.
2. Understand the combustion phenomena in I.C. Engines.
3. Analyze the performance of I.C engines.
4. Understand The Concept About Reciprocating And Rotary Compressors.
5. Understand The Concept About Centrifugal And Axial Compressors.

TEXT BOOKS:

1. I.C Engines – V. GANESAN, TMH/2nd Edition.
2. IC Engines – Ramalingam, Scietech publishers /Pvt.Ltd 2011/2nd Edition.
3. Thermal Engineering / Rajput / Lakshmi Publications 2010/9th Edition.

REFERENCES:

1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek / Pearson / PHI
3. Thermal Engineering / Rudramoorhty – TMH
4. Thermodynamics & Heat Engines / B.Yadav / Central Book Depot, Allahabad.
5. I.C Engines / Heywood / McGrawHill.
6. Thermal Engineering – R.S Khurmi & J.K Gupta – S.Chand
7. Thermal Engineering data book – B. Srinivasulu Reddy / JK international.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A54015) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

Objectives:

1. To expose the student to the fundamental aspects of fluids at rest, fluids in motion, fluid kinematics, fluid dynamics, fluid properties and methods of flow.
2. To impart knowledge of various types of hydraulic machines and their working principles. The course expose the student's to the applications of hydraulic devices and hydraulic systems.

UNIT – I

Fluid Statics: Units and Dimensions: physical properties of fluids - specific gravity, viscosity, surface tension problems – vapour pressure and their influence on fluid motion – atmospheric, gauge and vacuum pressures, Measurement of pressure: Piezometer, U-tube and differential manometers.

UNIT – II

Fluid Kinematics: Steam line, path line and stream lines and steam tube, classification of flows: steady & unsteady, uniform & non uniform, laminar & turbulent, rational & irrational flows, equation of continuity for one dimentional flow and three dimentional flows.

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a 2-D stream line, momentum equation and its application on force on pipe bend-Problems.

UNIT – III

Closed Conduit Flow: Reynold's experiment-Darcy Weisbach equation-Minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line. Measurement of flow: pitot tube, venture meter and orifice meter.

Boundary Layer Theory Of Concepts: Thicknes, characteristics along the thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

UNIT – IV

Basics Of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube theory – functions and efficiency.

UNIT – V

Performance Of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Centrifugal Pumps: Classification, working principle, work done – barometric head – losses and efficiencies, specific speed – performance characteristic curves. NPSH

Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.

Learning Outcomes:

1. Understand the Importance of fluid Mechanic, and behavior fluids Dimensions and units, physical properties of fluids, types of fluid flows, Stream line, path line and streak lines and stream tube, classification of flows.
2. Understand types of losses and measurement of fluid flows.
3. Apply the momentum principles for impact of jets.
4. Analyze the hydraulic pumps.
5. Analyze the hydraulic turbines

TEXT BOOKS:

1. Fluid Mechanics And Hydraulic Machinery MODI and SETH.

2. A Text Book Of Fluid Mechanics /R.K.Bansal/Laxmi publication(p)Ltd,2011/9th Edition.

3. Fluid Mechanics And Fluid Power Engineering By D.S. Kumar, Kotaria & Sons.

REFERENCE BOOKS:

1. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.

2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

3. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley ,John Wiley & Sons.

4. Fluid Mechanics and Hydraulic Machines by Rajput.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	0	**0**	**6**	**3**

(A54016) MACHINE DRAWING

Objectives:

To equip students with necessary skills in engineering graphics, Mechanical engineering drawing applications

Machine drawing conventions: Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views, Parts not usually sectioned.
c) Methods of dimentioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details – common abbriviations & their liberal usage.
e) Types of Drawings – working drawings for machine parts.

I. **Drawing of Machine Elements and simple parts:**

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

a) Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cottered joints and knuckle joint.
c) Rivetted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings.

II. Assembly Drawings: Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) **Engine Parts** – stuffing boxes, cross heads, Eccentric, Petrol Engine connecting rod, piston assembly.
b) **Other Machine Parts** – Screws jacks, Machine vices plummer block tailstock.
c) **Valves** : Steam stop valve, spring loaded safety valve, feed check valve and air cock.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Learning Outcomes:

1. Draw the conventional represent for screws, nuts, and bolts. Keys, gears, webs and ribs.
2. Drew the machine elements for riveted joints and bearings.
3. Drew the assembly the machine parts.

TEXT BOOKS:

1. Machine Drawing – K.L Narayana, P.Kannaiah & K.Venkata Reddy/ New Age/publishers.
2. Machine Drawing – Sidhishwar/TMH Publications/International Edition.
3. Machine Drawing- N.D.Bhatt./poetmba 2013.

REFERANCES:

1. Machine Drawing – P.S. Gill.
2. Machine Drawing – Luzzader
3. Machine Drawing – Rajput.
4. Machine Drawing – Ajeet Singh, TMH Publications.

Question Paper Pattern:

PART A:

TWO Questions need to be answered from 4 questions from Section - I for 2 X 15 = 30 Marks

PART B:

Only One question will be given from the Assembly Drawings for 45 marks. No Choice Cumpulsary Question.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A54001) PROBABILITY AND STATISTICS

Objectives: To learn

- Understand Chance causes and random variable that describes randomness or an uncertainty in certain realistic situation.
  It can be of either discrete or continuous type.
- In the discrete case, study of the binomial and the Poisson random variables and the Normal random variable for
  the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.
- The types of sampling, Sampling distribution of means ,Sampling distribution of variance, Estimations of statistical parameters, Testing of hypothesis of few unknown statistical parameters.
- Understanding the Experiment and the design of experiment.
- The random processes, The classification of random processes, Markov chain, Classification of states
- Stochastic matrix (transition probability matrix),Limiting probabilities, Applications of Markov chains

UNIT-I: Probability: Sample space and events, Classical and Statistical definition of Probability, The axioms of probability,
Some Elementary theorems of Probability, Conditional probability, Baye's theorem. Random variables, Discrete and
continuous random variable,

UNIT-II: Definitions of Probability Distribution function, Probability mass function, Probability density function and properties. Definitions of Mathematical expectation, Moments (about origin & Centre), Definition of moment generating function for discrete and continuous random variable.

Discrete Distributions: Binomial and Poisson distributions (definition and problems) their mean, variance and moment generating function.

Continuous Distribution: Normal and exponential distributions (definition and problems) related properties.

UNIT-III: Sampling distribution: Populations and samples - Sampling distributions of mean (σ known and unknown)

Estimation: Concept of Point estimation and its properties (definition only), Concept of interval estimation with examples.

Test of Hypothesis: Null & Alternative Hypothesis, Critical region, Type I and Type II errors, level of significance, one tail, two-tail tests.

UNIT-IV: Large sample test: concerning means – proportions (One and Two samples). Small sample test: Chi-Square test, Student's t-test (Single mean, Difference of mean and Paired samples) and F-test.

UNIT-V: Design of Experiment: Introduction to ANOVA (one – way, two – way), Principles of Design of Experiment, completely randomized design (CRD), randomized complete block design (RBD), Latin Square Design (LSD).(No Derivations only concept, definitions and problems)

Text Books:

1. Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Academic Press.
2. Probability and Statistics for Engineers by Richard A Johnson, Pearson Education.
3. Introduction to Probability by Charles M Grinstead, J Laurie Snell, American Mathematical Society.

Reference:

1. A.V. Skorokhod, Basic Principles and Applications of Probability Theory, Springer.
2. Arnold O. Allen, Probability & Statistics, Academic Press.
3. Hwei P. Hsu, Theory and Problems of Probability, Random Variables, and RandomProcesses, Schaum's Outline Series, McGraw- Hill.
4. Mendan Hall, Probability & Statistics, Beaver Thomson Publishers.
5. Miller and John E. Freund, Probability & Statistics for Engineers, Prentice Hall of India.
6. Montgomery: Design and Analysis of Experiments, Wiley.
7. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, JohnWiley & Sons, Ltd.
8. Zivorad R. Lazic, Design of Experiments in Chemical Engineering, Wiley-VCH.

Outcomes:

- Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variable involved in the probability models. It is quite useful for all branches of engineering.
- The student would be able to calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations .It is Mainly useful for non-circuit branches of engineering.
- The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in nth state. It is quite useful for all branches of engineering.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(A54207) PRODUCTION TECHNOLOGY LAB

Objectives:

The course will give the student an insight into working of various casting,welding,press working and processing of plastics.

Minimum of 12 Exercises need to be performed

I. Metal Casting Lab:

1. Pattern Design and making – for one casting drawing.
2. Sand properties testing – Exercise for strengths and permeability – 1
3. Moulding Melting and Casting – 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint – 2 Exercises
2. Spot Welding – 1 Exercises
3. Gas Welding – 1. Exercise
4. Soldering and Brazing – 2 Exercises

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending operations.

IV. Processing of Plastics:

1. Injection Moulding
2. Blow Moulding

Learning Outcomes:

1. Make a pattern design and making.
2. Understand about sand properties testing.
3. Understand about different type of joining process.
4. know the concept of mechanical pressing and processing of plastics.

Reference Book:

1. Dictionary of Mechanical Engineering – G.H.F Nayer, Jaico publishing.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(A54208) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

Objectives:

The course will give the student an insight into working of various fluid machines and be able to compare performance of fluid machines under different working conditions

1. Impact Of Jets On Vanes
2. Performance Test On Pelton Wheel
3. Performance test on Francis Turbine.
4. Performance test on single stage centrifugal pump.
5. Performance test on Multi stage centrifugal pump.
6. Performance test on Reciprocating pump.
7. Calibration of Venturimeter.
8. Calibration of Orifice mater.
9. Determination of friction factor for a given pipe line.
10. Determination of loss of head due to sudden contraction in a pipeline.
11. Verification of Bernoulli's theorems.
12. Performance Test on Kaplan Turbine.

Note: Any 10 of the above experiments are to be conducted.

Learning Outcomes:

1. Impact of jet
2. Performance test on Pelton wheel
3. Performance test on Francis turbine
4. Performance test on single stage centrifugal pump.
5. Performance test on multi stage centrifugal pump.
6. Performance test on reciprocating pump.
7. Calibration of venturimeter.
8. Calibration of orifice meter
9. Determine of friction factor for a given pipe line.
10. Determine of loss of head due to sudden contraction in a pipeline.

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B.Tech ME II Year II-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**0**

(A54209) HUMAN VALUES AND PROFESSIONAL ETHICS

Objectives:

- To help the students appreciate the essential complementarities between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.

UNIT - I:

Course Introduction - Need, basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration - what is it? - its content and process; 'Natural Acceptance' and Experiential Validation - as the mechanism for self exploration. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT - II:

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

UNIT - III:

Understanding Harmony in the Family and Society - Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astiva as comprehensive Human Goals. Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

UNIT - IV:

Understanding Harmony in the nature and Existence - Whole existence as Co-existence: Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astiva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

UNIT - V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order,
b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order.

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
b. At the level of society: as mutually enriching institutions and organizations.

TEXT BOOKS:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

REFERENCE BOOKS:

1. Ivan IIlich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E. F. Schumancher, 1973, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.
3. A Nagraj, 1998 Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986, 1991.
5. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.
6. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth - Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
10. M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Humna Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

1. value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charle Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology - the Untold Story

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B.Tech ME III Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A55017) MACHINE TOOLS AND METROLOGY

Course objective:

Students will be able to understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods, Alignment tests on machine tools

UNIT – I

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips.

Engine lathe – Principle of working, types of lathe, specifications.Taper turning,– Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

UNIT – II

Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines - Principles of working – machining time calculations.

UNIT – III

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters – methods of indexing.

Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations

UNIT – IV

Limits, fits and tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

Limit Gauges : Taylor's principle, Design of GO and NO GO gauges

Measurement of angles, Bevel protractor, Sine bar.

Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator.

UNIT – V

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf.

Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

Coordinate Measuring Machines: Types and Applications of CMM.

Course Outcomes:

- Get familiarity with terminology and errors in measurement.
- Get acquainted with limits, tolerances and gauge design.
- Understand the principles of linear and angular measuring instruments.
- Understand the surface roughness terminology and types of various surface roughness measuring instruments.
- Understand the strain measurement.
- Familiarize with temperature measuring instruments

TEXT BOOKS:

1. Engineering Metrology / I C Gupta./ Danpath Rai
2. Engineering Metrology / R.K. Jain / Khanna Publishers
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.
4. Production Technology by R.K. Jain and S.C. Gupta.

