ACADEMIC REGULATIONS, COURSE STRUCTURE

ANDDETAILED SYLLABUS

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from the Academic Year 2015-16

MECHANICALENGINEERING(ME)

For

B. Tech. Four Year Degree Course

(MR-15 Regulations)

MALLAREDDY ENGINEERING COLLEGE (Autonomous)

(An Autonomous Institution approved by UGC and affiliated to JNTUH, Approved by AICTE & Accredited by NAAC with 'A' Grade and NBA & Recipient of World Bank Assistance under TEQIP Phase – II, S.C 1.1)

Maisammaguda, Dhulapally (Post & Via Kompally), Secunderabad-500 100

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR 15 – ACADEMICREGULATIONS (CBCS) FOR B.Tech. (REGULAR) DEGREE PROGRAMME

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

The B.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To establish a reputable professional education centre, to impart high quality trend setting technologies in an ambience of humanity, wisdom, intellect and innovation to nurture the students to become competent and committed professionals with disciplined ethical values.

MISSION

Commitment to progress in mining new knowledge by adopting cutting-edge technologies to promote academic growth by offering state-of-the-art undergraduate and postgraduate programmes based on well-versed perceptions of global areas of specialization to serve the nation with advanced technical knowledge.

DEPARTMENTVISION

To provide world class platform for education, Research and knowledge technical skill in Mechanical Engineering and to create leaders with passion for innovation to ensure environment friendly development needs of the society.

DEPARTMENTMISSION

Create innovative learning atmosphere with superior and environment friendly infrastructure, for better understanding of the technical knowledge in practical situations, so as to make them effective ethical and global leaders.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. To develop the ability among students to synthesize data and technical concepts for application to product design in industry that need the global needs.
2. To provide students with sound foundation in the mathematical, scientific and engineering fundamental necessary to formulate, solve and analyse engineering problems and to prepare them to work as part of teams on multi disciplinary projects.
3. To promote student awareness of the lifelong learning and to create them with professional ethics and code of practice.

PROGRAMME OUTCOMES (POs)

a	an ability to apply knowledge of mathematics, science, and engineering,
b	an ability to design and conduct experiments, as well as to analyze and interpret data,
c	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
d	an ability to function on multidisciplinary teams,
e	an ability to identify, formulate, and solve engineering problems,
f	an understanding of professional and ethical responsibility,
g	an ability to communicate effectively,
h	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
i	a recognition of the need for, and an ability to engage in life-long learning,
j	a knowledge of contemporary issues,
k	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

1.Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

MREC (Autonomous) offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under Choice Based CreditSystem (CBCS) with effect from theAcademic Year 2015 - 16 onwards, in the following branchesof Engineering

Serial Number	Branch Code	Branch
1	01	CIVIL ENGINEERING (CE)
2	02	ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
3	03	MECHANICAL ENGINEERING (ME)
4	04	ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
5	05	COMPUTER SCIENCE AND ENGINEERING (CSE)
6	25	MINING ENGINEERING (MinE)

2. Eligibility for Admission

2.1 Admission to the UGP shall be made either on the basis of themerit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (TSEAMCET), or the University, or on the basis of any other order of meritapproved by the University, subject to reservations as prescribedby the Government from time to time.

2.2 The medium of instructions for the entire UGP in E&T willbe ENGLISH only.

3. B.Tech. Programme (UGP) Structure

3.1 The B.Tech. Programmes of MREC (A) are of SemesterPattern, with 8 Semesters. Each Semester shall be of 22Weeks duration (inclusive of Examinations), with a minimumof 90 Instructional Days per Semester.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adoptedappropriately for various terms and abbreviations used inthese Academic Regulations/ Norms, which are as listedbelow.

3.2.1 Semester Scheme:

Each UGP is of 8 Semesters, withthe academic year being divided into two Semesters of 22 weekseach, each Semester having - 'ContinuousInternal Evaluation (CIE)' and 'Semester End Examination(SEE)'. Choice Based Credit System (CBCS) and Credit BasedSemester System (CBSS) as denoted by UGC, andCurriculum/ Course Structure as suggested by AICTE arefollowed.

3.2.2 Credit Courses:

All Subjects/ Courses are to be registered by a studentin a Semester to earn Credits. Credits shall be assignedto each Subject/ Course in a L: T: P: C (Lecture Periods:Tutorial Periods: Practical Periods: Credits) Structure, basedon the following general pattern

- One Credit - for One hour/ Week/ Semester for Theory/Lecture (L) Courses; and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses or Tutorials (T).

Other student activities like NCC, NSS, Study Tour,Guest Lecture etc., and identified Mandatory / Audit Courses willnot carry Credits.

3.2.3 Subject/ Course Classification:

All Subjects/ Courses offered for the UGP are broadlyclassifiedas :

(a) Foundation Courses (FC),
(b) Core Courses (CC),
(c) Elective Courses (EC),
(d) Mandatory Courses (MC),
(e) Audit Courses (AC),
(f) Minor Courses (MiC)

- **Foundation Courses (FC**) are further categorized as:

(i) Humanities and Social Sciences (HS)
(ii) Basic Sciences (BS)
(iii) Engineering Sciences (ES).

- **Core Courses (CC) and Elective Courses (EC)** are categorized as Professional Subjects (PS), which are further subdivided as –
  (i) Professional/ Departmental Core (PC) Subjects,
  (ii) Professional/ Departmental Electives(PE),
  (iii) Open Electives (OE);
  (iv) Project Related (PR).
- **Mandatory Courses** (**MC** - Non-credit with evaluation).
- **Audit Courses** (**AC** – Non- credit without evaluation).
- **Minor Courses** (**MiC** – One or two credit courses)

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course-Structure Groupingfor the each of the UGP in E&T (B.Tech. DegreeProgrammes), is as listed below (along with AICTEspecified % Range of Total Credits)

Sl. No.	Classification		Course Work – Subject Area	Distribution of credits	as per AICTE
	AICTE	UGC			
1	HS	Foundation Courses	Humanities and Social sciences including English, Environmental Sciences and Management subjects	9.78	5- 10 %
2	BS		Basic Sciences (BS) including Mathematics, Physics, Chemistry.	17.40	15- 20%
3	ES		Engineering sciences (ES), including Engineering Workshop, Engineering Graphics, Basics of Electrical Electronics / Mechanical / Computer Engineering	17.40	15 – 20%
4	PC	Core Courses	Professional Core subjects are relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required.	31.52	30 – 40%
5	PR	Project Related	Minor and Major Projects, Technical Seminar and comprehensive viva-voce.	9.23	10 – 15%
6	PE	Professional Electives	Professional Electives are relevant to the chosen specialization/ branch;	9.78	10– 15 %
7	OE	Open Electives	Open Electives are the courses from other technical and/or emerging subject areas	4.89	5 – 10 %
8	MC	Mandatory Courses	These courses are non-credit courses with evaluation.	-	-
9	AC	Audit Courses	These courses are non-credit courses without evaluation	-	-
10	MiC	Minor Courses	These are one or two credit courses intended to improve the skills of the student in placements and entrepreneurship.	-	-
Total credits for UGP (B.Tech.)					**184 (100%)**

4. Course Work

4.1 A student, after securing admission, shall pursue the B.Tech. UGP in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (starting from the Date of Commencement of I year course work). Further 2 years of extension is allowed for appearing examinations.

4.2 Each student shall Register for and Secure the specifiednumber of Credits required for the completion of the UGPand Award of the B.Tech. Degree in respective Branch ofEngineering.

4.3 Total number of credits to be secured are 184 out of 184 for the entire B.Tech. Programme.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Under Graduate Programme (UGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

5.2 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work for the first semester through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'SUBSEQUENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'CURRENT SEMESTER'.

5.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from the Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

5.4 A Student may be permitted to Register for his Subjects/ Course of CHOICE with a typical deviation of ± 3 credits of the semester with minimum credits of 19 and maximum credits of 27, based on his PROGRESS and SGPA/CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/Courses, in the Department Course Structure and Syllabus contents. It needs specific approval and signature of the Faculty Advisor/Counselor and Head of the Department.

5.5 If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given specified Course/ Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

5.6 Subject/ Course Options exercised through ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5.7 For Audit Courses like Sports and NSS, Computational Mathematics Lab etc, a '**Satisfactory Participation Certificate**' from the concerned authorities for the relevant Semester is essential. No Marks or Credits shall be awarded for these activities.

5.8 For Mandatory Courses, a '**Satisfactory / Not Satisfactory' grade** is awarded based on the performance in both CIE and SEE.

6. Subjects/ Courses to be offered

6.1 A typical Section (or Class) Strength for each Semestershall be 60.

6.2 A Subject/ Course may be offered to the Students, ONLY IF a Minimum of 40 Students opt for the same. The Maximum Strength of a Section is limited to 70.

6.3 More than ONE TEACHER may offer the SAME SUBJECT(Lab / Practical may be included with the correspondingTheory Subject in the same Semester) in any Semester.However, selection choice for students will be based on -'FIRST COME FIRST SERVE Basis and CGPA Criterion'(ie., the first focus shall be on early ON-LINE ENTRY fromthe student for Registration in that Semester, and thesecond focus, if needed, will be on CGPA of the student).

6.4 If more entries for Registration of a Subject come intopicture, then the concerned Head of the Department shall takenecessary action, whether to offer such a Subject/ Coursefor TWO (or multiple) SECTIONS or NOT .

6.5 In case of options coming from Students of otherDepartments/ Branches/ Disciplines (not considering OPENELECTIVES), PRIORITY shall be given to the student ofthe 'Parent Department' first.

7. Attendance Requirements

7.1 A student shall be eligible to appear for the Semester End Examinations, if he acquires a minimum of 75% of attendance inaggregate of all the Subjects/ Courses (excluding Non-Credit Courses) for that Semester.

7.2 Condoning of shortage of attendance in aggregate up to 10%(65% and above, and below 75%) in each Semester may begranted by the College Academic Committee on genuine and **valid grounds such as Medical, NSS, Sports and Games,**based on the student's representationwith supporting evidence.

7.3 A stipulated fee shall be payable towards condoning of shortageof attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NOcase be condoned.

7.5 Students, whose shortage of attendance is not condoned in anySemester, are not eligible to register their Semester End Examinations, they get detained and their registration for thatSemester shall stand cancelled. They will not be promoted to thenext Semester. They may seek re-registration for all thoseSubjects registered in that Semester in which he gotdetained, by seeking re-admission for that Semester asand when offered; in case if there are any ProfessionalElectives and/ or Open Electives, the same may also be **re-registered**if offered, however, if those Electives are notoffered in later Semesters, then alternate Electives may bechosen from the **same** set of Elective Subjects offeredunder that category.

8. Academic Requirements

The following Academic Requirements have to be satisfied, inaddition to the Attendance Requirements mentioned in ItemNo.**7.**

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 40% marks (24 out of 60 marks) in the Semester End Examination, and a minimum of 40% of the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) marks taken together (i.e. 40 marks); in terms of Letter Grades, this implies securing P Grade or above in that Subject/ Course.

8.2 A student shall be deemed to have satisfied the AcademicRequirements and earned the Credits allotted to – Minor Project/Technical Seminar/Major Project, if he secures not less than40% of the total marks to be awarded for each.The student would be treated as failed, if he - (i) does notsubmit a report on his Minor Project / Technical Seminar / Major Project, ordoes not make a presentation of the same before theEvaluation Committee as per schedule, or (ii)secures less than 40% of marks in Minor Project/ Technical Seminar/Major Project evaluations.

He may reappear once for each of the above evaluations,when they are scheduled again; if he fails in such **'one-reappearance'** evaluation also, he has to reappear for thesame in the next subsequent Semester, as and when it isscheduled.

8.3 Promotion Rules: Every Student has to fulfil the Attendance and Academic Requirements by securing the required creditsas shown below:

S.No.	Semester		Requirement
	From (Even)	To (Odd)	
1	II	III	**50%** of registered credits are required upto II Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.
2	IV	V	**60%** of registered credits are required upto IV Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.
3	VI	VII	**60%** of registered credits are required upto VI Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.4A Student shall - register for all Subjects covering 184 Credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, put up all the Attendance and Academic requirements for 184 Credits securing a minimum of P Grade (Pass Grade) or above in each Subject, and 'earn all 184 Credits securing SGPA $\geq$ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) $\geq$ 5.0, to successfully complete the UGP.

8.5 After securing the necessary 184 Credits as specified forthe successful completion of the entire UGP, an exemption of 6 secured Credits (in terms of two of theircorresponding Subjects/Courses) may be permitted for optional drop out from these 184 Credits earned; resulting in 178 Credits for UGP performance evaluation, i.e., theperformance of the Student in these 178 Credits shall alonebe taken into account for the calculation of 'the final CGPA(at the end of UGP, which takes the SGPA of the VIII Semester into account)' , and shall be indicated in theGrade Card of VIII Semester; however, the Student'sPerformances in the earlier individual Semesters, with thecorresponding SGPA and CGPA for which already GradeCards are given, will not be altered. **Further, optional drop out for such 6 secured Credits shall be allowed only for professional and open electives**.

8.6 If a Student registers for some more **'Extra Subjects'** (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 184 Credits as specified in the Course Structure of his Department, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 184 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects'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 to 8.7 above.

8.7 When a Student is detained due to shortage of attendance inany Semester, he may be re-admitted into that Semester, asand when offered, with the Academic Regulations of that Batch into which he gets readmitted. However, no GradeAllotments or SGPA/ CGPA calculations will be done for thatentire Semester in which he got detained.

8.8 When a Student is detained due to lack of Credits in anyyear, he may be readmitted in the next year, after fulfilment ofthe Academic Requirements, with the Academic Regulations ofthat Batch into which he gets readmitted.

8.9A student eligible to appear in the Semester End Examination in any Subject/ Course, but absent at it orfailed (thereby failing to secure P Grade or above), mayreappear for that

Subject/ Course at the supplementaryexamination as and when conducted. In such cases,his Internal Marks (CIE) assessed earlier for that Subject/Course will be carried over, and added to the Marks to beobtained in the SEE supplementary examination, forevaluating his performance in that Subject.

9. Evaluation - Distribution and Weightage of Marks

The performance of a student in each Semester shall beevaluated Subject-wise (irrespective of Credits assigned) witha maximum of 100 marks for Theory or Practicals orSeminar or Drawing/Design or Minor Project or Minor Course, etc.,For all Subjects/ Courses, the distribution shall be 40 marks for CIE, and 60 marks for the SEE inclusive of minor and mandatory courses.However, the B.Tech. Major Project will be evaluated for 200 Marks. These evaluations shall be based on 20% CIE (Continuous InternalEvaluation) and 80% SEE (Semester End Examination), anda Letter Grade corresponding to the % marks obtained shallbe given.Students have to choose Open Electives from the givenlist. However, Students should not choose an Open Elective offered by their own (parent) Department, if it is already listed under any category of the courses offered by parent Department in any Semester.

9.1 Theory Courses:

9.1.1 Continuous Internal Evaluation (CIE):

During theSemester, there shall be **2 mid-term examinations** for 40 markseach. Each mid-term examination consists of online**objective paper** for 10 marks with duration of **20 minutes** and **subjective paper** for 20 marks withduration of **90 minutes**. Further, there will be anallocation of 5 marks each for Assignment and Attendance. Objective paper maybe set with multiple choice questions. Subjective paper shall contain 6 questions, out of which the Student has to answer 4 questions, each for 5 marks.

The allotment of 5 marks for attendance is as given below:

S.No.	% of Attendance Range	Marks
1	> 90 and ≤ 100	5
2	> 85 and ≤ 90	4
3	> 80 and ≤ 85	3
4	> 75 and ≤ 80	2
5	≥ 70 and ≤ 75	1

The first mid-term examination shall be conducted for thefirst 50% of the syllabus, and the second mid-termexamination shall be conducted for the remaining 50% of thesyllabus.

First Assignment should be submitted before the conduct ofthe first mid-term examinations, and the Second Assignmentshould be submitted before the conduct of the second midtermexaminations. The Assignments shall be as specifiedby the concerned subject teacher.

The first mid-term examination Marks, first AssignmentMarks and relative attendance marks shall make one set of CIE Marks, and the secondmid-term examination Marks, second Assignment Marks and relative attendance marks shall make second set of CIE Marks; and 70% of the best performed plus 30% of the other shall be taken as the final markssecured by the Student towards Continuous InternalEvaluation in that Theory Subject.

9.1.2 Semester End Examination (SEE):

The distribution of marks is as given below:

Semester End Examination				
Part	**Type of Questions**	**No. of questions to be answered**	**Marks per question**	**Total**
Part A	Compulsory Questions (One from each module)	5	2	10
Part B	Choice Questions (5 out of 8) (Minimum one from each module)	5	10	50
Grand Total				60

9.2 Practical Courses:

9.2.1 Continuous Internal Evaluation (CIE):

There will be CIE for 40 marks, shall be awarded with a distribution of 20 marks for day-to-day performance and timely submission of lab records, 5 marks for viva-voce,15 marks for internal lab exam (best out of two exams).

9.2.2 Semester End Examination (SEE):

There will be SEE for 60 marks, shall be awarded with a distribution of 20 marks for write-up on the given experiment, 20 marks for proficiency in the exam, 10 marks for results and 10 marks for viva-voce. For conducting SEE, one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations of the College. The external examiner should be selected from outside the College among the autonomous/reputed institutions from a panel of three examiners submitted by the concerned Head of the Department.

9.3 Design and/or Drawing:

For these Subjects, (such asEngineering Graphics, Machine Drawing,Production Drawing Practice, and Estimation), the distribution shall be 40 marks for **CIE** (20 marks for day-to-day work, 20 marks for internal test with a duration of 120 minutes(better out of two exams)).There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marksfor internal tests. The **SEE** will be evaluated for 60 marks.

9.4 Gender Sensitization:

9.4.1 Continuous Internal Evaluation (CIE):

There will beCIEfor40 marks shall be awarded with a distribution of 25 marksfor day-to-day performance and 15 marks for internal practical exam in the form of assignments shall be given and evaluated by the teacher concerned.

9.4.2 Semester End Examination (SEE):

TheSEEfor 60 marks shall be conducted with an external examiner and the laboratory teacher.To reduce the burden on the students, the External Lab Exam should be conducted as an open-book system for the duration of 120 minutes. Eight questions have to be given from **Essential Reading "Towards a World of Equals: A Bilingual Textbook on Gender"**, out of which students should answer only 5. Each question carries 12 marks. So, each answer will take nearly 24 minutes.

9.5 Projects:

9.5.1 Minor Project:

Minor Project has tobe taken up for about eight weeks including summer vacation after VI semester.**CIE** of 40 marks are awarded based on the performance in two presentations and **SEE** of 60 marks will be evaluated by a committee consisting of Head of the Department, supervisor and an external examiner. The external examiner should be selected from outside the College among the autonomous/reputed institutions from a panel of three examiners submitted by the concerned Head of the Department. The Minor Project shall be evaluated in the VII Semester.

9.5.2 Major Project:

Major Project has to be carried out during the VIII Semester, as per the instructions of the Project Supervisor assigned by the Head of the Department. Out of total 200 marks allotted for the Major Project, 40 marks shall be for **CIE** (Continuous Internal Evaluation) and 160 marks for the **SEE** (Semester End Viva-voce Examination). CIE 40 marks shall be awarded by a Departmental Committee consisting of Head of the Department, a senior faculty member and Project Supervisor, based on the work carried out and the presentation made by the Student during the Major Project. The Major Project Viva-voce shall be conducted by a Committee comprising of an External Examiner, Head of the Department and Project Supervisor. The external examiner should be selected from outside the College among the autonomous/reputed institutions from a panel of three examiners submitted by the concerned Head of the Department.

9.6 Technical Seminar:

For Technical Seminar Presentation, the student shall collect the information on a specialized topic, prepare a Technical Report and submit to the Department at the time of Seminar Presentation. The Seminar Presentation (along with the Technical Report) shall be evaluated by a committee consisting of Head of the Department and Two Faculty Members for 100 marks. There shall be no external evaluation.

9.7 Comprehensive Viva-Voce:

The Comprehensive Viva-Voce shall be conducted in VIII Semester for 100 marks. This Viva-Voce is intended to assess the students' understanding of various subjects studied during the B. Tech. programme of study and will be evaluated by a Committee, consisting of the Head of the Department and two senior faculty members.Thereshall be no external evaluation.

9.8 Non-Credit Courses:

9.8.1 Audit Courses:

For Audit Courses offered in any Semester, a '**Satisfactory Participation Certificate**' shall be issued to the Student from the concerned authorities, only after securing ≥ 65% attendance in such a Course. No marks or Letter Grade shall be allotted for these activities.

9.8.2 Mandatory Courses:

For Mandatory Non-Credit Courses offered in any semester, a 'Satisfactory / Not Satisfactory' shall be awarded to the student based on the performance in both CIE and SEE

10. Grading Procedure

10.1 Marks will be awarded to indicate the performance of eachstudent in each Theory Subject, or Lab/ Practical, or Seminar, or Project, or Minor-Project or Minor Course etc., based on the %marks obtained in CIE + SEE (Continuous Internal Evaluation+ Semester End Examination, both taken together) asspecified in Item 9 above, and a corresponding Letter Gradeshall be given.

10.2 As a measure of the student's performance, a 10-point AbsoluteGrading System using the following Letter Grades (UGCGuidelines) and corresponding percentage of marks shall befollowed

% of Marks	Grade Points	Letter Grade
≥80	10	O (Out Standing)
≥70 to < 80	9	A^+ (Excellent)
≥60 to < 70	8	A (Very Good)
≥55 to < 60	7	B^+ (Good)
≥50 to < 55	6	B (Above Average)
≥45 to < 50	5	C (Average)
≥40 to < 45	4	P (Pass)
< 40	0	F (Fail)
Absent	Ab	Ab

10.3 A student obtaining F Grade in any Subject shall be considered 'Failed' and will be required to reappear as'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted. In such cases,his Internal Marks (CIE Marks) in those Subject(s) willremain same as those he obtained earlier.

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

10.5 In general, a student shall not be permitted to repeat anySubject/ Course (s) only for the sake of 'Grade Improvement'or 'SGPA/ CGPA Improvement'. However, he has to repeatall the Subjects/ Courses pertaining to that Semester, whenhe is detained (as listed in Items 8.10- 8.11).

10.6 A student earns Grade Point (GP) in each Subject/ Course,on the basis of the Letter Grade obtained by him in thatSubject/ Course (excluding Mandatory non-credit Courses).Then the corresponding 'Credit Points' (CP) are computedby multiplying the Grade Point with Credits for that particularSubject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits …For a Course

10.7 The Student passes the Subject/ Course only when he getsGP ≥ 4 (P Grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated bydividing the Sum of Credit Points (ΣCP) secured from ALLSubjects/ Courses registered in a Semester, by the TotalNumber of Credits registered during that Semester. SGPA isrounded off to TWO Decimal Places. SGPA is thuscomputed as

$SGPA = \{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$ … for each Semester

where 'i' is the Subject indicator index (takes into accountall Subjects in a Semester), 'N' is the no. of Subjects'REGISTERED' for the Semester (as specifically requiredand listed under the Course Structure of the parentDepartment), is the no. of Credits allotted to the ithSubject, and represents the Grade Points (GP)corresponding to the Letter Grade awarded for that ithSubject.

10.9 The Cumulative Grade Point Average (CGPA) is a measureof the overall cumulative performance of a student over allSemesters considered for registration. The CGPA is theratio of the Total Credit Points secured by a student in ALLregistered Courses in ALL Semesters, and the TotalNumber of Credits registered in ALL the Semesters. CGPAis rounded off to TWO Decimal Places. CGPA is thuscomputed from the II Semester onwards, atthe end of each Semester, as per the formula

$CGPA = \{\sum_{j=1}^{M} C_j G_j\} / \{\sum_{j=1}^{M} C_j\}$… for all S semesters registered

(i.e., upto and inclusive of S semesters, S ≥ 2)

where 'M' is the TOTAL no. of Subjects (as specificallyrequired and listed under the Course Structure of the parentDepartment) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takesinto account all Subjects from 1 to S Semesters), is theno. of Credits allotted to the jth Subject, andrepresents the Grade Points (GP) corresponding

to theLetter Grade awarded for that jth Subject. After registrationand completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, asthere are no cumulative effects.

10.10 For Merit Ranking or Comparison Purposes or any otherlisting, ONLY the 'ROUNDED OFF' values of the CGPAswill be used.

10.11 For Calculations listed in Item 10.6 – 10.10, performance infailed Subjects/ Courses (securing F Grade) will also betaken into account, and the Credits of such Subjects/Courses will also be included in the multiplications andsummations. However, Mandatory Courses will not be takeninto consideration.

10.12 Passing Standards:

10.12.1 A student shall be declared successful or 'passed' in aSemester, only when he gets a SGPA ≥ 5.00 (at the endof that particular Semester); and a student shall bedeclared successful or 'passed' in the entire UGP, onlywhen he gets a CGPA ≥ 5.00; subject to the condition that hesecures a GP ≥ 4 (P Grade or above) in every registeredSubject/ Course in each Semester (during the entire UGP) forthe Degree Award, as required.

10.12.2 Inspite of securing P Grade or above in some (or all)Subjects/ Courses in any Semester, if a Student receives aSGPA < 5.00 and/ or CGPA < 5.00 at the end of such aSemester, then he 'may be allowed' (on the 'specificrecommendations' of the Head of the Department andsubsequent approval from the Principal) -(i) to go into the next subsequent Semester (subject tofulfilling all other attendance and academic requirements as listed under Items 7&8);(ii) to 'improve his SGPA of such a Semester (and henceCGPA) to 5.00 or above', by reappearing for ONE orMORE (as per Student's choice) of the same Course(s) in which he has secured P Grade(s) in thatSemester, at the Supplementary Examinations to be heldin the next subsequent Semester(s). In such cases, hisInternal Marks (CIE Marks) in those Subject(s) willremain same as those he obtained earlier. In these considerations, the newly secured Letter Gradeswill be recorded and taken into account for calculation ofSGPA and CGPA, only if there is an improvement.

10.12.3 A Student shall be declared successful in anyNon-Credit Course, if he secures a 'SatisfactoryParticipation Certificate' for that Audit Course and "Satisfactory Certificate' for Mandatory Course.

10.13 After the completion of each Semester, a Grade Card orGrade Sheet (or Transcript) shall be issued to all theRegistered Students of that Semester, indicating the LetterGrades and Credits earned. It will show the details of theCourses Registered (Course Code, Title, No. of Credits,and Grade Earned etc.), Credits earned, SGPA, and CGPA.

11. Declaration of Results

11.1 Computation of SGPA and CGPA are done using theprocedure listed in 10.6 – 10.10.

11.2 For Final % of Marks equivalent to the computed finalCGPA, the following formula may be used …

% of Marks = (final CGPA – 0.5) x 10

12. Award of Degree

12.1 A Student who register for all the specified Courses as listed in the Course Structure, satisfies all the Course Requirements, passes all the examinations prescribed in the entire UG Programme (UGP) within the specified period (refer 4.1), and secures the required number of 184 Credits (with CGPA ≥ 5.0), shall be declared to have 'QUALIFIED' for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

12.2 A Student who qualifies for the Award of the Degree aslisted in Item 12.1, shall be placed in the following Classes:

Class Awarded	CGPA
First Class with Distinction	≥ 8.00
First Class	≥ 6.50 and < 8.00
Second Class	≥ 5.50 and < 6.50
Pass Class	≥ 5.00 and < 5.50

12.3A student with final CGPA (at the end of the UGP) <5.00 will not be eligible for the Award of the Degree.

13. Withholding of Results

If the student has not paid fees to College atany stage, or has pending dues against his name due toany reason whatsoever, or if any case of indiscipline ispending against him, the result of the student may bewithheld, and he will not be allowed to go into the nexthigher Semester. The Award or issue of the Degree mayalso be withheld in such cases.

14. Transitory Regulations

Student who has discontinued for any reason, or has beendetained for want of attendance or lack of required creditsas specified, or who has failed after having undergone theDegree Programme, may be considered eligible for readmissionto the same Subjects/ Courses (or equivalent Subjects/Courses, as the case may be), and same ProfessionalElectives/ Open Electives (or from set/category of Electivesor equivalents suggested, as the case may be) as andwhen they are offered (within the time-frame of 8 yearsfrom the Date of Commencement of his I Semester).

15. Student Transfers

There shall be no Branch transfers after the completion ofAdmission Process.

16. Scope

i) Where the words “he”, “him”, “his”, occur in the write-upof regulations, they include “she”, “her”, “hers”.

ii) Where the words “Subject” or “Subjects”, occur in theseregulations, they also imply “Course” or “Courses”.

iii) The Academic Regulations should be read as a whole, forthe purpose of any interpretation.

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

MALPRACTICE 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 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 SEE)	Expulsion from the examination hall and cancellation of the performance in that course 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 exam hall in respect of any matter.	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 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 that 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 shall 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 SEE. The continuation of the programme by the candidate is subject 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 SEE. 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 Controller of Examinations (CCE) / Controller of Examinations (CE) / Assistant Controller of Examinations (ACE) / 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-incharge, 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 cases 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/year. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the

		candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in 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. 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.	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 SEE.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.	

Note:*The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.*

MALLAREDDY ENGINEERING COLLEGE (Autonomous)
Academic Year 2015-16 (Choice Based Credit System)
COURSE STRUCTURE – B.Tech. MECHANICAL ENGINEERING (ME)
(MR15 Regulations)
I SEMESTER

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	BS	50B01	Engineering Mathematics	3	2	-	4	40	60	100
2	BS	50B02	Applied Physics - I	2	2	-	3	40	60	100
3	BS	50B03	Applied Chemistry	2	2	-	3	40	60	100
4	ES	50501	Computer Programming	2	2	-	3	40	60	100
5	ES	50301	Engineering Graphics	1	1	3	3	40	60	100
6	BS	50B05	Applied Chemistry Lab	-	-	4	2	40	60	100
7	ES	50502	Computer Programming Lab	-	-	4	2	40	60	100
8	ES	50302	Engineering Workshop	-	-	4	2	40	60	100
9	AC	50A01	NSS, Sports& Yoga	-	-	2	-	-	-	-
Total				**10**	**9**	**17**	**22**	**Contact Hours:36**		

II-SEMESTER

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	HS	50H01	English	2	-	-	2	40	60	100
2	BS	50B06	Computational Mathematics	3	2	-	4	40	60	100
3	BS	50B07	Applied Physics - II	2	2	-	3	40	60	100
4	ES	50303	Engineering Mechanics	2	2	-	3	40	60	100
5	ES	50202	Basic Electrical & Electronics Engineering	3	2	-	4	40	60	100
6	HS	50H02	English language Lab	-	-	4	2	40	60	100
7	BS	50B04	Applied Physics Lab	-	-	4	2	40	60	100
8	ES	50304	Engineering Mechanics & AutoCAD Lab	-	-	4	2	40	60	100
9	AC	50A02	Computational Mathematics Lab	-	-	4	-	-	-	-
Total				**12**	**8**	**16**	**22**	**Contact Hours:36**		

III SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	ES	50305	Mechanics of Solids	2	2	-	3	40	60	100
2	PC	50306	Thermodynamics	2	2	-	3	40	60	100
3	ES	50307	Metallurgy and Material Science	2	2	-	3	40	60	100
4	PC	50308	Machine Drawing	2	-	4	2	40	60	100
5	PC	50309	Kinematics of Machines	2	2	-	3	40	60	100
6	BS	50B08	Elementary Calculus And Transforms	3	2	-	4	40	60	100
7	ES	50310	Metallurgy and Mechanics of Solids Lab	-	-	4	2	40	60	100
8	PC	50311	Thermodynamics Lab	-	-	4	2	40	60	100
9	MC	50H11	Human Values and Professional Ethics	-	2	-	-	40	60	100
Total				**13**	**12**	**12**	**22**	**Contact Periods : 37**		

IV SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PC	50312	Dynamics of Machines	2	2	-	3	40	60	100
2	PC	50313	Thermal Engineering – I	2	2	-	3	40	60	100
3	PC	50314	Production Technology	2	2	-	3	40	60	100
4	ES	50315	Fluid Mechanics and Hydraulic Machines	2	2	-	3	40	60	100
5	BS	50B09	Probability and Statistics	3	2	-	4	40	60	100
6	HS	50H16	Environmental Sciences	2	-	-	2	40	60	100
7	PC	50316	Production Technology Lab	-	-	4	2	40	60	100
8	ES	50317	Fluid Mechanics and Hydraulic Machines Lab	-	-	4	2	40	60	100
9	HS	50H17	Gender Sensitization	-	-	4	2	40	60	100
10	AC	50A03	Law for Engineers	-	2	-	-	-	-	-
Total				**13**	**12**	**12**	**24**	**Contact Periods :35**		

V SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	HS	50H12	Engineering Economics and Accountancy	2	2	-	3	40	60	100
2	PC	50318	Heat Transfer	2	2	-	3	40	60	100
3	PC	50319	Metal Cutting & Machine Tools	3	2	-	4	40	60	100
4	PC	50320	Design of Machine Members-I	3	2	-	4	40	60	100
5	PE-I	50321	Automobile Engineering	2	2	-	3	40	60	100
		50322	Foundry Technology							
		50323	Mechanics of Composite Materials							
6	PC	50324	Heat Transfer Lab	-	-	4	2	40	60	100
7	PC	50325	Kinematics & Dynamics Lab	-	-	4	2	40	60	100
8	PC	50326	Machine Tools Lab	-	-	4	2	40	60	100
9	PR	50H05	Soft Skills	-	-	2	1	40	60	100
Total				**12**	**10**	**14**	**24**	**Contact Periods :36**		

VI SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	HS	50H14	Industrial Management	2	-	-	2	40	60	100
2	PC	50327	Thermal Engineering-II	3	2	-	4	40	60	100
3	PC	50328	Design of Machine Members-II	3	2	-	4	40	60	100
4	PE-II	50329	Refrigeration & Air Conditioning	2	2	-	3	40	60	100
		50330	CNC Technology							
		50331	Finite Element Method							
5	PE-III	50332	Power Plant Engineering	2	2	-	3	40	60	100
		50333	Maintenance and Safety Engineering							
		50334	Mechanical Vibrations							
6	HS	50H03	Technical Communication and Presentation Skills	2	-	-	2	40	60	100
7	PC	50335	Thermal Engineering Lab	-	-	4	2	40	60	100
8	HS	50H04	Technical Communication and Presentation Skills Lab	-	-	4	2	40	60	100
9	PR	50336	Technical Seminar	-	-	4	2	100	-	100
Total				**14**	**8**	**12**	**24**	**Contact Periods :34**		

VII SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	**T**	**P**		**Internal (CIE)**	**External (SEE)**	
1	BS	50B11	Operations Research	2	2	-	3	40	60	100
2	PC	50337	CAD/CAM	2	2	-	3	40	60	100
3	PC	50338	Metrology & Instrumentation	2	2	-	3	40	60	100
4	PE-IV	50339	Computational Fluid Dynamics	2	2	-	3	40	60	100
		50340	Unconventional Machining Processes							
		50341	Mechatronics							
5	PE-V	50342	Renewable Energy Sources	2	2	-	3	40	60	100
		50343	Production Planning & Control							
		50344	Robotics							
6	OE		**Open Elective - 1**	2	2	-	3	40	60	100
7	PC	50345	CAD/CAM Lab & Production drawing Practice Lab	-	-	4	2	40	60	100
8	PC	50346	Metrology & Instrumentation Lab	-	-	4	2	40	60	100
9	PR	50347	Minor Project	-	-	2	2	40	60	100
10	AC	50A04	Foreign Language/ Fine arts	-	2	-	-			
Total				**12**	**14**	**10**	**24**	**Contact Periods :36**		

VIII SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PE-VI	50348	Nano Technology	2	2	-	3	40	60	100
		50349	Plant Layout and Material Handling.							
		50350	Automation in Manufacturing							
2	OE		**Open Elective-2**	2	2	-	3	40	60	100
3			**Open Elective-3**	2	2	-	3	40	60	100
4	PR	50351	Major Project	-	-	20	10	50	150	200
5	PR	50352	Comprehensive Viva Voce	-	2	-	2	100	-	100
6	HS	50H15	Entrepreneurship Skills	-	2	-	1	40	60	100
Total				**6**	**10**	**18**	**22**	**Contact Periods : 34**		

OPENELECTIVES

S. No.	Branch	Course Code	Name of the course
1	CE	50102	Surveying
2		50123	Air Pollution and Control
3		50124	Disaster Management
4		50150	Green Buildings
5	EEE	50203	Network Theory
6		50208	Control Systems
7		50229	Energy Auditing & Conservation
8		50241	Principles of Electrical Engineering
9	ECE	50414	Micro Processors and Interfacing
10		50448	Principles of Communication Engineering
11		50449	Embedded System Design
12	CSE	50503	Data Structures
13		50511	Database Management Systems
14		50571	Computer Graphics
15		50512	Operating Systems
16		50564	Artificial Intelligence
17	MINING ENGG.	52501	Fundamentals of Geology
18		52511	Mine Construction Engineering
19		52528	Introduction to Mineral Processing
20		52543	Tunneling Engineering
21	ENGLISH	50H08	Introduction to Interpretation of Literature and Analytical Writing
22		50H09	Business Communication
23		50H10	World Literatures
24	MATHS	50B23	Advanced Optimization Techniques
25		50B24	Mathematical Modeling
26		50B25	Differential Equations and Dynamical Systems
27	PHYSICS	50B20	Advanced Physics for Engineers
28		50B21	Nano Materials: Synthesis and Characterization
29		50B22	NDTand Vacuum Technology
30	CHEMISTRY	50B17	Chemistry of Engineering Materials
31		50B18	Nano Chemistry
32		50B19	Photochemistry and Spectroscopy

2015-16

Malla Reddy Engineering College (Autonomous)

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3 2 -

Course Code: 50B01 **Credits: 4**

B.Tech. – I Semester
ENGINEERING MATHEMATICS
(Common for CE, ME, EEE, ECE, CSE and Mining.Engg.)

Prerequisites: Pre calculus, concepts of Trigonometry etc.,

Objectives: This course provides knowledge of Matrices, Eigen values and Eigen Vectors, which are useful in signal processing and stability theory. The concept of Differential equation is essential to the learner to write the associated mathematical model and solving real time engineering problems using Laplace Transforms.

MODULE – I: Matrices and Linear systems of equations: [12 Periods]
A: Rank of the matrix - Elementary transformations –Echelon form – Normal form – PAQ Form - Inverse of a Matrix by applying Elementary transformations.

B: Solution of Linear Systems – Consistency of linear system of equations – Gauss elimination method – Gauss-Jacobi method - Gauss-seidal method- LU-Decomposition method –Solution of Tri-diagonal Systems (Thomas Algorithm).

MODULE – II: Eigen Values & Eigen Vectors [12 Periods]
A: Linear transformation - Eigen values - Eigen vectors – properties – Linearly independent and dependent vectors - Cayley-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Cayley-Hamilton theorem, Orthogonal Matrix.
B: Diagonolization of matrix-Calculation of powers of matrix, Quadratic forms – Modal and spectral matrices. Real matrices – Symmetric - skew – symmetric, Similarity Transformation, Orthogonal Transformation, Principle axis.

MODULE – III: Differential Equations of first order and first degree [12 Periods]
A:Formation of Differential Equations - Solutions of First order Differential Equations: Homogeneous - Non-homogeneous – Exact - Non-exact.
B: Leibnitz's Linear Equation - Bernoulli's Differential Equation
Applications of First Order Differential Equations: Orthogonal trajectories - Newton's Law of cooling - Law of natural growth and decay.

MODULE – IV: Differential Equations of Second & Higher Order[12 Periods]
A: Rules for finding Complementary function-Particular integral (Non-homogeneous term of the type e^{ax} , $Sin\, bx$ / $Cos\, bx$, $x^n, e^{ax}V(x), x^nV(x) only$)
Method of variation of parameters.
B: Equations reducible to constant coefficients - Cauchy - Euler and Legendre's differential equations. Applications to simple harmonic motion and LCR Circuits.

MODULE-V: Laplace Transforms [12 Periods]
A: Definition of Laplace transform - Condition for existence –Laplace transform of standard functions –Properties of Laplace transform – Laplace transform of function when they are multiplied or divided by 't' - Evalution of Integrals by using Laplace transforms.
B: Inverse transforms: Finding inverse using partial fractions – first shifting theorem – Inverse Laplace transforms of derivatives - Convolution theorem, Dirac's delta function – Unit step function. Application of Laplace transforms to ordinary differential equations

TEXT BOOKS:

1) Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers, 10th Edition, Reprint 2010.
2) Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers, 43rd Edition, Reprint 2011.
3) Introduction to Matrix Analysis by Richard Bellman, Dover Publications, 2nd Edition, 1970.

REFERENCES BOOKS:

1) Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Pub. House, Delhi.
2) Mathematical Methods of Science and Engineering by Kanti B.Datta ,Cengage Learning
3) Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
4) Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
5) Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education.

COURSE OUTCOME:

After completion of this course, students will be able to:

1. Do operations on Matrices like Row, Column operations, Rank of the Matrix etc.,
2. Able to check the Consistency and Inconsistency of the system of equations.
3. Find out Eigen values and Eigen vectors of the given Matrix.
4. Solve the first order first degree and higher order differential equations and apply them in real time environments.
5. Understand Laplace Transforms and perform various transformations and apply for linear differential equations and real-time signals.

2015-16

Malla Reddy Engineering College (Autonomous)

L T P
2 2 -

Course Code: 50B02 **Credits: 3**

B.Tech. - I Semester
APPLIED PHYSICS - I
(Common for CE, ME, EEE, ECE, CSE and Mining.Engg.)

Prerequisites: NIL

Objectives: The objective is to provide clear understanding of LASER, Optical Fiber, Ultrasonic and basic concepts of Statistical Mechanics to apply for Engineering and Technology problems.

Module- I: Optics **[9 Periods]**

Principle of superposition, Coherence - Spatial and Temporal; Introduction to Interference, Young's double slit experiment - Optical path difference and Fringe width - Interference in thin films (Reflected light) Cosine law – Newton's rings experiment - Determination of wavelength of light. Concept of diffraction, Diffraction grating as monochromator.

Module II: Laserand Optical Fibers

A: Laser: **[8 Periods]**

Characteristics of LASER; Absorption, Spontaneous and Stimulated transitions; Einstein's Coefficients and Relations between them; Population Inversion; Pumping - Optical and Electrical; Meta-stable State; Three and Four level pumping schemes; Ruby LASER; Helium-Neon LASER; Semiconductor Diode LASER; Applications of LASER - drilling, welding, data storage, optical signal processing and nuclear fusion.

B: Optical Fibers **[4 Periods]**

Principle of Optical Fiber; Acceptance angle and Acceptance cone, Numerical Aperture; Step and Graded index Optical Fibers and their Refractive Index profiles; Attenuation in Optical Fibers, Application of Optical Fibers - Medical, Level sensor and Communication system.

Module III: Acoustics & Ultrasonics

A: Acoustics **[4 Periods]**

Reverberation & Reverberation time, basic requirements of acoustically good hall; absorption Coefficient, Determination of absorption coefficient based on the standard times of reverberation, Sabine's formula (Qualitative treatment); Factors affecting the architectural acoustics and their remedies.

B: Ultrasonics **[8 Periods]**

Introduction, Concept of Magnetostriciton, Piezo and inverse Piezo electric effects; Production of Ultrasonic waves - Magnetostriction method; Piezo electric crystal method; Properties of Ultrasonic waves; Detection of Ultrasonics - Piezo electric detector, Kundt's tube, Sensitive flame method, Thermal detector; Applications - Communication, Industrial, Biological and Medical;

Module - IV: Waves and Vibrations **[9 Periods]**

Introduction, Differential equation for SHM and its solution; expression for energy of the oscillator; superposition of two linear SHMs (with same frequencies) - Lissajous figures; Damped vibrations - differential equation and its solution; Critical damping, under damping and over damping, logarithmic decrement; Qualitative treatment of Forced vibrations, sharpness of resonance, analogy between mechanical and electrical oscillator.

Module -V: Elements of Statistical Mechanics [8 Periods]

Introduction, Qualitative discussion on Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics, Properties of the Fermi-Dirac statistics, Photon Gas, Wien's displacement law, Rayleigh-Jeans Law, Planck's Law of black body radiation, Concept of Electron gas.

TEXT BOOKS:

1. K Vijay Kumar, S Chandralingam, "**Modern Engineering Physics**'', S. Chand and Company, 1st Edition, 2010.
2. D K Bhattacharya, Poonam Tandon, "**Engineering Physics**", Oxford University Press, 1st Edition, 2015.

REFERENCE BOOKS:

1) Eugene Hecht and A R Ganeshan, "**Optics**", Pearson Education, 4th Edition, 2015.
2) P K Palanisamy, **"Engineering Physics"**, SciTech Publication, 4th Edition, 2014.
3) B K Pandey and S. Chaturvedi, "**Engineering Physics**" Cengage Learning India Revised Edition, 2014.
4) R K Gaur and SL Gupta, "**Engineering Physics**" Dhanpat Rai Publications, Eighth Revised Edition, 2006.

COURSE OUTCOME:

After completion of the course, student will be able to:

1. Understand the concepts of Interference, diffraction, applications of LASER and Optical fibers.
2. Analyze the basic requirements of acoustically good hall, various production and Detection methods of ultrasonic besides the applications of ultrasonics.
3. Distinguish free, damped and forced vibrations.
4. Develop basic knowledge on the distribution functions and simple applications.

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Course Code: 50B03 **Credits: 3**

I-B.Tech.
Applied Chemistry
(Common for CE,ME,CSE,ECE,EEE and Mining.Engg)

Objectives:
The objective to make the learners aware of the standards and cleaning processes to maintain quality of water and to provide basic knowledge on electrochemistry, corrosion, polymers and energy science to apply for real-life situations.

Module I: Water **[10 Periods]**
Hardness of Water: causes of hardness, expression of hardness – units – types of hardness, Alkalinity of water specifications for drinking water (BIS and WHO standards); Estimation of temporary & permanent hardness of water by EDTA method - numerical problems. Boiler troubles – Scale &sludge, Priming and foaming, caustic embrittlement; Treatment of boiler feed water – Internal treatment (Phosphate, carbonate and calgon conditioning).External treatment – Lime Soda process and ion exchange process, Numerical Problems. Disinfection of water by chlorination and ozonisation.Desalination by Reverse osmosis.

Module II: Electrochemistry and Corrosion
A: Electrochemistry **[6 Periods]**
Introduction-Conductance-Specific and Equivalent conductance. Electrochemical cells-EMF, Galvanic Cells, calomel Electrode; Nernst equation and its applications- Batteries: Primary cells (dry cells) and secondary cells (lead-Acid cell, Ni-Cd cell). Applications of batteries.Fuel cells – Hydrogen – Oxygen fuel cell; Applications.
B: Corrosion: **[6 Periods]**
Causes and effects of corrosion: Theories of corrosion – Chemical & Electrochemical corrosion; Factors affecting rate of corrosion – Nature of metal and Nature of Environment – Corrosion control methods – Cathodic protection (Sacrificial anodic). Surface coatings: Metallic coatings & methods of application of metallic coatings - hot dipping (Galvanization), Cementation, Electroplating (Copper plating).

Module III: Polymers **[12Periods]**
Types of Polymerization-Chain (Free radical Mechanism)&Step growth. Plastics: Thermoplastic & Thermo setting plastics, Compounding& fabrication of plastics (Compression and injection moulding). Preparation, properties, engineering applications of PVC, Teflon of Nylon – 6,6 and Bakelite. Conducting polymers: Polyacetylene, Polyaniline, Mechanism of Conduction, doping; applications of Conducting polymers.Bio degradable polymers: poly lactic acid and poly vinyl acetate. Elastomers: Rubber-vulcanization.
Synthetic Rubber-preparatrion,properties and applications of BUNA-S,SBR.
Fibre-rerinforced polymers-properties and applications.

Module IV: Energy sciences &Combustion
A: Fuels **[6 Periods]**
Classification – solid fuels: coal – analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining. cracking- fixed bed catalytic cracking. Knocking – octane and cetane rating. Bio-diesels-advantages. Gaseous fuels - constituents, characteristics and applications of natural gas, LPG and CNG.
B: Combustion **[6 Periods]**
Definition, Calorific value of fuel – HCV, LCV; Determination of calorific value by Junkers

gas calorimeter – Numerical problems on combustion. Renewable energy sources-solar, wind, hydro power and biomass energy advantages, disadvantages and Applications

Module V: Composites, Nano Chemistry and Green Chemistry

A: Composites: **[3 Periods]**

Basics of composites, composition and characteristics-types of composites –particle and fiber reinforced composites and their applications..Concept of Bio-fuels,Bio sensors,BiSurfactants.

B: Nano Chemistry: **[3 Periods]**

Introduction and classification of Nanomaterials (Fullerence, Carbon nano tubes and nanowires only) - Application of nanomaterials. Brief introduction to nanocomposites

C: Green Chemistry: **[4 Periods]**

Introduction, principles of green chemistry, introduction to ultrasonic and microwave assisted reactions. Concept of R4M4 (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional, Multitasking and Multi-tracking).

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "**A text Book of Engineering Chemistry"**, DhanpatRai Publications, New Delhi, 12th Edition 2006.
2. Engineering chemistry by M.Thirumala Chary and E.Laxminarayana,Sci-Tech publications.
3. Engineering chemistry by R.P. Mani and B.Rama Devi by Cengage Learning India Pvt.Ltd.

REFERENCE BOOKS:

1. F.W. Billmeyer, "**Text Book of Polymer Science"**, John Wiley & Sons, 4th Edition, 1996.
2. M.G. Fontana, N. D. Greene, "**Corrosion Engineering"**, McGraw Hill Publications, New York, 3rd Edition, 1996.
3. B.R.Puri,L.R.Sharma&M.S.Pathania,"**Principles of Physical Chemistry",** S.Nagin Chand &Co., New Delhi, 23rd Edition, 1993.
4. P.W. Atkins and de Paula Julio, "**Physical Chemistry**", Oxford University Press, 8th Edition, (Indian Student Edition), 2009.
5. G.A.Ozin and A.C. Arsenault,"**Nanochemistry: A Chemical Approach toNanomaterials**", RSC Publishing, 3rdEdition, 2005.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand Water treatment, specifically hardness of water.
2. Acquire knowledge on Electrochemical cell, fuel cells, batteries and its applications.
3. Understand the properties and uses of polymeric materials.
4. Analyze the combustion mechanism of various types of fuels(solid,liquid,gas)
5. Acquire basic knowledge on the concepts of Composites,Nano and Green Chemistry

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Course Code:50501 **Credits: 3**

B.Tech. – I Semester

COMPUTER PROGRAMMING

(Common for CE, EEE, ME, ECE, CSE andMining.Engg)

Prerequisites: Nil.

Objectives: To develop programming concepts using C language to solve engineering and technology related problems.

ModuleI:Fundamentals& Introduction to C Language

A: Fundamentals: **[4 Periods]**

Hardware, Software, Programming languages, Translators, Introduction to Operating System, Program Development steps-Algorithm, Flow chart, Number Systems.

B: Introduction to C Language **[8 Periods]**

History, Simple C Program, Identifiers, Basic data types, User-defined data types, Variables, Constants, Type qualifiers, Managing Input / Output, Operators, Precedence and Associativity, Expression Evaluation, Type conversions, Simple C Programming examples.

Module II: Control Statements& Arrays

A: Control Statements: **[6 Periods]**

Conditional statements- if and switch statements, ?operator; Loop Control Statements – while, for, do-while statements, C Programming examples, Other statements related to control statements – break, continue, goto, C Programming examples.

B: Arrays **[4 Periods]**

Basic concepts, One-dimensional arrays, Two–dimensional arrays, Multi-dimensional arrays, C programming examples.

Module III: Strings&Functions

A: Strings: **[5 Periods]**

Basic concepts, String Input / Output functions, Arrays of strings, String handling functions, C programming examples.

B: Functions **[6 Periods]**

Basics, User defined functions, Interfunction communication, Standard functions, Storage Classes-auto, register, static, extern, Scope rules, Array and string manipulations using functions, Recursive functions, C programming examples.

Module IV: Derived types, Pointers & Preprocessor Directives

A: Derived types:[3 Periods]

Structures – Basic concepts, Nested structures, Arrays of structures, Structure manipulations using functions, Unions, bit fields, C programming examples.

B: Pointers: **[6 Periods]**

Basic concepts, Pointer arithmetic, Pointers and functions, Pointers and strings, Pointers and arrays, Pointers and structures, Self-referential structures, Dynamic Memory Allocation, C programming examples.

C: Preprocessor Directives: **[2 Periods]**

Include, define.

Module V: File I/O&Searching and Sorting:

A: File I/O: **[5 Periods]**

Basic concepts, Text files and Binary files, File input / output operations, File status functions (errorhandling), Command-Line Arguments, C programming examples

B: Searching and Sorting: [5 Periods]
Sorting- selection sort, bubble sort, insertion sort, Searching-linear and binary search methods.

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh,**"Programmingin C**", Oxford University Press, 2nd Edition, 2011.
2. E Balagurusamy, "**Computer Programming"**, Tata McGraw Hill,.1st Edition, 2013.

REFERENCES BOOKS:

1. Brian W. Kernighan, Dennis M. Ritchie, "**The C Programming Language"**, PHI, 2nd Edition, 1990.
2. Greg Perry and Dean Miller, "**C ProgrammingAbsolute beginner's guide**", QUE Publishers, 3rd Edition, 2013.
3. Paul Deitel and Harvey Deitel, "**C How to Program"**, PHI, 7th Edition, 2012.
4. Behrouz A. Forouzan, E.V.Prasad, Richard F.Gilberg, "**C programming: A Problem- Solving Approach**", Cengage Learning Press, 1st Edition, 2011

COURSE OUTCOME:

After completion of this course, student will be able to:

1. Write, compile and debug programs in C language.
2. Design programs involving decision structures, loops, arrays and functions.
3. Explain the difference between call-by-value and call-by-reference
4. Understand the dynamic allocation of memory by using pointers.
5. Use different file operations to create/update basic data files.
6. Use simple searching and sorting methods.

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Course Code: 50301 **Credits: 3**

B.Tech. – I Semester
ENGINEERING GRAPHICS
(Common for CE, MEand Mining.Engg)

Prerequisites: Mathematical Geometry.
Objectives: Ability to transform data into drawing to communicate with engineers manually and with the help of AutoCAD software.

Module I: Introduction to Engineering Drawing[Periods: 6T+12P]
Principles of Engineering Drawing – Drawing instruments – BIS Conventions - Lettering and Dimensioning practices.
Curves: Constructions of Curves used in Engineering Practice:
a) Conic Sections- General method only
b) Cycloid, Epicycloid and Hypocycloid
c) Involutes
Scales: Construction of different types of Scales- Plain, Diagonal and Vernier scale.

Module II: Orthographic Projections:[Periods: 5T+10P]
Projection: Principles of Orthographic Projections – Conventions – First Angle projections.
Projection of Points- Including Points in all four quadrants.
Projection of Lines - Parallel, perpendicular, inclined to one reference plane and inclined to both reference planes. True length and true angle of a line.

ModuleIII: Projection of Planes& Projection of Solids
A: Projection of Planes :[Periods: 3T+6P]
Plane parallel, perpendicular, inclined to one reference plane and Plane inclined to both the reference planes.
B: Projection of Solids:[Periods: 3T+6P]
Projections of regular solids, cube, prism, pyramid, tetrahedron, cylinder and cone. Axis inclined to both the reference planes.

Module IV: Development of Surfaces&Isometric Projections
A: Development of Surfaces :**[Periods: 3T+6P]**
Development of Surfaces of Right Regular Solids – Prism, Pyramid, Cylinder, and Cone.Frustum and Truncated solids.
B:Isometric Projections:[Periods: 3T+6P]
Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions –Plane Figures, Simple and Compound Solids

ModuleV: Transformation of Projections& Introduction to Auto CAD:
A: **Transformation of Projections :[Periods: 4T+8P]**
Conversion of Isometric Views to Orthographic Views.Conversion of orthographic views to isometric views – simple objects.
B:Introduction to AutoCAD: [Periods: 1T+2P]
Basic Display, Construction, Editing and dimensioning Commands.

TEXT BOOKS:

1. N.D. Bhat,"**Engineering Drawing"**, Charotar Publishing House, 53rd Edition, 2014.
2. BasantAgrawal**, "Engineering Drawing"** – Tata McGraw Hill, 2nd Edition, 2013.

REFERENCE BOOKS:

1. K.L.Narayana, P. Kannaiah, "**Engineering Drawing"**, SciTech Publishers. 2nd Edition, 2013
2. K. Venugopal, "**Engineering Drawing"**, New Age International Publishers, 3rd Edition, 2014.
3. Trymbaka Murthy, "**Computer Aided Engineering Drawing"**, I.K. international Publishing House, 3rd Edition, 2011.

COURSE OUTCOME:

After completion of the course, students will be able to

1. Understand the importance of curves, Projection of lines, planes and solids in Engineering applications
2. Convert orthographic views to isometric views and vice-versa.
3. Familiarize with AutoCAD two dimensional Commands.

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Course Code: 50B05 **Credits: 2**

I-B.Tech.
Applied Chemistry Lab
(Common for CE,ME,CSE,ECE,EEE and Mining.Engg)

List of Experiments:

1. Calibration of Volumetric apparatus.
2. Estimation of Hardness of water by EDTA Method.
3. Estimation of acid by pH metry.
4. Estimation of alkalinity of water.
5. Estimation of strong acid by Conductometry.
6. Estimation of strong acid by Potentiometry.
7. Determination of ferrous iron in cement by colorimetry.
8. Determination viscosity of given liquids.
9. Preparation of Bakelite.
10. Preparation of Thiokol Rubber.
11. Determination of surface tension of given sample using stalagnometer.
12. To Study the inversion of cane sugar by polarimeter.

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Course Code:50502 **Credits: 2**

B.Tech. – I Semester

COMPUTER PROGRAMMING LAB

(Common for CE, EEE, ME, ECE, CSE andMining.Engg)

1.

a) Practice various Menu items and debugging techniques in IDE.
b) Practicing sample C programs using Conversion specification.
c) Implement various programs logics using algorithms and flowcharts.

2.

a) Write a C program to find smallest and largest of given three numbers.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C program to implement basic arithmetic operations.

3.

a) Write a C program to find the sum of individual digits of a positive integer.
b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
c) Write a C program to find whether the given number is palindrome, perfect, Armstrong or strong.
d) Write a C program to generate all the prime numbers between n1 and n2, where n1 and n2 are values supplied by the user.

4.

Write C programs that use both recursive and non-recursive functions

a) To find the factorial of a given integer.
b) To find the GCD (greatest common divisor) of two given integers.

5.

a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program that uses functions to perform the following:
   i) Addition of Two Matrices
   ii) Multiplication of Two Matrices

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a) Write a C program that uses functions to perform the following operations:
   i) To insert a sub-string into given main string from a given position.
   ii) To delete n characters from a given position in a given string.
b) Write a C program to determine if the given string is a palindrome or not
c) Write a C program to find substring in a given string.
d) Write a C program to count the lines, words and characters in a given text.

7.

a) Write a C program to construct a pyramid of numbers.
b) Write a C program to generate Pascal‘s triangle.

8.

Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots + x^n$

For example: if n is 3 and x is 5, then the program computes 1+5+25+125. Print x, n, the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.

9.

a) 2‘s complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2‘s complement of 11100 is 00100. Write a C program to find the 2‘s complement of a binary number.

b) Write a C program to convert a Roman numeral to its decimal equivalent.

10.

a) Write a C program that uses functions to perform the following operations:
   i) Reading a complex number
   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Multiplication of two complex numbers
   (Note: represent complex number using a structure.)

b) Write a C program to find grades of a student’s using structures and unions.

11.

a) Write a C program which copies one file to another.

b) Write a C program to reverse the first n characters in a file.
   (Note: The file name and n are specified on the command line)

12.

a) Write a C program that uses non-recursive function to search for a Key value in a given list of integers using Linear search.

b) Write a C program that uses non-recursive function to search for a Key value in a given sorted list of integers using Binary search.

13.

a) Write a C program that implements the Selection sort method to sort a given array of integers in ascending order.

b) Write a C program that implements the Bubble sort method to sort a given list of names in ascending order.

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Course Code: 50302 **Credits: 2**

B.Tech. – I Semester
ENGINEERING WORKSHOP
(Common for CE, ME and Mining.Engg)

Objectives:

1. To understand the usage and applications of hand tools.
2. To acquire the skills in pattern/model making.
3. To familiarize with various work materials and tool materials.

I. Trades for Exercises:

At least two exercises from each trade:

a) Carpentry
b) Fitting
c) Tin-Smithy
d) House-wiring
e) Foundry
f) IT workshop – Hardware identification and connectivity, assembling, disassemblingand OS Installation.

II. Trades for Demonstration

a) Machine shop
b) Plumbing
c) Identification of Electronic Components.

TEXT BOOKS:

1. P. Kanniah, K. L. Narayana, "**Work Shop Manual"**, SciTech Publishers, 2nd Edition, 2009.
2. K. Venkat Reddy, "**Work Shop Practice Manual"** by,B.S. Publications, 6th Edition, 2015.

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Course Code: 50A01 **Audit Course**

B.Tech. – I Semester
NSS, SPORTS& YOGA
(Common for CE, EEE, ME, ECE, CSE andMining.Engg)

Course objectives:

- To develop physical skills and fitness specific to a particular sport.
- It also is intended to help them appreciate the sport while being able to execute the strategies while playing the game/sport.
- Provide them the training and coaching towards achieving their group goals.
- To give the students health and physical fitness to ensure mental and emotional balance.
- NSS (**National Service Scheme)** provides ample opportunities for the students to participate in the community service programs
- To encourage them to become socially and environmentally sensitive, empathetic and responsible individuals of the nation.

Module I: [2 Periods]
Introduction of physical education: Importance of physical education, Athletics (Track events and combined events), Basket ball, Throw ball, Foot ball.

Module II: [2 Periods]
Youth and yoga- yoga as a tool for healthy lifestyle, Yoga as a preventive, promotive & curative method.Pranayam and Different Yoga traditions and their impacts.
Various competitions at different levels- Athletics (field events), volleyball, handball, cricket. Indoor games: Table Tennis, Caroms, chess

Module III : [4 Periods]
Introduction and Basic concepts of NSS: History, Philosophy, aims & Objectives of NSS, Emblem, Motto, Song and Other Components of NSS, **NSS Programmes and Activities-Concept of regular activities,** Special camping, Day camps. Basis of adoption of villages/ slums & methodology of survey.

Module IV: [6 Periods]
Volunteerism and Shramdan- needs &Importance of Volunteerism, Motivation and Constraints of Volunteerism, Shramdan as a part of Volunteerism.**Environmental Issues-** Natural Resource Management (Rain water Harvesting, energy conservation etc.). Waste Management, Disaster Management- Role of youth in Disaster Management.
Civil / Self Defense- Aims and objectives of Civil defense and need for self defense training.

REFERENCE BOOKS:

1. Pamela Grundy & Susan Shackleford, "**Shattering the Glass: The Remarkable History of Women in Basketball**" Published 15th May, 2007.
2. Roger Kahn, "The **Boys of summer**", 1st Edition, May 9th 1973.
3. Jaci Burton, "**Perfect Play"**, 1st Edition, Feb 1st 2011, series 1.
4. Silva Mehta, Mira Mehta and Shyam Mehta, **"Yoga: The Iyengar Way",** Published by Knopp, 7th April, 1990.
5. Vishnu-Devananda, **"The Complete Illustrated Book of Yoga",** 18th April, 1995.
6. Timothy McCall, **"Yoga as Medicine: The Yogic Prescription for Health and Healing",** published by Harmony, 31st July 2007.
7. Christopher G. Petre, **"Social Work with Children and Their Families: Pragmatic Foundations "**, Journal Vol:24, No.3, September 18th, 2003, 2nd Edition.
8. Rashmi Bansal, "**Stay Hungry Stay Foolish",** 1st December 2008.

9. Beverly Schwartz, "**Rippling: How Social Entrepreneurs Spread InnovationThroughout the World"**, Published by Jossey – Bass, May 27th 2012.

COURSE OUTCOME:

On completion of this course students will be able to:

1. Develop physical fitness and will know the rules and regulations of various games.
2. Emerge victorious in Inter College and inter University competitions.
3. Will build a sense of social and civic responsibility in the students.
4. Participate with confidence and leadership qualities.

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Course Code: 50H01 **Credits: 2**

B.Tech – II Semester
ENGLISH
(Common for CE, ME and Mining.Engg)

Objectives:

To facilitate for the improvement of the English language competency of the students in English with emphasis on all language components namely grammar, vocabulary, listening skills, speaking skills, reading skills and writing skills.

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

ModuleI: **[6 Periods]**

Chapter entitled '**Going Places: Travel'** from *Resonance: English for Engineers and Technologists* published by Foundation Books

Speech **:** Grammar of Anarchy by Dr. B. R. Ambedkar
Vocabulary **:** Formation of words, prefixes, suffixes and root words
Grammar **:** Tense, aspect and concord
Reading **:**Skimming and Scanning
Writing **:**Introduction to writing skills, characteristics of effective writing

ModuleII:[6 Periods]

Chapter entitled **'Reaching Out: Mass Media**' from *Resonance: English for Engineers and Technologists* published by Foundation Books

Speech **:** Need of Discipline and Visionary Young India by Dr.APJ Abdul Kalam
Vocabulary **:** Homonyms, homophones, homographs
Grammar **:** Direct and Indirect Speech
Reading **:** Intensive Reading and Extensive Reading
Writing **:** Paragraph writing- use of cohesive devices; arranging jumbled sentences into paragraph

ModuleIII:[6 Periods]

Chapter entitled **'Ushering in a New Era: Networking'** from *Resonance: English for Engineers and Technologists* published by Foundation Books

Short Story **:** Death of a Hero by Jai Nimbkar
Grammar **:** Question Tags; Degrees of Comparison
Vocabulary **:** Idiomatic Expressions; Phrasal Verbs
Reading **:** Reading for theme and gist.
Writing **:** Essay Writing

Module IV:[6 Periods]

Chapters entitled '**Morphed Universe: Technology as a Double- edged Sword'** from *Resonance: English for Engineers and Technologists* published by Foundation Books

Short Story **:** The Doctor's Word by R.K. Narayan
Grammar **:** Voice – exercises
Vocabulary **:** One word substitutions; synonyms and antonyms
Reading **:** Reading for interpretation
Writing **:** Letter writing- both formal and informal

Module V:[6 Periods]

Chapter entitled **' The Indomitable Human Spirit: Facing Disasters'** from *Resonance: English for Engineers and Technologists* published by Foundation Books

Short story **:** Once There was a King by Rabindranath Tagore
Grammar **:** Types of Sentences, Conditionals
Vocabulary **:** Gender sensitive language, integrated exercises in vocabulary

Reading **:** Reading for specific purposes
Writing **:** Summarizing
* Exercises from the texts not prescribed shall also be used for classroom tasks.

Textbooks:

In order to improve the proficiency of the student in the acquisition of grammar, error free language, the following text and course content, divided into Five Units, is prescribed.

1. Elango, et all **,** ***Resonance:"English for Engineers and Technologists",*** published by Foundation Books, 2nd Edition, 2012.
2. Sudha Rani, et all,***"The Enriched Reading",*** published by Pearson Publications, New Delhi, 1st edition, 2015.

For Grammar practice

1. Sudha Rani Et all,*"**A Work Book on English Grammar and Composition",*** published by Tata Mac Graw –Hill, New Delhi, 2nd Edition, 2012.

Reference Books:

1. Azar, Betty and Stacy A. Hagen***: "Understanding and Using English Grammar***", Foundation Books, 4th Edition, 2009.
2. Chaudhuri ,Santanu Sinha: ***"Learn English: A Fun Book of Functional Language, Grammar, and Vocabulary",***Tata McGraw Hill Education,New Delhi, Paper Back Edition. 2013.
3. Eastwod, John: "***Oxford Guide to English Grammar",***Oxford University Press, 4th Edition, 1994.
4. Field, Marion**: "*Improve Your Written English"***, Kindle books, 5th Edition, 2009.
5. G. Leech and J. Svartvik (1975), "***A Communicative Grammar of English"***, London: Longman, 3rd Edition, 2002.
6. Murphy, Raymond**: "*Intermediate English Grammar"***,Foundation Books Pvt Limited, 2nd Edition, 2013.
7. Murphy, Raymond: "***Essential English Grammar: A Self-Study Reference and Practice***

Bookfor Intermediate Students of English with Answers", Cambridge University Press, 2nd Edition, 2007.
8. Swan, Michael: "***Basic English Usage",*** Oxford University Press, 1st Edition, 1984.