REFERENCE BOOKS:

1. Production Technology by H.M.T. (Hindustan Machine Tools)
2. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
3. Fundamentals of Dimensional Metrology 4e / Connie Dotson / Thomson
4. Workshop Technology – Vol.-II, B.S. Raghui Vamsi
5. Elements of Work Shop Technology – Vol. II, Hajra Choudry, Media Promoters.
6. Fundamentals of Metal Machining and Machine Tools, Geofrey Boothroyd, McGraw Hill

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B.Tech ME III Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A55018) DYNAMICS OF MACHINERY

Course objective:
To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines. To understand the concept of vibratory systems and their analysis and also the principles of governors.

Unit – I

Static And Dynamic Force Analysis Of Slider Crank Mechanism - Displacement of piston - Velocity of Piston - Acceleration of Piston- Net or Effective force on the Piston- Crank Effort- Angular Velocity and Angular Acceleration of Connecting rod

Gyroscopes: Gyroscopic effect-Derivation of basic equation, Effect of Precession Motion on the Stability of Moving Vehicles Such As Motor Car, Motor Cycle, Aero Planes And Ships.

Unit – II

Clutches: Friction Clutches – Single Disc Or Plate Clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes: Simple Block Brakes, Internal Expanding Brake, Band Brake of Vehicle,

Unit – III

Turning Moment Diagram And Fly Wheels: Turning Moment – Inertia Torque - Angular displacement of Crank Diagrams – Fluctuation Of Energy – Fly Wheels And Their Design.

Governor: Watt, Porter And Proell Governors, Spring Loaded Governors – Hartnell And Hartung With Auxiliary Springs, Sensitiveness, Isochronisms And Hunting.

Unit – IV

Balancing: Balancing Of Rotating Masses Single And Multiple – Single And Different Planes Analytical And Graphical Methods.

Balancing Of Reciprocating Masses, Primary And Secondary Balancing Of Reciprocating Masses. Analytical And Graphical Methods – Unbalanced Forces And Couples – Balancing Of Single Cylinder Engine

Unit – V

Vibration: Free Vibration Of Mass Attached To Vertical Spring (Parallel and Series), Types Of Free Vibrations, Natural Frequency Of Longitudinal Vibrations By Different Methods

Forced Damped Vibration, Vibration Isolation & Transmissibility – Introduction to Natural Frequency Of Transverse and Torsional Vibrations.

Course Outcomes:

- Understand how to balance several masses in different planes along with rotating and reciprocating masses.
- Analyze different types of governors which controls speed of the machine or engine
- Attain a deeper understanding on the gyroscopic effects of rotating bodies for aero-planes, naval ships, automobiles, and two wheelers
- Calculate natural frequencies for un damped and damped vibrating systems.
- Analyze the response of the vibrating mass at different operating conditions Calculate natural frequencies for different modes of vibrations for transverse and tensional loading conditions.

Text Books:

1. Theory Of Machines By T. Beven, Pearson Education
2. Kinematics And Dynamics Of Machinery By R.L.Norton, Mc Graw Hill.

References:

1. Theory Of Machines By SS. Ratan, Mc Graw Hill.
2. Theory Of Machines And Mechanisms By P.L. Ballaney, Khanna Publishers.
3. Mechanism And Machine Theory / JS Rao And RV Dukkipati / Newage
4. Theory Of Machines And Mechanisms By Uicker, Pennock And Shigley Oxford.

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	4	**1**	**0**	**4**

(A55019) DESIGN OF MACHINE MEMBERS-I

Course objectives:

- To understand the general design procedures and principles in the design of machine elements.
- To study different materials of construction and their properties and factors determining the selection of material for various applications.
- To determine stresses under different loading conditions.
- To learn the design procedure of different fasteners, joints, shafts and couplings.

Unit – I

Introduction: General Considerations In The Design Of Engineering, Materials And Their Properties – Selection – Manufacturing Consideration In Design. Stresses In Machine Members: Simple Stresses – Complex Stresses – Impact Stresses – Stress Strain Relations – Static Theories Of Failure – Factor Of Safety – Design For Strength And Rigidity – Preferred Numbers. The Concept Of Stiffness In Tension, Bending, Torsion And Combined Situations.

Stresses Due To Fatigue Loading: Stress Concentration – Theoretical Stress – Concentration Factor – Fatigue Stress Concentration Factor Notch Sensitivity – Design For Fluctuating Stresses – Endurance Limit – Estimation Of Endurance Strength – Fatigue Theories Of Failure – Goodman And Soderberg.

Unit – II

Riveted Joints: Modes Of Failure Of Riveted Joints – Strength Equations – Efficiency Of Riveted Joints – Design Of Boiler Joints – Eccentrically Loaded Riveted Joints.

Welded Joints: Design Of Fillet Welds – Axial Loads – Circular Fillet Welds – Bending And Torsion – Eccentrically Loaded Joints.

Unit – III

Bolted Joints: Design Of Bolts With Pre-Stresses – Design Of Joints Under Eccentric Loading – Bolt Of Uniform Strength, Cylinder Cover Joints.

Axially Loaded Joints: Keys, Cotters And Knuckle Joints: Design Of Keys-Stresses In Keys – Cottered Joints-Spigot And Socket, Sleeve And Cotter, Jib And Cotter Joints, Knuckle Joints.

Unit – IV

Design Of Shafts: Design Of Solid And Hollow Shafts For Strength And Rigidity – Design Of Shafts For Complex Loads – Shaft Sizes – BIS Code – Design Of Shaft For A Gear And Belt Drives.

Design Of Shaft Couplings : Rigid Couplings – Muff, Split Muff And Flange Couplings, Flexible Couplings – Pin – Bush Coupling.

Unit – V

Mechanical Springs: Stresses And Deflections Of Helical Springs – Extension – Compression Springs – Springs For Static And Fatigue Loading

Natural Frequency Of Helical Springs – Energy Storage Capacity – Helical Torsion Springs – Co-Axial Springs, Design Of Leaf Springs.

Outcomes:

- The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
- Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
- Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.

Text Books:

1. Joseph Edward Shigley, Mechanical Engineering Design, TATA McGraw Hill Publication, 6th Edition, 2005.
2. Machine Design By R.L.Norton, Mc Graw Hill/

References:

1. Mechanical Engineering Design By Bahi And Goel, Standard Publications.
2. Machine Design By Timothy H. Wenzell Pe, Cengage.
3. Machine Design By V.Bandari, Tmh Publishers
4. Machine Design By / Schaum Series
5. Machine Design By Pandya & Shah.
6. Machine Design By S. Md Jalaluddin, Anuradha Publishers.

Note: Use of Machine Design Data Book By PSG Tech is Permitted.

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	4	**1**	**0**	**4**

(A55020) THERMAL ENGINEERING – II

Course Objective:

To apply the laws of Thermodynamics to analyze steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

UNIT – I

BASIC CONCEPTS OF RANKINE CYCLE: Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

UNIT – II

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

UNIT – III

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio. Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at the Exit.

CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

UNIT IV

IMPULSE TURBINE: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine – Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of A Stage, Degree of Reaction –Velocity Diagram – Parson's Reaction Turbine – Condition for Maximum Efficiency.

UNIT V

GAS TURBINES: Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating – Closed And Semi-Closed Cycles – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants

JET PROPULSION: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Course Outcomes:

At the end of the course, the student should be able to

- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants
- Apply the laws of Thermodynamics to analyze thermodynamic cycles
- Differentiate between vapour power cycles and gas power cycles
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants
- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components

TEXT BOOKS:

1. Thermal Engineering / R.K Rajput / Lakshmi Publications
2. Gas Turbines – V. Ganesan / TMH

REFERENCES:

1. Thermodynamics and Heat Engines / R.Yadav / Central Book Depot.
2. Gas Turbines and Propulsive Systems – P. Khajuria & S.P.Dubey Dhanpatrai.
3. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman.
4. Thermal Engineering – R.S.Khurmi / JS Gupta / S.Chand.
5. Thermal Engineering – P.L Bellaney / Khanna publishers.
6. Thermal Engineering M.L. Mathur & Mehta / Jain Bros.
7. Basic and Applied Thermodynamics, P.K. Nag, TMH.
8. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International.

NOTE: Steam tables and Mollier charts to be supplied for exam.

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B.Tech ME III Year I-Semester	L	T	P	C
	3	1	0	3

(A55021) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course objective: To explain the basic principles of managerial economics, financial accounting and current business environment underlying business decision making.

UNIT – I

Introduction to Managerial Economics: Definition, Nature and scope of Managerial Economics, Demand Analysis- Demand Determinants, Law of Demand and its exceptions.

Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Methods of Demand Forecasting (Survey Methods, Statistical Methods, Expert Opinion Method, Test Marketing, Controlled Experiments, Judgmental Approach to Demand Forecasting)

UNIT – II

Theory of Production and Cost Analysis: Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Laws of Returns, Internal and External Economics of Scale.

Cost Analysis: Cost concepts, Opportunity Cost, Out of Pocket Costs vs. Imputed Costs. Breakeven Analysis (BEA) – Determination of Breakeven Point (simple problems), Managerial Significance and limitations of BEA.

UNIT – III

Market Structures& Pricing Policies:

Market structures: Types of Competition, Features of Perfect Competition, Monopoly and Monopolistic Competition, Price - Output determination in Perfect Competition and monopoly.

Objectives and Policies of Pricing: Objectives of pricing**,** Methods of Pricing - Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two - Part Pricing, Block Pricing, Peak Load Pricing, Cross Subsidization.

UNIT – IV

Capital and Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working Capital requirements. Nature and scope of Capital Budgeting, features of Capital budgeting proposals, Methods of Capital Budgeting-Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method, Profitability Index, Internal Rate of Return (simple problems).

UNIT – V

Introduction to Financial Accounting: Accounting, Double-Entry Book Keeping, Journal, Ledger, and Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and Quick Ratio), Activity Ratios (Inventory Turnover Ratio and Debtor Turnover Ratio), Capital Structure Ratios (Debt – Equity, Interest Coverage Ratio), and Profitability Ratios (Gross Profit Ratio, Net Profit Ratio, Operating Profit Ratio, P/E Ratio and EPS).

Course Outcomes: By the end of this course the students will be able to assess the costs useful for managerial decision making and determine Break Even Point (BEP) of an enterprise, the process & principles of accounting and prepare Journal, Ledger, Trial Balance and analyze, interpret & comment on the financial statements of a business enterprise by using ratios.

Text books:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. Varshney&Maheshwari, Managerial Economics, Sultan Chand& Sons, 2014.
3. S.A. Siddiqui and A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad, 2013

References:

1. Raghunatha Reddy &Narasimhachary, Managerial Economics & Financial Analysis, Scitech, 2009.
2. V. Rajasekarn& R. Lalitha, Financial Accounting, Pearson Education, New Delhi, 2010.
3. Domnick Salvatore, Managerial Economics in a Global Economy, 4th Edition, Cengage, 2009.
4. Subhash Sharma & M. P. Vittal, Financial Accounting for Management, Text & Cases, Machmillan, 2012.
5. S. N. Maheshwari& S. K. Maheshwari, Financial Accounting, Vikas 2012.
6. Truet and Truet, Managerial Economics; Analysis, Problems and Cases, Wiley, 2012.
7. Dwivedi, Managerial Economics, Vikas 2012.
8. M. Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, PHI, 2012.
9. Erich A. Helfert, Techniques of Financial Analysis, Jalco, 2007.

Codes / **Tables**: Present Value Tables need to be permitted into the Examination Hall.

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	3	**1**	**0**	**3**

(A55022) AUTOMOBILE ENGINEERING

(P E I)

Course objectives:

The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods.
The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

UNIT – I

INTRODUCTION: Introduction about evolution of modern automobiles**-** components of a four wheeler automobile – chassis and body – power unit –power Transmission – rear wheel drive, front wheel drive, four wheel drive – types of automobile engines, engine construction, turbo charging and super charging – oil filters, oil pumps – crank case ventilation.

UNIT--II

Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System, Anti freeze solutions, Lubrication Systems-Flash, Pressurized and Mist Lubrication.

FUEL SYSTEM: Fuel supply systems in S.I. Engines, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. M.P.F.I system. Fuel supply systems in C.I. Engines, requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection-- fuel pump, nozzle, spray formation, injection timing.

UNIT – III

IGNITION SYSTEM: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – IV

TRANSMISSION SYSTEM: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter. Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

STEERING SYSTEM: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages- Power steering.

UNIT – V

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Emission from Automobiles – Pollution Standards National and International – Pollution Control–Techniques –Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.

Course Outcomes:

At the end of the course, the student will be able to:

- Understand the basic lay-out of an automobile.
- Understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
- Understand the principles of transmission, suspension, steering and braking systems.
- Understand automotive electronics. Study latest developments in automobiles.