Related Websites:

1. http://www.slideshare.net/aszardini/word-formationroot-words-prefixes-and-suffixes
2. http://www.scribd.com/doc/37085980/Circulars-Circular-Letters-Notices-Memo#scribd
3. http://www.zsme.tarnow.pl/jezykiobce/wp-content/uploads/2013/11/writing-letters1.pdf.

COURSE OUTCOME:

1. Use of English Language, written and spoken.
2. Enrichment of language accuracy and fluency.
3. Gaining confidence in using English language and skills for writing in real life situations.
4. Ready to employ extensive and intensive reading skills

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Course Code: 50B06 **Credits: 4**

B.Tech – II Semester
COMPUTATIONAL MATHEMATICS
(Common for CE, ME, CSE & Mining.Engg)

Objectives: The course introduces various numerical techniques which are indispensible tools to solve many algebraic and transcendental equations. Mathematical methods are useful to reduce the global error involved in approximations.

MODULE – I: Algebraic and Transcendental Equations [12 Periods]
A: Introduction - Errors, types of errors, approximations, truncation error Solution of Algebraic and Transcendental Equations: The Bisection Method.
B: The Method of False Position - The Iteration Method – Newton-Raphson Method – Ramanujan's method to find smallest root of an equation.

MODULE – II: Interpolation: [12 Periods]
A: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences-Backward differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton's formulae for interpolation
B: Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

MODULE – III: Curve Fitting, Numerical Differentiation & Integration [12 Periods]
A: Curve fitting: Fitting a first degree (linear) and second degree (parabola), exponential, power curves for a data by the Method of least squares.
B: Numerical Differentiation & Integration: Evaluation of derivatives – Evaluation of maximum & minimum for a given data.
Numerical Integration: Trapezoidal Rule, Simpson's $1/3^{rd}$, 3/8 Rule.

MODULE – IV: Numerical solution of Ordinary Differential Equations[12 Periods]
A: Solution by Taylor's series method - Picard's Method of successive Approximations - Euler's Method-Modified Euler's Method –
B: Runge-Kutta Methods - Predictor-Corrector Methods: Milne's method - Adams- Bashforth Method.

MODULE – V: Numerical solution of PDE [12 Periods]
A: Classification of second order equations – Finite difference approximations to derivatives - standard 5 point formula – diagonal 5 point formula – solution of Laplace equation.
B: Solution of poission's equation. Solution of one dimensional heat, wave equations (by Crank-Nicolson explicit/implicit formula only).

TEXT BOOKS:

1) Introductory Methods of Numerical Analysis by S.S. Sastry, Prentice-Hall of India Private Limited.2003
2) NUMERICAL METHODS IN ENGINEERING & SCIENCE (WITH PROGRAMS IN C, C++ &MATLAB) BY B.S. GREWAL, KHANNA PUBLISHER. 2014
3) Numerical Methods for Scientists and Engineers by Sankara Rao K., Prentice-Hall. 7^{th} Edition, 2008

REFERENCES BOOKS:

1) Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Pub. House, Delhi.
2) Mathematical Methods of Science and Engineering by Kanti B.Datta ,Cengage Learning
3) Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
4) Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education.

COURSE OUTCOME:

After completion of this course, students will be able to:

1. Distinguish the error in exact and approximate methods and able to solve the algebraic and Transcendental equations.
2. Interpolate and predict the given data specifically using methods like Newton's , Gauss Siedal etc.
3. Fit the given data linear or Non-linear like first , second order and exponential
4. To find out the Numerical Differentiation and Integration from the given Tabular data.
5. To provide solutions to various ODE and PDE using various methods like Runge-Kutta methods, Adams- Bash forth, Method of Separation of Variables.

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Course Code: 50B07 **Credits: 3**

B.Tech. - II Semester
APPLIED PHYSICS - II
(Common for CE, EEE, ME, ECE, CSE and Mining.Engg)

Prerequisites: NIL

Objectives:
The objective to provide clear understanding of magnetism and super conductivity, quantum Mechanics and nanomaterial to apply for Engineering and Technical problems

Module I: Magnetism & Superconductivity [9 Periods]
Magnetic field and Magnetization, magnetic susceptibility, paramagnetism in transition, rare earth elements; magnetization and total angular momentum (definition and relationship);
Ferromagnetism, Anti ferromagnetism and Ferrimagnetism; Curie temperature, Hysteresis;
Concept of Perfect Diamagnetism; Meissner effect ; Type I and II Superconductors; BCS theory (qualitative); Applications of Superconductors - Smart magnets, SQUIDs, transmission lines, Mag-Lev Train.

Module II: Quantum Mechanics [8 Periods]
Louis De-Broglie's concept of Matter Waves; Davisson and Germer's experiment; Heisenberg's Uncertainty Principle, Illustration - Why an electron cannot exist in the nucleus?; Schrödinger's Time Independent Wave Equation - Physical Significance of the Wave Function; Energy of a particle in a one dimensional infinite potential well; Concept of
Potential barrier (Tunneling effect)

Module III: Band Theory of Solids & Semiconductor Physics
A: Band Theory of Solids: [8 Periods]
Qualitative discussion of Classical free electron theory, Fermi - Dirac distribution,
Qualitative discussion of Quantum free electron theory; Electron in a periodic Potential (Bloch Theorem), Kronig-Penny Model (Qualitative Treatment), Origin of energy Band formation in solids, Classification of materials into Conductors, Semi-Conductors &Insulators, Concept of effective mass of an electron.
B: Semiconductor Physics [9 Periods]
Direct and Indirect band gap semiconductors, Expression for Charge carrier concentration in Intrinsic semiconductors; Fermi Level in Intrinsic Semiconductors (Derivation) and Extrinsic semiconductor (dependence on temperature and doping concentration); concept of drift and diffusion currents, Continuity equation, Hall Effect; Photo conductivity, optical response, LED materials, Construction of LED; LCD- characteristics of Liquid crystal materials; actionof LCD display device; numeric displays;

Module IV: Physics of Nanomaterials [9 Periods]
Introduction - Nano scale, Surface to volume ratio and Quantum confinement; Optical Properties, Electrical properties; brief description of different methods of synthesis of nano materials - physical (LASER ablation, Ball milling), chemical (Vapor deposition, Sol - gel); Carbon nanotubes - properties and applications**,** Applications of nano materials - automobiles, electronics, medical, cosmetics, textile.

Module V: Electromagnetic Theory [7 Periods]
Gradient of Scalar field and its Physical Significance; Divergence and Curl of Vector field; Qualitative treatment of Gauss's Law of electrostatics and Gauss law of magnetostatics, Ampere's law, Faraday's law of electromagnetic induction, Induced E.M.F in a conductor, Lenz's Law , Displacement current, Maxwell equations in differential form, wave equation for free space.

TEXT BOOKS:

1. K Vijay Kumar, S Chandralingam, "**Modern Engineering Physics**'', S. Chand and Company, 1st Edition 2010.
2. D K Bhattacharya, Poonam Tandon, "**Engineering Physics**", Oxford University Press, 1st Edition, 2015.
3. David J Griffiths "**Introduction to Electrodynamics**" Prentice Hall, 4th Edition, 2012.

REFERENCE BOOKS:

1. Callister W D Jr, "**Material Science and Engineering: An introduction**", John Wiley & Sons Publications, 8th Edition, 2010.
2. P K Palanisamy, "**Engineering Physics"**, 4th Edition, SciTech Publications, 2014.
3. Ghatak Ajay and Lokanatham, "**Quantum Mechanics"**, Springer Publications, 1st Edition, 2014.
4. G Prasad and Bhimashankaram, "**Engineering Physics"**, B S Publications, 3rd Edition, 2008.
5. Sulabha K. Kulkarni, "**Nano technology - Principles and practices"**, Springer Publications.3rd Edition, 2014.
6. A K Sawhney, "**Electrical and Electronic Measurements and Instrumentation"**, Dhanpatrai and Sons publications, 19th revised Edition, 2014.

COURSE OUTCOME:

After completion of the course, student will be able to:

1. Distinguish ferro, ferri and anti-ferro magnetic materials and understands different types of superconductors.
2. Understand the Kronig penny model after having learnt one dimensional infinite Potential well problem. This knowledge will further help them to understand the concepts related to semi conductors.
3. The various synthesis methods of nano materials and different applications.
4. Students able to get basic knowledge on electromagnetic theory.

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Course Code: 50303 **Credits: 3**

B.Tech. – II Semester
ENGINEERING MECHANICS
(Common for CE, ME and Mining.Engg)

Prerequisites: Fundamental concepts of Physics
Objectives: The objective of this subject is to provide the basic concepts of effect of system of forces on rigid bodies, Geometrical Properties of Planes and Solids, problem solving in kinematics and kinetics using different methods.

Module I: Introduction &Systems of Forces
A: Introduction: **[Periods 2]**
Basic Concepts, Laws of Motion, Force-types, characteristics- Principle of transmissibility.
B: Systems of Forces: [Periods 10]
Classification**,** Coplanar Concurrent Forces – Components of force– Resultant- Triangle law of Forces-Polygon law of Forces- Parallelogram Law of Forces-Resolution and composition of Forces– Coplanar Non-Concurrent System of Forces, Resultant of Parallel system of Forces - Moment of Force and its Application – Varignon's theorem, Couples.
Module II: Equilibrium of Systems of Forces: **[Periods 10]**
Free Body Diagrams, Types of Supports and their reactions, Internal and External Forces - Types of Equilibrium, Equations of Equilibrium, Conditions of Equilibrium, Equilibrium of bodies under Coplanar concurrent system of forces – Lami's Theorem, Converse of the Triangle law of forces, converse of the polygon law of forces.

Module III: Centroid, Centre of Gravity, Area Moment of Inertia and Mass Moment of Inertia
A: Centroid : **[Periods 3]**
Centroids of Lines and Areas (from basic principles) –simple figures– Centroid of Composite Figures- Centroid of L, T, I, Z and channel Sections.
B: Centre of Gravity:[Periods 3]
Centre of gravity of simple solids (from basic principles), centre of gravity of composite solids, Pappu's-Guldinus theorems.
C: Area moment of Inertia:[Periods 3]
Definition –Moment of Inertia of plane areas, Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Moment of Inertia of L, T, I, and channel Sections.
D: Mass Moment of Inertia: [Periods 3]
Moment of Inertia of Simple solids, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

Module IV:- Kinematics & Kinetics
A: Kinematics: [Periods 5]
Rectilinear motion – Motion of Rigid Body under uniform and variable accelerations – motion under gravity-curvilinear motion -Projectiles-rotary motion, kinematics of general plane motion.
B: Kinetics: [Periods 5]
Analysis as a Particle and Analysis as a Rigid Body in Translation – D'Alemberts Principle – Connected bodies- Kinetics of rotating bodies- Equations of Plane Motion– Rolling Bodies.

Module V: Work, Power and Energy & Impulse-Momentum principle
A: Work, Power and Energy: [Periods 7]
Work-energy equation for translation-connected bodies on horizontal and inclined planes-pulleys-Work done by a spring-Work-energy equation to rotary motion and general plane motion.

B: Impulse-Momentum principle: [Periods 3]
Linear impulse and momentum-connected bodies-pile & hammer.

TEXT BOOKS:

1. S.Timoshenko, DH Young, JV Rao, SukumarPati, "**Engineering Mechanics"**, McGraw Hill Education Publisher,5th Edition(Special Indian Edition), 2013.
2. S.S. Bhavikatti, "**A Textbook of Engineering Mechanics"**, New Age International publishers,1st Edition,2008.
3. D.S.Kumar Patil, "**Engineering Mechanics"**, SK Kataria& Sons Publishers, 2nd Edition, 2009.

REFERENCES BOOKS:

1. Fedinand . L. Singer,**"Engineering Mechanics"**, Harper & Row Publishers, 3rd Edition, 1975.
2. K.Vijaya Kumar Reddy, J. Suresh Kumar**, "Engineering Mechanics"**, B S Publications, 3rd Edition, 2013.
3. R.S. Khurmi, "**A Text Book of Engineering Mechanics"**, S.Chand Publications, 21st Edition, 2007.
4.K L Kumar, "**Engineering Mechanics"**,TataMcGrawHillEducation,4th Edition, 2011.

COURSE OUTCOME:

After completion of this course, students will be able to:

1. Understand the basic concepts and types of forces.
2. Analyze centroid & centre of gravity, moment of inertia of different Planes and solids.
3. Apply De Alembert's principle, work-energy method and Impulse Momentum principle to solve dynamics problems.

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Course Code: 50202 **Credits: 4**

B.Tech. – II Semester

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common for CE, ME and Mining.Engg)

Prerequisites: NIL

Objectives: The objective of this Course is to provide an introductory and broad treatment of Electrical and Electronics Engineering.

ModuleI: Introduction to Electrical circuits [12 Periods]

Ohm's Law and Kirchhoff's Laws; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources-passive elements-Electromagnetism-Faradays Laws, Lenz's Law, concepts of self- inductance, mutual inductance and coefficient of coupling Network theorems-superposition theorem, maximum power transfer theorem, Thevenin's theorem (Statement only)

Module II: Single Phase A.C. Circuits [10 Periods]

Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current phasor representation of alternating quantities; series RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor

ModuleIII:Single phase transformers &3-PhaseInduction Motors[14 Periods]

A: Single phase transformers:

Principle of operation- construction details (core and shell types) - EMF equation, losses, efficiency

Alternators (or) Synchronous Generators:

Principle of operation; Types and constructional features; EMF equation-voltage regulation – EMF method

B: 3-PhaseInduction Motors

Principle of operation, types- Slip - Applications of squirrel cage and slip ring motors - speed-torque characteristics, speed control of 3-phase induction motor (stator voltage control technique only).

ModuleIV: Electronic Devices&Rectifiers

A: Electronic Devices [6 Periods]

PN Junction diode – symbol -principle of operation – characteristics, applications of diode Transistor- types- characteristics- Input and Output characteristics of transistor- Common Base, Common Emitter, and Common collector configurations- applications of a transistor - MOSFET – types- (Enhancement and depletion mode)- characteristics.

B: Rectifiers [5 Periods]

Half wave rectifier and full wave Rectifier with and without filter– ripple factor

ModuleV:Amplifiers & Basic Digital Electronics [5 Periods]

A: Amplifiers:

Principle of operation – types of amplifiers- h-parameter representation of a transistor- voltage gain, current gain, Input impedance and Output impedance-Introduction to feedback Amplifier.

B: Basic Digital Electronics [5 Periods]

Binary Number Systems and Codes; Basic Logic Gates and Truth Tables, Boolean Algebra, De Morgan‟s Theorems, Logic circuits, Flip-Flops –SR, JK, D type

TEXT BOOKS:

1. Nagrath I.J. and D. P. Kothari, "**Basic Electrical Engineering"**, Tata McGraw Hill, 3rd Edition, 2010.
2. R. S. Sedha, "**A Text Book of Electronic Devices and Circuits"**, S.Chand& Co., 7th Edition, 2008.
3. Thomas L. Floyd and R. P. Jain, "**Digital Fundamentals"**, Pearson Education, 10th Edition, 2011.

REFERENCE BOOKS:

1. R.L.Boylestad & Louis Nashlesky, "**Electronic Devices &Circuit Theory"**, Pearson Education, 10th Edition, 2009.
2. P.S.Bimra, "**Electrical Machinery"**, Dhanapatrai Publications, 7th Edition, 2012.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Learn how to develop and employ circuit models for elementary electrical components, e.g., sources, resistors, inductors, capacitors.
2. Determine voltages, currents, turns-ratios and power for single-phase transformers and synchronous generators.
3. Calculate motor horsepower, speed, slip, efficiency, power factor, and torque of three phase induction motor and applications.
4. Understand different electronic devices and application .of diodes in rectifiers.
5. Design digital control circuits to suite for engineering problems.

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Course Code: 50H02 **Credits: 2**

B.Tech. – II Semester
ENGLISH LANGUAGE LAB
(Common for CE, MEandMining.Engg)

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:
To sensitize the students to the intelligibility in their pronunciation of English, speech sounds, word accent, intonation and rhythm
To improve the fluency in spoken English and neutralize mother tongue influence
To facilitate honing of listening and speaking skills of students
To train students to understand nuances of both verbal and non verbal communication during all activities
To develop confidence to face the audience and participate in activities
To help the students shed inhibitions and communicate with clarity

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, awareness regarding 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
• Just A Minute(JAM) Sessions.

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

Module I:
CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session
Listening: listening for sounds in context, for ideas.

Speaking: ideation and translation of ideas into sentences.

Module II:
CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms -Consonant Clusters.
ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette.
Listening: listening for specific purposes, for details.
Speaking: speaking in the above situations with clarity, connectivity, maintaining voice characters.

Module III:
CALL Lab: Word accent and Listening Comprehension-reading(aloud) meaningfully.
ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.
Listening: listening for intelligible English
Speaking: formal and informal conversations, register.

Module IV:
CALL Lab: Intonation and Common errors in Pronunciation- reading aloud(evaluating through recording).
ICS Lab: Extempore- Public Speaking , Oral Presentation Skills
Listening: note taking and listening for speaker's tone/attitude
Speaking: organizing , connecting ideas and sentences, short forms in spoken English, errors in spoken English

ModuleV:
CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice
ICS Lab: Information Transfer, Debate
Minimum Requirement of infra structural facilities for ELCS Lab:
1. Computer Assisted Language Learning (CALL) Lab:
The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):
Computer network with Lan with minimum 60 multimedia systems with the following specifications:
a) P – IV Processor b) Speed – 2.8 GHZ, c) RAM – 512 MB Minimum
d) Hard Disk – 80 GB, e) 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):
Prescribed Lab Manual: Rani Sudha, "***English Language Communication Skills laboratory"*** *Manual* Published by **Pearson Publication**, 5 edition, New Delhi 2014

REFERENCE BOOKS:

1. Gairns ,Ruth and Redman , Stuart: "***Oxford Word Skills"***, *Learn and Practice English Vocabulary*, 2nd Edition, 2008.
2. Hughes , John and Mallett , Andrew: "***Successful Presentations"***: DVD and Student's Book Pack: "**A Video Series Teaching Business Communication Skills"** for Adult Professionals
3. Karia , Akash: "***Public Speaking Mastery, Speak Like a Winner***", Kindle Edition, 2013.

4. Lucas, Stephen: "***The Art of Public Speaking"*** : Tata McGraw Hill, 11th Edition, 2011.

Websites:

1. http://www.mindtools.com/CommSkll/ActiveListening.htm
2. http://www.slideshare.net/alisonkis/dialogue-and-roleplay-activity
3. http://www.hse.ru/pubs/lib/data/access/ram/ticket/2/14309868938d576a532b71360b7354268380727a22/An%20article%20for%20Monika%20(2010).pdf

COURSE OUTCOME:

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
4. Good understanding of listening skills and speaking skills and their application in real life situations.
5. Good understanding of non-verbal communication and developing confidence to face audience, shed inhibitions.

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Course Code: 50B04 **Credits: 2**

B.Tech. – II Semester
APPLIED PHYSICS LAB
(Common for CE, ME and Mining.Engg)

List of Experiments:

1. Dispersion of Light –Dispersive power of material of a given glass and calcite prism.
2. Diffraction grating – Determination of the wavelength of a Sodium vapour lamp.
3. Melde's Experiment – Longitudinal and Transverse modes.
4. The RLC series circuit – Determination of resonant frequency, bandwidth and quality factor.
5. Magnetic field along the axis of current carrying circular coil- Stewart and Gee's experiment.
6. LASER- Diffraction due to single slit.
7. Evaluation of Numerical aperture of the given fiber.
8. Energy band –gap of a material of a P-N junction diode.
9. Torsional Pendulum- Determination of Rigidity modulus of two different wires.
10. Sonometer- Frequency of A.C supply.
11. Newton's Rings (Demonstration only).
12. Michelson interferometer (Demonstration only).

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Course Code: 50304 **Credits: 2**

B.Tech. –IISemester

ENGINEERING MECHANICS & AutoCAD LAB

(Common for CE, ME and Mining.Engg)

Any **six** experiments from **Module - A:**

Module- A: Engineering Mechanics Lab

1. Verification of triangle law and polygon law of forces.
2. Equilibrium of coplanar concurrent force system-forces in the jib crane.
3. To determine the support reaction for a beam.
4. To determine the moment of inertia of a flywheel.
5. Verifying the law of moments by disc apparatus.
6. To determine the coefficient of friction.
7. To study equilibrium of Non Concurrent forces.
8. To verify the equilibrium of forces using force table.

Module B: AutoCAD Lab

Drafting: Development of part drawings for various components in the form of orthographic and isometric using AutoCAD software. Representation of dimensioning and tolerances scanning and plotting(2D Drawing).

The student must be in a position to execute the basic commands using AutoCAD package after completion of Module-B

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Course Code: 50A02 **Credits: -**

B.Tech. – II Semester
COMPUTATIONAL MATHEMATICS LAB
(Common for CE, ME, CSE & Mining.Engg)

Following Programming is to be done in C/ Matlab Language:

MODULE – I: Find the roots of

i. non-linear equation using Bisection method
ii. non-linear equation using iteration method
iii. Newton-Raphson method
iv. Regula - falsi method

MODULE – II:

i. Find the smallest root of non-linear equation using Ramanujam's method
ii. Solve the system of non-homogeneous tri-diagonal equations using Thomas Algorithm
iii. Solve the system of non-homogeneous linear equations using Gauss-iedal method
iv. Interpolate with unevenly spaced points using Lagrangian method for 4 paired values.

MODULE - III

i. Numerical integration using Trapezoidal rule.
ii. Numerical integration using Simpsons' $1/3^{rd}$ and $3/8^{th}$ rules
iii. Numerical solution of first order ordinary differential equation using Euler's method
iv. Numerical solution of first order ordinary differential equation using 4^{th} order Runge-Kutta method.

MANUAL:

NUMERICAL METHODS IN ENGINEERING & SCIENCE (WITH PROGRAMS IN C, C++ &MATLAB) BY B.S. GREWAL, KHANNA PUBLISHER. 2014

REFERENCES BOOKS:

1) Introductory Methods of Numerical Analysis by S.S. Sastry, Prentice-Hall of India Private Limited.2003

2) Numerical Methods for Scientists and Engineers by Sankara Rao K., Prentice-Hall. 7^{th} Edition, 2008

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Course Code: 50305 **Credits: 3**

B.Tech. – III Semester

MECHANICS OF SOLIDS

Pre-requisite: Engineering Mechanics, Material Science

Objectives: The objective of this subject is to provide the basic concepts of mechanical behavior of the materials under various loads, provides knowledge on shear force and bending moment diagrams of beams and knowledge about stress distribution across various cross sections of beams

MODULE – I: Simple Stresses & Strains [15 Periods]

Simple Stresses & Strains : Elasticityandplasticity–Typesof stresses&strains–Hooke'slaw – stress–strain diagramfor ductile and brittle material–Workingstress–Factorofsafety– Lateralstrain,Poisson'sratio &volumetricstrain–Elasticmodule & therelationshipbetweenthem– Barsofvaryingsection–composite bars–Temperaturestresses . Strainenergy–Resilience– Gradual,sudden,impactandshockloadings.

MODULE – II: Shear Forceand Bending Moment [12 Periods]

Shear ForceAnd Bending Moment: Definitionofbeam–Typesofbeams–Concept ofshear forceandbendingmoment–S.F andB.Mdiagramsforcantilever,simplysupportedandoverhanging beamssubjectedto pointloads, U.D.L.,uniformly varying loadsand combinationofthese loads– Pointof contraflexure–RelationbetweenS.F.,B.Mandrateofloading atasectionofabeam.

MODULE - III: BendingStresses & Shear Stresses [14 Periods]

A: BendingStresses: Theoryof simplebending–Assumptions–Derivationofbending equation:M/I=f/y=E/R - Neutralaxis–Determinationbendingstresses– sectionmodulusofrectangularandcircular sections(SolidandHollow),I, T, Angle andChannelsections–Designofsimplebeamsections.

B: Shear Stresses: Derivation offormula– Shearstressdistributionacrossvariousbeamssections likerectangular,circular,triangular,I,T and angle sections.

MODULE - IV: Deflection ofBeams &Torsion [17 Periods]

A: Deflection ofBeams: Bendingintoacircular arc–slope, deflectionandradiusofcurvature– Differentialequationfortheelasticlineofabeam– DoubleintegrationandMacaulay'smethods– Determinationofslope and deflectionforcantileverandsimplysupportedbeamssubjectedto pointloads, -U.D.L - uniformly varying load.

B: Torsion: Theory of pure torsion - Assumptions – Derivation of torsion equation, polar section modulus – power transmitted by shafts – combined bending and torsion.

MODULE - V: Analysis ofPin-JointedPlane Frames & Thin Cylinders[12 Periods]

A: Analysis ofPin-JointedPlane Frames: Determination of forces in the members of varioustypesof cantilever &simply–supportedtrusses-by (i) Method ofJoints (ii) Method ofSections.

B: Thin Cylinders: Thin seamlesscylindricalshells–Derivationofformulafor longitudinal and circumferentialstresses– hoop, longitudinalandvolumetricstrains– changesindia,andvolume ofthin cylinders.

TEXTBOOKS:

1.S.Timshenko **"StrengthofMaterials",** D. Van Nostrand Company, inc., 3rd edition, 1983.
2. Ramamrutham **"Strengthofmaterials"**Dhanpat Rai Publishing Company, 17th edition, 2013

REFERENCE BOOKS:

1.R..K. Rajput, **"StrengthofMaterials"**S. Chand company Pvt, 5th edition, 2014,
2.R K Bansal **"StrengthofMaterials"**Lakshmi – publication, 6th edition, 2015
3.Bhavikatti **"Strengthofmaterials"**Lakshmi publications, 4th edition, 2014.
4. Sadhu Sing, **"StrengthofMaterials"**, khanna bool publication, 1st edition, 2012
5. Popov **"StrengthofMaterials"**Prentice Hall Publisher.
6. D S Kumar, **"StrengthofMaterials,** S K Kataria & Sons, Reprint 2013, 2013.

COURSE OUTCOME:

After completion of the course, students will be able to:

1.Know various stress and strains.
2. Calculate shear force and bending moment
3. Utilize knowledge acquired in this subject in day –to -day life for designing of machine elements.

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Course Code: 50306 **Credits: 3**

B.Tech. – III Semester

THERMODYNAMICS

Pre-requisite: Applied Physics.

Objectives

To understand the basic concepts of thermal engineering, thermodynamics useful in thermal design of devices/machines employed in industries/other applications like heat engines, automobiles, heat transfer, refrigeration & air conditioning.

MODULE – I: Introduction:BasicConcepts &ZerothLawofThermodynamics. **[16 Periods]**

A:
Introduction:BasicConcepts: System,ControlVolume,Surrounding,Boundaries,Universe,Typesof Systems,MacroscopicandMicroscopicviewpoints,ConceptofContinuum,ThermodynamicEquilibrium, State,Property,Process,Cycle–Reversibility–Quasi–staticProcess,IrreversibleProcess,Causesof Irreversibility–EnergyinStateandinTransition,Types,WorkandHeat,Point andPathfunction.
B: ZerothLawofThermodynamics–Concept ofqualityofTemperature– PrinciplesofThermometry– ReferencePoints–Const.VolumegasThermometer– ScalesofTemperature,IdealGasScale–PMM I- Joule'sExperiments–FirstlawofThermodynamics– Corollaries–FirstlawappliedtoaProcess– appliedtoaflowsystem–SteadyFlowEnergyEquation.

MODULE – II: LimitationsoftheFirstLaw **[15 Periods]**

LimitationsoftheFirstLaw–
ThermalReservoir,HeatEngine,Heatpump,Parametersofperformance, Second LawofThermodynamics,Kelvin-PlanckandClausiusStatementsandtheirEquivalence/Corollaries, PMMofSecondkind,Carnot'sprinciple,Carnotcycleanditsspecialties,Thermodynamic scaleof Temperature,ClausiusInequality,Entropy,Principle ofEntropyIncrease– EnergyEquation,Availability andIrreversibility– ThermodynamicPotentials,GibbsandHelmholtzFunctions,MaxwellRelations– ElementaryTreatmentoftheThirdLawofThermodynamics.

MODULE – III: Perfect GasLaws & PureSubstances **[16 Periods]**

A: Perfect GasLaws–EquationofState,specificandUniversalGasconstants– variousNon-flowprocesses, properties, end states,HeatandWorkTransfer,changesinInternalEnergy– ThrottlingandFreeExpansion Processes–Flowprocesses–DeviationsfromperfectGasModel– VanderWaalsEquation ofState– Compressibilitycharts–variablespecificHeats– GasTables.
B: PureSubstances: P-V-T-surfaces,T-S and h-sdiagrams,MollierCharts,PhaseTransformations–Triple pointatcritical statepropertiesduringchange ofphase,DrynessFraction–Clausius–ClapeyronEquation Propertytables.Molliercharts–VariousThermodynamicprocessesand energyTransfer–Steam Calorimetry.

MODULE – IV: Power Cycles &Mixturesof perfectGases **[16 Periods]**

A: Power Cycles: Otto,Diesel,DualCombustion cycles,SterlingCycle,AtkinsonCycle,EriccsonCycle, LenoirCycle–Description andrepresentation onP–V andT-S diagram,ThermalEfficiency,Mean EffectivePressuresonAirstandardbasis– comparisonofCycles.
B: Mixturesof perfectGases–MoleFraction,Massfriction GravimetricandvolumetricAnalysis– Dalton's Lawof partial pressure,Avogadro'sLawsofadditivevolumes– Molefraction,Volumefraction and partial

pressure,EquivalentGasconst.AndMolecularInternalEnergy,Enthalpy, sp.HeatsandEntropyof Mixture of perfectGasesandVapour,Atmosphericair-

MODULE – V: RefrigerationCycles &Introduction to Psychrometry [15 Periods]

A: RefrigerationCycles: Brayton cycle –PerformanceEvaluation–combinedcycles,Bell-Coleman cycle,Vapourcompressioncycle-performanceEvaluation.

B: Introduction to Psychrometry: PsychrometricProperties–DrybulbTemperature, WetBulbTemperature,DewpointTemperature,ThermodynamicWetBulbTemperature,Specific Humidity, RelativeHumidity,saturatedAir,Vapour pressure,Degreeofsaturation– AdiabaticSaturation, Carrier's Equation–Psychrometricchart.

TEXTBOOKS:

1.YunusCengel&Boles"**ThermodynamicsanEngineeringApproach"**, TMH, 2010

2. PKNag "**EngineeringThermodynamic",** TMH,3rd Edition, 2013.

REFERENCE BOOKS:

1. Jones& Dugan "**EngineeringThermodynamics",** Prentice Hall Publisher, 1st edition, 1996

2.J.P.Holman "**Thermodynamics",**MGraw Hill publications, 2nd edition, 1974.

4.YVC Rao "**AnintroductiontoThermodynamics"**, NewAge Publications, 2004.

5. K.Ramakrishna "**EngineeringThermodynamics",**AnuradhaPublishers.

6. SonntagBorgnakkeandvanwylen "**Fundamentals"ofThermodynamics,** (ASIA)Pte Ltd, JohnWiley&sons, 8th edition, 2012.

COURSE OUTCOME:

After completion of the course, students will be able to:

1**.**Understand the different processes

2. Know the conversion of energy to mass and vice versa of different processes

3. Know different cycles, Psychrometric properties

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Course Code: 50307 **Credits: 3**

B.Tech. – III Semester

METALLURGY AND MATERIALS SCIENCE

Pre-requisite: Applied Chemistry,Physics.
Objectives: The objective of this subject is to provide the basic concepts of composition of materials and to analyze the mechanical properties and applications of materials.

MODULE – I: Crystallography &ConstitutionofAlloys [15 Periods]
A: Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numerical related to crystallography. Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations.
B: ConstitutionofAlloys: Necessityof alloying,typesofsolidsolutions,HumeRotherysrules, intermediate alloyphases,andelectron compounds.

MODULE – II: EquilibriumofDiagrams [15 Periods]
EquilibriumofDiagrams: Experimentalmethodsofconstruction ofequilibriumdiagrams,Isomorphous alloysystems,equilibriumcoolingandheatingof alloys,Leverrule,coringmiscibilitygaps,eutectic systems,congruentmeltingintermediatephases,peritecticreaction.Transformationsinthe solidstate– allotropy, eutectoid, peritectoidreactions,phaserule,relationshipbetweenequilibriumdiagramsand propertiesofalloys.Studyofimportantbinaryphase diagramsofCu-Ni-,Al-Cu,Bi-Cd,Cu-An,Cus-Sn andFe-Fe3C.

MODULE - III: CastIrons & Steels [13 Periods]
A: CastIrons: Structure and propertiesofWhiteCast iron,MalleableCastiron,greycastiron, Spheriodalgraphitecastiron,Alloycastirons.
B: Steels: Classificationof steels,structureandpropertiesofplain carbon steels,Lowalloysteels,Hadfieldmanganesesteels,toolanddiesteels.

MODULE - IV: HeattreatmentofAlloys & Non-ferrousMetals andAlloys [13 Periods]
A: HeattreatmentofAlloys: Effectof alloyingelementsonFe-Fe3C system,Annealing,normalizing, Hardening,TTTdiagrams,tempering,Hardenability, surface-hardeningmethods,Agehardeningtreatment, Cryogenictreatment ofalloys.
B: Non-ferrousMetals andAlloys: Structure and propertiesof copperanditsalloys,Aluminumand its alloys,Titaniumanditsalloys.

MODULE - V: Ceramicmaterials & Compositematerials [12 Periods]
A: Ceramicmaterials: Crystalline ceramics, glasses, cermaets, abrasivematerials,nano materials– definition, propertiesand applications.
B: Compositematerials: Classificationofcomposites,variousmethodsofcomponentmanufacture of composites,particle–reinforcedmaterials,fiberreinforcedmaterials,metalceramicmixtures,metal–matrixcompositesandC –Ccomposites.

TEXTBOOKS:

1. SidneyH.Avener **"IntroductiontoPhysicalMetallurgy",** Tata McGraw Hill publications, 2nd edition, 2013
2. DonaldR.Askeland **"Essential ofMaterialsscienceandengineering",**Thomson, 3rd edition, 2013
3. V.Rahghavan**"ElementsofMaterialscience",**PHI Publications, 6th edition, 2015.