TEXT BOOKS:

1. Automobile Engineering / William Crouse, TMHILL Publishers.
2. A systems Approach to Automobile Technology, Jack Erjavec, YESSDEE Publishers Pvt. Ltd. New Delhi.
3. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors,

REFERENCES:

1. Automotive Mechanics / G.B.S.Narang
2. Automotive Mechanics / Heitner
3. Automotive Engines / Srinivasan
4. Automobile Engineering – K.K Ramalingam / Scitech Publications
5. Automotive Engineering / Newton steeds & Garrett.

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B.Tech ME III Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A55023) WELDING TECHNOLOGY

(P.E- I)

Course objectives:

- To understand different types of welding process.
- To study process parameters, tool geometry of different alloys.
- To defective analysis of friction welded components.

UNIT- I

Solid state welding: classification of solid state welding processes, Adhesive bonding , advantages and applications.

UNIT-II

Friction welding: Friction welding process variables, welding of similar and dissimilar materiasl, Defective analysis of friction welded components, Friction welding of materials with inter layer.

UNIT-III

Friction stir welding: Processes parameters, tool geometry, welding of Aluminium alloys, Friction stir welding of Aluminum alloys and Magnesium alloys.

UNIT-IV

Electron Beam welding (EBW): Electron Beam welding process parameters, atmospheric affect Defective analysis of Electron beam welds and Electron Beam welding dissimilar materials.

UNIT-V

Laser Beam welding (LBW): Laser Beam welding process parameters, atmospheric affect and Laser Beam welding of steels. Selection power source : Constant voltage and constant current power sources.

Weldability of cast iron and steel : weldability studies of cast iron and steel.

Course Outcomes:

At the end of the course, the student should be able to

- Understand the different types of welding process.
- Understand the operation of FSW,EBW,LBW.
- Understand the principles of various surface hardness techniques.

References:

1. Nadkarni S.V., Modern Welding Technology, Oxford IBH Publishers, 1996.
2. Parmar R. S., Welding Engineering and Technology, Khanna Publishers, 2005.
3. D. L. Olson, T. A. Siewert, *Metal Hand Book, Vol 06,* Welding, Brazing and Soldering, ASM International Hand book Metals Park, Ohio USA, 2008.

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B.Tech ME III Year I-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A55024) TURBO MACHINERY

(P.E- I)

Course objectives:

To apply the laws of Thermodynamics to analyze steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

To apply the principles of Thermodynamics to analyze different types of refrigeration and air conditioning systems and to understand the functionality of the major components.

UNIT-I

IC Engines: Review of construction and working of two stroke and four stroke engines – Types of carburetor – Wankel engines – SI engines – Fuel systems – Simple carburetor – Ignition systems – Combustion – Detonation factors and remedies – Rating of fuels – Introduction to multi point and microprocessor based fuel injection system CI engines – Fuel injection system – Fuel pump – Combustion – Knocking – Factors and remedies – Rating of fuels – Cooling and lubrication of IC engines.

UNIT II

Performance of IC Engines:

Supercharging and turbocharging of IC engines and their effect on various parameters – Stratified charged engines – Lean burn engines; Performance test- Measurement of brake power – Indicated power – Fuel consumption – Air consumption; Heat balance test – heat carried away by exhaust gases and Morse test on IC engines – Standard testing procedure of IC engines – Performance curves and effect of various parameters on the performance of the engines.

UNIT III

Positive Displacement Compressors and Steam Nozzles

Reciprocating compressors – Construction – Working – Effect of clearance volume – Multi staging - Volumetric efficiency - Isothermal efficiency.

Steam Nozzle – One-dimensional steady flow of steam through a convergent and divergent nozzle – Equilibrium and Meta stable flow.

UNIT IV

Refrigeration

Reverse Carnot cycle- Bell-Colman's cycle – Air craft refrigeration cycles – Vapor compression cycle – Components – Working – P-H and T-S diagrams – Calculation of COP – Effect of sub-cooling and super-heating – Vapour absorption system – Ideal and actual cycles – Cryogenic engineering- Introduction – Liquefaction of gases – Application.

UNIT V

Air Conditioning and Waste Heat Recovery Systems

Psychometric - Processes – Chart – Summer and winter air conditioning – Cooling load calculations – SHF – RSHF – GSHF – ESHF components used in air conditioner – Types of air conditioning units. Sources of waste heat – Heat recovery for industrial application – Thermal storage principles and applications of hot and cold systems – Sensible heat and latent heat system – Phase change storage materials.

Course Outcomes:

At the end of the course, the student will be able to:

Apply thermodynamic concepts to analyze turbo machines.
Analyze power plant and propulsion cycles.
Analyze impulse and reaction turbo machines for energy transfer.
Design gas turbine and steam turbine components.
Evaluate the performance of turbo machine components

Text Books

1. Rajput R.K., (2010), Thermal Engineering, Eighth Edition, Laxmi Publications(P) Ltd.
2. Mathur.M.L & Sharma R.P, (2009), Internal Combustion Engine, Dhanpat Rai Publications.

References

1. Manohar Prasad., (2007), Refrigeration and Air Conditioning, New Age International .
2. Soman.K, (2011), Thermal Engineering , PHI Learning Private Ltd. Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

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B.Tech ME III Year I-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(A55205) METROLOGY AND MACHINE TOOLS LAB

MACHINE TOOLS:

- Get exposure to hand tools, equipments and machines.
- Categorize the choice and care of the tools
- Get acquainted with the types of motions.
- Understand the mechanisms of all the machine tools.

  Understand the usage of different types of machine tools.

SECTION – A:

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Use of gear teeth vernier calipers and checking the chordal addendum and choral height of spur gear.
3. Machine tool " alignment test on the lathe.
4. Machine tool alignment test on milling machine.
5. Tool makers microscope.
6. Angle and taper measurements by Bevel protractor & sine bars.
7. Use of spirit level in finding the flatness of surface plate.
8. Thread measurement by Two wire / Three wire method or Tool makers microscope.

Metrology Lab:

- Understand the procedures to measure the internal taper of bore gauge
- Analyse the some of the tool angles in tool signature by using tool maker's microscope.
- Understand the procedure for setting the given object to a required angle using sinebar.
- Utilize profile projector in estimation of thread profile parameters.
- Measure the effective diameter of thread profile by using the three wire method.
- Understand the procedure for measuring the external taper for the given taper gauge.

SECTION – B

1. Introduction of general purpose machines – lathe, Drilling machine, Milling machine, shaper.
2. Planing machine, slotting machine, Cylindrical grinder, surface grinder and tool and cutter grinder.
3. Step turning and taper turning on lathe machine.
4. Thread cutting and knurling on lathe machine.
5. Drilling and tapping
6. Shaping and planning
7. Slotting
8. Milling
9. Cylindrical surface grinding
10. Grinding of tool angles.
11. Surface Grinder.

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	0	**0**	**3**	**2**

(A55206) THERMAL ENGINEERING LAB

Course Outcomes:

- Measure the thermal properties of different fuels.
- Analyze the properties of various fuels and emission standards
- Determine the efficiency of compressor and blower.
- Analyze the performance and determine the operating characteristics of I.C engines [2-stroke, 4-stroke, petrol, diesel] using rope brake, hydraulic and, electrical dynamometers.
- Draw the valve and port timing diagrams of two and four stroke engines.

PERFORM ANY 10 OUT OF THE 12 EXERCISES

1. I.C. Engines valve / Port Timing Diagrams.
2. I.C. Engines Performance test (4 – Stroke Diesel Engine)
3. I.C. Engines Performance test on 2 – stroke petrol engine.
4. Evaluate of engine friction by conducting morse test on 4 stroke Multi cylinder petrol engine.
5. Evaluate of engine friction by conducting retardation test on 4 stroke diesel engine.
6. Heat balance on IC Engines.
7. Determination of A/F Ratio and volumetric efficiency on IC ENGINES.
8. Determination of Economical speed test for fixed load on 4-stroke engine.
9. Performance test on variable compression ratio engine.
10. Dis-assembly / assembly of engines.
11. Performance test on reciprocating air-compressor unit.
12. Study of boilers.

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	3	**1**	**0**	**3**

(A56015) DESIGN OF MACHINE MEMBERS – II

Course objectives:

- To gain knowledge about designing the commonly used important machine members such as bearings, engine parts, springs , belts, gears etc.
- To design the components using the data available in design data books.

Unit – I

Sliding Contact Bearings: Types Of Journal Bearings – Basic Modes Of Lubrication – Bearing Construction – Bearing Design – Bearing Materials – Selection Of Lubricants.

Rolling Contact Bearings: Types Of Rolling Contact Bearings – Selection Of Bearing Type – Selection Of Bearing Life – Design For Cyclic Loads And Speeds – Static And Dynamic Loading Of Ball & Roller Bearings.

Unit – II

Design Of IC Engine Parts: Design Of Connecting Rod; Thrust In Connecting Rod – Stress Due To Whipping Action On Connecting Rod Ends – Cranks And Crank Shafts, Strength And Proportions Of Over Hung And Center Cranks – Crank Pins, Crank Shafts, Pistons, Forces Acting On Piston – Construction, Design And Proportions Of Piston, Cylinder, Cylinder Liners.

Unit – III

Design Of Belt, Rope & Chain Drives: Transmission Of Power By Belt And Rope Drives, Transmission Efficiencies, Belts – Flat And V Types – Ropes – Pulleys For Belt And Rope Drives, Materials, Chain Drives.

Unit – IV

Design Of Spur And Helical Gear Drives: Spur And Helical Gears – Load Concentration Factor – Dynamic Load Factor, Surface Compressive Strength – Bending Strength – Design Analysis Of Spur And Helical Gears – Estimation Of Centre Distance, Module And Face Width, Check For Plastic Deformation, Check For Dynamic And Wear Considerations.

Design Of Bevel Gear Drives: Bevel Gears – Load Concentration Factor – Dynamic Load Factor, Surface Compressive Strength – Bending Strength – Design Analysis Of

Bevel Gears – Estimation Of Centre Distance, Module And Face Width, Check For Plastic Deformation, Check For Dynamic And Wear Considerations.

Unit – V

Design Of Worm Gears: Worm Gears – Properties Of Worm Gears – Selection Of Materials – Strength And Wear Rating Of Worm Gears – Force Analysis – Friction In Worm Gears – Thermal Considerations.

Design Of Power Screws: Design Of Screw, Square Acme, Buttress Screws, Design Of Nut, Compound Screw, Differential Screw, Ball Screw – Possible Failures.

Course Outcomes:

At the end of the course, the student should be able to

- Knowledge about journal bearing design using different empirical relations.
- Estimation of life of rolling element bearings and their selection for given service conditions.
- Acquaintance with design of the components as per the standard, recommended procedures which is essential in design and development of machinery in industry.

Text Books:

1. Joseph Edward Shigley, Mechanical Engineering Design, TATA McGraw Hill Publication, 6th Edition, 2005.
2. Machine Design / R.N.Norton
3. Design Data Books – P.S.G College Of Technology – Mahadevan.

References:

1. Design Of Machine Elements By Kulkarni, Mc Graw Hill.
2. Machine Design, By T.V.Sundarajan Murthy And N,Shanmugam – Anuradha Publications.
3. Machine Design By V.Bandari, Tmh Publishers
4. Design Of Machine Elements By Pandya And Shah.

Note: Use Of Machine Design Data Book By PSG Tech Is Permitted.

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B.Tech ME III Year II-Semester	**L**	**T**	**P**	**C**
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(A56016) HEAT TRANSFER

Course Objectives:

To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – Basic laws of heat transfer – General discussion about applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – General 3-dimensional heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

SIMPLIFICATION AND FORMS OF THE FIELD EQUATION – steady, unsteady and periodic heat transfer – initial and boundary conditions.

UNIT – II

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANSFER: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation.

Variable thermal conductivity – systems with heat sources or Heat generation, Extended surface (Fins) Heat Transfer – Long Fin, Fin with insulated tip and short Fin, Application to error measurement of temperature.

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers – Chart solutions of transient conduction systems – Concept of Functional body.

UNIT – III

CONVECTIVE HEAT TRANSFER: Classification of systems based on causation of flow, condition of flow, medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem and method , application for developing semi – empirical non – dimensional correlation for convection heat transfer – Significance of non – dimensional numbers – Concepts of Continuity, Momentum and Energy equations.

FORCED CONVECTION: EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer - Flat plates and cylinders.

INTERNAL FLOWS: Concepts of hydrodynamic and thermal entry lengths – Division of internal flow based on this – Use of empirical relations for Horizontal Pipe Flow and annulus flow.

FREE CONVECTION: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.

UNIT – IV

HEAT TRANSFER WITH PHASE CHANGING: Boiling - Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods – Problems using LMTD and NTU methods.

UNIT – V

RADIATION HEAT TRANSFER: Emission characteristics and laws of black-body radiation – irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefen and Boltzmann – heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

Course Outcomes:

At the end of the course, the student should be able to

- Formulate heat conduction problems in rectangular, cylindrical and spherical coordinate system, by transforming the physical system into a mathematical model.
- Familiarize with time dependent heat transfer.
- Compute convective heat transfer coefficients in forced convection, natural convection for internal flows & external flows.
- Know the fundamental mechanism involved in boiling and condensation.
- Know the design fundamentals for heat exchangers, which include the LMTD and ε-NTU approaches.
- Understand radiation heat transfer and can compute radiation heat transfer between black and non-black bodies.

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer / R.C. SACHDEVA / New Age International.
2. Heat Transfer – P.K.Nag / TMH

REFERENCE BOOKS:

1. Heat Transfer / HOLMAN / TMH
2. Heat Transfer – Ghoshdastidar – Oxford University Press – II Edition
3. Heat and Mass Transfer – Cengel – McGraw Hill.
4. Heat and Mass Transfer – R.K.Rajput – S.Chand & Company Ltd.
5. Heat and Mass Transfer – Christopher A Long / Pearson Education.
6. Heat and Mass Transfer – D. S Kumar / S.K.Kataria & Sons
7. Heat and Mass Transfer – Kondandaraman *C.P., New Age Publ.*
8. Fundamentals of Heat Transfer & Mass Transfer – incropera & Dewitt / John Wiley Pub.
9. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International,

NOTE: **Heat and Mass Transfer Data Book is Permitted for Exam.**

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	4	**1**	**0**	**4**

(A56017) REFRIGERATION AND AIR CONDITIONING

Course Objective:

To apply the principles of Thermodynamics to analyse different types of refrigeration and air conditioning systems and to understand the functionality of the major components.

UNIT - I

INTRODUCTION TO REFRIGERATION: Basic concepts - Unit of refrigeration and C.O.P – refrigerators - heat pump- carnot refrigerators – applications, Mechanical Refrigeration – Types of ideal cycles of refrigeration.

AIR REFRIGERATION: Bell Coleman cycle and Brayton cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air craft's.

UNIT – II

REFRIGERANTS: Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

VAPOUR COMPRESSION REFRIGERATION (VCR) System: Basic cycle- Working principle and essential components of the plant – COP – Representation of cycle on T-S and p-h charts – Expander Vs. Throttling, effect of sub cooling and super heating – cycle analysis – Actual cycle influence of various parameters on system performance – Construction and use of P-H charts – numerical problems.

UNIT – III

VAPOUR ABSORPTION REFRIGERATION (VAR) SYSTEM: Description and working of NH_3 – water system and Li Br – water (Two shell & four shell) system - Calculation of max COP. Principle and operation of Three Fluid vapour absorption refrigeration system.

STEAM JET REFRIGERATION SYSTEM: Working Principle and Basic Components, Principle and operation of i) Thermoelectric refrigerator, ii) Vortex tube or Hilsch tube.

PRINCIPLES OF EVAPORATORS: Classification – working Principles, Expansion devices – Types – working principles.

UNIT – IV

INTRODUCTION TO AIR CONDITIONING: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation, Consideration of Infiltrated Air – Heat Load Concepts.

AIR CONDITIONING SYSTEMS: Air Cooler (Evaporative Cooling) Window, Split, summer, winter, Year Round, Central Air Conditioning Systems.

UNIT V

AIR CONDITIONING EQUIPMENT: Humidifiers – Dehumidifiers – Air Filters, Fans and Blowers. Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump – Heat Sources – Different Heat Pump Circuits.

Course Outcomes:

At the end of the course, the student should be able to

- Understand and analyze air refrigeration, simple and complex vapor compression refrigeration systems and their subsystems.
- Understand the operation of various devices of VCR system and their effect on the performance of whole refrigeration system
- Analyze the aqua ammonia and LiBr absorption refrigeration and understand their merits as alternatives to VCR systems.
- Select the most appropriate refrigerant for a given cooling application and understand the impact of refrigerants on the environment
- Understand thermodynamics of air –vapor mixtures and various A/C process and presenting them on psychometric chat.
- Understand various A/C systems and heat pump circuits and using them in combination to design real world heating & cooling needs

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai

REFERENCES:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration – Dossat / Pearson Education.
3. Refrigeration and Air Conditioning - P.L. Bellaney
4. Basic Refrigeration and Air Conditioning –P.N. Ananthanarayanan / TMH.
5. Refrigeration and Air Conditioning – R.S. Khurmi & J.K Gupta – S.Chand – Eurasia Publishing House (P) Ltd.

NOTE: Tables/Codes: Thermal Engineering Data Book containing Refrigerant and Psychrometric property Tables and charts are permitted in Exam.

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B.Tech ME III Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A56018) OPERATIONS RESEARCH

Objectives:

Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

UNIT-I

Development-definition- characteristics and phases- types of models-operation research models-applications.

Allocation: linear programming problem forumulation-graphical solutions-simplex method-artificial variables technics,two- phase method big M method

UNIT-II

Transportation problem- formulation-optimal solution,unbalanced transportation problem-degeneracy.

Assignment problem-formulation- optimal solution-variants of assignment problem-travelling sales man problem

UNIT-III

Sequencing: Introduction – flow- shop sequenceing -njobs through two mechines -njob through 3 mechaines-job shop sequencing-two job through m mechines

Replacement: Introduction- replacement of items that deteriorate with time -when money value is not counted and counted- repolacement of itmes that fail completely-group replacement

UNIT-IV

Theory of games: Introduction-terminology-solution of games with saddle points-and with out saddle points 2 by 2 games- dominance principle- m by 2 and 2 by N games-graphical method

Inventory Models: Definition- Functions-Inventory associated costs- Statement of inventory problem-Classification of inventory problems/Models: Deterministic inventory models- Constant price models-without shortage, with shortage, infinite production rate, finite production rate, and with shortage and finite production rate. Price break models:

Single price break & Multi price break model. Stochastic Inventory models: Single period models-Discrete and Continuous models.

UNIT-V

Waiting lines: Introduction-terminology single channel-poission arrivals and exponential service times -with infinite population and finite populations models- and exponential service times with infinite populations

Dynamic programming: Introduction -terminology - bell mans principle of optimality - applications of dynamic programming -shortest path problem- linear programming problem

Advancteges and dis advanteges applications of simulation to quewing and invntary

Outcome:

Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization

Text books:

1. Operation Research / J K Sharma 4e / MacMilan.
2. Indtroduction to OR/Hiller & Liberman/TMH

Refference books

1. Introduction to OR/Taha/PHI
2. Operation Research/NVS Raju/SMS education/3rd revised edition
3. Operation Research/AM Natarajan,P Balasubrmanian,A Tamilarasi/person education
4. Operation Research/Wagner/PHI Publications
5. Operation Research/MV Durga prasadh,vijaykumar Reddy,J Suresh kumar/Cengage learning.

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	3	**1**	**0**	**3**

(A56019) INDUSTRIAL MANAGEMENT

Course Aim: The aim of this course is to enable the students to see that many managerial decision-making situations can be addressed using standard techniques and methods, provide a comprehensive and concise introduction to the key techniques and methods used within management science that are directly relevant to the managerial context, enable you to see both the benefits, and limitations, of the techniques and methods presented.

Unit-I:

Introduction to Management: Nature and importance of management, Functions of Management, Taylor's Scientific Management Theory, Fayol's principles of management, Maslow's theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two factor Theory of Motivation. Systems Approach to Management, Leadership Styles, Social Responsibilities of Manager, Organization levels and types of organization structures.

Unit-II

A) Operations Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass production), Work Study - Basic procedure involved in Method Study and Work measurement- Statistical Quality Control - X chart, R chart, C chart, P chart, (simple problems), Acceptance Sampling, Deming's contribution to quality.

B) Materials Management: Objectives, Need for inventory control, EOQ, ABC Analysis, Purchase procedure, Stores management and Stores records, Supply chain management.

Unit –III

A) Human Resources Management (HRM): Evolution of HRM, Concepts of HRM, Basic functions of HR Manager - Manpower Planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

B) Marketing: Functions of Marketing, Marketing Mix, Marketing strategies based on Product Life cycle, Channels of distribution.

Unit –IV

Project Management(PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method(CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing.(Simple problems)

Unit –V

Strategic &Contemporary Management Practices: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of corporate planning process, Environmental Scanning, SWOT analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Basic concepts of Just-In-Time(JIT) system, Total Quality Management(TQM), Six Sigma and Capability Maturity Model(CMM) levels, Value chain Analysis.

Course Outcomes: On completion of the course, the student should be able to discuss the main techniques and methods used within management science, critically appraise the strengths and limitations of these techniques and methods, carry out simple exercises using such techniques and methods themselves.

Text books:

1. Aryasri, Management Science, TMH, New Delhi, 2009

References:

1. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, 2012.
2. Koontz and Weihrich, Essentials of Management, McGraw Hill, 2012.
3. Thomas N. Duening and John M. Ivancevich Management, Principles and Guidelines, Biztantra, 2012.
4. KanishkaBedi, Production and Operations Management, Oxford University Press, 2012.
5. Samuel C. Certo, Modern Management, 2012.
6. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, 2012.
7. Parnell, Strategic Management, Cengage, 2012.
8. Lawrence R Jauch, R. Gupta and William F. Glueck: Business Policy and Strategic Management Science, McGraw Hill, 201

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	3	**1**	**0**	**3**

(A56020) NANO TECHNOLOGY

(P.E-II)

Course Objectives:

To enable the student to understand fundamentals of Nano materials and technologies for these materials and their manufacturing, applications in various fields.

Unit – I

Introduction to Nanotechnology: Importance Of Nano Scale, Nanostructure Types, Electronic, Magnetic, Optical Properties Of Nano Materials, Top-Down And Bottom – Up Approach To Nanostructures.

Quantum Mechanical Phenomenon In Nano Structures: Quantum Confinement Of Electrons In Semiconductor Nano Structures, One Dimensional Confinement (Quantum Wires), Two Dimensional Confinements (Quantum Wells), Three Dimensional Confinements (Quantum Dots).

Unit – II

Carbon Nano Structures: Carbon Nano Tubes (CNT), Fullerenes, C60, C80 And C240 Nanostructures, Properties (Mechanical, Optical And Electrical) And Applications.

Fabrication Of Nano Materials: Physical Methods; Inert Gas Condensation, Arc Discharge, Rf Plasma, Plasma Arc Technique, Ion Sputtering, Laser Ablation, Laser Pyrolysis, Molecular Beam Epitaxy, Chemical Vapour Deposition Method.

Unit – III

Nano Scale Characterization Techniques: Scanning Probe Techniques (AFM, MFM, STM, SEM, TEM, HRTEM), XRD profiles SAED pattern FTIR spectra

Nanodevices And Nanomedicine: Lab On Chip For Bioanalysis, Core / Shell Nanoparticles In Drug Delivery Systems (Site Specific And Targeted Drug Delivery), Cancer Treatment, And Bone Tissue Treatment.

Unit- IV

Nano And Molecular Electronics: Resonant – Tunneling Structures, Single Electron Tunneling, Single Electron Transistors, Coulomb Blockade, Giant Magneto Resistance, Tunneling Magneto Resistance.

Unit – V

Properties of Nanofluid - Scientific and Engineering Significance - Possible Mechanisms of Thermal Conduction Enhancement - Brownian Motion - Liquid Layering - Nanoparticle Aggregation

Convective Heat Transfer in Nanofluids - Thermophysical Properties of Nanofluids - Heat Transfer Coefficients in Laminar Flow - Heat Transfer Coefficients in Turbulent Flow

Course Outcomes:

- To evaluate electronic structural studies of nano materials and different synthesis methods to obtain nano structures.
- Understand characterization techniques through various measurements to study electrical, mechanical,thermal properties of nano materials.
- Applications of nano materials for specific purposes like MEMS, NEMS, nano electronics, energy storage.

Text Books:

1. Charles.P.Pode, Introduction To Nanotechnology, Springer Publications.
2. Heat Transfer Enhancementwith Nanofluids, Vincenzo Bianco, Oronzio Manca,Sergio Nardini, Kambiz Vafai CRC Press
3. Taylor & Francis Group Springer Handbook Of Nanotechnology – Bharat Bhusan

Reference Books:

1. Phani Kumar, Principles Of Nanotechnology, Scitech Publications.
2. David Ferry " Transport In Nano Structures" Cambridge University Press 2000
3. Nanobiotechnology; Ed. C.M.Niemeyer, C.A. Mirkin.
4. Nanofabrication Towards Biomedical Application, Techniques, Tools, Application And Impact – Ed. Challa S.S.R.Kumar, J.H.Carola.