REFERENCE BOOKS:

1. kodgire "**MaterialScience andMetallurgy"**, Everest Publishing House, 6th editions, 2011.
2. Agarwal "**ScienceofEngineeringMaterials"**, Tata McGrawHill, 8th edition, 2012.
3. Williamandcollister "**MaterialsScienceandEngineering",** 8th edition, 2010.
4. W.g.vinas&HLMancini "**An introductionto Materialscience"**, 4th edition, 2011
5. C.D.Yesudian&harrisSamuel "**Material science& Material"**, 3rd edition, 2014
6. R.A.FlinnandP K Trojan"**EngineeringMaterialsandTheirApplications",**JaicoBooks, 7th edition, 1999
7. R.K.Rajput "**EngineeringMaterialsandMetallurgy**" S.Chand Publisher, 3rd edition, 2012.
8. Pakirappa "**MaterialsScienceandEngineering",** 6th edition, 2013

COURSE OUTCOME:

After completion of the course, students will be able to:

1**.**UnderstandCrystallography.
2. Learn composition of various materials
3. Know about heat treatment of different alloys

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Course Code: 50308 **Credits: 2**

B.Tech. – III Semester

MACHINE DRAWING

Pre-requisite: Engineering Drawing

Objectives: To understand projections of simple machine elements and to understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Machine vice, Screw jack, Plummer block,Tail stock& valves etc.

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 dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details - common abbreviations & 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, cotter joints and knuckle joint.
c) Riveted 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, Eccentrics, Petrol Engine connecting rod, piston assembly.
b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock and Square tool post.
c) Valves: Steam stop valve, spring loaded safety valve, feed check valve

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

TEXT BOOKS:

1. K.L.Narayana, P.Kannaiah **"Machine Drawing"**, New Age Publishers, 4th edition, 2014.
2. RK Dhawan "**Machine Drawing"**,S.Chand Publications, 2nd edition,1998

REFERENCE BOOKS:

1. N.D.Bhatt "**Machine Drawing"** Charotar Publishing House pvt ltd, 42nd edition, 2008.
2. P.S.Gill "**Machine Drawing"** S.K. Kataria & Sons publisher, 17th edition, 2009
3. Rajput "**Machine Drawing"** Lakshmi Publications

COURSE OUTCOME:

After completion of the course, students will be able to:

1.Study and draw assembly drawings of machine parts.
2. Know the importance of keys, couplings and engine parts.
3. Know the importance of various important machine parts.

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Course Code: 50309 **Credits: 3**

B.Tech. – III Semester

KINEMATICS OF MACHINES

Pre-requisite: Engineering Mechanics, Engineering Drawing, Mechanics of Solids
Objectives: The objective of this subject is to provide basic concept of Mechanisms used in different machines elements like cams, gears and other power transmitting elements.

MODULE – I: Mechanisms & Machines [15 Periods]
A: Mechanisms: Elements or Links , Classification, Rigid Link, flexible 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 .
B: Machines: Mechanism and machines, classification of machines, kinematic chain , inversion of mechanism, inversion of mechanism , inversions of quadric cycle, chain , single and double slider crank chains.

MODULE – II: Straight Line Motion Mechanisms, Steering Mechanisms & Hooke's Joint [15 Periods]
A: 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.
B: Steering Mechanisms: Conditions for correct steering Davis Steering gear, Ackermans steering gear velocity ratio.
C: Hooke's Joint: Single and double Hookes joint Universial coupling application problems.

MODULE - III: Kinematics & Plane motion of body. [16 Periods]
A: Kinematics: Velocity and acceleration - Motion of link in machine - Determination of Velocity and acceleration diagrams - Graphical method - Application of relative velocity method four bar chain.
Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider - Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.
B: Plane motion of body: Instantaneous center of rotation, centroids and axodes - relative motion between two bodies - Three centres in line theorem - Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links

MODULE - IV: Cams, Analysis of motion of followers & Belt Rope and Chain Drives. [16 Periods]
A: Cams: Definitions of cam and followers their uses Types of followers and cams Terminology Types of follower motion - Uniform velocity Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.
B: Analysis of motion of followers: Roller follower circular cam with straight, concave and convex flanks.
C: Belt Rope and Chain Drives: Introduction, Belt and rope drives, selection of belt drive- types of belt drives-belts, 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- length, angular speed ratio, classification of chains.

MODULE - V: Gears &Gear Trains [15 Periods]

A: Gears: Higher pairs, friction wheels and toothed gears types law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding phenomena of interferences Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact - Introduction to Helical, Bevel and worm gearing.

B: 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. Selection of gear box-Differential gear for an automobile.

TEXT BOOKS:

1. Thomas Bevan **"Theory of Machines"** by / CBS
2. PL. Balaney **"Theory of machines"**/ /khanna publishers.
3. S.S.Rattan **"Theory of Machines and Mechanisms"**/ /Tata McGraw Hill Publishers

REFERENCES BOOKS:

1. Shiegley **"The theory of Machines"**, Oxford.
2. JS Rao and RV Dukkipati **"Mechanism and Machine Theory",** New Age International Publishers
3. R.K Bansal "**Theory of Machines"**, Fire Wall media Publisher

COURSE OUTCOME:

After completion of the course, students will be able to:

1**.** Understand the relative motions incurred in different mechanisms.
2. Know the mechanisms in different machines.
3. Know different power transmitting devices with mechanisms.

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Course Code: 50B08 **Credits: 4**

B.Tech. – III Semester
ELEMENTARY CALCULUS AND TRANSFORMS

PREREQUISITES: Basics of Mathematics.
OBJECTIVES: The main objective of the course is to teach transforms based calculus like Laplace transforms and its applications to real life problems. Particularly while solving the differential equations transforms are the powerful aid to simplify the labor involved in calculation part. For time –invariant systems z-Transforms are useful. Fourier Transforms plays important role to solve some partial differential equations. Curve tracing is a draftsman art to identify the curve nature and by using it one can evaluate multiple integrals in the specified domain.

MODULE – I: Fourier series and transforms [12 Periods]
Fourier series: Determination of Fourier coefficients – Fourier series – even and odd functions – Half-range Fourier sine and cosine expansions.
Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.
Fourier Transforms: Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms - Finite Fourier transforms – Parsvel's Identity

MODULE –II: Z-Transforms &Partial Differential Equations [12 Periods]
Introduction: Definition, Region of convergence, Linearity property, Damping rule, shifting theorems multiplication theorem, initial value theorem, final value theorem.

Inverse z-transforms: power series method, partial fraction method, convolution theorem, Introduction to Partial differential equations, Formation, Linear partial differential equation (Lagrangian Equation) , Non-Linear Partial Differential equation of first order (standard forms).

MODULE – III: Curve Tracing and Multiple Integrals [12 Periods]
Tracing of curves in Cartesian and Polar forms.
Multiple integrals, double and triple integrals, Change of order of integration, change of variables, polar , spherical, cylindrical coordinates.

MODULE –IV: Differential Calculus [12 Periods]
Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's mean value Theorem, Generalized Mean Value theorem. (Only statements with geometrical interpretation)
Differentiability of multivariable functions: Jacobian, Functional dependence, Maxima and Minima of functions of two variables with constraints and without constraints (Lagrange's method of multipliers).

MODULE – V: Vector Calculus: [12 Periods]
Point function, Gradient, Divergence, Curl, Directional derivative, angle between two surfaces.Line integral – Application to work done by a force, Circulation, Potential function.
Surface integrals, volume integrals.Vector integral theorems: Green's theorem-Stoke's and Gauss's Divergence Theorem (without proof). verification.

TEXT BOOKS:

1. Kreyszig, **"Advanced engineering Mathematics"**, John Wiley & Sons, 10th Edition, 2010. (Modules I, II, III, IV & V)
2. B.S. Grewal, **"HigherEngineering Mathematics"**, Khanna Publishers, 43rd Edition, 2014. (Modules I, II, III, IV & V)

3. Ian Sneddon, **"Elements of Partial Differential equations"**, Dover Publishers, 4th Edition, 2006. (Module II)

REFERENCES BOOKS:

1. R.K. Jain & S.R.K. Iyengar, **"Advanced Engineering Mathematics"**, Narosa Publications, 4th Edition, 2014.
2. Kanti B. Datta, **"Mathematical Methods of Science and Engineering"**, Cengage Learning, 1st Edition, 2011.
3. T.K. V. Iyengar, **"Engineering Mathematics – I"**,S Chand, 13th Edition, 2014.
4. D. S. Chandrasekhar, **"Engineering Mathematics – I"**, Prism Books pvt. LTD, 5th Edition, 1999.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Learn the basic rules in Laplace transformations and able to find associated transformations of the defined function.
2. Solve ordinary differential equations by using Laplace Transformations.
3. Learn the concept of region of convergence for the time-invariant systems and associated transformations.
4. Learn the basic rules to form the partial differential equation and solution techniques.
5. Learn the concept of slope of a curve which can be mapped to functions to evaluate mean values.
6. Learn the concept of curve tracing which can use in evaluating the multiple integrals
7. Find the Gradient, Divergence and Curl of a vector valued function in order to evaluate work done by a force, Angular velocity.
8. Know the concept of Line integral, surface integral and volume integral which are used in verifying the Green's and Gauss and Stokes theorems.

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Course Code: 50310 **Credits: 2**

B.Tech. – III Semester

METALLURGY AND MECHANICS OF SOLIDS LAB

Note: Any 6 Experiments to be performed from each section

I. MetallurgyLab: Observation and usage of microstructures of various metals.

1.PreparationandstudyoftheMicroStructureof puremetalslikeIron,CuandAl.

2.PreparationandstudyoftheMicrostructureofMild steels,lowcarbonsteels,high–C steels.

3.StudyoftheMicroStructuresofCastIrons.

4.StudyoftheMicroStructuresofNon-Ferrousalloys.

5.StudyoftheMicrostructuresofHeattreatedsteels.

6.HardenabilityofsteelsbyJominyEndQuenchTest.

7.Tofindoutthehardnessof varioustreatedanduntreatedsteels.

II. Mechanics ofSolids Lab:

1. Tensiletestby using UTM

2.Bendingtest on

a) Simplysupported beam b)Cantileverbeam

3.Torsiontest

4.Hardnesstest

a)Brinell'shardnesstest b)Rockwell hardnesstest

5.Test onsprings

a) Compression spring b) Tension spring

6) Impacttest

a) Izod b) Charpy

7. FatigueTest

8. Hoop stress and strain relationship for the Thin Cylinder.

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Course Code: 50311 **Credits: 2**

B.Tech. – III Semester
THERMODYNAMICS LAB

1. Determination of Flash and Fire points of Liquid fuels/Lubricants by pesky martins closed cup.
2. Determination of Flash and Fire points of Liquid fuels/Lubricants by Cleveland open cup.
3. Determination of Carbon residue of a given fuel.
4. Determination of Viscosity by Say bolt Viscometer.
5. Determination of Viscosity by Redwood Viscometer
6. Determination of Calorific value of Solid/Liquid by Bomb Calorimeter
7. Grease penetration test.
8. Determination of Gaseous fuels by Junkers Gas Calorimeter.
9. To determine the Coefficient of friction using Thurston oil Tester
10. Evaluate performance parameters of Mechanical Heat pump**.**

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Course Code: 50H11 **Credits: Nil**

B.Tech. – III Semester
HUMAN VALUES AND PROFESSIONAL ETHICS

Prerequisite: NIL
Objectives: To make students familiar with Human value with professional ethics.

Introduction:
The term 'ethics' is derived from the Greek word ***ethos*** which can mean custom, habit, character or disposition. Ethical awareness is an integral part of professional attitude and it is necessary to take time for reflection-on-action. Building professional attitude begins by understanding what it means to be a professional and how a professional should relate and react to her work environment The Course, Professional Ethics and Human Values will be a part of Value Education leading towards sensitizing the students on Values of Life and preparing them for life. The colleges are centers of excellence for the education of students. Many of these students will be the professionals of tomorrow: Engineers, Business administrators, and so forth. Their expertise, knowledge and power will exercise a crucial influence on the quality of life of millions of citizens. The question is whether they will be sufficiently prepared to recognize the ethical aspects of their professional decisions and to understand the social consequences of their work. The institutions prepare them to become experts in a very limited field, to find technical solutions to specific problems. But often they do not learn how to resolve ethical problems or to make themselves into responsible persons.
The term 'ethics' is derived from the Greek word ***ethos*** which can mean custom, habit, character or disposition. Ethical awareness is an integral part of professional attitude and it is necessary to take time for reflection-on-action. Building professional attitude begins by understanding what it means to be a professional and how a professional should relate and react to her work environment
Objectives:

- To create an awareness on Professional Ethics and Human Values.
- To understand social responsibility of any profession
- To appreciate ethical dilemma while discharging duties in professional life.
- To help the students appreciate the essential complementarily between Values and Skills to ensure sustained happiness and prosperity which are the core aspirations of all human beings
- To develop Holistic Perspectives towards life
- To enable students to lead a practical life adding value to human relations
- To generate capacity for making intelligent and independent value judgments in real life situations.

MODULE –I Human Values: **[05 Periods]**
Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Character.

MODULE –II:Professional Ethics: **[09 Periods]**
Variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

MODULE-III: Human values, Ethics, Life Skills: [09 Periods]
Goals in life – Goal setting – Differentiating Right and Wrong – Integrity – Adaptability – Sense of Humor - Valuing Time – Co-operation – Commitment

MODULE-IV: Harmony in Human Beings Vs Harmony in self: [05 Periods]
Understanding self and body – Human Interactions – Human-Human relationships – Respect and Differentiation – Humanistic education, Humanistic Constitution, Humanistic Universal Order

BOOKS FOR REFERENCE:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
4. Naagarazan. R.S "A Textbook on Professional Ethics and Human Values", New Age International Publishers, 2001
5. A N Tripathy, "Human values", New Age International Publishers, 2003
6. George Reynolds, "Ethics in Information Technology", Cengage Learning, 2002

COURSE OUTCOME:
Upon completion of the course, the students are expected to:
1. To define various terms related to Human value with professional ethics..
2. To understand the professional responsibilities.
3. To analyse the soft ware engineering ethics and practices.

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Course Code: 50312 **Credits: 3**

B.Tech. – IV Semester

DYNAMICS OF MACHINES

Pre-requisite: Engineering Mechanics and Kinematics of Machinery
Objectives: The objective of this subject is to know static and dynamic behavior of mechanisms under different loading conditions.

MODULE – I: Precession **[8 Periods]**
Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

MODULE–II: Static and Dynamic Force Analysis of Planar Mechanisms & Synthesis of Linkages **[14 Periods]**
A: Static And Dynamic Force Analysis Of Planar Mechanisms: Introduction -Free Body Diagrams – Conditions for equilibrium – Two, Three and Four Members – Inertia forces and D'Alembert's Principle – planar rotation about a fixed centre.
B: Synthesis Of Linkages: Three position synthesis – Four position Synthesis – Precision positions – Structural error – Chebychev's spacing, Freudentein's equation, Problems

MODULE - III: Clutches & Turning Moment Diagram and Fly Wheels **[14 Periods]**
A: Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch. **Brakes and Dynamometers:** Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operations.
B: Turning Moment Diagram and Fly Wheels: Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design.

MODULE - IV: Balancing & Vibration **[14 Periods]**
A: Balancing: Balancing of rotating masses Single and multiple – single and different planes.
Balancing of Reciprocating Masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods.Unbalanced forces and couples – examination of "V", multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing.
B: Vibration: Free Vibration of mass attached to vertical spring – Simple problems on forced damped vibration, Vibration Isolation & Transmissibility Whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

MODULE - V: Governers **[10 Periods]**
Governers: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and hartung with auxili ary springs. Sensitiveness, isochronism and hunting.

TEXT BOOKS:

1. Thomas Bevan **"Theory of Machines"** CBS Publishers,3rd edition,2005.
2. Jagadish Lal & J.M.Shah **"Theory of Machines"**, Metropolitan,2002.

REFERENCE BOOKS:

1. Shiegly **"Theory of Machines",** MGH Publishers,5th edition,1988.
2. JS Rao and RV Dukkipati **"Mechanism and Machine Theory",** New Age International Publishers, 2008.
3. S.S Ratan **"Theory of Machines",** Mc. Graw Hill Publishers, 3rd editions, 2009.
4. Khurmi **"Theory of machines"**, S.Chand Publications, 14th edtion, 2005

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Know kinematics and dynamic analysis of machine elements
2. Measure vibrations, balancing of the systems.
3. Know the importance of governors in balancing.

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Course Code: 50313 **Credits: 3**

B.Tech. – IV Semester

THERMAL ENGINEERING -I

Pre-requisite: Thermodynamics

Objectives:

1.The objective of this subject is to provide basic knowledge of working and performance of IC, EC Engines &compressors, Air-Conditioners.

Codes/Tables: Refrigeration tables, Psychrometric chart

MODULE – I: Actual Cycles and their Analysis & I.C. Engines [15 Periods]

A: Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles.Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

B: 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, Ignition, Cooling and Lubrication.

MODULE – II: Combustion in S.I. Engines & Combustion in C.I. Engines [15 Periods]

A: 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.

B: Combustion in 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.

MODULE - III: Testing and Performance – I & Testing and Performance - I [14 Periods]

A: Testing and Performance - I: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power.

B: Testing and Performance – II: Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart. Performance Test on multi cylinder engine (Morse Test).

MODULE - IV: Compressors, Reciprocating & Rotary (Positive displacement type) [16 Periods]

A: 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.

B: Reciprocating: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

C: Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor –mechanical details and principle of working – efficiency considerations.

MODULE - V: Dynamic Compressors & Axial Flow Compressors [15 Periods]

A: Dynamic Compressors: 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.

B: 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 – Polytrophic efficiency.

TEXT BOOKS:

1. V. GANESAN "**I.C. Engines",** TMH Publishers, Tata McGrawHill edelins, 4th edition, 2002.
2. SM Yahya "**Turbines, Pumps, Compressors",** TMH Publishers, McGrawHil, 4th edition, 2005.
3. Rajput "**Thermal Engineering",** Lakshmi Publications, 4th edition, 2010

REFERENCE BOOKS:

1. Mathur & Sharm **"IC Engines",** Dhanpath Rai & Sons, 4th edition, 2010
2. Pulkrabek **"Engineering fundamentals of IC Engines",** Pearson PHI, 2nd edition
3. Rudramoorthy **"Thermal Engineering",** TMH Publishers, 3rd edition
4. B. Yadav **"Thermodynamics & Heat Engines"**, Central Book Depot., Allahabad, 6th edition, 2012.
5. Heywood **"I.C. Engines",** McGrawHill Publishers, 2nd edition.
6. R.S. Khurmi & J.K.Gupta **"Thermal Engineering",** S.Chand Publishers, 5th edition, 2013.
7. Ramalingam **"IC Engines",** Scietech publishers, 6th edition.
8. B.Srinivasulu Reddy **"Thermal engineering data book",** JK International Pub, 2014

COURSE OUTCOME:

After completion of the course, students will be able to:

1.Know various engines working principles.
2. Know different cycles upon which compressors are working.
3. Calculate performance of engines and compressors.

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Course Code: 50314 **Credits: 3**

B.Tech. – IV Semester

PRODUCTION TECHNOLOGY

Pre-requisite: Basic Engineering Workshop
Objectives: The objective of this subject is to provide knowledge of various manufacturing methods of components and various metal joining process used manufacturing industries.

MODULE – I: Casting &Methods of Melting [16 Periods]
A: Casting: 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. 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., Mould making machines .
B: Methods of Melting: Crucible melting, blast furnace and cupola operation, steel making processes.

MODULE – II: Welding & Cutting of Metals [15 Periods]
A: Welding: Classification of welding process types of welds and welded joints and theircharacteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding.
B: Cutting of Metals: Oxy - Acetylene Gas cutting, Cutting of ferrous metals.
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 nondestructive testing of welds.

MODULE - III: Hot working & Stamping, forming and other cold working processes [15 Periods]
A: Hot working: cold working, 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 products. Forces in rolling and power requirements.
B: Stamping, forming and other cold working processes: Blanking and piercing Bending and forming Drawing and its types wire drawing and Tube drawing coining Hot and cold spinning Types of presses and press tools. Forces and power requirement in the above operations.

MODULE - IV: Extrusion of Metals & Forging processes [14 Periods]
A: Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion Impact extrusion Hydrostatic extrusion.
B: Forging processes: Principles of forging Tools and dies Types Forging Smith forging, Drop Forging Roll forging, Forging hammers, forging defects.

MODULE - V: Processing of Plastics & Moulding Equipment [10 Periods]
A: Processing of Plastics: Types of Plastics, Properties, applications and their Processing Methods.
B: Moulding Equipment: Injection moulding, Types of Injection moulding, Blow moulding.

TEXT BOOKS:

1. Serope Kalpakjin & Stephen Schmid **"Manufacturing Engineering and Technology",** Pearson Edu, 6th edition, 2006.
2. Sarma P C **"Production Technology",** S.Chand Publication, 6th edition, 2007.
3. P.N. Rao **"Manufacturing Technology"**, TMH, 4th edition, Volume -I.

REFERENCE BOOKS:

1. R.K. Jain **"Production Technology",**Khanna Publications, 5th edition, 1977
2. P.N. Rao **"Manufacturing Technology"**, TMH, 4th edition, 2007
3. R S Paramar **"Welding Process",** Allied Publishers
4. Suresh Dalela & Ravi Shankar **"A Text Book of Production Engineering",** Galgotia Publications Pvt. Ltd.

COURSE OUTCOME:

After completion of the course, students will be able to:

1**.** Student shall be able to know the different furnaces for melting metal and non-metals..
2. Students shall be able to know different techniques of producing products.
3. Students shall be able to know different plastics, used and their processing methods.

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Course Code: 50315 **Credits: 3**

B.Tech. – IV Semester

FLUID MECHANICS AND HYDRAULIC MACHINES

Pre-requisite: Engineering Mechanics
Objectives:1.The objective of this subject is to provide the knowledge of fluid power and analyze the performance of various hydraulic machines like turbines, compressors and pumps.

MODULE – I: Fluid statics [13 Periods]
Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension- vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure- Piezometer, U-tube and differential manometers.

MODULE – II: Fluid kinematics & Fluid dynamics [15 Periods]
A: Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.
B: Fluid dynamics : Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine flow meter, momentum equation and its application on pipe bend.

MODULE - III: Closed conduit flow & Boundary Layer Concepts [14 Periods]
A: Closed conduit flow: Reynold'sexperiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line
B: Boundary Layer Concepts: Definition, thickness, characteristics alon thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

MODULE - IV: Basics of turbo machinery, Hydraulic Turbines & Performance of hydraulic turbines [15 Periods]
A: 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 don and efficiency, flow over radial vanes.
B: Hydraulic Turbines : Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tube theory- functions and efficiency.
C: 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.

MODULE – V: Centrifugal pumps & Reciprocating pumps [13 Periods]
A: Centrifugal pumps: Classification, working, work done – manomertic head- losses and efficiencies specific speed- pumps in series and parallel-performance characteristic curves, NPSH.
B: Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Victor L. Streeter, E Benjamin wylie **"Fluid Mechanics"**, McGrawhill Publications,9th edition, 1998.
2. Dr. P.N. MODI and Dr. S. M. SETH **"Hydraulics and Fluid Mechanics Including Hydraulic Machines", Rajsons publication Pvt Ltd, 20th editions, 2014.**

REFERENCES BOOKS:

1. D.S. Kumar **"Fluid Mechanics and Fluid Power Engineering"**, Kotaria & Sons, 1st edition, 2009.
2. D. Rama Durgaiah **"Fluid Mechanics and Machinery"**, New Age International (P) Ltd, 1st editions, 2007
3. James W. Dally, William E. Riley **"Instrumentation for Engineering Measurements",** John Wiley & Sons Inc. 3rd editions, 1989.
4. R K Rajput **"Fluid Mechanics and Hydraulic Machines",** S.Chand Publications, 12th edition.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. The students shall be able to know thebehavior fluids at different conditions
2. The student shall be able to apply the knowledge to access the performance of hydraulic machines.
3. The students are able to calculate the performance of pumps and turbines.

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Course Code: 50B09 **Credits: 4**

B.Tech. – IV Semester
PROBABILITY AND STATISTICS
(Common for CE, ME & Mining Engg.)

OBJECTIVES: The main objective of the course probability& Statistics is to revise elementary concepts and techniques encountered in the Set theory. Extended to teach the basics of probability, axioms to familiarize the knowledge on the concept of random variables.Introduced new techniques for carrying out probability calculations and identifying probability distributions. To motivate the use of statistical inference in practical data analysis by introducing so many tests which are fit for small and large data. The process of queuing theory is also introduced to learn the concept of optimize the system service rate by reducing the idle time. By enlarge we are focused on elementary concepts and techniques in statistical methodology to solve their project work.

MODULE –I **[12 Periods]**
Introduction to Probability, events, sample space, mutually exclusive events.Exhaustive events.Addition theorem for 2& n events and their related problems.Dependent and Independent events, conditional probability, multiplication theorem.Boole's inequality, Baye's Theorem.

MODULE-II **[12 Periods]**
Random variables – Discrete Probability distributions.Bernoul, Binomial, poission, geometric, mean, variance, moment generating function–related problems.Continuous probability distribution, Normal distribution, Exponential, Rectangular, Weibull distribution, Beta and Gamma distributions, mean, variance, moment generating function–related problems.

MODULE-III **[12 Periods]**
Sampling Distributions: Definitions of population-sampling-statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance.Parameter estimations – likelihood estimate, point estimation and interval estimation.
Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, and Level of significance. One sided test, two sided test.
Large sample tests:
(i) Test of Equality of means of two samples equality of sample mean and population mean (cases of known variance & unknown variance, equal and unequal variances)
(ii) Tests of significance of difference between sample S.D and population S.D.
(iii) Tests of significance difference between sample proportion and population proportion & difference between two sample proportions.

MODULE-IV: Small sample tests: **[12 Periods]**
Student t-distribution, its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples, Snedecor's F ,distribution and it's properties.Test of equality of two population variances, Chi-square distribution, its properties, Chi-square test of goodness of fit

MODULE-V **[12 Periods]**
Correlation & Regression: Correlation, Coefficient of correlation, the rank correlation.
Regression, Regression Coefficient, The lines of regression: simple regression, regression for 3 independent variables.

Queuing Theory: Structure of a queuing system , Operating Characteristics of queuing system, Transient andSteady states, Terminology of Queuing systems, Arrival and service processes, Pure Birth-Death processDeterministic queuing models, (M/M/1):(∞:FIFO) Model, (M/M/1):(N:FIFO) Model .

TEXT BOOKS:

1) Probability & Statistics for Engineers & Scientists –Walpole Myers Myers Ye.
2) Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers
3) Probability and Statistics for Engineers and Scientists by Sheldon M.Ross, Academic Press
4) Operations Research by S.D. Sarma.
5) Operations Research by Taha

REFERENCES BOOKS:

1) Mathematics for Engineers by K.B.Datta and M.A S.Srinivas, Cengage Publications
2) Probability and Statistics by T.K.V.Iyengar & B.Krishna Gandhi Et
3) Fundamentals of Mathematical Statistics by S C Gupta and V.K.Kapoor
4) Probability and Statistics for Engineers and Scientists by Jay l.Devore.

COURSE OUTCOME:
After completion of the course, students will be able to:

1. Determine measure of probability, of a given problem. Introduction of random variables and construction of probability distribution function/density function.
2. Identify the distribution of a random variable (discrete or continuous) of interest in an experiment, and calculate the probability that the random variable can take on certain values.
3. Conduct hypothesis test and construct confidence intervals for the population mean, variance, or proportion (one sample and two samples).
4. Apply the principles of linear correlation and regression to predict the courseoutcome of certain experiment parameters.
5. Apply the queuing theory concept to reduce the long queues in the form of fast service rate.

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Course Code: 50H16 **Credits: 2**

B.Tech. – IV Semester
ENVIRONMENTAL SCIENCES

PREREQUISITES: Environment

OBJECTIVES: An interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo systems, biology, chemistry, economics, political science and international processes. The ability to work effectively as a member of an interdisciplinary team on complex problems of environment.

MODULE - I: Ecosystems [07 Periods]
Definition, Scope and Importance of ecosystem, Concept ofecosystem, Classification of ecosystems, Structural Components of anecosystem, Functions ofecosystem,Foodchains,foodwebsandecological pyramids.Flowofenergy.

MODULE - II:Natural resources, Biodiversity and biotic resources [09 Periods]
Natural resources: Classification of Resources: Living and Non-Living resources, Renewable and non-renewable resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources – case studies. Growing energy needs-Energy resources: renewable and non renewable energy sources.
Biodiversity and biotic resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values.

MODULE - III: Environmentalpollutionandcontrol [09 Periods]
Classificationofpollution andpollutants, causes,effectsandcontroltechnologies.AirPollution:Primaryandsecondarypollutants,Automobileand Industrialpollution,Ambientairqualitystandards.Waterpollution:Pointandnon-pointsourcesofpollution, Major pollutantsofwaterandtheirsources,drinkingwaterquality standards,SoilPollution:Soilassinkforpollutants,Impactofmodernagricultureonsoil,degradationofsoil.MarinePollution: MisuseofInternationalwaterfordumpingofhazardouswaste,coastalpollutiondue tosewage and marine disposal of industrial effluents.

MODULE - IV: Globalenvironmentalproblemsand globalefforts [06 Periods]
Greenhouseeffect,GreenHouse Gases (GHG), Global Warming, Sea level rise, climate change andtheir impacts on humanenvironment.OzonedepletionandOzonedepletingsubstances(ODS).Deforestation anddesertification.Internationalconventions/Protocols:Earthsummit,Kyotoprotocol andMontréalProtocol.

MODULE - V:TowardsSustainableFuture [08 Periods]
Concept ofSustainable Development,Threatsto Sustainability, Populationanditsexplosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainabledevelopment, EnvironmentalEducation,Conservation ofResources,UrbanSprawl,Sustainable CitiesandSustainable Communities,Humanhealth,RoleofITinEnvironment,EnvironmentalEthics,EnvironmentalEconomics,ConceptofGreenBuilding,CleanDevelopmentMechanism(CDM).

TEXT BOOKS:

1. R. Rajagopalan, **"Environmental studiesFromcrisistocure"**, Oxford University Press,2nd Edition, 2005. (Modules I, II, III, IV)
2. Anubha Kaushik, C. P. Kaushik, **"Environmental studies"** New age International Publishers, 4th Edition, 2012. (Modules I, II, III, IV & V)
3. Erach Bharucha, **"Environmental studies"**UniversityGrants Commission,and UniversityPress, 1st Edition, 2005. (Modules I, II, III, IV & V)

REFERENCE BOOKS:

1. M. AnjiReddy "**TextbookofEnvironmental ScienceandTechnology"**3rd Edition, 2007.
2. RichardT. Wright, **"EnvironmentalScience:towardsasustainablefuture"**PHLLearning, PrivateLtd.NewDelhi, 2nd Edition, 2008.
3. Gilbert McMastersandWendell P. Ela, **"Environmental Engineeringandscience"**, 3rd Edition,PHI Learning Pvt.Ltd., 2008.

COURSE OUTCOME:

At the end of the course students are able to:

1. Enable the students to realize the importance of the sustainable use of natural resources.
2. Make the students aware of the impacts of human actions on environment and measures to minimize and mitigate them.
3. Enable the students to become aware of the current issues and problems pertaining to the environment.

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Course Code: 50316 **Credits: 2**

B.Tech. – IV Semester

PRODUCTION TECHNOLOGY LAB

Note: Any 12 Experiments need to be performed

I. METAL CASTING LAB:

1. Pattern making - for one casting drawing.
2. Sand properties testing - Exercise -for strength and permeability - 1
3. Mould making-1 Exercise
4. Melting and Casting - demonstration

II WELDING LAB:

1. Arc Welding (Lap & Butt) Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Gas welding-1 Exercise

III MECHANICAL PRESS WORKING:

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

IV PROCESSING OF PLASTICS:

1. Injection Moulding-3Exercises
2. Blow Moulding

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Course Code: 50317 **Credits: 2**

B.Tech. – IV Semester

FLUID MECHANICS AND HYDRAULIC MACHINES LAB

1. Impact of jet on Vanes.

2. Performance Test on Pelton Wheel.

3. Performance Test on Francis Turbine.

4. Performance Test on Kaplan Turbine.

5. Performance Test on Single Stage Centrifugal Pump.

6. Performance Test on Multi Stage Centrifugal Pump.

7. Performance Test on Reciprocating Pump.

8. Calibration of Venturimeter.

9. Calibration of Orifice meter.

10. Determination of friction factor for a given pipe line.

11. Determination of loss of head due to sudden contraction in a pipeline.

12. Verification of Bernoulli's Theorems.

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Course Code: 50H17 **Credits: 2**

B.Tech. – III Semester

GENDER SENSITIZATION
(An Activity-based Course)

OBJECTIVE:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some 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 violence.
- To expose students to more egalitarian interactions between men and women.

MODULE-I:UNDERSTANDING GENDER **[Periods:6]**

Gender: Why Should 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 Caste.DifferentMasculinities.

Just Relationships: Being Together as Equals *(Towards* a *World of Equals:* Unit *-2)* Mary iKorn and Onler. Love and Acid just do not Mix. Love Letters. Mothers aniJ Fathers. Further Reading: Rosa Parks-The Brave Heart.

MODULE-II:GENDER AND BIOLOGY **[Periods:6]**

Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals:* Unit -4) Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary *(Towards* a *World of Equals:* Unit -10)
Two or Many?Struggles with Discrimination.
Additional Reading: Our Bodies, Our Health *(Towards a World of Equals:* Unit -13)

MODULE-III:GENDER AND LABOUR **[Periods:6]**

Housework: the Invisible Labour *(Towards a World* of *Equals:* Unit -3)
"My Mother doesn't Work." "Share the I.oad."
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.

MODULE-IV:ISSUES OF VIOLENCE **[Periods:6]**

Sexual Harassment: Say Nol *(Towards a World of Equals:* Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: *"Chdpulum.*
Domestic Violence: Speaking Out *(Towards a World of Equals:* Unit -5)

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-1 Fought for my Life...." - Further Reading: The Caste Face of Violence.