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	3	**1**	**0**	**3**

(A56021) TRIBOLOGY

(P.E-II)

Course objectives:

- To expose the student to different types of bearings, bearing materials,
- To understand friction characteristics and power losses in journal bearings.
- To learn theory and concepts about different types of lubrication.

UNIT - I

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used. Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT - II

Hydrodynamic theory of lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti-friction bearing.

UNIT – III

Friction and power losses in journal bearings: Calibration of friction loss friction in concentric bearings, bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing design considerations.

UNIT -IV

Air lubricated bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.Study of current concepts of boundary friction and dry friction.

UNIT - V

Types of bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings.

Bearing materials: General requirements of bearing materials, types of bearing materials.

Outcomes:

- Understanding friction characteristics in journal bearings.
- Knowledge about different theories of lubrication to reduce friction and wear.

TEXT BOOK :

1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI
2. Tribology in Industry **:** Sushil Kumar Srivatsava, S. Chand &Co.

REFERENCE :

1. Tribology – B.C. Majumdar

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	0	**0**	**3**	**2**

(A56205) HEAT TRANSFER LAB

Course Objectives:

To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications

Outcome:

At the end of the lab sessions, the student will be able to

- Perform steady state conduction experiments to estimate thermal conductivity of different materials
- Perform transient heat conduction experiment
- Estimate heat transfer coefficients in forced convection, free convection , condensation and correlate with theoretical values
- Obtain variation of temperature along the length of the pin fin under forced and free convection
- Perform radiation experiments: Determine surface emissivity of a test plate and Stefan- Boltzmann's constant and compare with theoretical value

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat Transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin.
6. Experiment on Transient Heat Conduction
7. Heat Transfer in forced convection apparatus
8. Heat Transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissive apparatus.
11. Stefan Boltzman Apparatus
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Experiment on film wise and drop wise condensation.
15. Vapour Compression Refrigerent Test Rig

PERFORM ANY 12 OUT OF THE 15 EXERCISES

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	0	**0**	**3**	**2**

(A56206) Advanced English Communication Skills Lab

(Common for all Branches)

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use good‘

English and perform the following:

- Gather ideas and information, to organize ideas relevantly and coherently.
- Participate in group discussions.
- Face interviews.
- Write formal letters
- Write project/research reports/technical reports.
- Make oral presentations.
- To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

To improve the students’ fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.

Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

1. **Vocabulary Building** –Word Roots, Prefixes and Suffixes, Study of Word Origin, Analogy, One-Word Substitutes, Synonyms and Antonyms, Idioms and Phrases.

2. **Reading Comprehension –** Reading for Facts, Guessing meanings from context, Skimming, Scanning, Inferring Meaning, and Critical Reading.

3. **Writing Skills** – Coherence, Cohesion, Sub-skills in writing, Letter Writing, Resume Writing, Covering Letter, e-correspondence.

4. **Technical Writing**- Formats and Styles of Technical Report Writing, Research Abilities/Data Collection/Organizing Data/Tools/Analysis.

5. **Group Discussion** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency

6. **Presentation Skills** – Oral presentations (individual and group) through JAM sessions/Seminars, Written Presentations (Projects/ PPTs) through e-mails.

7. **Interview Skills** – Strategies of Pre, During and Post – Interview Skills, Opening, Answering Strategies, Interview through Telephone and Video-Conferencing.

4. Minimum Requirement: The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 30 students with 30 systems, one master console, LAN facility and English language software for self- study by learners.

ii) The Communication Skills Lab with chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc

System Requirement (Hardware component): Computer network with Lan with minimum 30 multimedia systems with the following specifications:

i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

- Clarity Pronunciation Power – part II □
- Oxford Advanced Learner's Compass, 7th Edition □
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech.
- TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS) □
- The following software from ‗train2success.com' □
  i. Preparing for being Interviewed,
  ii. Positive Thinking,
  iii. Interviewing Skills,
  iv. Telephone Skills,
  v. Time Management
  vi. Team Building,
  vii. Decision making
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

6. **Books Recommended:**

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. English Language Communication : A Reader cum Lab Manual Dr A. Ramakrishna Rao, Dr G. Natanam & Prof S.A. Sankaranarayanan, Anuradha Publications, Chennai 2008.
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
7. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
10. English for Technical Communication for Engineering Students, Aysha Vish hwamohan, Tata Mc Graw-Hil 2009.
11. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/Cambridge University Press.
12. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

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(A57019) CAD/CAM

Course objectives:

To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture. To understand the need for integration of CAD and CAM

UNIT – I

INTRODUCTION: Computers in industrial Manufacturing, Product cycle, CAD/CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

Geometric modelling: Requirements, geometric models, curve representation methods, surface representation methods, modeling facilities desired.

Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimentioning, solid modeling.

UNIT – III

Numerical control: NC, NC modes, NC elements, NC machine tools structure of CNC machine tools, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming DNC, Adaptive control systems.

Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided processes Planning, Retrieval type and Generative type

UNIT – IV

Computer aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods – optical, noncontact,

inspection methods – nonoptical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – V

Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

Course Outcomes:

Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces .Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components .To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

TEXT BOOKS:

1. CAD / CAM A Zimmers & P.Groover / PE / PHI
2. CAD / CAM Theory and Practice / ibrahim Zeid / TMH

REFERENCES:

1. Automation, Production systems & Computer integrated Manufacturing / Groover / P.E
2. Computer Aided Design and Manufacturing – Lalit Narayan , etal – PHI
3. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
4. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
5. CAD / CAM : Concepts and Applications / Alavala / PHI

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(A57020) INSTRUMENTATION & CONTROL SYSTEMS

Course Objectives: Understanding the basic characteristic of a typical instrument. Identifying errors and their types that would occur in a instrument. Identifying properties used for evaluating the thermal systems. The concept of transducer and Various types and their characters.

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, inductive capacitance, resistance, ionization and Photo electric transducers Calibration procedures.

UNIT – II

Measurement Of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance Thermistor – Thermocouple – Pyrometers – Temperature indicators.

Measurement Of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure guages, Bellows – Diaphragm guages. Low pressure measurement – Thermal conductivity guages – ionization pressure gauges, Mcleod pressure guage.

UNIT – III

Measurement of Level: Direct method – indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement Of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Non – contact type of tachometer.

UNIT – IV

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, strain gauge Rosettes

UNIT – V

Measurement Of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

Measurement Of Force, Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

Course Outcome: To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments. Analysis of errors so as to determine correction factors for each an instrument. To understand static and dynamic characteristics of instrument and should be able to determine loading response time. For given range of displacement should be able to specify transducer, it accurate and loading time of that transducer.

TEXT BOOKS:

1. Measurement Systems : Applications & Design by D.S Kumar, Anuradha Agencies.
2. Instrumentation, measurement & analysis by B.C.Nakra & K.K.Choudhary, TMH

REFERENCE BOOKS:

1. Instrumentation and Control systems / S.Bhaskar / Anuradha Agencies
2. Experimental Methods for Engineers / Holman
3. Mechanical and industrial Measurements / R.K Jain / Khanna Publishers.
4. Mechanical Measurements / Sirohi and Radhakrishna / New Age
5. Instrumentation & mech. Measurements by A.K.Tayal, Galotia Publications.

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(A57021) FINITE ELEMENT METHODS

Course Objectives:

- Apply governing principles of the problem at element level and develop element matrices
- Observe the symmetries in the system to minimize the geometry of FE model
- Classify the problems as 1-D, 2-D and 3-D based on the system behavior
- Analyze of linear structural and steady state heat transfer problems

UNIT – I

INTRODUCTION TO FEM: Basic concepts, Historical back ground, application of FEM, general description, comparison of FEM with other methods. Basic equations of elasticity, Stress – Strain and strain – displacement relations. Rayleigh – Ritz method, weighted residual methods.

UNIT – II

ONE DIMENSIONAL PROBLEMS: Stiffness equations for a axial bar element in local co-ordinates using Potential Energy approach and Virtual energy principle – Finite element analysis of uniform, stepped and tapered bars subjected to mechanical and thermal loads – Assembly of Global stiffness matrix and load vector – Quadratic shape functions – properties of stiffness matrix.

UNIT – III

ANALYSIS OF TRUSSES: Stiffness equations for a truss bar element oriented in 2D plane – Finite Element Analysis of Trusses – Plane Truss and space Truss elements – methods of assembly.

ANALYSIS OF BEAMS: Hermite shape functions – Element stiffness matrix – Load vector – Problems.

UNIT – IV

2-D STRUCTURAL PROBLEMS: CST – Stiffness matrix and load vector – Isoparametric element representation – Shape functions – convergence requirements – problems.

Two dimensional four noded isoparametric elements – Numerical integration – Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements.

UNIT – V

ANALYSIS OF HEAT TRANSFER PROBLEMS: 1D Heat conduction – 1D fin elements – 2D heat conduction – analysis of thin plates – Composite slabs – problems.

DYNAMIC ANALYSIS: Dynamic equations – Lumped and consistent mass matrices – Eigen Values and Eigen Vectors – mode shapes – modal analysis for bars and beams.

Course Outcomes:

At the end of the course, the student should be able to

- Understand the philosophy of discretization of continuum
- Assemble element matrices based on local-global connectivity to generate total system equations
- Impose boundary conditions and solve for unknown field variables
- Interpret results from the calculated field variables

TEXT BOOKS:

1. The Finite element method in engineering science – O.C. Zienkoitz, McGrawhill.
2. Concepts and applications of finite element analysis – Robert Cook – Wiley.

REFERENCES:

1. Introduction to finite elements in engineering – Tirupathi K. Chandrupatla and Ashok D. Belagundu.
2. The finite element methods in Engineering – S.S.Rao – Elsevier 4th edition.
3. Finite Element Methods / Alavala / TMH
4. An introduction to Finite Element Methods – J.N. Reddy – Mc Grawhill.
5. Introduction of Finite Element Analysis – S. Md. Jalaludeen – Anuradh publications.

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(A57022) POWER PLANT ENGINEERING

(P.E-III)

Objectives:

The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include

1. Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
2. A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
3. Awareness of the economic, environmental, and regulatory issues related to power generation.

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cylone furnace, design and construction, Dust collectors, Electrostatic precipitators, cooling towers and heat rejection, corrosion and feed water treatment.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems

UNIT – II

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage

Gas Turbine Plant: Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT III

Hydro Electric Power Plant: Water power – Hydrological cycle – Hydrographs – storage and Pondage – Numerical examples of construction of Hydrograph, Load duration curves -classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – Turbines and Generator-Types-plant auxiliaries – plant operation pumped storage plants.

UNIT – IV

NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

Power from Non-Conventional Sources: Utilization of solar – Collectors – Principle of working, Wind energy – Types – HAWT, VAWT – Tidel energy.

UNIT – V

Direct energy conversion: solar energy, Fuel cells, Thermo electric and thermo ionic, MHD generation.

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve, Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related numerical exercises, Effluents from power plants and impact on environment – pollutants and pollution standards – Methods of Power plant Pollution control.

Course Outcomes:

- Understand the principle of various sources of energy, resources and development of power.
- To know the concept of internal combustion engine power plant.
- To know the concept of gas turbine power plant.
- To know the concept of hydro electric power plant.
- To know the concept of power from non conventional sources.
- To know the concept of nuclear power stations and its types.
- Understand the power plant economics and environmental considerations.

TEXT BOOKS:

1. Power Plant Engineering – P.C.Sharma / S.K.Kataria Publications.
2. A Course in Power Plant Engineering: / Arora and S.Domkundwar.

REFERENCES:

1. A Text book of Power Plant Engineering / R.K. Rajput / Laxmi Publications
2. Power plant Engineering / S. Ramalingam / Scietech Publishers.
3. Power Plant Engineering: P.K.Nag / ii Edition / TMH.
4. An introduction to Power Plant Technology / G.D. Rai.
5. Power plant Engg – Elanchezhian – I.K international Publications.

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(A57023) CNC Technologies

(PE – III)

Course objectives:

Importance of CNC machines. Understand the fundamentals of it. Learning various methods of tooling with the CNC machines. Various controlling methods, learning the part programming.

UNIT – I

Features of NC Machines: fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, features of NC machine tools, design consideration of NC machine tool, methods of improving accuracy.

CNC Machines and elements: Machine structure – guide ways – feed drives – spindles – spindle bearings – measuring systems – tool monitoring systems.

UNIT – II

Tooling for CNC machines: interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

NC Part Programming: Manual programming – Basic concepts, point to point contour programming, canned cycles, parametric programming.

UNIT – III

Compute – Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processor s, introduction to CAD/CAM software, Automatic Tool Path generation.

DNC Systems and Adaptive Control: introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control of optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

UNIT – IV

Micro controlers: introduction, Hardware components, I/O pins, ports external memory, counters, timers and serial data I/O interrupts, selection of micro controllers, embeded controllers, Applications and programming of micro controllers.

UNIT – V

Programming logic controllers (PLC's): introduction, hardware components of PLC, system, basic structure, principle of operations, Programming mnemonics timers, internal relays and counters applications of PLC's in CNC Machines.

Course outcomes:

At the end course, one should be able to select tooling method, control mechanism and do part programming for a given product.

TEXT BOOKS:

1. Computer control of manufacturing systems / Yoram koren / Mc Graw Hill intl. 1983.
2. CAD/CAM – Michel P.Groover, TMH

REFERENCES:

1. Machining tools hand book Vol-3, (Automation & control) Manfred Weck / John Wiley and sons, 1984.
2. Mechatronics - HMT,TMH.

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(A57024) UNCONVENTIONAL MACHINING PROCESSES

(**PE – III**)

Course Objectives:

1. To understand the need for the development of UnConventional machining processes.

2. To know various methods of material removal processes.

3. To know the principles and applications of Non-Conventional machining processes.

UNIT – I

INTRODUCTION – Need for non-convention machining methods, Classification of non - conventional machining processes, considerations in process selection, materials, general characteristics and applications of un-conventional machining processes.

UNIT – II

MECHANICAL MATERIAL REMOVAL PROCESSES: Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining – basic principles, components, process variables, advantages and disadvantages, applications.

UNIT – III

THERMAL MATERIAL REMOVAL PROCESSES: General Principle and applications of Electric Discharge Machining, Electric discharge grinding and electric discharge wire cutting processes – Power circuits for EDM, mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection, wire EDM, principle applications.

UNIT – IV

CHEMICAL MATERIAL REMOVAL PROCESSES: Electro Chemical Machining, Electro Chemical Grinding, Electro Chemical Honing, and Electro Chemical De burring - basic principles, components, process variables, advantages and disadvantages, applications.

Powder Metallurgy Technology: Concepts of PM Technology, Production process & Applications.

UNIT-V

MICRO MACHINING: Bulk micromachining, surface micromachining and LIGA process – General description, basic principles, components, process variables, advantages and disadvantages, applications.

Course Outcomes:

1.Student will identify the problem faced in traditional metal cutting and come to an understanding of the need for the development of Unconventional machining processes.

2.Gain the knowledge of basic mechanism of various Unconventional maching processes and related equipment, variables, advantages, disadvantages, applications.

3. Given a set of physical, electrical and other parameters. Student can identify a suitable Unconventional machining process.

TEXT BOOKS:

1. Non-Traditional Machining/ P.K.Mishra (New Age)
2. Advanced machining processes/ VK Jain/ Allied publishers.
3. Manufacturing engineering and Technology, serope kalpakjian and steven R. Schmid, Ed-4, pearson publications,2001.

REFERENCE BOOKS:

1. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGraw Hill
2. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH
3. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.
4. Unconventional Machining Processes / C. Elanchezhian, B.vijaya Ramnath and M. vijayan/ Anuradha publications / 2005

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(A57025) AUTOMATION IN MANUFACTURING

(PE – IV)

Course Objective:
The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types

UNIT – I

Introduction: Types and stratergies of automation, pneumatic and hydraulic components circuits,

Automation in machine tools, Mechanical feeding and too changing and machine tool control transfer the automation.

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

UNIT – II

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexiable assembly lines.

UNIT – III

Automated material handling: Types of equipment , functions, analysis and design of material handling systems conveyor systems, automated guided vechicle systems.

Automated storage systems, Automated storage and retrieval systems, work in progress storage, interfacing handling and storage with manufacturing.

UNIT – IV

Fundamentals of industrial controls: Review of control theory, logic c:ontrols, sensors and actuators, Data communication and LAN in Manufacturing.

UNIT – V

Business process Re-engineering: introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of rapid Proto typing.

Course Outcome:

After completion of this unit students are able to understand the applications of various types of end effectors, and sensor devices

TEXT BOOK:

1. Automation, Production systems and computer integrated manufacturing : M.P.Groover 3e / PE / PHI, 2009

REFERENCES:

1. Computer Aided Manufacturing, Tien – chien chang, Richard A Wysk and Hsu-Pin Wang, Pearson,2009.
2. Automation by W.Buekinsham.

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(A57026) PLANT LAYOUT AND MATERIAL HANDLING

(PE – IV)

Course Objective:

- To know the basic concepts involved in Plant Layout and its types.
- Evaluate the basic concepts involved in Process Layout and Product Layout.
- To know the basic concepts involved in Group Layout

Unit – I

Important Factors in Location/Site Selection - Specific Location Factors for Service Organization - Dominant Factors - Secondary Factors.

Objectives of Layouts - Principles of Plant Layout - Good Poor Layout Characteristics - Overview Of The Plant Layout.

Unit – II

Classification of Layout - Functional Layout (Process Layout) - Line Layout (Product Layout) - P-Q Análisis - Comparison Of Product And Process Layout

Static Product Layout (Fixed Position) - Group Layout (Cellular Layout) - Combination Layout (Hybrid Layout). Advantages and Limitations of Different Layouts, Selection, Specification, Implementation.

Unit – III

Computerized Layout Planning - Types - Construction Programs - Improvement Programs – Program in Detail Algorithm and Problems On CRAFT.

Program in Detail Algorithm and Problems on ALDEP and CORELAP.

Unit – IV

Material Handling Principles - Planning Principle – Operation - Principle – Equipment Principle – Costing Principle

Classification Of Material Handling Equipment, Relationship of Material Handling To Plant Layout. Basic Material Handling Systems, Selection,

Unit – V

Material Handling Method – Path, Equipment, Function Oriented Systems.

Methods to Minimize Cost of Material Handling – Maintenance of Material Handling Equipments - Safety in Handling.

Course Outcome:

- Understand the basic concepts involved in Material Handling systems.
- Understand the basic concepts involved in Material Handling Oriented systems.
- Understand the basic concepts involved in methods to minimizing Material Handling systems.
- Understand the basic concepts involved in Ergonomics of Material Handling equipments.

Text Books:

1. James M Apple “Plant Layout And Material Handling” John Willey & Sons, New york, Third Edition, 1983.
2. Facility Layout & Location An Analytical Approach / Rl Francis / Lf Mc Linnis Jr. White / PHI

References:

1. Mikell .p. Groover “Automation Production System and Computer Integrated Manufacturing”, Prentice Hall of India Pvt. Ltd, First edition, 1987
2. Govindan K.R. “Plant Layout And Material Handling”, Anuradha Agencies, First Edition, 1997
3. Operations Management / Pb Mahapatra / PHI
4. Aspects Of Material Handling / Dr. Kc Arora & Shinde, Lakshmi Publications.
5. Production And Operations Management / R. Paneerelvam / PHI
6. Introduction To Material Handling / Ray, Siddhartha / New Age.

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(A57027) COMPUTATIONAL FLUID DYNAMICS

(PE – IV)

Course Objective:

- This course covers topics related to Computational Fluid Dynamics (CFD). CFD is an important tool in engineering analysis and design of fluid systems.
- In this course Students will develop the equations describing fluidflow and numerical solutions to these equations.
- Emphasis will be placed on understanding different approaches employed for both time and spatial discretization and how to evaluatethese approaches.
- Students will look at time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible andincompressible approaches, stability considerations, etc. These techniques will be applied to applications of mixing and heat transfer.

Unit – I

Need-Applications- Mathematical description of physical phenomena- Governing differential equations- Derivation of , momentum, energy equations by model of infinitesimally small element fixed in space

Exact Solutions Fully-developed flow between infinite parallel plates. Plane Poiseuille flow - Couette flow Solution of energy equation for hydrodynamically and thermally fully-developed flow between infinite parallel plates - Fully-developed flow in a pipe with circular cross-section (Circular Poiseuille flow)

Unit – II

Initial and Boundary conditions. Classification of Partial Differential Equations. Methods of discretization, Basics of discretization methods- Taylor series formulation- Finite difference representation- central-forward-backward differences. One dimensional steady state conduction in slabs

Solution by Tri-Diagonal Matrix Algorithm and Gauss Seidel iterations - relaxation parameter. Numerical errors- Optimum step size- grid independence test.

Unit – III

Convective and Radiative fins with I, II and III kind boundary conditions for tip- solution by Tri- Diagonal Matrix Algorithm and Gauss Seidel iterations. Two-dimensional steady state Conduction in slab with various boundary conditions by finite difference approach.

One-dimensional transient conduction- Explicit – Implicit - Semi Implicit Schemes. Stability and convergence. Two-dimensional transient conduction in slabs- Alternating Direction Implicit scheme. One-dimensional radial conduction problems in cylindrical and spherical coordinates.

Unit – IV

Governing equations- Stream function vorticity method (including derivation)- Solution -Algorithm- Specification of boundary conditions. Creeping flow. Determination of pressure for viscous flow (including derivation).

Primitive variable approach- Staggered grid- SIMPLE procedure- SIMPLE algorithm. Steady one dimensional convection and diffusion –Upwind scheme- False diffusion, Onedimensional
unsteady convection diffusion.

Unit – V

Steady Flow, Dimensionless Form Of Momentum And Energy Equations, Stokes Equation, Conservative Body Force Fields, Stream Function – Vorticity Formulation.

Finite Volume Method : Approximation Of Surface Integrals, Volume Integrals, Interpolation And Differentiation Practices, Upwind Interpolation, Linear Interpolation And Quadratic Interpolation.

Course Outcome:

- The information about some techniques for numerical solutions for flow problems. These equations are applicable to time and space marching solutions especially parabolic hyperbolic and elliptic equations.
- How to descretize partial differential equations, including the governing flow equations which is the foundation for the finite difference method.
  Explicit and implicit approaches represent the fundamental distinction between various numerical techniques.
- The fundamental principles of fluid mechanics, its governing differential equations and boundary conditions.

Text Books:

1. Numerical Heat Transfer And Fluid Flow / Suhas V. Patankar Hema Shava Publishers Coporation & Mc Graw Hill.
2. 2. Steven C. Chapra and R.P. Canalae, Numerical Methods for Engineers, Tata McGraw-Hill, 2002.

References:

1. P S Ghoshdastidar, Computer Simulation of flow and heat Transfer, Tata Mc Graw-Hill, 1998
2. Tannehill J.C., Anderson D, and Pletcher R.H, Computational Fluid Mechanics and HeatTransfer, 2 nd Edition, Taylor & Francis. 1997.
3. Computational Fluid Dynamics; Basics With Applications – John D. Anderson / Mc Graw Hill.
4. Computational Fluid Flow And Heat Transfer / Muralidharan – Narosa Publications
5. Fundamentals Of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.

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(A57207) COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING LAB

Course objectives:

To be able to understand and handle design problems in a systematic manner. To be able to apply CAD in real life applications. To be understand the basic principles of different types of analysis.

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric, Representation of dimensioning and tolerances scanning and plotting, study of script DXE AND IGES FILES.

2. **Part Modeling**: Generation of various 3D Models through protrusion revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and assembly modeling, study of various standard translators, Design simple components.
3. (a) Determination of deflection and stresses in 2D and 3D trusses and beams.
   (b) Determination of deflections component and principal and von-mises stresses in plane stress, plane , plane strain and Axi-symmetric components.

   (c) Determination of stresses in 3D and shell structures (at least one example in each case)

   (d) Estimation of natural frequencies and mode shapes, harmonic response of 2D beam.

   (e) Steady state heat transfer analysis of plane and Axi-symmetric components.

4. (a) Development of process sheets for various components based on tooling

   Machines.

   (b) Development of manufacturing and tool management systems.

   (c) Study of various post processors used in NC Machines.

   (d) Determination of CNC part program for turning components

   (e) Machining of simple components on NC lathe and Mill by transferring NC code / from a CAM package. Through RS 232.

   (f) Quality control and inspection.

Course out comes:

To understand the analysis of various aspects in of manufacturing design

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B.Tech ME IV Year I-Semester	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

(A57208) PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

- Draw and understand about the conventional representations of Materials, Screws, Welded joints, springs, gears, and electrical, pneumatic, hydraulic circuits.
- Draw and understand about the limits and fits used in engineering drawing.
- Draw and understand about the form and positional tolerances used in engineering drawing.
- Draw and understand about the surface roughness and its indications used in engineering drawing.
- Draw and understand about the heat treatment and surface treatment symbols used in engineering drawing.
- Draw and understand about the drawings of parts from assembly drawings

A) Production Drawing Practice

PRACTICE – I

Conventional representation of materials – conventional representation of parts – screw joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

PRACTICE – II

Limits and Fits: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

PRACTICE – III

Form and Positional Tolerances: introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

PRACTICE – IV

Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

PRACTICE – V

Heat treatment and surface treatment symbol used on drawings.