MODULE-V:GENDER STUDIES **[Periods:6]**

Knowledge: Through the Lens of Gender *(Towards a Work/ 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 Bilingual Textbook on Gender"* written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Mina Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Thant

Note: Since it Is Interdisciplinary Course, Resource Persons can be drawn from 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 Review of Books 37.20 (20 December 1990). Print. We *Were Making History...' Life Stories of Women in the ToIrmgana People's Struggle.* New Delhi: Kali for Women, 1989.
2. Tripti Lahiri. "By the Numbers: Where Indian Women Work." ***Women's*** *Studios Journal* (14 November 2012) Available online at: http:// blogs.visj.com/ India real time/2012/11/14/by -the-numbers-where-Indan-womenworkP
3. K. Satyanarayana and Susie Thant (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada htto://harooreollins.co.in/BookDetailasp?Flook Cndet'3732
4. Vimata. "Vantillu (The Kitchen)". *Women Writing in India: 600 BC to the Present. Volume II:* The 20th Century. Ed. Susie Thaw and K. Lalita. Delhi: Oxford University Press 1995. 599-601.
5. Shatrughna, Veena et al. *Women's Work and its Impact on Child Health end Nutrition,* Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.
6. Stree Shakti Sanghatana. 'We Were *Making I listory ....' Life Stories of Women in the Telangana* People's *Struggle.* New Delhi: Kali for Women, 1989.
7. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
8. Jayaprabha, A. "Chupulu (Stares)'. *Women Writing in India: 6008C to the Present. Volume II:* The 20" Century Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press, 1995.596-597.
9. Javeed, Shayan and Anupam Manuhaar. "Women and Wage Discrimination in India: A Critical Analysis.' *International Journal of Humanities and Social Science Invention* 2.4(2013)
10. Gautam, l.iela and Gila Ramaswamy. 'A 'conversation' between a Daughter and a Mother.' *Broadsheet on Contemporary Politics.* Special Issue on *Sexuality and Harassment: Gender Politics on Campus Today.* Ed. Madhumeeta Sinha and Asma Rasheed. Hyderabad: Anveshi Research Center for Women's Studies, 2014.
11. Abdulali Sohaila. *'I Fought For My Life...and*Won."Availableonline at: htte://www.thealternativeinilifestylefi-fouoht-for-mv-lifeand-won-sohaila-abdulall
12. Jeganathan Pradeep, Partha Chatterjee (Ed). *`Community, Gender and Violence Subaltern Studies Xi* Permanent Black and Ravi Dayal Publishers, New Delhi, 2000

13. K. Kapadia. The *Violence of Development: The Politics of Identity, Gender and Social Inequalities in India.* London: Zed Books, 2002
14. S. Benhabib. *Situating the Salt Gender, Community, and Postmodernism in Contemporary Ethics,* London: Routledge, 1992
15. Virginia Woolf. A *Room of One's Own.* Oxford: Black Swan. 1992.
16. T. Banuri and M. Mahmood, *Just Development: Beyond Adjustment with a Human Fars,* Karachi: Oxford University Press 1997

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 derived 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 professionals 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 new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

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Course Code: 50A03 **Credits: Audit Course**

B.Tech. – IV Semester
LAW FOR ENGINEERS

Objectives: The objective of the course is to familiarize students (Prospective engineers) withelementary knowledge of laws that would be of utility in their profession. The syllabuscovers Constitution of India and new areas of law like Cyber, IPR, Human Rights, Right toInformation, Corporate and Labour.

Module I **[6 Periods]**

Constitutional Law covering the Preamble; Fundamental Rights, Fundamental Duties;
Human Rights and Public International Law - Theoretical foundation, human rights and international law; UNMechanism and specialized agencies, (UNICEF, UNESCO, WHO, ILO);International NGOs – Amnesty International, Human Rights Watch, Greenpeace Foundation;Enforcement of Human Rights in India including Supreme Court, High Courts, StatutoryCommissions – NHRC, NCW, NCM, NC-SCST.

Module II **[6 Periods]**

Right to Information Act, 2005 - Evolution and concept; Practice andprocedures;
Labour Laws - Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923;(3 Lectures)
Corporate Laws - Law relating to public, private and multinationalcompanies, collaboration agreements fortechnology transfer

Module III **[6 Periods]**

Introduction to IT laws & Cyber Crimes –Cyber Crime Investigation and Cyber Security.
Intellectual property – meaning, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets;Patentable inventions, Rights and obligations of patentee, Duration of patents – law andpolicy considerations, Infringement and related remedies;

TEXTBOOKS/REFERENCE BOOKS:

1. H.M. Seervai - Constitutional Law of India - Tripathi Publications – 4th Edition, 1991
2. S.K. Kapur - Human Rights under International Law and Indian Law - Central Law Agency – 2001
3. Cornish W. R. - Intellectual Property Rights, Patents, Trademarks, Copyrights & Allied Rights - Sweet & Maxwell– 2008
4. Avtarsingh - Company Law - Eastern Book Co.–2007
5. James Graham - Cyber Security Essentials - CRC Press - 1st Ed., 2011

COURSE OUTCOME:

After the course, the student will able to:

1. Understand Fundamental rights, duties and different organizations for human rights protection.
2. Know Labour laws, Corporate Law and Right to Information Act.
3. Learn about Intellectual property rights, cyber crimes and laws.

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Course Code: 50H12 **Credits: 3**

B.Tech. – V Semester
ENGINEERING ECONOMICS AND ACCOUNTANCY

PREREQUISITES: Nil

OBJECTIVES:EEAA is a think beyond program which will make the student to examine the application of microeconomics theory as applied to the manager's responsibilities in an organization. To explain the basic principles of managerial economics, accounting and current business environment underlying business decision making. This course should emphasize the quantitative and qualitative applications of economic principle to business analysis

MODULE – I: Managerial Economics and Demand [12 Periods]
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, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

MODULE – II: Theory of Production and Cost Analysis [11 Periods]
Theory of Production: Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.
Cost Analysis: Cost concepts, Opportunity cost, fixed vs. Variable costs, explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEA.

MODULE – III: Market structures and Pricing Policies [11 Periods]
Introduction to Markets & Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.
Pricing Policies & Methods: Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two-Part Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization.

MODULE – IV: Business Environment and Capital Budgeting [11 Periods]
Business & New Economic Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario.
Capital And Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. 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 (simple problems)

MODULE – V: Financial Accounting and Ratios [11 Periods]
Introduction to Financial Accounting: Double-Entry Book Keeping, Journal, Ledger, 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 ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

TEXT BOOKS:

1. Aryasri, **"Managerial Economics and Financial Analysis"**, TMH, 2nd Edition, 2005. (Modules I, II, III, IV & V)
2. Varshney & Maheswari, **"Managerial Economics"**, Sultan Chand, 5th Edition, 2003. (Modules I, II & III)

REFERENCE BOOKS:

1. H. Craig Peterson & W. Cris Lewis, **"Managerial Economics"**, PHI, 4th Edition.
2. Domnick Salvatore, **"Managerial Economics In a Global Economy"**, Thomson, 4th Edition.
3. Raghunatha Reddy & Narasimhachary, **"Managerial Economics& Financial Analysis"**, Scitech, 4th Edition.
4. S. N. Maheswari & S. K. Maheswari, **"Financial Accounting"**, Vikas, 6th Edition.
5. Dwivedi, **"Managerial Economics"**, Vikas, 6th Edition.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Think in the terms of a managerial economist.
2. Appraise economic articles in newspapers such as Economic Times.
3. Solve quantitative problems in a business environment.
4. Acquire an ability to apply knowledge of economic concepts, accounting concepts.
5. Identify, formulate, and solve financial problems.
6. Gain knowledge of Financial Concepts as applied to Business Management.

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Course Code: 50318 **Credits: 3**

B.Tech. – V Semester

HEAT TRANSFER

Pre-requisite: Thermodynamics
Objectives: The objective of this subject is to provide knowledge of modes of heat transfer.
Codes/Tables: Heat and Mass Transfer data book

MODULE – I: Introduction, Conduction Heat Transfer & One Dimensional Steady State Conduction Heat Transfer [15 Periods]

A: Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

B: Conduction Heat Transfer: Fourier rate equation – General 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.

C: One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation

MODULE – II: One Dimensional Steady State Conduction Heat Transfer & One Dimensional Transient Conduction Heat Transfer [15 Periods]

A: One Dimensional Steady State Conduction Heat Transfer: 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.

B: One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems.

MODULE - III: Convective Heat Transfer & Forced convection [16 Periods]

A: Convective Heat Transfer : Classification of systems based on causation of flow, condition of flow, configuration of flow and 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.

B: 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 about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

MODULE - IV: Free Convection, Heat Transfer with Phase Change & Condensation [15 Periods]

A: Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.

B: Heat Transfer with Phase Change: Boiling – Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

C: Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

MODULE - V: Heat Exchangers & Radiation Heat Transfer [15 Periods]

A: 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.

B: Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchhoff, Lambert, Stefan 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.

TEXT BOOKS:

1. M Necati Ozisik **"Heat Transfer"**, McGraw-Hill Publishers, 1994.
2. R S Yadav **"Heat and Mass Transfer",** Centre Publishing House, 1992
3. D.S.Kumar **"Heat and Mass Transfer",** S.K.Kataria & Sons Publishers, 2013.

REFERENCE BOOKS:

1. Frank P. Incropera, David P. Dewitt, therodre L Bergman & Adrienne S. Lavene **"Fundamentals of Heat Transfer & Mass Transfer"** Wiley India Pvt Ltd, New Delhi.
2. R.C.Sachdeva **"Fundamentals of Engg. Heat and Mass Transfer"** New Age International, 2010.
3. P.K.Nag **"Heat Transfer"** TMH Publications, 2011.
4. Ghoshdastidar **"Heat Transfer"** Oxford University Press – 2nd Edition 2008.
5. Yunvs Cengel and Afshin Ghajar **"Heat and Mass Transfer"**, McGraw Hill Publications, 2011
6. R.K. Rajput **"Heat and Mass Transfer"** S.Chand & Company Ltd, 2008.
7. Christopher A Long **"Essential Heat Transfer"** Pearson Education, 1999.
8. Kondandaraman **"Heat and Mass Transfer Data Book"** 8th edition, 2014.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand heat transfer through various modes.
2. Understandhow heat and energy is transferred between the elements of a system for different configurations,
3. Solve problems involving one or more modes of heat transfer.

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Course Code: 50319 **Credits: 4**

B.Tech. – V Semester

METAL CUTTING & MACHINE TOOLS

Pre-requisite: Kinematics of Machinery, Production Technology
Objectives: The objective of this subject is to provide basic knowledge of all conventional Machine tools and to measure cutting forces while machining.

MODULE – I: Elementary Treatment of Metal Cutting Theory [13 Periods]
Elementary Treatment of Metal Cutting Theory: Element of cutting process – Geometry of single point tool and angles chip formation and types of chips – built up edge and its effects chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants, machinability – Tool materials.Cutting tool temperature measuring methods.

MODULE – II: Lathe Machines [14 Periods]
Lathe Machines: Principle of working, specification of lathe – types of lathe – work holders tool holders – Box tools Taper turning thread turning – for Lathes and attachments. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes..

MODULE - III: Shaping, Slotting and Planing Machines &Drilling and Boring Machines. [14 Periods]
A: Shaping, Slotting and Planning Machines: Principles of working – Principal parts – specification classification, operations performed. Machining time calculations.
B: Drilling and Boring Machines: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine. Deep hole drilling machine.

MODULE - IV: Milling machine & Grinding machine [15 Periods]
A: Milling machine – Principles of working – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – machining operations Types geometry of milling cutters – milling cutters – methods of indexing – Accessories to milling machines milling cutters – methods of indexing.
B: Grinding machine – Fundamentals – Theory of grinding – classification of grinding machine – cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Different types of abrasives – bonds specification of a grinding wheel and selection of a grinding wheel.

MODULE - V: Lapping, Honing and Broaching Machines & Principles of design of Jigs and fixtures and uses [15 Periods]
Lapping, Honing and Broaching Machines: Lapping, honing and broaching machines – principle of working, specification of broaching machines, methods of broaching, broaching tools, Classification of Broaching machines, Broaching operations. comparison to grinding – lapping and honing. Kinematics scheme of Lapping, Honing and Broaching machines. Constructional features of speed and feed Units, machining time calculations
Principles of design of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and fixtures.

TEXT BOOKS:

1. **Production Technology,** H.M.T. (Hindustan Machine Tools), 5th edtion, 1986
2. R.K. Jain and S.C. Gupta **Production Technology,** Khanna Publications, 2014.
3. P N RAO Vol II **Manufacturing Technology,** Tata Mc Graw Hill Education, 2nd edition, 2011

REFERENCE BOOKS:

1. C.Elanchezhian and M. Vijayan **Machine Tools**, Anuradha Agencies Publishers, 2nd edition, 2008
2. B.S.Raghu Vamshi – Vol II **Workshop Technology,**Anuradha Agencies Publishers, Dhanpat rai & company, 10th revised, 2014,
3. PC Sharma **Production Technology (Machine Tools),** S.Chand Publishers,7th edition,2006

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Know the importance of various machines.
2. Measure the technique of measuring cutting forces
3. Select suitable machine for an appropriate operation.

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Course Code: 50320 **Credits: 4**

B.Tech. – V Semester

DESIGN OF MACHINE MEMBERS – I

Pre-requisite: Engineering Mechanics, Mechanics of solids and Kinematics of Machinery
Objectives: The objective of this subject is to providethe knowledge to design the machine members like welded joints, bolted joints, shafts, couplings by considering different stresses.

MODULE – I: Introduction & Stresses in Machine Members [15 Periods]
A: Introduction: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. Tolerance and fits-BIS codes of Steels
B: Stresses In Machine Members: Simple stresses –Introduction to Torsion- Complex stresses – impact stresses – stress strain relation – Various theories of failure – factor of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

MODULE – II: Fatigue Loading [13 Periods]
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.

MODULE - III: Riveted, Welded & Bolted Joints [13 Periods]
A: 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.
B: Bolted Joints: – Design of bolts with pre-stresses – Design of joints under eccentric loading – bolt of uniform strength, Cylinder cover joints

MODULE - IV: Design of Shafts, Shaft Coupling & Axially Loaded Joints [13 Periods]
A: Design of Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code – Design of shaft for a gear and belt drives.
B: Shaft Coupling: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Pin - Bush coupling.
C: Axially Loaded Joints: Keys, Cotters and Knuckle Joints:Design of Keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.

MODULE - V: Mechanical Springs [12 Periods]
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.

TEXT BOOKS:
1**.** Shigley "**Mechanical Engineering Design",** McGraw-Hill, 8th edition, 2006
2. Pandya & shah "**Machine design",** Charotar Publishers, 19th edition, 2014

REFERENCE BOOKS:
1. V.M. Faires "**Design of Machine Elements",** C.B.S. Publishers & Distributors, the Macmillan company, 4th edition,1965

2. Allen s. Hall "**Machine design"** / Schaum Series, McGraw hill, 1966
3. S MD Jalaludin "**Machine Design",** Anuradha Publishers Chennai.
4. Data Books: (I) P.S.G. College of Technology (ii) Mahadevan,CBS publisher, 3rd edition, 2010

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Know a particular sub-set of machine elements and a given problem, Define failure, Decide on an appropriate failure model.
2. Design an appropriate machine element using allowable load (under the given operating conditions), required element life, Manufacturing considerations, and Manage engineering projects.

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Course Code: 50321 **Credits: 3**

B.Tech. – V Semester

AUTOMOBILE ENGINEERING

(PROFESSIONAL ELECTIVE-I)

Pre-requisite: Thermal Engineering

Objectives: The objective of this subject is to provide knowledge about various systems involved in automobiles.

MODULE – I: Introduction, Fuel System & C.I. Engines [15 Periods]

A: 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, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, re boring, de carbonization, Nitriding of crank shaft..

B: Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection.

C: C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.

MODULE – II: Cooling System & Ignition System [15 Periods]

A: Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

B: 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.

MODULE - III: Emission from Automobiles & Electrical System [15 Periods]

A: Emission from Automobiles: Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG,CNG, liquid Fuels and gaseous fuels, electrical-their merits and demerits.

B: 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.

MODULE - IV: Transmission System [14 Periods]

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 – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

MODULE - V: Suspension System, Braking System & Steering System [15 Periods]

A: Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

B: Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

C: 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.

TEXT BOOKS:

1. William Crouse **"Automobile Mechanics",** TMH Education, 10th edition
2. Gupta, Vol – 2 **"Automobile Engineering",** Standard Publications,

REFERENCE BOOKS:

1. Newton Steeds & Garrett **"Automotive Engineering",**
2. G.B.S. Narang **"Automotive Mechanics",** Khanna Publishers
3. Heitner **"Automotive Mechanics",** D. Van Nostrand company
4. Srinivasan **"Automotive Engines",** Tata McGraw-Hill Education
5. K.K. Ramalingam **"Automobile Engineering",** Scitech Publications (India) PVT.LTD.
6. Kripal Sing -Vol. 1 & Vol. 2 **"Automotive Mechanics",** Standard Publishers

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Know the various parts of automobile.
2. Understand various systems involved and their importance in automobiles.

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Course Code: 50322 **Credits: 3**

B.Tech. – V Semester
FOUNDRY TECHNOLOGY
(PROFESSIONAL ELECTIVE-I)

Pre-requisite: Production Technology.
Objectives: Provide the students with knowledge on the principles that guides production of sound engineering castings

MODULE – I: Introduction to Foundry [13 Periods]
Introduction to Foundry: 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.

MODULE – II: Solidification of casting [12 Periods]
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., Mould making machines.

MODULE – III: Directionality of Solidification & Methods of Melting [13 Periods]
A: Directionality of Solidification, Characteristics of different alloys, system of determining the feeder head requirements, Feeder head efficiency, and concept of feeding range,
B: Methods of Melting: Crucible melting, blast furnace and cupola operation, steel making processes.

MODULE – IV: Special casting processes & Industrial melting practices [12 Periods]
A: Special casting processes: Investment casting, Die casting, centrifugal casting, full mould casting, vacuum shield casting etc.
B: Industrial melting practices: Aim of melting and melting practices as adopted in case of Cast Irons, Steel, Cu, Al and its alloys.

MODULE – V: Casting defects & their remedies [12 Periods]
Casting defects & their remedies: Shaping faults arising in pouring, Inclusions and sand defects, gas defects, shrinkage defects during solidification in liquid phase. Contraction defects, Dimensional errors, compositional errors and segregation.

TEXT BOOKS:
1. Beeley, P.R., "**Foundry Technology"**, Butterworth and Co, 1st edition, 1972.
2. Webster, P.D., "**Fundamentals of Foundry Technology"**Redhill, Surrey: Portcullis Press, 2nd edition, 1980.

REFERENCE BOOKS:
1. Mukherjee, P.C, **"Fundamentals of Metal casting Technology"**, 2nd edition, 1988
2. O P Khanna, **"Foundry Technology", Dhanpat Rai Publications"**, 17th edition, 2011

COURSE OUTCOME:
After completion of the course, students will be able to:

1. Describe moulding, casting and solidification processes;
2. Differentiate between the different casting processes and their end products
3.Understand melting practice and chemical reactions that take place in the furnaces

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Course Code: 50323 **Credits: 3**

B.Tech. – V Semester

MECHANICS OF COMPOSITE MATERIALS

(PROFESSIONAL ELECTIVE-I)

Pre-requisite: Mechanics, Strength of Materials

Objectives: The objective of the subject is to provide the knowledge on the stress-strain relationship of composite lamina and laminates.

MODULE – I: Basic concepts and characteristics, Reinforcements & Manufacturing methods [14 Periods]

Basic concepts and characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosetting plastics, metal matrix and ceramic composites.

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

MODULE – II: Micromechanics [12 Periods]

Micromechanics: Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

MODULE – III: Coordinate transformations [13 Periods]

Coordinate transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

MODULE – IV: Elastic behavior of unidirectional composites [14 Periods]

Elastic behavior of unidirectional composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

Strength of unidirectional lamina: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects.Micro mechanical predictions of elastic constants.

MODULE – V: Elastic behavior of laminates [13 Periods]

Elastic behavior of laminates: Basic Assumptions, Strain –Displacement relations, Stress-Strain relations, laminate stiffness, laminate compliance, symmetric laminates, Orthotropic Laminates, laminate engineering properties, computational procedure for determination of elastic properties.

TEXT BOOKS:

1. R. M. Jones, "**Mechanics of Composite Materials**, Mc Graw Hill Company, New York, 2nd edition, 1993.
2. Isaac and M.Daniel"**Engineering Mechanics of Composite Materials,** Oxford University Press. Vol. 13, 2006.

REFERENCE BOOKS:

1. B. D. Agarwal and L. J. Broutman, "**Analysis and performance of fibre Composites"**, Wiley-Interscience, New York.
2. L. R. Calcote, "**Analysis of Laminated Composite Structures"**, Van Nostrand Rainfold

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understanding of types, manufacturing processes, and applications of composite materials.
2. analyze problems on macro mechanical behavior of laminate
3. Obtain laminate behavior under loads.

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Course Code: 50324 **Credits: 2**

B.Tech. – V Semester

HEAT TRANSFER LAB

Note: Any 12 experiments need to be performed.

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 apparatus
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. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

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Course Code: 50325 **Credits: 2**

B.Tech – V Semester
KINEMATICS & DYNAMICS LAB

Note: Any 12 experiments need to be performed

1. Cam Analysis – Cam Profile and Jump-speed Characteristics
2. Determination of Critical Speed
3. Determination of Gyroscopic Couple
4. Determination of Natural Frequency-spring mass system
5. Determination of Natural Frequency-free transverse system
6. Determination of Radius of Gyration and Moment of Inertia-compound pendulum
7. Determination of Radius of Gyration and Moment of Inertia-bifilar system
8. Balancing of Rotating Masses-static
9. Balancing of Rotating Masses-dynamic
10. Speed Ratio of Epi-cyclic Gear Train
11. To study various types of Kinematic links, pairs, chains and Mechanisms.
12. To study various types of gear trains – simple, compound, reverted, epicyclic and differential
13. To generate spur gear involute tooth profile using simulated gear shaping process.
14. Governor apparatus with differential attachments
15. To study various type of cam and follower arrangements

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Course Code: 50326 **Credits: 2**

B.Tech. – V Semester

MACHINE TOOLS LAB

Note: Any 12 experiments need to be performed

1. Introduction of general purpose machines - Lathe, Drilling machine, Milling machine, Shaper, Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
2. Step turning, taper turning (swelling compound rest),grooving on lathe machine.
3. Taper turning by taper turning attachment.
4. Thread cutting and knurling using lathe machine.
5. Drilling a hole using lathe machine.
6. Drilling and Tapping using Radial drilling machine
7. Cutting 'V' groove using shaping machine
8. Cutting slots on circular shaft using slotting machine.
9. Cutting key ways using milling machines.
10. Surface Grinding using surface grinding machine.
11. Setting tool angles using tool & cutter grinder.
12. Cutting grooves/Plain surface using planing machine.
13. Cylindrical grinding by cylindrical grinding machine.

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Course Code: 50H05 **Credits: 1**

B.Tech. – V Semester
SOFT SKILLS

Introduction:

Today's dynamic business world seeks ways to help their work force learn as they progress through applicable information to help drive business. In keeping with the evolving need of firms and the recruiting process, this course aims at catering to the needs of the students fresh from the academic background ready to enter the world of work from the HR perspectives of any company. Perhaps it is noticed that an intelligent individual lacks the ability to work on team assignments, communicate with clients, or maintain professionalism. This course is a comprehensive preparation and a bridge course that would enable the students to be industry ready before they wind up their undergraduate course. The modules that are chosen are the ones that the industry experts from Infosys emphasize upon. Apart from the technical skills, the course intends to enhance the employability skills and make them employment ready.

Objectives:

- To broaden the perspective of job seekers and help them gain awareness on the standards and the expectations of the recruiters in the industry.
- To draw a link between the academics and the industry and emphasize the importance of the right attitude, grooming, etiquette, self motivation, empathy, commitment, responsibility, self awareness and patience while dealing with a variety of people
- Refining the communication skills of the students
- Sharpen the analytical skills for appropriate decision making
- To develop the art of communication; verbal and non verbal for effective inter and intra personal skills

Syllabus:

1. Spoken aspects of Communication
2. Work/Business etiquette- dressing and grooming, telephone etiquette, meeting etiquette, dining etiquette, small talk, dealing with people
3. Business communication-Fundamentals of effective communication, Barriers and filters
4. Work in teams-Team concept, advantages of working in teams, team players/leaders
5. Intra personal skills- handling negative emotions;attitude,self confidence, self esteem
6. Principles of goal setting
7. Effective Time management skills
8. Reading skills
9. Writing skills
10. Digital language

Reference books:

- The Power of Habit: Why We Do What We Do in Life and Business by Charles Duhigg
- The Zen of Steve Jobs (Paperback) by Caleb Melby
- Software Systems Architecture: Working with Stakeholders Using Viewpoints and Perspectives by Nick Rozanski
- The Art of Focused Conversation: 100 Ways to Access Group Wisdom in the Workplace (Paperback) by R. Brian Stanfield
- The Little Book of Talent: 52 Tips for Improving Your Skills by Daniel Coyle

- The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change (Paperback) by Stephen R. Covey
- How to Win Friends and Influence People (Paperback) by Dale Carnegie
- Thinking, Fast and Slow by Daniel Kahneman
- Never Eat Alone: And Other Secrets to Success, One Relationship at a Time by Keith Ferrazzi
- Emotional Intelligence: Why It Can Matter More Than IQ by Daniel Goleman
- The Effective Executive: The Definitive Guide to Getting the Right Things Done (Paperback) by Peter F. Drucker
- How to Recruit and Hire Great Software Engineers: Building a Crack Development Team (Paperback) by Patrick McCuller
- Quiet: The Power of Introverts in a World That Can't Stop Talking by Susan Cain
- The $100 Startup: Reinvent the Way You Make a Living, Do What You Love, and Create a New Future by Chris Guillebeau
- The Presentation Secrets of Steve Jobsby Carmine Gallo Ackoff,Ressel Lincoln.The art of Problem solving.New York:Wiley.
- The Leader's Guide to Influence: How to Use Soft Skills to Get Hard Results (Paperback) by Mike Brent

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Course Code: 50H14 **Credits: 2**

B.Tech. – VI Semester

INDUSTRIAL MANAGEMENT

PREREQUISITES: NIL

COURSE OBJECTIVES:

Through reading the text, references and discussion of cases students should be able to understand the fundamentals underlying the management of an organization and Industrial Management.

MODULE – I **(12 Periods)**

Introduction to Management: Concepts of Management and organization-nature, importance and Functions of Management, Taylor's Scientific Management Theory, Fayols

Principles of Management,: Mayo's Hawthorne Experiments, 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 Management.

MODULE – II **(11 Periods)**

Designing Organizational Structures: Basic concepts related to Organization - Departmentation and Decentralization, Types of mechanistic and organic structures of organization

Types of Organizations: Line organization, Line and staff organization, functional organization ,committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat Organization structure and their merits, demerits and suitability.

MODULE – III **(11 Periods)**

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,

a) **Material Management:** Objectives, Need for Inventory Control, EOQ, ABC Analysis, Purchase procedure, Store Management and Stores Records –Supply Chain Management
b) **Marketing:** Functions of Marketing, Marketing Mix, Marketing Strategies based on Product life Cycle., Channels of Distribution

MODULE – IV **(11 Periods)**

Human Resource 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.

Project Management: (PERT/CPM): Network Analysis, 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)

MODULE – V **(11 Periods)**

Contemporary Management Practices: Basic Concepts of Just -In-Time (JIT) systems, Total Quality Management (TQM), Six sigma and capability maturity modal (CMM) levels, Value Chain Analysis, Entrepreneurship Resource Planning (ERP), Performance Management, business

process Outsourcing (BPO), Business process re-engineering 5s Model, Deming's PDCA, Kaizen, Poka-Yoke, Muda, Bench marking, Balanced Score Card.
Strategic Management: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of corporate planning process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, generic Strategy Alternatives.

TEXT BOOKS:

1. Aryasri: *Management Science*, TMH, 2004.
2. Stoner, Freeman, Gilbert, *Management*, 6th Ed, Pearson Education, New Delhi, 2004.

REFERENCE BOOKS*:*

1. Stoner, Management, Person, 2009.
2. Kotler philipand Keller Kevin Lane: Marketing Management PHI, 2009.
3. Koontz, Weihrich, and Aryasri: Principles of Management, TMH, 2009.
4. Thomas N.Duening & John M. Ivancevich Management, Principles and Guidelines, Cengeage, 2009.
5. Kaniska Bedi, Production and Operations management, Oxford University Press, 2009.
6. Memoria & S.V. Ganker, Personnel Management, Himalaya, 2009.
7. Schermerhon: Management, Wiley, 2009.
8. Parnell: Stragic Management, Biztantra, 2009.
9. L.S.Srinath: PERT/CPM, Affiliated East-West Press, 2009.
10. William J.Stevenson & Ceyehun Ozgur: Introduction to Management Science, TMH, 2007.

COURSE OUTCOME:
After completion of the course, students will be able to:

1. Learn the history of management and the contributions of important management techniques.
2. Understand the relevance of environmental scanning, planning and how to take decisions.
3. Delegate authority and use power to influence people to get the work done through proper communication and control.
4. Learn HR strategies of recruitment and selections and Marketing strategies.

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Course Code: 50327 **Credits: 4**

B.Tech. – VI Semester

THERMAL ENGINEERING –II

Pre-requisite: Thermodynamics, Thermal Engineering - I
Objectives: The objective of this subject is to provide knowledge about different cycle used in power plants andto provide knowledge about boilers, turbines and their principle of operations.

MODULE – I: Basic Concepts [13 Periods]
Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating. **Combustion**: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, flue gas analysis

MODULE – II: Boilers [14 Periods]
Boilers : Classification – Working principles – with sketches including H.P.Boilers – Mountings and Accessories – Working principles, Boiler horse power, equivalent evaporation, efficiency and heat balance – Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced draft.

MODULE - III: Steam Condensers & Steam Nozzles [15 Periods]
A: Steam Condensers : Requirements of steam condensing plant – Classification of condensers – working principle of different types of condensers vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement
B: 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 to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

MODULE - IV: Steam Turbines & Reaction Turbine [15 Periods]
A: Steam Turbines: Classification – 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.
B: 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.

MODULE - V: Gas Turbines, Jet Propulsion & Rockets [16 Periods]
A: 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 about compressors, combustion chambers and turbines of Gas Turbine Plant.
B: 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 engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

C: Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. V.Ganesan "**Gas Turbines",** TMH Publishers, 3rd edition, 2010.
2. R.K. Rajput "**Thermal Engineering",** Lakshmi Publications, 9th edition, 2013.

REFERENCE BOOKS:

1. R. Yadav "**Thermodynamics and Heat Engines",** Central Book Depot,7th edition, 2007.
2. P.Khajuria & S.P.Dubey "**Gas Turbines and Propulsive Systems",** Dhanpatrai Publications, 2012
3. Cohen, Rogers and Saravana Muttoo, Addison Wesley – Longman "**Gas Turbines",** Pearson publishers, 5th edition, 2001.
4. R.S Khurmi "**Thermal Engineering",** JS Gupta S.Chand Publishers, 5th edition, 1978
5. P.L.Bellaney "**Thermal Engineering",** khanna publishers. 5th edition, 2010
6. M.L.Marthur & Mehta "**Thermal Engineering",** Jain bros Publishers, 3rd edition, 2014.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Cycles used in different power plants.
2. Know the principle of operation of various turbines.
3. Calculate efficiency of various power plants.

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Course Code: 50328 **Credits: 4**

B.Tech. – VI Semester

DESIGN OF MACHINE MEMBERS – II

Pre-requisite: Design of Machine Members-I
Objectives: The objective of this subject is To provide knowledge of designing bearings and power transmitting elements like pulleys and gears.

MODULE – I: Sliding Contact Bearings & Rolling ContactBearings [14 Periods]
A: Sliding Contact Bearings: Types of Journal bearings – Basic modes of Lubrication – Bearing construction –bearing design –bearing materials – Selection of Lubricants
B: Rolling ContactBearings: 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

MODULE – II: Design of IC Engine Parts [13 Periods]
Design of IC Engine Parts: 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.

MODULE - III: Power Transmissions Systems &Ropes &Pulleys [13 Periods]
A: Power Transmissions Systems: Transmission of power by Belt and Rope drives, Transmission efficiencies. Belts – Flat and V types
B: Ropes &Pulleys: Rope pulleys for belt and rope drives, Materials, Chain drives

MODULE - IV: Spur Gear Drives & Helical and Bevel Gear Drives [16 Periods]
A: Spur Gear Drives: Spur gears- Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.
B: Helical and Bevel Gear Drives: Helical and Bevel gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of Helical and Bevel gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

MODULE - V: Design of Worm Gears & Design of Power Screws [14 Periods]
A: 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.
B: Design of Power Screws: Design of screw, Square ACME, Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

TEXT BOOKS:
1. JE Shigley "**Mech. Engg. Design",** Tata McGraw-Hill Education, 6th edition, 2001
2. V.Bhandari "**Machine Design",** TMH Publishers, 1994.

REFERENCE BOOKS:
1. R.N. Norton "**Machine Design",**Penton IPC
2. Kannaiah "**Machine Design",** Scietech Publishers, 2010
3. S MD Jalaludin "**Machine Design",** Anuradha Publishers.

4. R S khurmi & J S Gupta "**Machine Design",** S Chand Publishers, 25th edition 2005.
5. Data Books: (I) P.S.G. College of Technology (ii) Mahadevan, CBS publishers, 4th edition 2013.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Apply best practice of manufacturing and assembly guidelines to their designs.
2. Understand the capabilities and limitations of the main production processing groups in relation with the design, apply process selection, component costing, manufacturing planning and design strategies to their projects.

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Course Code: 50329 **Credits: 3**

B.Tech. – VI Semester

REFRIGERATION AND AIR CONDITIONING

(PROFESSIONAL ELECTIVE-2)

Pre-requisite: Thermodynamics and Thermal Engineering
Objectives: The objective of this subject is to provide knowledge about different cycles and working principle of refrigeration and air conditioning systems.
Codes/Tables: Refrigeration Tables and psychrometric charts

MODULE – I: Introduction to Refrigeration & Air Refrigeration [14 Periods]
A: Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. –Mechanical Refrigeration – Types of Ideal cycles of refrigeration.
B: Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air craft's.

MODULE – II: Principles of Evaporators & Vapour compression refrigeration. [15 Periods]
A: Principles of Evaporators: classification – Working Principles, Expansion devices – Types – Working Principles Refrigerants – Desirable properties – classification refrigerants used – Nomenclature
B: Vapour Compression Refrigeration: working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems.

MODULE - III: Vapor Absorption System & Steam Jet Refrigeration System. [14 Periods]
A: Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System. Principle of operation Three Fluid absorption system, salient features.
B: Steam Jet Refrigeration System – Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube

MODULE - IV: Introduction to Air Conditioning [13 Periods]
Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

MODULE - V: Requirements of human comfort and concept of effective temperature & Air Conditioning systems [14 Periods]
A: Requirements of human comfort and concept of effective temperature- Comfort chart – Comfort Air conditioning – Requirements of Industrial air conditioning, Air conditioning Load Calculations.
B: Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers fans and blowers. Heat Pump – Heat sources – different heat pump circuits.

TEXT BOOKS:
1. CP Arora "**Refrigeration and Air Conditioning",** McGrawhill Education Publishers, 3rd edition, 2008.

2. SC Arora & Domkundwar "**A Course in Refrigeration and Air conditioning",** Dhanpatrai Publications, 3rd edition, 1980.

REFERENCE BOOKS:

1. Lang "**Air Conditioning",** Thomson delmas learning publishers, 5th edition, 1995.
2. Dossat "**Principles of Refrigeration",** Pearson Education.1997.
3. P.L.Bellaney "**Refrigeration and Air Conditioning",** Khanna Publishers, 3rd edition, 2013.
4. Ananthanarayanan "**Basic Refrigeration and Air-Conditioning",** TMH Publishers, 2005.
5. R.S. Khurmi & J.K Gupta **"A Text Book of Refrigeration and Air Conditioning",** S. Chand – Eurasia Publishing House (P) Ltd., 2006
6. Manohar Prasad "**Refrigeration and Air Conditioning",** New Age International Publisher, 2007.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand of the fundamentals of refrigeration.
2. Know main system, components and the range of applications, including air conditioning and heat pumps, the use of controls, and the key provisions and impact of recent legislation on the sector.

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Course Code: 50330 **Credits: 3**

B.Tech. – VI Semester

CNC TECHNOLOGY

(PROFESSIONAL ELECTIVE-2)

Pre-requisite: Metal cutting and Machine Tools

Objectives: The objective of the subject is to provide the knowledge programming and operation of computer numerical controlled machines.

. **MODULE – I: Features of NC Machines & NC Part Programming [15 Periods]**

A: Features of NC Machines: Fundamentals of Numerical Control, advantages of NC systems, classifications of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of N/C Machine Tools, Design consideration of NC machine tool, methods of improving machine accuracy.

B: NC Part Programming: Manual Programming- Basic concepts, point to point counter programming canned cycles, parametric programming.

MODULE – II: CNC Machine Elements & Tooling for CNC Machines [14 Periods]

A: CNC Machine Elements: Machine Structure- Guide ways- feed drives-spindles- spindle bearings – measuring systems- Tool monitoring systems.

B: Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling systems, modular fixturing, quick change tooling system, automatic head changers.

MODULE - III: Computer-Aided Programming & NC programming [13 Periods]

Computer-Aided Programming: General information, APT programming Examples Apt programming problems (2D machining only)

NC programming: CAD/CAM Systems, the design and implementation of post processors Introduction to CAD/CAM Software, Automatic Tool path generation

MODULE - IV: DNC Systems and Adaptive control [13 Periods]

DNC Systems and Adaptive control: Introduction type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining process like turning, grinding.

MODULE - V: Micro Controllers & Programming Logic Controllers (PLC'S)

[15 Periods]

A: Micro Controllers: Introduction, Hardware components, I/O pins, ports external memory, counters, timers and serial data I/O INTERRUPTS. Selection of Micro Controllers, Embedded Controllers, Applications and Programming of Micro Controllers.

B: Programming Logic Controllers (PLC'S): Introduction, Hardware components of PLC, system, basic structure principles of operations, programming mnemonics timers, Internal relays and counters, Applications of PLC'S in CNC Machines.

TEXT BOOKS:

1. Yoram Koren **"Computer Control of Manufacturing systems"** Mc Graw Hill Publishers.
2.Michel P.Groover **"CAD/CAM"** TMH Publishers, 1994.

REFERENCE BOOKS:

1. Manfred Week **"Machining Tools Hand Book"** Vol 3, (Automation and Control), John Wiley and Sons, 1984
1.**"Mechatronics"** HMT Publishers
2.**"Production Technology"** HMT Publishers

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Generate the G-code.
2. Troubleshoot the program by running the simulation.
3. Fabricate the part as per the drawing.

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Course Code: 50331 **Credits: 3**

B.Tech. – VI Semester

FINITE ELEMENT METHODS
(PROFESSIONAL ELECTIVE-2)

Pre-requisite: Engineering Mechanics, Mechanics of solids and Design of Machine Members
Objectives: The objective of this subject is to provide knowledge of formulating and solving of physical problems using finite element methods.

MODULE – I: Introduction to FEM & Basic Equation of elasticity [14 Periods]
A: Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM With other methods.
B: Basic Equation of elasticity: Stress-strain and strain-Displacement relations, Raleigh-Ritz method, weighted residual methods

MODULE – II: One Dimensional Problems [16 Periods]
One Dimensional Problems: Stiffness equation for a axial bar element in local co-ordinates using Potential energies approach and Virtual energy principle-Finite Elements analysis of uniforms, stepped and tapered bars subjected to mechanical and thermal loads-assembly of Global Stiffness matrix and load vector-quadric shape functions –properties of stiffness matrix.
Stiffness equation for a truss bar element oriented in 2D plane-Finite Element analysis of trusses-plane truss and Space truss elements-methods of assembly

MODULE - III: Analysis of Beams & Stiffness matrix [8 Periods]
A: Analysis of Beams: Hermite shape functions.
B: Stiffness matrix: Element stiffness matrix-Load vector –problems.

MODULE - IV: 2-D Problems [14 Periods]
A: 2-D Problems: CST **–** stiffness matrix and load vector –Isoperimetric element representation – shape function –convergence requirements-problems.
Two dimensional four nodded Isoperimetric elements – Numerical integration- Finite Element Modeling of Ax symmetric solids subjected to Axisymmetric loading with triangular elements-3D Problems-Tetrahedran elements

MODULE - V: Scalar field problems & Dynamic Analysis [13 Periods]
A: Scalar field problems : 1D Heat conduction- 1 D Fin Elements – 2D Heat Conduction-Analysis of thin plates-Composite slabs- Problems.
B: Dynamic Analysis: Dynamic equations-Lumped and Consistent Mass Matrices- Eigen Values and Eigen Vectors-Mode shapes- Model Analysis for Bars and Beams

TEXT BOOKS:

1. S.S.Rao-Elsevier **"The Finite Element Methods in Engineering"** 4th Edition, Elsevie Publishers, 5th edition, 2010.
2. Tirupati.K Chandrupatla and Ashok. D. Belagunda **"Introduction to Finite Elements in Engineering"** Pearson Prentice Hall, 3rd edition, 2002

REFERENCE BOOKS:

1. Alavala **"Finite Element Methods",** PHI Publishers, 2008.
2. J.N.Reddy **"An Introduction to finite element methods"**, TMH Publishers, 3rd edition, 2005.
3. O.C.Zienkowitz **"The Finite element method in engineering science",** McGrawhill Publishers, 2010.
4. Robert Cook **"Concepts and Applications of finite element analysis"** Wiley Publishers, 2009
5. S.Md.Jalaludeen **"Introduction to Finite Element Analysis",** Anuradha publications

COURSE OUTCOME:

After completion of the course, students will be able to:

1.Develop comprehensive knowledge in the fundamental mathematical and physical basis of FEM, how to do build FEM models of physical problems and apply appropriate constraints and boundary conditions along with external loads and exercise critical thinking in interpreting results from FEM analysis.

2. Identify bad results by looking at deflected shapes, stress contours, eigen frequency animations as well as field distributions.

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Course Code: 50332 **Credits: 3**

B.Tech. – VI Semester

POWER PLANT ENGINEERING

(PROFESSIONAL ELECTIVE-3)

Pre-requisite: Thermal engineering - II
Objectives: The objective of this subject is to provide knowledge of Power generating units and their working principle with operations.
Codes/Tables: Steam tables.

MODULE – I: Steam Power Plant &Combustion Process & Combustion Process [15 Periods]

Introduction to the Sources of Energy – Resources and Development of Power in India.
A: 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.
B: 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, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

MODULE – II: Internal Combustion Engine Plant & Gas Turbine Plant [14 Periods]
A: Internal Combustion Engine Plant: Diesel Power Plant Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.
B: Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

MODULE - III: Hydro Electric Power Plant, Hydro Projects and Plant, Power from Non-Conventional Sources & DirectEnergy Conversion [14 Periods]
A: Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.
B: Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.
C: Power From Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy**.**
D: DirectEnergy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

MODULE - IV: Nuclear Power Station, Types of Reactors & Types of Reactors [14 Periods]

A: Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.
B: 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.

MODULE - V: Power Plant Economics and Environmental Considerations [15 Periods]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 exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS:

1.Arora and S. Domkundwar **"A Course in Power Plant Engineering",**Dhanpat Rai Publisher, latest
2.P.C.Sharma **"Power Plant Engineering"** S.K.Kataria Publisher,2013

REFERENCE BOOKS:

1. P.K.Nag "**Power Plant Engineering"**, TMH Publishers, II Edition, 2006
2. Ramalingam "**Power plant Engineering",** Scietech Publishers, 2006
3. ElWakil **"Power station Engineering"** McHill Publisher,2nd edtion, 2013
4. G.D. Rai **"An Introduction to Power Plant Technology"** Khanna Publishers,3rd edition,2013
5. Elanchezhian **"Power plant Engg"** I.K. International Pub, 2007
6. Rajput "**A Text Book of Power Plant Engineering"** Laxmi Publications,4th edition,2007

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Assess the design and working principle of the power plants.
2. Know power plant economics, and their impact on environment.

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Course Code: 50333 **Credits: 3**

B.Tech. – VI Semester

MAINTENANCE AND SAFETY ENGINEERING

(PROFESSIONAL ELECTIVE-3)

Pre-requisite:No

Objectives: The objective of this subject is to provide knowledge of types of maintenance, quality, safety, Inventory and Reliability control in maintenance.

MODULE – I: Introduction [12 Periods]

Introduction: Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.

MODULE – II: Maintenance Management and Control & Types of Maintenance [16 Periods]

A: Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management. Maintenance project control Methods, Maintenance Management Control Indices.

B: Types of Maintenance: Preventive maintenance elements of preventive, maintenance program, Establishing Preventive maintenance program PM Program Evaluation and improvement, PM Measures, PM Models, Corrective maintenance, maintenance types Corrective maintenance steps and Downtime Components, Corrective maintenance measures Corrective maintenance models

MODULE - III: Inventory control in Maintenance [13 Periods]

A: Inventory control in Maintenance - I: Inventory control Objectives and basic Inventory decision, ABC Inventory control method.

B: Inventory control in Maintenance - II: Inventory Control Models Two-Bin inventory control and Safety Stock, Spares Determination factors Spares calculation Methods.

MODULE - IV: Quality and Safety in Maintenance [16 Periods]

Quality and Safety in Maintenance: Needs for Quality Maintenance process, Maintenance work quality, Use of quality Control charts in Maintenance Work Sampling, post Maintenance Testing, Reasons of Safety problems in Maintenance, Guidelines to improve safety in Maintenance work, Safety Officer's Role in Maintenance Work, protection of Maintenance workers. Maintenance Costing: Reasons for Maintenance costing, Maintenance Budget preparation Methods and Steps, Maintenance Labor cost Estimation, Material cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

MODULE - V: Reliability, Reliability controlled Maintenance, RCM, & Maintainability [16 Periods]

A: Reliability, Reliability controlled Maintenance, RCM: Goals and principles, RCM process and Associated Questions, RCM program Components Effectiveness Measurement Indicators. RCM Benefits and Reasons for its Failures. Reliability Versus Maintenance and Reliability in support Phase. Bathtub Hazard Rate Concept, Reliability Measures and Formulas Reliability Networks, Reliability analysis Techniques.

B: Maintainability: Maintainability Importance and Objective Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS:

1.Dr. A.K.Guptha "**Reliability: Maintenance and Safety Engineering",** Laxmi Publications.
2.L.M. Deshmukh "**Industrial Safety Management",** TMH Pulications

REFERENCE BOOKS:

1. R.C.Mishra "**Maintenance Engineering & Management"**, PHI Publications
2. Elsayed"**Reliability Engineering",** Pearson Publishers
3.B.S.Dhallon"**Engineering Maintenance a Modern Approach**" C.R.R publishers, 2002

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Know the need of quality and safety in maintenance
2. Understand the concept behind maintenance andMaintenance Management and Control.

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Course Code: 50334 **Credits: 3**

B.Tech. – VI Semester

MECHANICAL VIBRATIONS

(PROFESSIONAL ELECTIVE-3)

Pre-requisite: Dynamics of Machines

Objectives: An introductory course in linear mechanical vibrations where students acquire the ability toformulate mathematical models of problems in vibrations using Newton's second law or energy principles, determine a complete solution to mechanical vibration problems using mathematical or numerical techniques and physical and design interpretations from the results.

MODULE – I: Introduction [10 Periods]

Introduction: Importance and scope ,definition and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

MODULE – II: Single Degree Freedom Systems-I, Single Degree Freedom Systems-II & Single Degree Freedom Systems with Forced Vibrations [17 Periods]

A: Single Degree Freedom Systems-I: Un damped free vibration: Classical method, Energy method, phase plane method, equivalent systems, torsional systems.

B: Single Degree Freedom Systems-II: Damped free vibration: Viscous damping, under damping, critical damping, coulomb damping, equivalent damping coefficient

C: Single Degree Freedom Systems With Forced Vibrations: Steady state forced vibration, sources of excitation, impressed harmonic force, impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and vibro meter, methods of vibration control, excitation reduction at source, system modification.

MODULE - III: Two Degree Freedom Systems [10 Periods]

Two Degree Freedom Systems: Natural frequencies and modes of vibration by classical method of spring-mass system, forced vibration, dynamic vibration absorber

MODULE - IV: Multi Degree Freedom Systems [12 Periods]

Multi Degree Freedom Systems: Influence co-efficient method, damped mass and distributed mass systems, stodola method, Holzer's method, newtons iteration method, orthogonality of mode shapes.

MODULE - V: Vibration in Continuous Systems [14 Periods]

Vibration In Continuous Systems: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts.

Whirling of shafts critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

TEXT BOOKS:

1. G.K.Grover "**Mechanical Vibrations",** Nem Chand Publisher
2. J.S.Rao and K.Gupta "**Theory and practice of mechanical Vibrations",** New Age International Publishers

REFERENCE BOOKS:

1. W.T.Thomson "**Vibration Theory and Applications",** CRC Press Publishers
2. Timeshenko and Young "**Vibration problems in Engineering",** Oxford City Press Publishers
3. S.S. Rao "**Mechanical Vibrations",** Pearson Edu
4. Tongue "**Principles of Vibrations",** Oxford Univ. Press
5. "**Mechanical Vibration"**, Shyam Series.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Construct the equations of motion from free-body diagrams.
2. Solve the motion and the natural frequency of (a) a freely vibrating single degree of freedom un damped motion and (b) a freely vibrating single degree of freedom damped motion.
3. Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force.
4. Decompose any periodic function into a series of simple harmonic motions using Fourier series analysis.
5. Solve the motion and the natural frequency for forced vibration of a single degree of freedom damped or un-damped system.

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Course Code: 50H03 **Credits: 2**

B.Tech. – VI Semester

TECHNICAL COMMUNICATION AND PRESENTATION SKILLS

Pre-requisite: Basic English.

Introduction: Identifying the importance of communication at work and the nuances of technical communication became imperative to technical graduates. This course intends to introduce the importance, characteristics and nuances of technical communication. Technical communication is all about exchange of information that helps people interact with technology and solve complex problems. Since the communication skills cannot be taught but be developed through practice the student will be competent communicator through application and the use of the concepts and activities in different units.

Objectives: The learners need to be aware of the characteristics of technical communication. The learners are exposed different channels of technical communication**.** The learners should be an effective communicator.

Methodology: Facilitator's role: Since classroom learning augments thinking process, helping them to develop written, spoken and non verbal communication, the facilitator / Faculty would briefly discuss the topics with the students and later on guide them while the students involve in activities, writing work and while making presentations. The facilitator is required to design a lot of practical/industry oriented project works for the students
*Students are required to participate, perform, write and submit the work in the form of written documents or Power Point Presentations to hone their spoken written and non verbal communication skills. Students are to take up field work and submit the project work.

MODULE - I: Technical Vocabulary **[6 Periods]**
Building vocabulary – identify formal and informal vocabulary – identify technical vocabulary – tips to enhance technical vocabulary, Basics of English Pronunciation.

MODULE - II: Technical writing **[6 Periods]**
Characteristics of writing – mechanics of writing – methodology of writing – format & style-structures of writing – circular writing – memo writing – instructions writing.

MODULE - III: Technical Report writing **[6 Periods]**
Types of report, Abstract Writing, Project report writing, importance of pictorial presentation-graphs, diagrams etc
Instruction: The students are required to work on a project. Field work and collection of information, prepare a project report.

MODULE - IV:Oral Presentations **[6 Periods]**
Types of Presentations, 4Ps of Effective Presentation, Elements of effective presentations, Planning and preparing a model presentation, organizing, Barriers of making effective presentation.
Present the project in the form of Power Point Presentation and written document. This report will be given weightage during the external examination.
*This particular module is for internal evaluation purpose(s).

MODULE - V:Strategies of Reading Technical Text **[6 Periods]**
Note - making, SQR3, Reading and answering the technical texts, Reading for Specific Purposes.

REFERENCE BOOKS:

1. Chrissie, "**Handbook of Practical Communication Skills",** Jaico Publishing house, 1999.
2. Daniels, Aubrey, **"Bringing Out the Best in People"**, Tata McGraw-Hill: New York, 2003.Wright, Goulstone, Mark, **"Just Listen: Discover the Secret to getting through to absolutely anything"**, American Management Association, 2010.
3. Leslie. T. Giblin, **"Skill with people"**, Publication details not known.
4. Lewis, Norman, **"Word Power Made Easy",**Goyal Publications, New Delhi, 2009.
5. Murthy, A.G, Krishna, **"Ten Much",** Tata McGraw-Hill, New Delhi, 2010.
6. Pease , Barbara and Pease, Allan: **"The Definitive Book on Body Language",** Manjul Publishing House Pvt Limited, 2011
7. Rizvi M Ashraf, **"Effective Technical Communication"**, Tata McGraw-Hill, New Delhi, 2010.
8. Whitcomb, Susan Britton, **"Resume Magic: Trade Secrets of a Professional Resume"**, JIST Works, 2010.

WEBSITES:

1. http://www.mindtools.com/pages/article/newTMC_05.htm
2. http://www.kent.ac.uk/careers/intervw.htm
3. http://www.wikihow.com/Write-a-Report

COURSE OUTCOME:

After completion of the course, students will be able to:

1. The learner is ready to bring into play latest communication devices.
2. The learner is equipped with the nuances of technical communication

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Course Code: 50335 **Credits: 2**

B.Tech. – VI Semester

THERMAL ENGINEERING LAB

Note: Any 12 experiments need to be performed

1. I.C. Engine Valve/ Port timing diagrams
2. I.C. Engine Performance Test(4 -Stroke Diesel Engine)
3. I.C. Engine Performance Test (2-Stroke Petrol engine)
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol engine
5. Evaluation of Engine friction by conducting Motoring /Retardation test on 4 stroke Diesel Engine
6. Heat balance Test on Diesel Engine
7. Determination of A/F Ratio and Volumetric Efficiency on 4 Stroke Multi Cylinder Petrol Engine
8. Determine of Economical speed test for fixed load on 4-stroke Petrol Engine
9. Determine optimum cooling water temperature on Diesel Engine
10. Disassembly / Assembly of Engine
11. Performance test on Reciprocating Air-compressor Test Rig
12. Study of Boilers
13. Evaluation of Variable CompressionRatio using Single Cylinder engine (Dual fuel)

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Course Code: 50H04 **Credits: 2**

B.Tech. – VI Semester

TECHNICAL COMMUNICATION AND PRESENTATION SKILLS LAB

Introduction: Effective Communication binds any progressive organization. At the B Tech third year level, the Technical Communication and Presentation skills laboratory is introduced to help students succeed in attaining a challenging and a professional career. Each unit aims to reinforce learning and helps the learners perform well before and after they enter the world of work. The course is designed to be practical, stimulating and challenging providing opportunities to the learners to go beyond the classrooms and get empowered in Technical Communication skills. The course enables the students understand the employers' expectations that are varied from company to company while giving them insight into the acceptable norms of attitude, behavior and etiquette. The course also focuses on the presentation skills of the learners

OBJECTIVES: To help the students understand the requisites to successfully deliver as professionals and the challenges they need to encounter. To help them make a smooth transition from the academic world into the professional world. To refine their style of individual communication and develop a personal style.To broaden and raise awareness about the dynamics of technical communication in the work environment.To integrate the learning experience with the functional areas of communication. Helping the students to become industry ready

Methodology: Facilitator's role: Since classroom learning augments thinking process, helping them to develop written, spoken and non verbal communication, the facilitator / Faculty would briefly discuss the topics with the students and later on guide them while the students involved in activities, writing work and while making presentations. The facilitator is required to design a lot of practical/industry oriented project works for the students

*Students are required to participate, perform, write and submit the work in the form of written documents or Power Point Presentations to hone their spoken written and non verbal communication skills. Students are to take up field work and submit the project work.

MODULE – I: Oral Presentation

Mechanics of Presentations – Methodology of Presentation, Importance of Non-verbal communication during presentations– Nuances of Presentation.

*This particular module is for internal evaluation purpose(s).

MODULE – II: Job hunt process

SWOT analysis, correspondence and browsing the internet to search for a suitable job(s), job application-cover letter drafting, drafting a winning resume', types of resume's -electronic, video and printed resume's

- Instruction: Students are required to prepare their video resume which will be assessed by the faculty member.

MODULE – III: Group Discussion

Initiators- Contributor-Informer-Team Leader-Motivator-Creative Contributor , Importance of , Non verbal communication -eye contact, voice characters, posture, gestures, do's and don'ts, Role play and Simulation- Learners assuming the roles of characters and participating in Group discussion, analysis, or prediction with strictly defined goals.

MODULE – IV: Interview skills & Office etiquette

Preparing for the interview, types of interviews, interview session, importance of non verbal communication during the interview, do's and don'ts of interview, follow up and thanking letter.

FAQ's.Formal Conversation, office attire- do's and don'ts, greetings and meetings, speaking to seniors and handshakes, offering and taking visiting cards.

MODULE – V: E - Correspondence and Email etiquette

Common web mail services, yahoo, gmail etc, fields to pay attention- To:, Cc:, Bcc:, Reply All, Subject, Salutation, Body, Signature, Font, Caps Lock , Highlight, The 'KISS' strategy (Keep It Simple and Short,)Points to remember while signing off, Introduction to Technical Vocabulary

- This unit is purely for internal assessment/evaluation

REFERENCES BOOKS:

1. Chrissie: **Handbook of Practical Communication Skills**: Jaico Publishing house, 1999.
2. Daniels, Aubrey: **Bringing Out the Best in People**: Tata McGraw-Hill: New York, 2003.Wright, Goulstone, Mark: **Just Listen: Discover the Secret to getting through to absolutely anything** : American Management Association, 2010.
3. Leslie. T. Giblin: **Skill with people** Publication details not known
4. Lewis, Norman: **Word Power Made Easy**: Goyal Publications: New Delhi, 2009.
5. Murthy, A.G, Krishna,:**Ten Much** : Tata McGraw-Hill :New Delhi, 2010.
6. Pease, Barbara and Pease, Allan: **The Definitive Book on Body Language**: Manjul Publishing House Pvt Limited, 2011
7. Rizvi M Ashraf: **Effective Technical Communication** : Tata McGraw-Hill: New Delhi, 2010.
8. Whitcomb, Susan Britton: **Resume Magic: Trade Secrets of a Professional Resume**: JIST Works, 2010.

WEBSITES:

1. http://www.mindtools.com/pages/article/newTMC_05.htm
2. http://www.kent.ac.uk/careers/intervw.htm
3. http://www.wikihow.com/Write-a-Report

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Course Code: 50336 **Credits: 2**

B.Tech. – VI Semester

TECHNICAL SEMINAR

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Course Code: 50B11 **Credits: 3**

B.Tech. – VII Semester

OPERATIONS RESEARCH

Pre-requisite: Mathematics

Objectives: The objective of this subject is to provide knowledgeabout the importance and application areas of Operations Research and solving the models for their optimal solutions.

MODULE – I: Allocation [15 Periods]

Development – Definition– Characteristics and Phases – Types of models – operation Research models – applications.

A: Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method –Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

B: Transportation and Assignment Problems: Transportation Problem– Formulation – Optimal solution, unbalanced transportation problem –Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem-Traveling Salesman problem.

MODULE – II: Sequencing, Replacement & Theory of Games [17 Periods]

A: Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

B: Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

C: Theory of Games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games -graphical method.

MODULE - III: Waiting Lines &Multichannel [13 Periods]

A: Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models

B: Multichannel: Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

MODULE - IV: Inventory [15 Periods]

Inventory : Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost-single period model.

MODULE - V: Dynamic Programming & Simulation [15 Periods]

A: Dynamic Programming: Introduction – Terminology-Bellman's Principle of optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

B: Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages –Brief introduction of Simulation Languages.

TEXT BOOKS:

1. Taha **"Introduction to O.R"** Prentice Hall Publishers,9th Edition,2010
2. S.D.Sharma **"Operations Research"** Kedarnath & Ramnath Publisher, 15th edition,2013
3. Hiller & Libermann **"Introduction to O.R"**, McGraw Hill Publications, 9th Edition,2010

REFERENCE BOOKS:

1. A.M.Natarajan, P.Balasubramani,A. Tamilarasi, "**Operations Research"**, Pearson Education, 2nd edition, 2006.
2. Maurice Saseini, Arhur Yaspan & Lawrence Friedman "**Operations Research: Methods & Problems",** Literary Licensing, 1st edition, 2013
3. R.Pannerselvam, "**Operations Research"**, PHI learning pvt ltd, 2nd edition, 2006.
4. Harvey M.Wagner,"**Principles of Operations Research, with Applications to Managerial Decisions",** Prentice Hall Publishers, 2nd edition, 1975.
5. "**Operation Research"** /J.K.Sharma/MacMilan Publisher
6. A.P. Verma, "Operation Research", S K Kataria & sons, 7th edition, 2013

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Develop the skills to solve real-world problems usingan appropriate modeling framework in linear programming
2. Solve the models for their optimal solutions; interpret the models' solutions and infer solutions to the real-world problems

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Course Code: 50337 **Credits: 3**

B.Tech. – VII Semester

CAD / CAM

Pre-requisite: Engineering Drawing, Machine drawing and Machine Tools

Objectives: 1.The objective of this subject is to provide knowledge of drafting 2D and 3D drawings and writing CNC part programming for CNC Machines.

MODULE – I: Introduction to Computers &Computer Graphics [13 Periods]

Basics of Computers: Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, and 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.

MODULE – II: Geometric modeling [12 Periods]

Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

MODULE - III: Drafting and Modeling systems & Numerical control [15 Periods]

A: Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

B: Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming fundamentals, manual part programming methods, Computer Aided Part Programming.

MODULE - IV: Group Tech [15 Periods]

Group Tech: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

Flexible Manufacturing Systems: Introduction of FMS, FMS equipments, Material handling and control systems Advantages and limitations of FMS

MODULE - V: Computer Aided Quality Control & Computer integrated manufacturing systems [16 Periods]

A: Computer Aided Quality Control: Terminology in quality control, the computer in QC, contacts inspection methods, noncontact inspection methods-optical, noncontact inspection methods-non optical, computer aided testing, integration of CAQC with CAD/CAM.

B: Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, and human labor in the manufacturing systems, CIMS benefits.

TEXT BOOKS:

1.Ibrahim Zeid **CAD / CAM Theory and Practice** / / TMH Publishers, 2nd edition, 2014

2.A Zimmers & P.Groover **CAD / CAM** / /PE/PHI Publishers

REFERENCE BOOKS:

1. Groove**Automation, Production systems & Computer integrated Manufacturing**/ r/Pearson Education,3rd edition,2007
2. Radhakrishnan and Subramanian **CAD / CAM / CIM** / / New Age Publishers
3. Farid Amirouche **Principles of Computer Aided Design and Manufacturing** / / Pearson Edu

4. Alavala **CAD/CAM: Concepts and Applications**/ / PHI Publishers
5. **Computer Numerical Control Concepts and programming** / Warren S Seames / Thomson Publishers

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Know drafting of 2D&3D drawings.
2. Write part programming for CNC Machines.
3. Know about various parts and accessories of CNC Machines.

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Course Code: 50338 **Credits: 3**

B.Tech. – VII Semester

METROLOGY & INSTRUMENTATION

Pre-requisite: Physics

Objectives: The objective of this subject is to provide basic knowledge of different mechanical measuring instruments in manufacturing process.

MODULE – I: Systems of Limits and Fits & Limit Gauges [15 periods]

A: Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – British standard system, International Standard system for plain ad screwed work.

B: Limit Gauges: Taylor's principle – Design of go and No go gauges, plug ring, snap, gap, taper, profile and position gauges.

MODULE – II: Linear Measurement, Measurement of Angles and Tapers, Flat Surface Measurement & Optical Measuring Instruments [10 periods]

A: Linear Measurement: Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator.

B: Measurement of Angles and Tapers: Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar – Rollers and spheres used to determine the tapers.

C: Flat Surface Measurement: Measurement of flat surfaces – straight edges – surface plates – optical flats and their uses.

D: Optical Measuring Instruments: Tool maker's microscope and its uses – collimators, optical projector, auto collimator and interferometer.

MODULE – III: Surface Roughness Measurement & Instrumentation [15 periods]

A: Surface Roughness Measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R, R.M.S Values – Rz values, Rz value. Methods of measurement of surface finish-profilo graph. Talysurf, ISI symbols for indication of surface finish. Comparators-Types-Mechanical, Electrical, optical and pneumatical compactors.

B: Instrumentation – 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.

MODULE – IV: Measurement of Displacement & Measurement of Temperature[10periods]

A: Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

B: Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

MODULE – V: Stress Strain Measurements & Elements of Control Systems [10 periods]

Stress Strain Measurements: Various types of stress and strain measurements – electricalstrain gauge – gauge factor – method of usage of resistance strain gauge for bendingcompressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Elements of Control Systems: Introduction, Importance – Classification – Open and closedsystems Servomechanisms–Examples with block diagrams–Temperature, speed & positioncontrol systems.

TEXT BOOKS:

1. R.K. Jain "**Engineering Metrology",** Khanna Publishers
2. M. Mahajan"**A Text book of Metrology",** Danpath Rai & Co.
3. BeckWith, Marangoni,Linehar"**Mechanical Measurements"**, PHI Publisher
4. D.S Kumar"**Measurement Systems:Applications& design"**, McGrawHill Publishers

REFERENCE BOOKS:

1. Connie Dotson "**Fundamentals of Dimensional Metrology",**Thomson publishers, 4th edition,
2. I C Gupta"**Engineering Metrology",** Danpath Rai & Co.
3. Holman"**Experimental Methods for Engineers"**, McGraw-Hill Education
4. S.Bhaskar"**Instrumentation and Control systems"**, Anuradha Agencies.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Work in Quality control and quality assurance divisions inindustries.
2. Design measuring equipments for the measurement ofstress analysis, temperature and fluid flow.
3. Maintain quality in engineering products.

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Course Code: 50339 **Credits: 3**

B.Tech. – VII Semester

COMPUTATIONAL FLUID DYNAMICS

(PROFESSIONAL ELECTIVES – 4)

Pre-requisite: Fluid Mechanics and hydraulic machines.

Objectives: To develop an understanding of the major theories, approaches andimplementation of CFD methods and gain experience in the application of CFD analysis to real engineering designs.

MODULE – I: Elementary details in numerical Techniques [14 Periods]

Elementary details in numerical Techniques: Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences.

MODULE – II: Applied Numerical Methods [15 Periods]

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

Finite Difference Applications in Heat conduction and Convention - Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, and finite difference application in convective heat transfer.

MODULE - III: [13 Periods]

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

MODULE - IV: [14 Periods]

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling.conservative property, the upwind scheme.

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navierstokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

MODULE - V: [14 Periods]

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

TEXT BOOKS:

1. Suhas V. Patankar "**Numerical Heat Transfer and Fluid Flow",** Butter-Worth Publications.
2. John. D. Anderson "**Computational Fluid Dynamics - Basics with applications",** Mc Graw Hill Publications.

REFERENCE BOOKS:

1. Niyogi "**Computational Fluid Flow and Heat Transfer",** Pearson Publications.
2. Tapan K. Sengupta "**Fundamentals of Computational Fluid Dynamics",** Universities Press.
3. Jiyuan and Others "**Computational Fluid Dynamics",** Elsevier Publications.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Undertake problem identification, formulation and solution.
2. Utilize a systems approach to design and operational performance.
3. Understanding of the social, cultural, global and environmental responsibilities of the professional Engineer, and the principles of sustainable design and development.

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Course Code: 50340 **Credits: 3**

B.Tech. – VII Semester

UNCONVENTIONAL MACHINING PROCESSES

(PROFESSIONAL ELECTIVES – 4)

Pre-requisite: Machine Tools.
Objectives: The objective of this subject is to provide knowledge of using various unconventional machining processes and their applications.

MODULE – I: Introduction [14 Periods]
Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection - Materials - Applications.
Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

MODULE – II: Abrasive jet machining, Water jet machining and abrasive water jet machine &Electro – Chemical Processes [15 Periods]
A: Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.
B: Electro – Chemical Processes : Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate.

MODULE - III: Thermal Metal Removal Processes &Parameters, Tool and Dielectric Fluid [14 Periods]
A: Thermal Metal 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.
B: Parameters, Tool and Dielectric Fluid: 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.

MODULE - IV: [13 Periods]
Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

MODULE - V: [13 Periods]
Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Fundamentals of Chemical machining-principle- maskants –etchants- advantages and applications.
Magnetic abrasive finishing, Abrasive flow finishing, Electrostream drilling, Shaped tube electrolytic machining.

TEXT BOOKS:

1.VK Jain **"Advanced machining processes"**, Allied publishers, 2010
2.P. K. Mishra **"Unconventional machining process",** Standard Publishers, 1997

REFERENCE BOOKS:

1. Pandey P.C. and Shah H.S. **"Modern Machining Process",** TMH Publishers, 1st edition, 2013.
2. Bhattacharya A **"New Technology",** the Institution of Engineers India 1984.
3. Baffa & Rakesh Sarin **"Modern Production and Operations Management",**John Wiley & Sons, 8th edition, 1987.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand the principle of operation of the non-conventional machining processes.
2. Specifications of machines, non-conventional machining techniques and Tooling requirements.

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Course Code: 50341 **Credits: 3**

B.Tech. – VII Semester

MECHATRONICS

(PROFESSIONAL ELECTIVES – 4)

Pre-requisite: No

Objectives: The objective of this subject is to provide knowledge about design a system formulate, and solve engineering problems within realistic constraints.