PRACTICE – VI

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, from and position errors etc.

PRACTICE – VII

Part drawing using computer aided drafting by CAD software.

TEXT BOOKS:

1. Production drawing – K.L.Narayana & P.Kannaiah / New Age
2. Machine Drawing with AutoCAD – Pohit and Ghosh,PE

REFERANCES:

1. Geometric dimensioning and tolerancing – James D.Meadows / B.S Publications.

(B) INSTRUMENTATION LAB

1. Calibration of pressure gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain guage for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rota meter for flow measurement.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod guage for low pressure.

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B.Tech ME IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58013) INDUSTRIAL ROBOTICS

(PE – V)

Course Objective:

To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods

UNIT – I

INRODUCTION: Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Degrees of freedom – End effectors; Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design.

UNIT – II

MOTION ANALYSIS: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

MANIPULATOR KINEMATICS: D-H notations – joint coordinates and world coordinates – Forward and inverse kinematics – problems.

UNIT – III

DIFFERENTIAL KINEMATICS: Differential kinematics of planar and spherical manipulators – Jacobians – Problems.

ROBOT DYNAMICS: Lagrange – Euler formulations – Newton - Euler formulations – Problems on planar two link manipulators.

UNIT – IV

TRAJECTORY PLANNING: Joint space scheme – cubic polynomial fit – Avoidance of obstacles.

TYPES OF MOTION: Slew motion – joint interpolated motion – straight line motion – problems.

ROBOT ACTUATORS: Actuators- Pneumatic and Hydraulic actuators, Electric Actuators: DC servo motors – stepper motors.

UNIT – V

FEED BACK COMPONENTS: position sensors – potentiometers, resolvers and encoders – velocity sensors – Tactile sensors.

ROBOT APPLICATION IN MANUFACTURING: Material Transfer and loading/unloading Material handling – Assembly and inspection.

Course Outcomes:

At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors

TEXT BOOKS:

1. Industrial Robotics / Groover M.P / Pearson Edu.
2. Introduction to Robotic Mechanics and control by JJ Craig, Pearson, 3rd edition.

REFERENCES:

1. Robotics / Fu K.S / McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and intelligence / Asada and Slotine / Wiley inter Science.
4. Robot Dynamics & Control – Mark W. Spong and M.Vidyasagar / John Wiley & sons (ASIA) Pte. Ltd..
5. Robotics and control / Mittal R.K & Nagrath I.J / TMH.

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B.Tech ME IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58014) MECHATRONICS

(PE – V)

Course Objective:

To make the students to learn about the Basic electronics, electrical and mechanical components used to control the machines and industries. Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems. Micro controllers, PLCS and PLC program and programmable motion control systems.

UNIT – I

Introduction: Definition – Trends – Control Methods; Stand alone, PC Based (Real Time Operating Systems, Graphical User interface, simulation) – Applications; SPM, Robot, CNC, FMS, CIM.

Signal Conditioning: introduction – Hardware – Digital I/O, Analog input – ADC, resolution, speed channels filtering noise using passive components – Resistors, capacitors – Amplifying signals using OP amps – Software – Digital Signals Processing – Low pass, high pass, notch filtering.

UNIT – II

Precision Mechanical Systems: Pneumatic Actuation Systems – Electro – pneumatic Actuation Systems – Timing Belts – Ball Screw and Nut – Linear Motion Guides – Linear Bearing – Harmonic Transmission – Bearings – Motor / Drive selection.

UNIT – III

Electronic interface sub systems: TTL, CMOS interfacing – Sensor interfacing – Actuator

Interfacing – solenoids, motors isolation schemes – opto coupling, buffer IC's- Protection schemes – circuit breakers, over current sencing, reset able fuses, thermal dissipation – Power Supply – Bipolar transistors / mosfets

Electromechanical Drives: Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4 quadrant servo drives, PWM's – Pulse width Modulation – Variable Frequency Drives, Vector Drives – Drive system load calculation.

UNIT – IV

Microcontrollers Overview: 8051 Microcontroller, micro processor structure – Digital interfacing – Analog interfacing – Digital to analog convertors – Analog to Digital convertors – Applications, Programming – Assembly, C (LED Blinking, Voltage measurement using ADC)

Programmable Logic Controllers: Basic structure programming; Ladder diagram – Timers internal Relays and counters – Shift registers – Master and jump controls – Data handling – Analog input / output – PLC Selection – Application.

UNIT – V

Programmable Motion Controllers: introduction – system transfer function – laplace transform and its application in analyzing differential equation of a control system – feedback devices; Position velocity sensors – optical incremental encoders – Proximity sensors; inductive, capacitive, infrared – continuous and discrete processes – control system performance & turning – digital controllers – P, PI, PID control – control modes – position, velocity and torque – velocity profiles – Trapezoidal – S.Curve – electronic

gearing – controlled velocity profile – multi axis interpolation, PTP, Linear, Circular – Core functionalities – home, record position, Go to position – applications; SPM, Robotics.

Course Outcomes:

At the end of the course, the student will be able to, Model, analyze and control engineering systems. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product. Develop PLC programs for a given task. Evaluate the performance of mechatronic systems.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.

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B.Tech ME IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58015) COMPOSITE MATERIALS

(**PE-V)**

Course Objective:

- To understand the variety of composite materials (anisotropic material) vis a vis metals and alloys from the view point of industrial applications.
- To understand manufacturing methods of composites for economic production.
- To understand methods of analysis to help effective product design.

Unit-I

Introdutction to Composite Materials: Introdutction**,** classification, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber, reinforced composites and nature-made composites and applications.

Refinforcements: Fibers Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide, fibres. Particulate composites, Polymer compsosites, Thermoplastics, Thermosetts , Metal matrix and ceramic composites.

UNIT – II

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man lay up, pultrusion, RTM.

Macromechanical Analysis of a " Lamina" : introduction, Definitions: stress, strain, Elastic Moduli, strain Energy. Hooke's Law for different types of materials, Hooks Law for a two dimentional unidirectional lamina, plane stress assumption, reduction of Hooks Law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of a lamina.

UNIT – III

Hookes Law for a Two-Dimensional Angle Lamina, Engineering constants of an Angle Lamina. Invariant Form of Stiffness and compliance Matrices for an Angle Lamina Strength Failure. Envelops, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu Failure Theory Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress-Strain Reltationships for a Unidirecetional Lamina, Hygrothermal Stress-Strain Relationships for a Angle Lamina.

Unit – IV

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

Unit- V

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress-Strain Relations for a Laminate, In-Plane and Flexural Moduls of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates.

Failure Analysis and Design of Laminates: Introduction Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

Course Outcomes:

- It is to understand the need of composite materials and know the properties, types and Applications of various types of composites
- Student can able to understand the properties advantages, limitations of carbon composites and manufacturing methods of carbon composites.
- Is to understand the properties advantages, limitations of ceramics, types of ceramics and manufacturing methods of ceramic composites.

TEXT BOOKS:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
2. R. M. Jones Mechanics of Composite Materials, McGraw Hill Company, New York, 1975.

REFERENCES:

1. B. D. Agarwal and L.J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), By Autar K. Kaw, Publisher: CRC
3. Ever J. Barbero, Finite Element Analysis of Composite Materials CRC Press, 2007.
4. 3.L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.
5. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2009.
6. Krishan K. Chawla, Composite Materials Science and Engineering, Springer, 2009, Ed. 6. Robert M. Jones, Mechanics of Composite Materials, 1999, Ed. 2.

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B.Tech ME IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58016) PRODUCTION PLANNING AND CONTROL

(PE-VI)

Course Objectives:
Understand the importance of Production planning & control. Learning way of carrying out various functions so as to produce right product, right quantity at right time with minimum cost.

UNIT – I

Introduction : Definitions – objectives of production planning and control – functions of production planning and control – elements of production control – types of production – organization of production planning and control – internal organizations department.

Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting techniques – Qualitative methods and quantitative methods.

UNIT – II

Inventory management – Functions inventory – Relevant inventory cost – ABC analysis – VED Analysis – EOQ model – inventory control systems – P – Systems and Q – Systems , aggregate planning – methods for aggregate planning

Introduction to MRP And ERP, jit inventory, Japanease concepts, Ranked positional concepts

UNIT – III

Line balancing : definition,methods to LOB and terminology :RPT METHOD Routing – Definition – routing procedure – Route sheets – Bill of material – factors affecting routing procedure.

UNIT – IV

Scheduling policies, Schedule – definition – difference with loading – techniques, standard scheduling methods – job shop, flow shop.LOB (Line of balance).

UNIT – V

Dispatching – Activities of dispatcher – Dispatching procedure – follow up – definition – reasons for existence of functions – types of follow up, – Chase planning, expediting, control aspects.

Applications of computer in production planning control.

Course Outcomes:

At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems**.**

TEXT BOOKS:

1. Production Planning and Control – Samuel and Eon
2. Production Planning and Control Jain & Jain – Khanna publications

REFERENCE BOOKS:

1. Production Planning and Control – Text & cases / SK Mukhopadhyaya.
2. Production and operations Management – R.Paneer Selvam – PHI
3. Operations Management by Chase / phi
4. Operations Management by Steven son

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B.Tech ME IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58017) MECHANICAL VIBRATIONS

(PE-VI)

Course objectives:

Understand various levels of vibrations and remedies for each of them.

Unit I:

Introduction: Causes and effects of vibration, Classification of vibrating system, Discrete and continuous systems, degrees of freedom, Identification of variables and Parameters, Linear and nonlinear systems, linearization of nonlinear systems, Physical models, Schematic models and Mathematical models.

Unit II:

SDF systems: Formulation of equation of motion: Newton –Euler method, De Alembert's method, Energy method,
Free Vibration:: Undamped Free vibration response, Damped Free vibration response, Case studies on formulation and response calculation.

Unit III:

Forced vibration response: Response to harmonic excitations, solution of differential equation of motion, Vector approach, Complex frequency response, Magnification factor Resonance, Rotating/reciprocating unbalances, Force Transmissibility, Motion Transmissibility, Vehicular suspension, Vibration measuring instruments, Case studies on forced vibration.

Unit IV:

Two degree of freedom systems: Introduction, Formulation of equation of motion: Equilibrium method, Lagrangian method, Case studies on formulation of equations of motion
Free vibration response, Eigen values and Eigen vectors, Normal modes and mode superposition, Coordinate coupling, decoupling of equations of motion, Natural coordinates, Response to initial conditions, free vibration response case studies, Forced vibration response, undamped vibration absorbers, Case studies on undamped vibration absorbers.

Unit V:

Multi degree of freedom systems: Introduction , Formulation of equations of motion, Free vibration response, Natural modes and mode shapes, Orthogonally of model vectors, normalization of model vectors, Decoupling of modes, model analysis, mode superposition technique, Free vibration response through model analysis, Forced vibration analysis through model analysis, Model damping, Rayleigh's damping, Introduction to experimental model analysis.

Course Outcomes:

At the end of the course, the student will be able to, Understand the causes and effects of vibration in mechanical systems. Develop schematic models for physical systems and formulate governing equations of motion. Understand the role of damping, stiffness and inertia in mechanical systems Analyze rotating and reciprocating systems and compute critical speeds. Analyze and design machine supporting structures, vibration isolators and absorbers

Text books:

1. L. Meirovich, Elements of Vibration analysis, 2nd Ed. Tata Mc-Grawhill 2007
2. Reference Books:
3. Singiresu S Rao, Mechanical Vibrations. 4th Ed. , Pearson education 2011
4. W.T., Thompson, Theory of Vibration. CBS Publishers
5. Clarence W. de Silva , Vibration: Fundamentals and Practice, CRC Press LLC, 2000 .

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B.Tech ME IV Year II-Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58018) FLEXIBLE MANUFACTURING SYSTEMS

(**PE-VI)**

Course Objective:

- Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

Unit I:
Understanding of FMS: Evolution of Manufacturing Systems, Definition, objective and Need, Components, Merits, Demerits and Applications of FMS

Unit II:
Processing stations: Machining Centers, Turning centers, CMM, Washing/ Deburring station, etc. Different Layouts and their Salient features

Unit III:

Material Handling System: An introduction, Conveyor, AGV, ASRS, Robots, etc. and their salient features.