MODULE – I: Introduction [12 Periods]

Introduction: Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, and Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

MODULE – II: Signal Conditioning & Electronic Interface Subsystems [15 Periods]

A: Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, sped channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

B: Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resettable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

MODULE - III: Precision Mechanical Systems & Electromechanical Drives [15 Periods]

A: Precision Mechanical Systems : Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

B: 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.

MODULE - IV: Microcontrollers Overview &Programmable Logic Controllers [15 Periods]

A: 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).

B: 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.

MODULE - V: Programmable Motion Controllers [17 Periods]

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 & tuning - 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.W Bolton **"Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering"**, Pearson Education Press, 3rd edition, 2005.
2. M.D.Singh**,** J.G.Joshi **"Mechatronics**", PHI Publishers

REFERENCE BOOKS:

1. Newton C Brag **"Mechatronics Source Book",** Thomson Publications, Chennai.
2. N. Shanmugam **"Mechatronics",** Anuradha Agencies Publisers.
3. Devdas shetty,Richard **"Mechatronics System Design",** Thomson Publishers

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Model and analyze electrical and mechanical systems and their interconnection.
2. Integrate mechanical, electronics, control and computer engineering in the design of mechatronics systems.
3. Do the complete design, building, interfacing and actuation of a mechatronic system for a set of specifications.

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Course Code: 50342 **Credits: 3**

B.Tech. – VII Semester

RENEWABLE ENERGY SOURCES

(PROFESSIONAL ELECTIVES – 5)

Pre-requisite: Thermal Engineering

Objectives: The objective of this subject is to provide knowledge about different alternative energy sources.

MODULE – I: Principles of Solar Radiation [14 Periods]

Principles of Solar Radiation : Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

MODULE – II: Solar Energy Collection & Solar Energy Storage and Applications [14 Periods]

A: Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

B: Solar Energy Storage and Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

MODULE - III: Wind Energy & Bio-Mass [14 Periods]

A: Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

B: Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

MODULE - IV: Geothermal Energy & Ocean Energy [14 Periods]

A: Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

B: Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

MODULE - V: Direct Energy Conversion [15 Periods]

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Tiwari and Ghosal "**Renewable Energy Resources"**, Narosa Publishers
2. G.D. Rai "**Non-Conventional Energy Sources",** Khanna Publishers

REFERENCE BOOKS:

1. Twidell & Weir "**Renewable Energy Sources",** Taylor and Francis Group Publishers

2. Sukhatme **"Solar Energy",** TMH Publications
3. B.S Magal Frank Kreith & J.F Kreith "**Solar Power Engineering",** McGraw-Hill Publications
4. Frank Krieth & John F Kreider "**Principles of Solar Energy",** CRC Press Publications.
5. Ashok V Desai "**Non-Conventional Energy"**, Wiley Eastern Publishers
6. K Mittal "**Non-Conventional Energy Systems",**Wheeler Publishers
7. Ramesh & Kumar "**Renewable EnergyTechnologies",** Narosa Publications

COURSE OUTCOME:

After completion of the course, students will be able to:

1.Know different types of renewable energy sources which are available naturally.
2. Know the effective conservation of renewable energy sources into useful work.

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Course Code: 50343 **Credits: 3**

B.Tech. – VII Semester

PRODUCTION PLANNING AND CONTROL

(PROFESSIONAL ELECTIVES – 5)

Pre-requisite: Industrial Management.

Objectives: The objective of this subject is to provide knowledge of Planning, scheduling and various production activities of an Industry.

MODULE – I: Introduction [13 Periods]

Introduction: Definition – 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 department – Internal organization of department.

MODULE – II: [12 Periods]

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

MODULE - III: Inventory management & Inventory control systems [12 Periods]

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model

Inventory control systems – P–Systems and Q-Systems, Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts.

MODULE - IV: Routing [14 Periods]

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading, Scheduling Policies – Techniques, Standard scheduling methods,

MODULE - V: [14 Periods]

Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects.

Dispatching – Activities of dispatcher – Dispatching procedure – follow-up – definition – Reason for existence of functions – types of follow-up, applications of computer in production planning and control.

TEXT BOOKS:

1.Samuel Eilon **"Elements of Production Planning and Control",** Macmillan Publishers

2.Baffa & Rakesh Sarin **"Modern Production and operation managements",** John Wiley Publishers

REFERENCE BOOKS:

1. S.N. Chary **"Operations Management",** TMH Publishers
2. Martin K. Starr and David W. Miller **"Inventory Control Theory and Practice",** Prentice-Hall Publishers
3. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy **"Reliability Engineering & Quality Engineering",** Galgotia Publications, Pvt., Limited.
4. John E. Biegel **"Production ControlA Quantitative Approach",**Prentice-Hall
5. Moore **"Production Control",**McGraw-Hill Publishers
6. Joseph Monks **"Operations Management",** McGraw-Hill Ryerson Publishers

COURSE OUTCOME:
After completion of the course, students will be able to:

1. Understand the activities of Production &Planning in manufacturing.
2. Understand the activities of inventory control, line balancing, etc.

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Course Code: 50344 **Credits: 3**

B.Tech. – VII Semester

ROBOTICS

(PROFESSIONAL ELECTIVES – 5)

Pre-requisite: Kinematics and dynamics of machinery

Objectives: The objective of this subject is to provide knowledge ofdesign of robot arm, kinematics and dynamics, Trajectory planning of robot and its applications in automation of Industries.

MODULE – I: Introduction [15 Periods]

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

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.

MODULE – II: Motion Analysis & Manipulator Kinematics [13 Periods]

A: Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

B: Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

MODULE - III: Dynamics [14 Periods]

Differential transformation and manipulators, Jacobians – problems.

Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

MODULE - IV: Robot actuators and Feedback components [13 Periods]

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

MODULE - V: [12 Periods]

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Groover M P "**Industrial Robotics",** Pearson Edu.
2. Mittal R K & Nagrath I J "**Robotics and Control",** TMH.

REFERENCE BOOKS:

1. Fu K S "**Robotics",** McGraw Hill.
2. P. Coiffet and M. Chaironze "**An Introduction to Robot Technology"**, Kogam Page Ltd. 1983 London.
3. Richard D. Klafter "**Robotic Engineering",** Prentice Hall Publishers
4. Asada and Slow time "**Robot Analysis and Intelligence",** Wiley Inter-Science.
5. John J Craig "**Introduction to Robotics",** Pearson Edu.

6. Mark W. Spong and M. Vidyasagar "**Robot Dynamics & Control",** John Wiley & Sons (ASIA) Pvt Ltd.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand design and working of Robot.
2. Understand kinematics & dynamics and robot applications in automated manufacturing.

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Course Code: 50345 **Credits: 2**

B.Tech. – VII Semester

CAD / CAM LAB & PRODUCTION DRAWING PRACTICE LAB

Note: Any 12 experiments need to be performed

A: **CAD / CAM LAB:**

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 strain and Axisymmetric 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 Axisymmetric 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). Development of NC code for free form and sculptured surfaces using CAM packages.
   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.

Any Six Software Packages from the following:

Use of AutoCAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.

B: PRODUCTION DRAWING PRACTICE

MODULE – I:

Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

MODULE – II:

Limits and Fits: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

MODULE – III:

Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of run out and total run out and their indication.

MODULE IV:

Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

MODULE V:

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc .Part drawing using computer aided drafting by CAD software

TEXT BOOKS:

1. Production and Drawing – K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing with Auto CAD- Pohit and Ghosh, PE

REFERENCE BOOKS:

1. Geometric dimensioning and tolerancing- James D. Meadows/ B.S Publications
2. Engineering Metrology, R.K. Jain, Khanna Publications

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Course Code: 50346 **Credits: 2**

B.Tech. – VII Semester

METROLOGY & INSTRUMENTATION LAB

Note: Any 6 Experiments needs to be performed from each section.

A: METROLOGY

1. Measurement of lengths, heights, diameters by vernier caliper and micrometer etc.
2. Measurement of bores by internal micrometer and dial bore indicator.
3. Use of gear teeth vernier caliper and checking the chordal addendum and chordal height of spur gear.
4. Machine tool - alignment test on the lathe.
5. Machine tool alignment test on milling machine.
6. Measurement of screw thread and cutting tool profiles using Tool maker's microscope.
7. Angle and taper measurements by Bevel protractor and Sine bar.
8. Use of spirit level in finding the flatness of surface plate.
9. Measurement of effective diameter of screw thread by two wire / three wire method.
10. Surface roughness measurement.

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 gauge 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 rotometer for flow measurement.
10. Study and calibration of Mcleod gauge for low pressure.

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Course Code: 50A04 **Credits: Nil**

B.Tech. –VII Semester
FOREIGN LANGUAGE / FINE ARTS

Objectives:

- To introduce a new language to the students.
- To impart basic knowledge of foreign language to the students to be useful for everyday and Professional Purposes

Module –I:-

- Basic introduction of the language and its importance.
- Introduction to the script, words and sentences.

Module –II

- Construction of simple sentences for everyday needs like,
  - Greeting
  - Apologies
  - Enquiry
  - Bargaining
  - Seeking directions etc.

Module –III

- Language for workplace
  - Participating in meetings.
  - Party etiquette
  - Dining etiquette
  - Self-introductions
  - Introducing others etc…

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Course Code: 50347 **Credits: 2**

B. Tech. – VII Semester

MINOR PROJECT

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Course Code: 50348 **Credits: 3**

B.Tech. – VIII Semester
NANO TECHNOLOGY
(PROFESSIONAL ELECTIVE – 6)

Pre-requisite: basic chemical and physical concepts Mechanics and Thermodynamics.
Objectives: The objective of this subject is to understand basic nanosystems and physical reasoning to develop simple nanoscale models to interpret the behavior of such physical systems.

MODULE-I: General Introduction: **[6 Periods]**
Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.
Silicon Carbide: **[4 Periods]**
Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles,
Nano particles of Alumina and Zirconia: **[4 Periods]**
Nano materials preparation, Characterization, Wear materials and nano composites,

MODULE-II: Mechanical properties: **[4 Periods]**
Strengthof nano crystalline SIC, Preparation for strength measurements, Mechanical properties, Magnetic properties,
Electrical properties: **[4 Periods]**
Switching glasses with nanoparticles, Electronic conduction with nano particles
Optical properties: **[4 Periods]**
Optical properties, special properties and the coloured glasses
MODULE-III: Processes: **[6 Periods]**
Process of synthesis of nano powders, Electro deposition, Important naon materials
Investigating and manipulating materials in the nanoscale: **[6 Periods]**
Electron microscopics, scanning probe microscopics, optical microscopics for nano science and technology, X-ray diffraction.

MODULE- IV: Nanobiology : **[10 Periods]**
Interactionbetween bimolecules and nano particle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, naoprobes for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology,Current status of nano Biotechnology, Future perspectives of Nanobiology, Nanosensors.

MODULE- V: Nano Medicines : **[12 Periods]**
Developing of Nanomedicens Nanosytems in use, Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nanomechanics, Molecular devices, Nanotribology, studying tribology at nanoscale, Nanotribology applications.

TEXT BOOKS:
1. A.K.Bandyopadhyay/ **Nano Materials** / New Age Publishers/2011.
2. T.Pradeep/ **Nano Essentials** /TMH Publishers/2007.

REFERENCE BOOKS:

1. Charles P.Poole Jr/ **Introduction to Nanotechnology/** Frank J.Owens, Wiley India Pvt. Ltd.
2. Chatopadhya.K.K, Benerjee A.N. **/ Introduction to Nano science and Nanotechnology**
3. Phani Kumar**/Introduction to Nanotechnology**.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand the major issues in producing a sustainable nanotech industry

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Course Code: 50349 **Credits: 3**

B.Tech. – VIII Semester

PLANT LAYOUT AND MATERIAL HANDLING

(PROFESSIONAL ELECTIVE – 6)

Pre-requisite: Industrial Management
Objectives: The objective of this subject is to provide knowledge of Layout planning, and different material handling equipments.

MODULE – I: Introduction & Process layout and product layout [14 Periods]
Introduction: Classification of Layout, Advantages and Limitations of different layout, Layout design procedures, Overview of the plant layout.
Process layout and product layout: Selection, specification Implementation and follow up, comparison of product and process layout.

MODULE – II: Heuristics for plant layout & Group Layout, Fixed position layout [10 Periods]
Heuristics for plant layout- ALDEP, CORELAP, CRAFT.
Group Layout, Fixed position layout. Quadratic assignment model Branch and Bound method.

MODULE - III: [Periods]
Introduction, Material Handling Systems.Material handling principles.
Classification of Material Handling Equipment, Relationship of Material Handling to plant layout.

MODULE - IV: Basic Material Handling Systems [10 Periods]
Basic Material Handling Systems: Selection, Material Handling method path, Equipment, function oriented systems.

MODULE - V: Methods to minimize cost of material handling [13 Periods]
Methods to minimize cost of material handling.Maintenance of Material handling Equipments, Safety in handling.Ergonomics of Material Handling equipment.Design, Miscellaneous equipments.

TEXT BOOKS:
1.PB Mahapatra **"Operation Management",** PHI Publications
2.DR. K C Arora & Shinde **"Aspects of Material Handling",** Lakshmi Publications.

REFERENCE BOOKS:
1.RL Francis **"Facility Layout and Location: An Analytical Approach",** LF Mc Linnis jr and White / PHI Publications.
2.R Pannerselvam **"Production and Operation Management",** PHI Publications
3.Ray and Sidhartha **"Introduction to Material Handling",** New Age Publications.

COURSE OUTCOME:
After completion of the course, students will be able to:

1. Know different handling equipments in manufacturing industry at different stages.
2. Know different plant layouts and product layouts.

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Course Code: 50350 **Credits: 3**

B.Tech. – VIII Semester

AUTOMATION IN MANUFACTURING

(PROFESSIONAL ELECTIVE – 6)

Pre-requisite: Metal Cutting &Machine Tools and CNC Technology

Objectives: The objective of this subject is to provide knowledge of automated flow lines, line balancing, adoptive control systems and Business process Re- Engineering in manufacturing units.

MODULE - I: [8 Periods]

Introduction Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

MODULE - II:Automated flow lines&Analysis of Automated flow lines [8 Periods]

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

MODULE - III: Assembly system and line balancing [8 Periods]

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

MODULE - IV: Adaptive control systems [8 Periods]

Automated storage systems, automated storage and retrieval systems, work in process storage, interfacing handling and storage with manufacturing.

Adaptive control systems: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

MODULE - V: Business process Re-engineering [8 Periods]

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of Rapid Proto typing.

TEXT BOOKS:

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover. / PE/PHI Publishers

REFERENCE BOOKS:

1. Computer control of Manufacturing Systems by Yoram Coreom / TMH Publishers
2. CAD / CAM/ CIM by Radhakrishnan / New Age International Publishers
3. Automation by W. Buekinsham / Prometheus Books Publishers

COURSE OUT COME:

After completion of the course, students will be able to:

1. Know automated flow lines and their analysis, line balancing.
2.Know assembly systems, adoptive control systems.

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Course Code: 50351 **Credits: 10**

B.Tech. – VIII Semester
MAJOR PROJECT

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Course Code: 50352 **L T P**

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Credits: 2

B.Tech. – VIII Semester
COMPREHENSIVE VIVA VOCE

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Course Code:50H15 **Credits: 1**

B.Tech. – VIII Semester
ENTREPRENEURSHIP SKILLS

Pre-Requisite: Nil
Objectives: The aim of this course is to inspire students to become entrepreneurs so that they will emerge as job providers rather than job seekers.

MODULE-I: **[5 Periods]**
Understanding Entrepreneurial Mindset-characteristics of an entrepreneur -The evolution of entrepreneurship-Approaches to entrepreneurship- The challenges of new venture start-ups-Critical factors for new venture development.-Twenty first centaury trends in entrepreneurship-Difference between entrepreneur and entrepreneurship.

MODULE-II: **[5 Periods]**
The individual entrepreneurial mind-set and Personality-The entrepreneurial journey-Women entrepreneurship: growth problems in India-Entrepreneurial motivations. Corporate Entrepreneurial Mindset-the nature of corporate entrepreneur- -sustaining corporate entrepreneurship.

MODULE-III: **[5 Periods]**
Launching Entrepreneurial Ventures-opportunities identification-entrepreneurial Imagination and Creativity-the nature of the creativity process-Innovation and entrepreneurship.Methods to initiate Ventures-Creating new ventures-Acquiring an Established entrepreneurial venture -Intellectual property protection-Patents, Copyrights-Trademarks and Trade secrets.

TEXT BOOKS:

1. D F Kuratko and T V Rao "Entrepreneurship-A South-Asian Perspective "Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)

REFERENCES BOOKS:

1. Vasant Desai "Small Scale industries and entrepreneurship" Himalaya publishing 2012.
2. Rajeev Roy "Entrepreneurship" 2e, Oxford, 2012.
3. B.Janakiramand M.Rizwana" Entrepreneurship Development :Text & Cases,Excel
4. Books,2011.
5. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
6. Robert Hisrich et al "Entrepreneurship" 6the, TMH, 2012.
7. Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

COURSE OUTCOME:
After completion of the course, students will be able to:

1. Understand the mindset of the entrepreneurs, identify ventures for launching, and develop an idea on the legal framework.
2. Understand strategic perspectives and legal challenges of Entrepreneurship.

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Course Code: 50102 **Credits: 3**

SURVEYING
(Open Elective)

Pre-Requisite: Nil

Objectives:

Student will be able to learn and understand the various basic concept and principles used in surveying like Chain Surveying, Compass Surveying, Plane Table Surveying, Leveling and to calculate Horizontal Angle, Vertical Angle, Horizontal distance and Vertical distance to study the area of ground profile

MODULE-I: Introduction Basic Concepts&Measurement of Distances and Directions

A: Introduction Basic Concepts [6 Periods]

Introduction, Objectives, classifications and Principles of surveying, Scales, Shrinkage of maps, conventional symbols and code of signals, Surveying Accessories, phases of surveying.

B: Measurement Of Distances And Directions [6 Periods]

Linear distances: Approximate methods, Direct methods-chains – tapes, ranging- tape corrections, Indirect methods- optical methods –E.D.M methods.

Prismatic Compass:Bearings Included Angles, Local Attraction, Magnetic Declination and Dip.

MODULE-II: Leveling&Contouring

A: Leveling [6 Periods]

Basic definitions, types of levels and leveling staves, Temporary and permanent adjustments-method of leveling. Booking and determination of levels-HI method – Rise and fall method, effect of curvature if earth and refraction

B: Contouring [6 Periods]

Characteristics and Uses of contours, Direct and indirect methods of contour surveying, interpolation and sketching of Contours.

MODULE-III: Computation of Areas and Volumes&Theodolite Surveying

A: Computation of Areas and Volumes [6 Periods]

Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries, Planimeter. Volumes:Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

B: Theodolite Surveying [6 Periods]

Types of Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles.Principles of Electronic Theodolite. Trigonometrical leveling when the base is accessible and in accessible

MODULE-IV: Traversing&Tacheometric Surveying

A: Traversing [6 Periods]

Methods of traversing traverse computation and adjustments , gale's traverse table, omitted measurements

B: Tacheometric Surveying [6 Periods]

Principles of tacheometry,Stadia and tangential methods of Tacheometry.

MODULE-V: Curves&Introduction to Modern Surveying Methods

A: Curves [6 Periods]

Types of curves, design and setting out – simple and compound curves.

B: Introduction To Modern Surveying Methods [6 Periods]

Total Station, Global positioning system and Geographic information system (GIS).

TEXT BOOKS:

1. B.C.Punmia Ashok Kumar Jain and Arun Kumar Jain "**Surveying**" (Vol – 1, 2 & 3), Laxmi Publications (P) ltd., 14th Edition, 2014.
2. Duggal S K, "**Surveying**" (Vol – 1 & 2), Tata Mc.Graw Hill Publishing Co. Ltd. 4th Edition, 2004.

REFERENCE BOOKS:

1. Arror K R "**Surveying Vol 1, 2 & 3"**, Standard Book House, Delhi, 4th Edition, 2004
2. Chandra A M, "**Plane Surveying**", New age International Pvt. Ltd., Publishers, New Delhi, 4th Edition 2002.
3. Chandra A M, "**Higher Surveying**", New age International Pvt. Ltd., Publishers, New Delhi, 4th Edition 2002.

WEB REFERENCE BOOKS:

1. http://v5.books.elsevier.com/bookscat/samples/9780750669498/9780750669498.PDF
2. http://www.whycos.org/fck_editor/upload/File/Pacific
3. HYCOS/Surface_Waters/Levelling_and_surveying.pdf

COURSE OUTCOME:

After completion of the course, students will be able to:

- Student will be able to prepare Map and Plan for required site with suitable scale
- Student will be able to prepare contour Map and Estimate the Quantity of earthwork required for formation level for Road and Railway Alignment.
- Student will be able to prepare LS & CS, contour maps and carryout surveying works related to land and civil engineering projects

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Course Code: 50123 **Credits: 3**

AIR POLLUTION AND CONTROL
(Open Elective)

Pre-requisites: Environmental Studies

Objectives:

This course provides the knowledge and understanding of the problems associated with air pollution indoor and outdoor. It also describes the regulations pertinent to air pollution especially due to industries making the student to design proper air pollution control devices

MODULE I: Air Pollution [12 periods]

Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non- Point, Line and Areal Sources of air pollution- stationary and mobile sources. Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes etc., ambient air quality standards.

MODULE II:Thermodynamics and Kinetics of Air-Pollution [12 periods]

Applications in the removal of gases like SOx, NOx, CO, HC etc., air-fuel ratio, Computation and Control of products of combustion.

.

MODULE III: Meteorological Parameters and Wind Behaviour

A: Meteorology [6 periods]

Properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity, Influence of Meteorological phenomena on Air Quality-wind rose diagrams Lapse Rates, Pressure Systems

B: Plume Dispersion [6 periods]

Winds and moisture plume behaviour and plume Rise Models; Gaussian Model for Plume Dispersion.

MODULE IV: Control of Particulates [12 periods]

Control at Sources, Process Changes, Equipment modifications, Design and operation of control equipments – Settling Chambers, Centrifugal separators, Filters, Dry and Wet scrubbers, Electrostatic precipitators.

MODULE V: General Methods of Control of No_x And So_x Emissions [12 periods]

In-plant Control Measures, process changes, dry and wet methods of removal and recycling. Air Quality Management – Monitoring of SPM, SO; NO and CO Emission Standards.

TEXT BOOKS:

1. M.N.Rao and H.V.N.Rao, **"Air pollution"**, Tata Mc.Graw Hill Company, 26th reprint 2007.
2. R.K. Trivedy and P.K. Goel, **"An introduction to Air pollution"**, B.S. Publications, 2nd revised edition, 2005.

REFERENCE BOOKS:

1. Wark and Warner, "**Air Pollution**" Harper & Row Publicatons, New York, 2nd edition, 1981.
2. S.C. Bhatia, "**Textbook of Air Pollution and Its Control",** Atlantic Publishers, 1st edition, 2007.
3. Karl B. Schnelle Jr.,Charles A. Brown, **" Air Pollution Control Technology Handbook"**, Published by CRC Press, 1st edition, 2002.

WEBREFERENCE BOOKS:

1. http://www3.cec.org/islandora/en/item/2195-best-available-technology-air-pollution-control-en.pdf
2. http://www.eolss.net/sample-chapters/c09/e4-11-05.pdf
3. https://www.env.go.jp/earth/coop/coop/document/01-apctme/contents.html

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Understand in general terms, the major issues and challenges in Air pollution.
2. Design air pollution control equipment keeping in mind the stringent regulations laid by Pollution control board.

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2 2 -

Course Code: 50124 **Credits: 3**

DISASTER MANAGEMENT
(Open Elective)

Prerequisites: Nil

Objectives

This course provides the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences along with International Strategy for Disaster Reduction. It also has the potential to make the student design and implement disaster mitigation measures.

MODULE I: Concept of Hazards and Disasters

A: Environmental Hazards & Disasters: [5 periods]

Concept of Environmental Hazards, Environmental stress & Environmental Disasters.Different approaches & relation with human Ecology – Landscape, Ecosystem and Perception approach - Human ecology & its application in geographical researches.

B: Types of Environmental Hazards & Disasters: [5 periods]

Natural hazards and Disasters – Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

MODULE II: Classification of Hazards

A: Endogenous Hazards [8 periods]

Volcanoes- Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions – Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - Earthquake Hazards in India - Human adjustment, perception & mitigation of earthquake, Landslides- causes and impacts, Avalanches -causes and impacts.

B: Exogenous Hazards [12 periods]

Infrequent events: Cyclones – Lightning – Hailstorms, Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms [causes , distribution human adjustment, perception & mitigation], Cumulative atmospheric hazards/ disasters : Floods- Droughts- Cold waves- Heat waves Floods:- Causes of floods- Flood hazards India- Flood control measures [Human adjustment, perception & mitigation], Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures, Extra Planetary Hazards/ Disasters-Man induced Hazards /Disasters- Physical hazards/ Disasters-Soil Erosion Soil Erosion:-- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion, Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes, Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation, Biological hazards/ disasters:- Population Explosion.

MODULE III:Approaches and Measures in Disaster Management

A: Emerging Approaches [4 periods]

Three Stages: 1. Pre- disaster stage [preparedness] 2. Emergency Stage 3. Post Disaster stage- Rehabilitation

B: Natural Disaster Reduction & Management [4 periods]

1] Provision of Immediate relief measures to disaster affected people 2] Prediction of Hazards & Disasters 3] Measures of adjustment to natural hazards

MODULE IV:Disaster Management [12 periods]

An integrated approach for disaster preparedness, mitigation & awareness.

Mitigation- Institutions- discuss the work of following Institution.

a. Meteorological observatory

b. Seismological observatory
c. Volcanological institution
d. Hydrology Laboratory
e. Industrial Safety inspectorate
f. Institution of urban & regional planners
g. Chambers of Architects
h. Engineering Council
i. National Standards Committee
Integrated Planning- Contingency management Preparedness –
a] Education on disasters
b] Community involvement
c] The adjustment of Human Population to Natural hazards & disasters Role of Media Monitoring Management- Discuss the programme of disaster research & mitigation of disaster of following organizations.
a] International Council for Scientific Unions [ICSU]- Scientific committee on problems of the Environment [SCOPE], International Geosphere- Biosphere programme [IGBP]
b] World federation of Engineering Organizations [WFED]
c] National Academy of Sciences
d] World Meteorological organizations [WMO]
e] Geographical Information System [GIS]
f] International Association of Seismology & Physics of Earth's Interior [IASPEI]
g] Various U.N agencies like UNCRD, IDNDR, WHO, UNESCO, UNICEF, UNEP.

MODULE V: Disaster Management In India [10 periods]
a. A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India
b. Ecological planning for sustainability & sustainable development in India- Sustainable rural development: A Remedy to Disasters -Role of Panchayats in Disaster mitigations
c. Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

TEXT BOOKS:
1.Jagbir singh, **"Disaster management–Future challenges and opportunities"**, I.K. International publishing house, 1st edition, 2005.
2.Coppala P Damon, **"Introduction to International Disaster management",** ABD publishers**,** 2007**.**

REFERENCE BOOKS:
1.R.B.Singh [Ed], **"Environmental Geography"**, Heritage Publishers, New Delhi, 1st edition, 1990.
2.Kates,B.I& White. G.F, **"The Environment as Hazards"**, oxford publishers, 5th edition, New York, 1978.
3.R.B. Singh [Ed], **"Disaster Management"**, Rawat Publication, New Delhi, 1st edition, 2000.

Weblinks:
1.http://www.wcpt.org/disaster-management/what-is-disaster-management
2.http://study.com/academy/lesson/what-are-cyclones-types-causes-effects.html

COURSE OUTCOME:
After completion of the course, students will be able to:

- To analyze, evaluate and manage the environmental, social, cultural, economical, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
- To assess the different public health aspects at local and global levels as a result of disaster, and can well plan to mitigate them.

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Course Code: 50150 **Credits: 3**

GREEN BUILDINGS
(Open Elective)

Prerequisites: Nil

Objectives

The purpose of the course is provide an overview of emerging delivery systems for high performance green buildings and the basis on which their sustainability can be evaluated.

MODULE – I **[12 periods]**

Introduction to green buildings, green materials, sources of green materials, high-performance green buildings Impacts of building construction, operation, and disposal Methods and tools for building assessment, Green Globes.

MODULE – II **[12 periods]**

The green building process, Design and construction relationships, benefits of green building, quality, healthy and safe environments , Site and landscape strategies.

MODULE – III **[12 periods]**

Building energy system strategies, Water cycle strategies, Materials selection strategies, Indoor Environmental Quality [IEQ].

MODULE – III **[12 periods]**

Analysis and strategies, Construction, team responsibilities and controls, Building commissioning strategies.

MODULE – IV **[12 periods]**

Economic issues and analysis, Use of the Green Strategies cost estimating tool, Future directions in green, high performance building technologies.

MODULE – V **[12 periods]**

Carbon accounting Green Building Specification

TEXT BOOKS:

1. Green Building, Principles and Practices in Residential Construction, In 2012, Abe Kruger and Carl Seville publication.
2. Green Building Materials: A Guide to Product Selection and Specification, 3rd Edition, Ross Spiegel, Dru Meadows.October 2010

REFERENCEBOOKS:

1. Sustainable Construction: Green Building Design and Delivery Hardcover – Import, 16 Nov 2012 by Charles J. Kibert [Author].

WEB REFERENCE BOOKS:

- http://www.ncrec.gov/Pdfs/bicar/GreenBuilding.pdf

COURSE OUTCOME:

The benefits of green building – quality, healthy and safe environments that are cost effective – should be available to all.

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Course Code: 50203 **Credits: 3**

NETWORK THEORY
(Open Elective)

Prerequisites: Basic knowledge on Electrical circuits

Objectives: This course introduces the concepts of circuit analysis which is the foundation for all courses of the Electrical and Electronics Engineering discipline.

MODULE I: Network Theorems (Both AC & DC Networks) [12 periods]

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's and Compensation and Tellegen's theorems- Statement of theorems and numerical problems.

MODULE II: Three Phase Circuits [10 periods]

Introduction to three phase circuits – types of connection - Star and delta– Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits –Measurement of active and reactive power of balanced and Unbalanced 3 phase circuits .

MODULE III: Two Port Network Parameters [12 periods]

Open circuit impedance(Z) network parameters, Short circuit admittance(Y) network parameters –Transmission(ABCD), Inverse transmission($A^1B^1C^1D^1$) and hybrid parameters – Relationship between two port network parameters – Reciprocity and Symmetry concepts of two port network parameters.

MODULE IV: DC Transient Analysis [13 periods]

Introduction - Initial conditions of all elements-Transient response of Series R-L, R-C and R-L-C circuits – Solution using differential equation approach and Laplace transform approach.

MODULE IV: AC Transient Analysis [12 periods]

Transient response of Series R-L, R-C and R-L-C circuits – Solution using differential equation approach and Laplace transform approach.

TEXT BOOKS:

1. William Hayt and Jack E. Kimmerly, "**Engineering circuit analysis**", McGrawHill Company, 6th Edition, 2005.
2. Joseph Edminister & mahmood Nahvi, "**Electric circuits**", Schaum outline Series – Tata McGraw Hill, 3rd Edition, 1999.

REFERENCES BOOKS:

1. Vanvalkenburg, "**Network Analysis"**, Prentice Hall of India, 3rd Edition, 1974.
2. A. Chakrabarthy, "**Circuit Theory"** by DhanipatRai & Co., 6th Edition, 2010.
3. N. N. Parker smith, "**Problems in Electrical Engineering"**, 9th Edition, 1981.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Analyze electrical circuits using network theorems.
2. Apply the concepts of three phase electrical circuits to electrical machines and power systems.
3. Calculate the different parameters of a given two port electrical network.
4. Draw the transient response of a network for the given input.
5. Build the electrical circuit for the given impedance, admittance functions.

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Course Code: 50208 **Credits: 3**

CONTROL SYSTEMS
(Open Elective)

Prerequisites: Basic of Mathematics, Laplace Transforms and Matrices.
Objectives: This course introduces the basics of control systems, types of control systems, mathematical modeling, block diagram representation, signal flow graph, Time domain and frequency domain specifications, stability and state space analysis.

MODULE - I: Introduction [12 Periods]
Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback, Mathematical models – Differential equations, Impulse Response and transfer functions.
Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

MODULE - II: Time Response Analysis [12 Periods]
Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

MODULE - III: Stability Analysis in S-Domain [12 Periods]
The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.
Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

MODULE - IV: Frequency Response Analysis [12 Periods]Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin - Stability Analysis from Bode Plots. Polar Plots - Nyquist Plots.
Compensation techniques – Lag, Lead and Lead -Lag Controllers design in frequency Domain**.**

MODULE - V: State Space Analysis of Continuous Systems [12 Periods]
Concepts of state, state variables and state model, derivation of state models from block diagrams, diagonalization - Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and observability.

TEXT BOOKS:
1. I. J. Nagrath and M. Gopal, "**Control Systems Engineering"**, New Age International Publishers, 5th edition, 2007. (Modules I, II, III & IV)
2. A.Nagoor kani, "**Control Systems**", RBA Publications, 2nd Edition, 2006. (Modules I, II, III, IV & V)

REFERENCE BOOKS:
1. Benjamin.C.Kuo, **"Automatic Control Systems"**, Prentice Hall of India, 7th Edition, 1995.
2. M.Gopal, **"Control System"** – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.

3. Schaum's Outline Series, **"Feedback and Control Systems"**Tata McGraw-Hill, 2007.
4. John J.D'azzo & Constantine H.Houpis, **"Linear control system analysis and design"**, Tata McGraw-Hill, Inc., 1995.
5. Richard C. Dorf & Robert H. Bishop, **"Modern Control Systems"**, Addidon – Wesley, 1999.
6. **http://nptel.ac.in/courses/108103007/8**

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Grasp the basics of open loop and closed loop control systems, concept of feedback in control systems, mathematical modeling and transfer function derivations of Synchros, AC and DC servo motors.
2. Apply the basics of Transfer function representation through block diagram, signal flow graphs, time response analysis of different order systems through their characteristic equation with time-domain specifications, stability analysis of control systems in S-domain through R-H criteria and root-locus techniques, frequency response analysis through bode diagrams, Nyquist, polar plots.
3. Apply the above conceptual things to real-world electrical and electronics problems and applications with the basics of state space analysis, design of PID controllers, lag, lead, lag-lead compensators.