Unit IV:

Management technology: Tool Management, Configuration planning and routing, Production Planning and Control, Scheduling and control
Computer networks and control: Hardware, Software and database of FMS

Unit V:

Design of FMS: Performance Evaluation, Analytical model and Simulation model of FMS
Case studies: Typical FMS problems from researches papers

Course Outcomes:

At the end of the course, the student will be able to

- Understand FMS and job-shop and mass production manufacturing systems.
- Understand processing stations and material handling systems
- used in FMS environments.
- Design and analyze FMS using simulation and analytical techniques.
- Understand tool management in FMS.

Textbooks:

1. Groover,M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009 .
2. Tempelmeier.H and Kuhn.H. "Flexible Manufacturing system: Decision support for design and operation", John Wiley and Sons 2003.
3. Maleki A. "Flexible Manufacturing Systems: the technology and management". Prentice Hall International –2009

OPEN ELECTIVE I

ANURAG ENGINEERING COLLEGE
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B.Tech MECHANICAL ENGINEERING	L	T	P	C
	3	1	0	3

(A56305) ADVANCED ENGINEERING MATERIALS

OPEN ELECTIVE I

Course Objectives:

5. To introduce the basic concepts concerning the Advanced Engineering materials in the world.
6. To explain the ferrous and non ferrous metals and alloys have led to our understanding of Advanced materials structure and properties.
7. To explain the ceramic ,plastic, composite materials and super alloys.
8. To provide sufficient background material to enable students to continue with more specialized courses, such as Nano Science and other physical science subjects.

Unit I:

Ferrous Metals & Alloys:

Special topics in materials engineering: Selection for economy in manufacture, guidelines for selection of materials.

Unit II:

Non Ferrous Materials & Alloys:

Aluminium: Wrought & cast aluminium alloys – properties.

Copper: Properties of wrought copper alloys & copper alloy castings. Selection & application of copper alloys.

Zinc & Tin: Properties, selection & application.

Unit III:

Plastics:

General properties of plastics: Introduction, Polymeric materials to designers & selection of plastics. Plastic additives. Mechanical behaviour of plastics.

Unit IV:

Composites:

Introduction: Conventional engineering materials, What are composites? Functions of fibre & matrix, special features, drawbacks, processing, product fabrication, applications.

Ceramics

Oxide surfaces, ceramic forming & metal ceramic interface.

Unit V:

Intermetallics

Properties and application of Titanium aluminides, Nickel aluminides, Iron luminides, Beryllides & Silicides.

Superalloys

Properties, selection & engineering application of: Nickel based super alloys, Cobalt based super alloys & Iron based super alloys.

Learning Outcomes:

- Acquire an understanding of the main concepts related to the structure and properties of advanced materials
- Understand the basic concepts of ferrous and non ferrous metals and alloys.
- Understand the ceramics and composite materials
- To understand the application of super alloys and intermetalic
- Understand the basic methods of manufacturing various types of composite materials.

Text Book:

1. **Engineering Materials, Properties & Selection** - Ken Budinski & Michael K.Budinski, Prentice Hall.

Reference Books:

1. **Materials Selection in Mechanical Design** - Michael Ash by Butterworth – Heinemann.
2. **Materials Selection & Applications in Mechanical Engineering** - Dr.A.Raman, Industrial Press Inc.
3. **Selection & Use of Engineering Materials -** F.A.A.Crane, J.A.Charles & Justin Furness, Butterworth – Heinemann.

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B.Tech MECHANICAL ENGINEERING	L	T	P	C
	3	1	0	3

(A58014) MECHATRONICS

OPEN ELECTIVE I

UNIT – I

Introduction: Definition – Trends – Control Methods; Stand alone, PC Based (Real Time Operating Systems, Graphical User interface, simulation) – Applications; SPM, Robot, CNC, FMS, CIM.

Signal Conditioning: introduction – Hardware – Digital I/O, Analog input – ADC, resolution, speed channels filtering noise using passive components – Resistors, capacitors – Amplifying signals using OP amps – Software – Digital Signals Processing – Low pass, high pass, notch filtering.

UNIT – II

Precision Mechanical Systems: Pneumatic Actuation Systems – Electro – pneumatic Actuation Systems – Timing Belts – Ball Screw and Nut – Linear Motion Guides – Linear Bearing – Harmonic Transmission – Bearings – Motor / Drive selection.

UNIT – III

Electronic interface sub systems: TTL, CMOS interfacing – Sensor interfacing – Actuator

Interfacing – solenoids, motors isolation schemes – opto coupling, buffer IC's- Protection schemes – circuit breakers, over current sencing, reset able fuses, thermal dissipation – Power Supply – Bipolar transistors / mosfets

Electromechanical Drives: Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4 quadrant servo drives, PWM's – Pulse width Modulation – Variable Frequency Drives, Vector Drives – Drive system load calculation.

UNIT – IV

Microcontrollers Overview: 8051 Microcontroller, micro processor structure – Digital interfacing – Analog interfacing – Digital to analog convertors – Analog to Digital convertors – Applications, Programming – Assembly, C (LED Blinking, Voltage measurement using ADC)

Programmable Logic Controllers: Basic structure programming; Ladder diagram – Timers internal Relays and counters – Shift registers – Master and jump controls – Data handling – Analog input / output – PLC Selection – Application.

UNIT – V

Programmable Motion Controllers: introduction – system transfer function – laplace transform and its application in analyzing differential equation of a control system – feedback devices; Position velocity sensors – optical incremental encoders – Proximity sensors; inductive, capacitive, infrared – continuous and discrete processes – control system performance & turning – digital controllers – P, PI, PID control – control modes – position, velocity and torque – velocity profiles – Trapezoidal – S.Curve – electronic

gearing – controlled velocity profile – multi axis interpolation, PTP, Linear, Circular – Core functionalities – home, record position, Go to position – applications; SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.

OPEN ELECTIVE II

ANURAG ENGINEERING COLLEGE

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B.Tech MECHANICAL ENGINEERING	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A57022)POWER PLANT ENGINEERING

OPEN ELECTIVE II

Objectives:

The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include

4. Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
5. A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
6. Awareness of the economic, environmental, and regulatory issues related to power generation.

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cylone furnace, design and construction, Dust collectors, Electrostatic precipitators, cooling towers and heat rejection, corrosion and feed water treatment.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems

UNIT – II

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage

Gas Turbine Plant: Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT III

Hydro Electric Power Plant: Water power – Hydrological cycle – Hydrographs – storage and Pondage – Numerical examples of construction of Hydrograph, Load duration curves -classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – Turbines and Generator-Types-plant auxiliaries – plant operation pumped storage plants.

UNIT – IV

NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

Power from Non-Conventional Sources: Utilization of solar – Collectors – Principle of working, Wind energy – Types – HAWT, VAWT – Tidel energy.

UNIT – V

Direct energy conversion: solar energy, Fuel cells, Thermo electric and thermo ionic, MHD generation.

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve, Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related numerical exercises, Effluents from power plants and impact on environment – pollutants and pollution standards – Methods of Power plant Pollution control.

Course Outcomes:

- Understand the principle of various sources of energy, resources and development of power.
- To know the concept of internal combustion engine power plant.
- To know the concept of gas turbine power plant.
- To know the concept of hydro electric power plant.
- To know the concept of power from non conventional sources.
- To know the concept of nuclear power stations and its types.
- Understand the power plant economics and environmental considerations.

TEXT BOOKS:

- Power Plant Engineering – P.C.Sharma / S.K.Kataria Publications.
- A Course in Power Plant Engineering: / Arora and S.Domkundwar.

REFERENCES:

- A Text book of Power Plant Engineering / R.K. Rajput / Laxmi Publications
- Power plant Engineering / S. Ramalingam / Scietech Publishers.
- Power Plant Engineering: P.K.Nag / ii Edition / TMH.
- An introduction to Power Plant Technology / G.D. Rai.
- Power plant Engg – Elanchezhian – I.K international Publications.

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B.Tech MECHANICAL ENGINEERING	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

(A58013)INDUSTRIAL ROBOTICS

OPEN ELECTIVE II

Course Objective:

To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods

UNIT – I

INRODUCTION: Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Degrees of freedom – End effectors; Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design.

UNIT – II

MOTION ANALYSIS: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

MANIPULATOR KINEMATICS: D-H notations – joint coordinates and world coordinates – Forward and inverse kinematics – problems.

UNIT – III

DIFFERENTIAL KINEMATICS: Differential kinematics of planar and spherical manipulators – Jacobians – Problems.

ROBOT DYNAMICS: Lagrange – Euler formulations – Newton - Euler formulations – Problems on planar two link manipulators.

UNIT – IV

TRAJECTORY PLANNING: Joint space scheme – cubic polynomial fit – Avoidance of obstacles.

TYPES OF MOTION: Slew motion – joint interpolated motion – straight line motion – problems.

ROBOT ACTUATORS: Actuators- Pneumatic and Hydraulic actuators, Electric Actuators: DC servo motors – stepper motors.

UNIT – V

FEED BACK COMPONENTS: position sensors – potentiometers, resolvers and encoders – velocity sensors – Tactile sensors.

ROBOT APPLICATION IN MANUFACTURING: Material Transfer and loading/unloading Material handling – Assembly and inspection.

Course Outcomes:

At the end of the course, the student will be able to understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward and inverse kinematics of robot manipulators. Analyze forces in links and joints of a robot. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors

TEXT BOOKS:

3. Industrial Robotics / Groover M.P / Pearson Edu.
4. Introduction to Robotic Mechanics and control by JJ Craig, Pearson, 3rd edition.

REFERENCES:

6. Robotics / Fu K.S / McGraw Hill.
7. Robotic Engineering / Richard D. Klafter, Prentice Hall
8. Robot Analysis and intelligence / Asada and Slotine / Wiley inter Science.
9. Robot Dynamics & Control – Mark W. Spong and M.Vidyasagar / John Wiley & sons (ASIA) Pte. Ltd..
10. Robotics and control / Mittal R.K & Nagrath I.J / TMH.

OPEN ELECTIVE III

ANURAG ENGINEERING COLLEGE

(An Autonomous Institution)

B.Tech MECHANICAL ENGINEERING

L	T	P	C
3	1	0	3

(A58305)RENEWABLE ENERGY SOURCES

OPEN ELECTIVE III

UNIT-I: Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II: Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III: Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV : Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V: Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

a. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
b. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

Reference:

1. Power plant technology by J Wakhil
2. Non-Conventional Energy Sources by G.D Rai
3. Solar Energy - Principles of thermal collection and storage S. P. Sukhatme
4. Solar Engineering of Thermal Processes J. A. Duffie and W. A. Beckman
5. Biomass Regenerable Energy D. D. Hall and R. P. Grover.
6. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
7. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
8. Peter Gevorkian, Sustainable Energy Systems Engineering, McGraw Hill,2007
9. Kreith, F and Kreider, J. F., Principles of Solar Engineering, McGraw-Hill, 1978.
10. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.
11. Veziroglu, T.N., Alternative Energy Sources, Vol 5 and 6, McGraw-Hill, 1990
12. Anthony San Pietro, Biochemical and Photosynthetic aspects of Energy Production, Academic Press, 1980.
13. Bridgurater, A.V., Thermochemical processing of Biomass, Academic Press, 1981.
14. Bent Sorensen , Renewable Energy, Elsevier, Academic Press, 2011

ANURAG ENGINEERING COLLEGE

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B.Tech MECHANICAL ENGINEERING

L	T	P	C
3	1	0	3

(A55022)AUTOMOBILE ENGINEERING

OPEN ELECTIVE III

UNIT – I

Introduction : Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarburization, Nitriding of crank shaft..

Emission from Automobiles – Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

UNIT – II

Fuel System : S.I. Engine : Fuel supply systems, Mechanical and electrical fuel pumps – carburetor – types – air filters – petrol injection.

C.I. Engines : Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, Alternative fuels for Automobiles-injection,Classification,Properties, Hybrid vehicles injection timing, testing of fuel, pumps.

UNIT – III

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

Ignition System : Function of an ignition system, battery ignition system, constructional features of storage battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

UNIT – IV

Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

Transmission System : Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – Gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box , over drive torque converter.

Propeller shaft – Hoatch – Kiss drive, Torque tube drive universal joint, differential rear axles – types – wheels and tyres.

UNIT – V

Steering System : Steering geometry – camber, castor, king pin rake, combined angle toe in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

Suspension System : Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

Braking System : Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

TEXT BOOKS :

1. Automobile Engineering ,Vol. 1 & Vol. 2/ Kripal Singh
2. Automobile Engineering , Vol. 1 & Vol. 2 ,by K.M Gupta,Umesh publication

REFERENCE BOOKS:

1. A System approach to Automotive Technology by Jack Erjavec YesDee publishing pvt Ltd.
2. Automobile Engineering / William Crouse
3. Automotive Mechanics / Heitner
4. Alternative fuels of Automobiles by P.RamiReddy,Frontline publications.