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Course Code: 50229 Credits: 3

ENERGY AUDITING & CONSERVATION
(OPEN ELECTIVE)

Course Objective:

To have the knowledge about the concept of energy conservation, energy management, different approaches of energy conservation in industries, economic aspects of energy conservation project and energy audit in commercial and industrial sector will be achieved by this course

MODULE I: BASIC PRINCIPLES OF ENERGY AUDIT [12 PERIODS]

Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit

MODULE II: ENERGY MANAGEMENT [12 PERIODS]

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting, Energy manger, Qualities and functions, language, Questionnaire - check list for top management

MODULE III: ENERGY EFFICIENT MOTORS [12 PERIODS]

Energy efficient motors , factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit

MODULE IV: POWER FACTOR IMPROVEMENT, LIGHTING & ENERGY INSTRUMENTS [14 PERIODS]

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f. , p.f motor controllers - Good lighting system design and practice, lighting control ,lighting energy audit,

Energy Instruments- watt meter, data loggers, thermocouples, pyrometers,lux meters, tongue testers ,application of PLC's

MODULE V: ECONOMIC ASPECTS AND ANALYSIS & ITS COMPUTATION [12 PERIODS]

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method , replacement analysis, life cycle costing analysis - Energy efficient motors, Calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXT BOOKS:

1. W.R. Murphy & G. Mckay Butter worth**"Energy management"**, Heinemann publications.
2. John .C. Andreas **"Energy efficient electric motors"**, Marcel Dekker Inc Ltd- 2nd edition, 1995

REFERENCES BOOKS:

1. Paul o' Callaghan**"Energy management"**, Mc-graw Hill Book company-1st edition, 1998
2. W.C.Turner**"Energy management hand book"** John wiley and sons
3. **"Energy management and good lighting practice"** : fuel efficiency- booklet12-EEO

Course Outcome: After completion of the course student will have the awareness of

- Different types of industries which are consisted of various energy intensive processes.
- Various energy intensive processes in different industries and to find out the energy conservation opportunities.
- Various methods of energy management and energy auditing on the site.
- Energy auditing and managing the energy demand in industry.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 50241 **Credits: 3**

PRINCIPLES OF ELECTRICAL ENGINEERING
(Open Elective)

PREREQUISITES: Electrical Circuits.

OBJECTIVES: This course introduces the basic concepts of transient analysis of the circuits, the basic two-port network parameters, the design analysis of filters and attenuators and their use in circuit theory. The emphasis of this course is laid on the operation of the transformers and basic Principle of operation of three phase Induction Motor and Alternators.

MODULE – I: Transient Analysis (First and Second Order Circuits) [13 Periods]

Transient Response of RL , RC Series, RLC Circuits for DC excitations, Initial Conditions, Solution using Differential Equations approach and Laplace Transform Method.

MODULE – II: Two Port Networks [13 Periods]

Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Conversion of one Parameter to another, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations, Image Parameters, Illustrative problems.

MODULE – III: Filters and Symmetrical Attenuators [10 Periods]

Classification of Filters, Filter Networks, Classification of Pass band and Stop band, Characteristic Impedance in the Pass and Stop Bands, Constant-k Low Pass Filter, High Pass Filter, m-derived T-Section, Band Pass filter and Band Elimination filter, Illustrative Problems. Symmetrical Attenuators – T-Type Attenuator, π–Type Attenuator, Bridged T type Attenuator, Lattice Attenuator.

MODULE – IV: Network Theorems (A.C. & D.C) [12 Periods]

Tellegen's, Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's and Compensation theorems for A.C & D.C excitations.

MODULE – V: Electrical Machines [12 Periods]

Principle of Operation of Single Phase transformer, Types, Constructional Features, Phasor Diagram on No Load and Load, Equivalent Circuit, Losses and Efficiency of Transformer and Regulation, OC and SC Tests (Simple Problems). Principle of operation of 3Ø Induction Motor and Alternators.

TEXT BOOKS:

1. A. Chakrabarhty, **"Electric Circuits",** Dhanipat Rai & Sons.
2. B.L.Theraja, A.K.Theraja, **"ELECTRICAL TECHNOLOGY",** S.Chand Publications. Volume II
3. P. S. Subramanyam,**"Basic Concepts of Electrical Engineering"**, BS Publications.

REFERENCE BOOKS:

1. William Hayt and Jack E. Kemmerly, **"Engineering circuit analysis"**, Mc Graw Hill Company, 7th Edition.
2. S.N. Singh, **"Basic Electrical Engineering"**, PHI.
3. David A. Bell, **"Electrical Circuits"**, Oxford University Press.
4. K. S. Suresh Kumar, **"Electric Circuit Analysis"**, Pearson Education.

COURSE OUTCOME:

After completion of the course, students will be able to:

1. Apply the above conceptual things to real-world electrical and electronics problems and applications with the basic transient analysis of circuits, filters, attenuators.
2. Apply their knowledge on operation of Single Phase Transformers & Basics of Induction Motors, Alternators with which, the student can able to do the conceptual things to real-world problems and applications.

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Course Code: 50414 **Credits: 3**

B.Tech.
MICRO PROCESSORS AND INTERFACING
(Open Elective)

PREREQUISITES: Digital Electronics.
OBJECTIVES: This course introduces microprocessor architecture and microcomputer systems, including memory and input/output interfacing. Topics includes the architecture, assembly language programming, bus architecture, bus cycle types, I/O systems, memory systems, interrupts, and other related topics of 8085 & 8086. It also includes the architectures of advanced microprocessors like 80186, 80286, 80386 and 80486.

MODULE - I: 8085 Architecture [12 Periods]
Introduction to microprocessor, 8085 microprocessor architecture, address, data and control buses, 8085 pin functions, demultiplexing of buses, generation of control signals, instruction cycle, machine cycles, t-states, memory interfacing.
Instruction Set: classification of instructions, addressing modes, 8085 instruction set, instruction and data formats, writing, assembling & executing a program.

MODULE - II: Assembly Language Programming [14 Periods]
Assembly Language Programming of 8085: Writing 8085 assembly language programs with decision making and looping using data transfer, arithmetic, logical and branch instructions. Stack & subroutines, developing counters and time delay routines.
Interfacing with 8085: Interfacing concepts, ports, interfacing of i/o devices, interrupts in 8085, programmable interrupt controller 8259a, programmable peripheral interface 8255a.

MODULE - III: 8086 Architecture [10 Periods]
8086 architecture-functional diagram, register organization, memory segmentation, programming model, memory addresses, physical memory organization, architecture of 8086, signal descriptions of 8086- common function signals, timing diagrams, interrupts of 8086.
Instruction set and assembly language programming of 8086: instruction formats, addressing modes, instruction set, assembler directives, macros. Simple programs.

MODULE - IV: Interfacing [14 Periods] I/o interface: 8255 ppi, various modes of operation and interfacing to 8086, interfacing keyboard, display, d/a and a/d converter.
Communication interface: serial communication standards, serial data transfer schemes, 8251 USART architecture and interfacing.
Interfacing with advanced devices: memory interfacing to 8086, interrupt structure of 8086, vector interrupt table, interrupt service routine.

MODULE - V: Advanced Microprocessors [10 Periods]
80186, 80286, 80386 and 80486 microprocessors: 80186 architecture, enhancements of 80186 . 80286 architecture:real and virtual addressingmodes. 80386 architecture, special registers, me mory management, memory paging mechanism, 80486architecture , enhancements, cache memor ytechniques, exception handling,comparison ofmicroprocessors (8086 80186 –80286 – 80386 – 80486).

TEXT BOOKS:

1. Ramesh Gaonkar, **"Microprocessor Architecture, Programing and Application with 8085"**, Penram, 5th Edition, 2002. (Modules I & II)
2. A.K.Ray, **"Advanced Microprocessors and Peripherals"**, Tata McGraw-Hill, 2nd Edition, 2006. (Modules III, IV & V)

REFERENCE BOOKS:

1. D. V. Hall, **"Microprocessors and Interfacing"**, TMH, 2nd Edition, 2006.
2. K. Uday Kumar, B.S.Umashankar, **"The 8085 Microprocessor: Architecture, programming and Interfacing"**, Pearson, 2008.

COURSEOUTCOME:

After completion of the course, students will be able to:

1. Describe the basic architecture of 8085 & 8086 microprocessors.
2. Write assembly language programs for 8085 & 8086 microprocessors.
3. Describe a typical I/O and Memory interfacing microprocessor systems.
4. Know the architectures of advanced microprocessors.

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Course Code: 50448 **Credits: 3**

PRINCIPLES OF COMMUNICATION ENGINEERING
(Open Elective)

PREREQUISITES: Basic Electronic Circuits.

OBJECTIVES: This course introduces the need for Modulation of various analog and digital modulation and demodulation techniques. And also introduces the concepts of Digital data transmission. It also discusses the basics of satellite and optical communication.

MODULE - I: Fundamentals of Analog Communication [15 Periods]
Principles of amplitude modulation, AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM Voltage distribution, AM power distribution, Angle modulation - FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation, Frequency analysis of angle modulated waves. Bandwidth requirements for Angle modulated waves.

MODULE - II: Digital Communication [9 Periods]
Introduction, Shannon limit for information capacity, digital amplitude modulation, frequency shift keying, FSK bit rate and baud, FSK transmitter, BW consideration of FSK, FSK receiver, phase shift keying – binary phase shift keying – QPSK, Quadrature Amplitude modulation, bandwidth efficiency, carrier recovery – squaring loop, Costas loop, DPSK.

MODULE - III: Digital Transmission [12 Periods]
Introduction, Pulse modulation, PCM – PCM sampling, sampling rate, signal to quantization noise rate, companding – analog and digital – percentage error, delta modulation, adaptive delta modulation, differential pulse code modulation, pulse transmission – Inter symbol interference, eye patterns.

MODULE - IV: Spread Spectrum and Multiple Access Techniques [16 Periods]Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques – wireless communication, TDMA and CDMA in wireless communication systems, source coding of speech for wireless communications.

MODULE - V:Satellite and Optical Communication [8 Periods]
Satellite Communication Systems-Keplers Law,LEO and GEO Orbits, footprint, Link model-Optical Communication Systems-Elements of Optical Fiber Transmission link, Types, Losses, Sources and Detectors.

TEXT BOOKS:

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2007. (Modules Iv & V)
2. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2001. (Modules I, Ii & Iii)

REFERENCE BOOKS:

3. H. Taub, D L Schilling, G Saha, “Principles Of Communication”, 3rd Edition, 2007.
4. B. P. Lathi, “Modern Analog And Digital Communication Systems”, Oxford University Press, 3rd Edition, 2007.
5. Blake, “Electronic Communication Systems”, Thomson Delmar Publications, 2002.
6. Martin S. Roden, “Analog And Digital Communication System”, Phi, 3rd Edition, 2002.

7. B. Sklar, “Digital Communication Fundamentals and Applications”, Pearson Education, 2nd Edition, 2007.

COURSE OUTCOME:

At The End Of The Course Students Are Able To:

1. Know The Concepts of Various Analog anddigital modulation and demodulation techniques.
2. Know the concepts of Digital data transmission.
3. Understand the spread spectrum and multiple access techniques.
4. Understand Satellite and Optical communication.

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Course Code: 50449 **Credits: 3**

EMBEDDED SYSTEM DESIGN
(Open Elective)

Prerequisites: Microprocessors and Microcontrollers.

Objectives: This course introduces the difference between Embedded Systems and General purpose systems. This course familiarizes to compare different approaches in optimizing General purpose processors. This course provides the design tradeoffs made by different models of embedded systems.

MODULE - I: Introduction to Embedded Systems [08 Periods]

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

MODULE - II: Typical Embedded System [14 Periods]

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

MODULE - III: Embedded Firmware [12 Periods]

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

MODULE - IV: RTOS Based Embedded System Design [12 Periods]

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

MODULE - V: Task Communication [14 Periods]

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1. Shibu K. V, **"Introduction to Embedded Systems"**, McGraw Hill, 2013. (Modules I, II, III, IV & V)

REFERENCE BOOKS:

1. Raj Kamal, **"Embedded Systems"**, TMH.
2. Frank Vahid, Tony Givargis, John Wiley, **"Embedded System Design"**.
3. Lyla**, "Embedded Systems"**, Pearson, 2013.
4. David E. Simon, **"An Embedded Software Primer"**, Pearson Education.

COURSE OUTCOME:

At the end of the course students are able to:

1. Understand the basics of an embedded system.
2. Design, implement and test an embedded system.
3. Understand the design tradeoffs made by different models of embedded systems.

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Course Code: 50503 **Credits: 3**

DATA STRUCTURES

(open elective)

Prerequisites: NIL

Objectives: To develop skills to use and analyze simple linear and nonlinear data Structures and Strengthen the ability to identify and apply the suitable data structure for the given real world problem

MODULE I: Stacks and Queue

A: Operations on Stacks [04 Periods]

Basic stack operations, Representation of a stack using arrays, Stack Applications: Reversing list, factorial calculation, infix-to-postfix transformation, postfix expression evaluation

B: Operations on Queues [05 Periods]

Basic queue operations, Representation of a queue using array, Classification and implementation – Circular and Dequeues, Applications of Queues.

MODULE II: Lists

A: Linear lists [09 Periods]

Introduction, linked lists, single linked list, representation of a linked list in memory, operations on a single linked list, advantages and disadvantages of single linked list. Stacks and Queues representation using Single linked list

MODULE III: Searching and sorting

A: General Notations and complexities [02 Periods]

Algorithm specification, Time and Space complexities using Asymptotic notations

B: Searching [03 Periods]

Basic concepts, linear search, binary search

C: Sorting techniques [04 Periods]

Basic concepts, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort and their implementation programs

MODULE IV:Trees

A: Types of Trees [09 Periods]

Introduction, Basic terminology, Types of trees, Creating a binary tree from a general tree, Traversing a binary tree, Huffman's trees, applications of trees.

MODULE V: Graphs

A: Traversal of Graphs [09 Periods]

Introduction, Graph terminology, Directed graphs, Bi-connected components, representation of graphs, Graph traversal algorithms (BFS algorithm, DFS algorithm), applications of graphs.

TEXT BOOKS:

1. Data Structures using C by Reema Thareja – Second Edition, Oxford University Press.
2. Data Structures: A Pseudocode Approach with C by R.F.Gilberg and B.A.Forouzan - Second Edition, Cengage Learning.
3. Beginning XML, Joe Fawcett, Danny Ayers, Liam R. E. QuinJoe Fawcett, Danny Ayers, Liam R. E. Quin, Wrox Press.2012.
4. Eclipse: Programming Java Applications , Steve Holzner, O'Reilley, 2004.

REFERENCE BOOKS:

1. C& Data structures by P. Padmanabham - Third Edition, B.S. Publications.
2. Data Structures using C by A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein – Seventh Edition, Pearson Education
3. C Programming & Data Structures by E. Balagurusamy - TMH.
4. C& Data structures by E V Prasad and N B Venkateswarlu - S. Chand & Co.

COURSE OUTCOME:

At the end of the course, students able to:

1. Use and analyze different data structures
2. Identity the appropriate data structure for given problem
3. Analyzes the programs for time and space complexities
4. Understand the basic concepts of searching and sorting methods
5. Use tree concepts and operations to solve problems
6. Applications of graphs in BFS, and DFS

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Course Code: 50511 Credits: 3

DATABASE MANAGEMENT SYSTEMS

(open elective)

Prerequisite: NIL

Objectives: To understand the data management and its relations, transactions, concurrency control**.**

MODULE I: Introduction to Databases and Database Management System

A: Basic Operations on Database System [04 Periods]

Database system Applications - Advantages of DBMS over File System - Data Models – Instances and schema - View of Data - Database Languages -DDL-DML - Database Users and Administrator - Database System Structure.

B: Database Design and ER diagrams [05 Periods]

Attributes and Entity Sets – Relationships and Relationship Sets – Constraints - Keys - Design Issues - Entity-Relationship Diagram-Weak Entity Sets - Extended E-R Features- Database Design with ER model - Database Design for Banking Enterprise

MODULE II: Relational Model and SQL

A: Introduction to the Relational Model [04 Periods]

Structure of RDBMS - Integrity Constraints over Relations – Enforcing Integrity Constraints – Querying Relational Data - Relational Algebra and Calculus.

B: Introduction to SQL [05 Periods]

Data Definition commands, Data Manipulation Commands, Basic Structure, Set operations Aggregate Operations - Join operations - Sub queries and correlated queries, SQL functions , views ,Triggers, Embedded SQL.

MODULE III: Dependencies

A: Functional Dependencies [09 Periods]

Introduction , Basic Definitions, Trivial and Non trivial dependencies, closure of a set of dependencies, closure of attributes, irreducible set of dependencies- Schema Refinement in Database Design- Problems Caused by Redundancy – Decompositions – Problem Related to Decomposition –- Lossless Join Decomposition – Dependency Preserving Decomposition - FIRST, SECOND, THIRD Normal Forms – BCNF — Multivalued Dependencies – Fourth Normal Form.

MODULE IV: Transactions and Recovery

A: Transaction concept [06 Periods]

Transaction state- Implementation of atomicity and Durability-Concurrent executions – Serializability, Recoverability Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiple Granularity, Dead Lock Handling – Failure Classification – Storage Structure

B: Recovery and Atomicity [03 Periods]

Log Based recovery – Recovery with concurrent transactions– Checkpoints .

MODULE V: File Organization

A: Storage of files using Various Techniques [09 Periods]

Organization of records in file - Data Dictionary Storage – Indexing and Hashing – Basic Concepts , Ordered Indices, B^+ Tree Index files, B- tree index files– Static Hashing – Dynamic Hashing – Comparison of Indexing with Hashing.

TEXT BOOKS:

1. Database System Concepts, Silberschatz, Korth , Fifth Edition, McGraw hill (1,2,3 & 5 Units)
2. Database Management Systems, Raghuramakrishnan, Johannes Gehrke, TATA Mc Graw Hill(1,2,3 & 5 Units)

3. Introduction to Database Systems, C.J.Date, Pearson Education (4^{th} Unit)

REFERENCE BOOKS:

1. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
2. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.

COURSE OUTCOME:

After completion of the course, the students will able to:

1. Understand the fundamental concepts of database management system. These concepts include aspects of database design, database languages, and database-system implementation.
2. The students will be able to design and query databases, as well as understand the internals of databases.
3. Define the basic functions of DBMS & RDBMS.

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Course Code: 50571 **Credits: 3**

COMPUTER GRAPHICS
(Open Elective)

Prerequisites: NIL

Objectives: To understand and use the application programming interface for the implementation of the graphics and its pipeline and modeling.

MODULE I: Introduction of Graphics

A: Basics of Graphics [04 Periods]

Introduction, Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphicsmonitorsandworkstationsandinputdevices.

B: Outputprimitives [05 Periods]

Pointsandlines,linedrawingalgorithms,mid-pointcircle andellipsealgorithms.Filledareaprimitives:Scan linepolygonfillalgorithm, boundary-fillandflood-fillalgorithms.

MODULE II: Transforming and Viewing

A: 2-Dgeometricaltransforms [03 Periods]

Translation,scaling,rotation,reflectionandshear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

B: 2-Dviewing [06 Periods]

Theviewingpipeline,viewingcoordinatereferenceframe,window toview-portcoordinatetransformation,viewingfunctions,Cohen-Sutherlandand Cyrus-beck lineclippingalgorithms, Sutherland –Hodgeman polygon clippingalgorithm.

MODULE III: 3D Objects

A: 3-D Object Representation [09 Periods]

Polygon surfaces, quadric surfaces, spline representation,Hermitecurve,BeziercurveandB-Splinecurves,BezierandB- Splinesurfaces.Basic illuminationmodels,polygonrenderingmethods.

MODULE IV:3D Transforming and Viewing

A: 3-DGeometrictransformations [04 Periods]

Translation, rotation,scaling,reflectionand Shear transformations,composite transformations.

B: 3-Dviewing [05 Periods]

Viewingpipeline,viewingcoordinates,viewvolumeandgeneralprojectiontransformsandclipping.

MODULE V: Surface detection Methods and Animation

A: Visiblesurfacedetectionmethods [05 Periods]

Classification,back-facedetection,depth-buffer,scan-line, depth sorting,BSP-treemethods,areasub-divisionandoctreemethods.

B: Computer Animation [04 Periods]

Design of animation sequence, generalcomputer animationfunctions,rasteranimation,computeranimationlanguages,keyframe systems,motionspecifications

TEXT BOOKS:

1. "ComputerGraphics*Cversion*",DonaldHearnandM.PaulineBaker,PearsonEducatio.
2."Computer Graphics Principles &practice", second edition in C, Foley,VanDam,FeinerandHughes, PearsonEducation.

REFERENCE BOOKS:

1.“ComputerGraphics”,secondEdition,DonaldHearnandM.PaulineBaker, PHI/Pearson Education.

2. “ComputerGraphicsSecondedition”,Zhigandxiang,RoyPlastock,Schaum’s outlines,TataMc-Grawhilledition.

COURSE OUTCOME:

Upon completion of the course, the students are expected to:

1. Upon successful completion of the course, students will- gain a proficiency with OpenGL, a standard specification defining a cross-language, cross-platform API for writing applications that produce 2D and 3D computer graphics.
2. Learn the principles and commonly used paradigms and techniques of computer graphics.
3. Develop a facility with the relevant mathematics of computer graphics
4. Be able to write basic graphics application programs including animation
5. Understand the basic aspects of 2D image representations and transformation

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Course Code: 50512 **Credits: 3**

OPERATING SYSTEMS
(Open Elective)

Prerequisite: NIL

Objectives: To learn the basics of operations of system and its processing and memory management with file system operations.

MODULE I: Computer System and Operating System Overview

A: Basic system and process operations **[09 Periods]**

Overview of Computer System hardware, Operating System Objectives and functions, Evolution of operating System, Example Systems. Operating System Services, System Calls, System Programs.Process Management: Process Description, Process Control, Process States, Cooperating Processes, Inter-process Communication.

MODULE II: Scheduling and Concurrency

A: CPU Scheduling **[04 Periods]**

Basic Concepts, Scheduling Criteria, Scheduling Algorithms and evaluation, Threads Overview, Threading issues.

B: Concurrency **[05 Periods]**

Principles of Concurrency, Mutual Exclusion, Software and hardware approaches, Semaphores, Monitors, Message Passing, Classic problems of synchronization.

MODULE III: Deadlocks

A: Principles of deadlock **[09 Periods]**

System Model, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlocks, Dining philosopher's problem.

MODULE IV: Memeory

A: Memory Management **[04 Periods]**

Basic concepts, Swapping, Contiguous memory allocation, Paging, Segmentation, Virtual memory, Demand paging, Page-replacement algorithms, Thrashing.

B: Secondary storage structure **[03 Periods]**

Disk structure; Disk scheduling, Disk management, Swap-space Management, RAID structure, Stable-storage Implementation, Tertiary-Storage Structure

C: I/O systems **[02 Periods]**

I/O hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O request to hardware operations, STREAMS

MODULE V: Files

A: File Management **[07 Periods]**

File system-File concepts, Access methods, Directory structure, File system mounting, File sharing and Protection. Implementing file systems-File system structure and implementation, Directory implementation, Allocation methods, Free-space management, Efficiency and performance

B: Security **[02 Periods]**

Security threats, Protection, Intruders, Viruses, Trusted System.

TEXT BOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Operating Systems - Internal and Design Principles, Stallings, Fifth Edition-2005, Pearson education/PHI

REFERENCE BOOKS:

1. Operating System A Design Approach-Crowley,TMH.
2. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI.
3. "An Introduction to Operating Systems, Concepts and Practice", PHI, 2003 – Pramod Chandra P. Bhat.
4. Operating Systems – A concept based approach – DM Dhamdhere – 2nd Edition TMH

COURSE OUTCOME:

After completion of this course, the students will able to:

1. Identify the System calls, protection and interrupts of any GOS.
2. Explain Input/output, disk access, file systems facilities any GOS
3. Write application keeping Concurrency and synchronization Semaphores/monitors, shared memory, mutual exclusion Process scheduling services of an GOS in the mind.
4. The student will learn the responsibilities of OS in concerned with process management and memory management.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 50564 **Credits: 3**

B.Tech.
ARTIFICIAL INTELLIGENCE
(Open Elective)

Perquisite: NIL
Objectives: This course contributes to the development of the following capabilities Enabling Knowledge, Problem Solving: and Critical Analysis.

MODULE I:
Introduction **[09 Periods]**
AI problems, AI Technique, defining problem as a static space search production systems, problem characteristics, production system characteristics. Heuristic **Search B:Techniques:** Generate –and –test, hill climbing, Best –First Search, problem reduction, constraint satisfaction, means-ends analysis.

MODULE II:
Knowledge Representation **[09 Periods]**
Issues, predicate logic, resolution, representing, knowledge using rules, forward versus Backward reasoning, Matching, control knowledge, weak slot –and –filler structures, semantic nets, frames, strong slot –and –filler structures, conceptual dependency, scripts

MODULE III:
Reasoning Techniques **[09 Periods]**
Nonmonotonic reasoning, Augmenting a problem solver, implementation of depth first search and Breadth first search, statistical reasoning, probability and Bayes theorem, certainty factors and rule - based systems, Bayesian Networks.

MODULE IV:
Game Playing **[09 Periods]**
Mini max search, alpha – beta cutoffs, planning system, Goal stack planning, hierarchical planning, understanding, understanding as constraint satisfaction, Waltz algorithm, natural language processing, syntactic processing, Augmented transition Networks, semantic analysis, case grammars.

MODULE V:
Learning **[09 Periods]**
Role learning, learning by taking advice, learning in problem solving, learning from examples, Winston's learning program, Decision trees, perception, vision, speech recognition, Navigation, manipulation, Robot architectures, Expert systems, shell, explanation, knowledge acquisition.

TEXT BOOKS:
1. "Artificial Intelligence", 2nd Edition., E. Rich and K. Knight (TMH).
2. Neural Computing: Theory and practice – Waserman

REFERENCE BOOKS:
1.Artificial Intelligence Structures and Strategies complex problem Solving – George F. Lugar Pearson Education

COURSE OUTCOME:

After completion of this course, the students will able to:

1. Describe the key components of the artificial intelligence (AI) field
2. Describe search strategies and solve problems by applying a suitable search method
3. Describe minimax search and alpha-beta pruning in game playing.
4. Describe and apply knowledge representation
5. Describe and list the key aspects of planning
6. Describe and apply probability theorem and Bayesian networks.
7. Describe the key aspects of intelligent agents

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Course Code: 52501 **Credits: 3**

FUNDAMENTALS OF GEOLOGY
(OpenElective)

Pre-Requisite: Under graduate Physics and Chemistry

Objectives: To introduce fundamentals of geology to the student emphasizing the importance of mineralogy,structural geology, stratigraphy of earth, course is also aimed at explanation of seismic zones, geology and mineral resources of India.

MODULE-I:General Geology [12 Periods]

Origin, age, internal structure and composition of Earth.

Landforms: Origin or mode of development, characteristic features and engineering considerations of landforms developed by Rivers, Wind, Glaciers, Oceans and Volcanoes.

MODULE-II: [12 Periods]

A: Mineralogy:Minerals: Physical and chemical properties; Classification of minerals and properties of common silicate minerals (Quartz, Feldspar, Pyroxene, Amphibole, Garnet, Olivine, Mica), sulphides (Pyrite, Chalcopyrite, Galena, Sphalerite) and oxides (Haematite, Magnetite, Chromite, Pyrolusite, Psilomelane).

B: Petrology Igneous rocks: Magma and lava, extrusive and intrusive forms, textures; Classification and description of some common igneous rocks (Granite, Dolerite, gabbro, Basalt, Rhyolite, Pegmatite). Sedimentary rocks: Sedimentation processes; Classification and description of some common sedimentary rocks (Conglomerate, Sandstone, Shale, Limestone).

Metamorphic rocks: Processes of metamorphism, textures and structures of metamorphic rocks; Classification and description of some common metamorphic rocks (Slate, Phyllite, Schist, Gneiss, Quartzite, Marble).

MODULE-III: PART-A:Structural Geology [6 Periods]

Strike and Dip, Fundamental types, characteristic features and mechanics of folds.

PART-B: [6 Periods]

Faults, joints (fractures) and unconformities.Foliation and Lineation.

MODULE-IV:Stratigraphy [12 Periods]

Principles of stratigraphy , geological time scale, stratigraphic succession, description and mineral wealth of archeans, proterozoic basins, Gondwanas, Deccan traps and Himalayas.

MODULE-V:Groundwater [12 Periods]

Hydrological cycle, vertical distribution of groundwater.Types of aquifers, geological formations as aquifers, springs, engineering considerations of groundwater and groundwater exploration.

Earthquakes: Mode of propagation of seismic energy, causes, effects and distribution of earthquakes, seismic Zoning Map of India.

TEXT BOOKS:

1. A Text Book of Geology by P.K. Mukherjee/ The world press Pvt Ltd.(2005)
2. Engineering Geology by D.V Reddy,vikas publishing house pvt Ltd.,(2010),

REFERENCE BOOKS:

1 Fundamentals of Engineering Geology by F.G. Bell ; Butterworth-Heinemann.(1983)
2 Principles of Physical Geology by Arthur Holmes/ Van Nostrand Reinhold (UK). (1978)
3.Engineering and General Geology, Singh, Parbin ; 6th ed.,Katson Publishing House, Ludhiana(1994)
4. Read, H.H. (1984), “Rutley’s Elements of Mineralogy”, 26th ed.,CBS, New Delhi

5.Text Book of Applied Engineering Geology, Maruthesh Reddy, New Age International Pvt. Ltd. Publishers, New Delhi(2008)
6. Principles of Petrology,-Tyrell GW, Chapman and Hall Publications, New edition
7. Billings, M.P. Structural Geology, Prentice Hall Ino., N. Jersey, USA, 1972.
8. Krishnan M.S. Geology of India and Burma, 3rd Edition, IBH Publishers, N. Delhi, 1984.

COURSE OUTCOME:

After completion of this course, the students will able to:

Mining engineering students are expected to know about the geology of the ground in which miningactivity is proposed or in vogue. This course gives opportunity to get acquainted with the geological conditions of the ground and helps students to plan better and safer mining activity as an outcome of this course.

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Course Code: 52511 **Credits: 3**

MINE CONSTRUCTION ENGINEERING
(OpenElective)

Pre-Requisite: Environmental Studies

Objectives : This course introduces site selection procedure, Shaft sinking methods, Mechanization, Loose groundshaft lining, Design of lining, Surface layouts, Open pit mines opening out trenches, Scheduling for mine constructions PERT/CPM.

MODULE-I **[12 Periods]**

Size of mine Environment and ecology, selection criteria for site of the openings geological investigation.

MODULE-II **[12 Periods]**

Underground mine shaft sinking methods through alluvium, soft and hard rock, Mechanization, consolidation of loose ground shaft lining , ground pressure, thickness of lining.

MODULE-III

PART-A: **[6 Periods]**

Design and procedure of laying the lining, construction of shaft collar heap stead.

PART-B: **[6 Periods]**

Design and construction of insets, shaft bottom, excavation for mechanized decking of cages, skip loading, pit bottom lay outs, installation of main haulages.Main sump size, construction underground substation, first aid room and office.

MODULE-IV **[12 Periods]**

Surface inclines, drivage through soft and hard rock, construction and lining of inclines, lateral and vertical and vertical pressures. Underground development, drivage of roads in stone and coal, mechanization support systems opening of faces.

Surface layouts pit top circuits and coal handling and coal preparation plant, railway sifting and weigh bridges, surface and underground coal bunkers winding house substation, lamp room. Pit head bath, crèche dispensary: office, work-shop, material handling stowing installations, bunker, water tanks, mixing chamber.

MODULE-V **[12 Periods]**

Open pit mines opening out trenches, haul roads, construction of benches. Assembling and transporting of draglines, shovels etc. Scheduling for mine constructions PERT/CPM.

TEXT BOOKS:

1. Design of Underground hard coal mine, J. Pazdziora, Elsevier.
2. Opencast Mining: MODULE Operations, V. V. Rzhevsky- Mir Publications.

REFERENCE BOOKS:

1. Working of Mineral Deposits—G. Popov, International Law & Taxation Publishers
2. Bokey ―Mining.

COURSE OUTCOME:

After completion of this course, the students will able to:

Students can get knowledge of selection of suitable site for mines, different sinking methods, procedureof laying lining, Scheduling for mine construction.

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Course Code: 52528 **Credits: 3**

INTRODUCTION TO MINERAL PROCESSING
(OpenElective)

PRE-REQUISITE: Development of Mineral Deposits
OBJECTIVES: This course introduces Objectives of mineral processing, characteristics of minerals and coal, crushingmethods, separation methods, methods of concentration, fields of application and limitations.

MODULE-I: Introduction **[12 Periods]**
Scope, objectives and limitations of mineral processing, liberation and beneficiation characteristics ofminerals and coal.
Comminution:
Theory and practies of crushing and grinding; different types of crushing an grinding equipments – their applications and limitations.

MODULE-II: Size Separation **[12 Periods]**
Laboratory size analysis and interpretation; settling of solids in fluids; industrial screens,
Gravity Concentration Methods:
Jigging, Heavy media separation, flowing film concentrators–theory, applicationsand limitations.

MODULE-III:
PART-A: **[6 Periods]**
Mechanicalclassifiers and hydro cyclones.
PART-B: Froth Floatation **[6 Periods]**
Physico-chemical principles, reagents, machines, floatation of sulphides, oxides and coal.

MODULE-IV: Electrical Methods of Concentration **[12 Periods]**
Principles, fields of applications and limitations.

MODULE-V: Flow Sheets **[12 Periods]**
Simplified flow sheets for coal, zinc, iron, and manganese ores.
Magnetic methods of concentration Principles, Fields of Application and Limitation.

TEXT BOOKS:
1. Introduction to Mineral Processing – V. Malleswar Rao, Indian Academy of Geoscience
2. Mineral Processing – Barry AWills, Elsevier.

REFERENCE BOOKS:
1. Mineral Processing – S.K. Jain, CBS Publishers & Distributors

COURSE OUTCOME:
Student can understand characteristics and processing of minerals and size separation after crushing,different methods of separation, flow charts for coal, zinc, iron and manganese.

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Course Code: 52543 **Credits: 3**

TUNNELING ENGINEERING
(OpenElective)

PRE-REQUISITE: Environmental Engineering, Mine construction Engineering.

OBJECTIVES: This course introduces Geological concept of tunneling, Stresses and displacements associated withexcavating tunneling, Design of supports of tunnels, Numerical techniques etc

MODULE-I **[12 Periods]**

Introduction to tunneling; geological concept of tunneling.

MODULE-II **[12 Periods]**

Influence of geological aspects on design & construction of tunnels.

Tunneling Methods: Conventional and special Drill & blast roadway drivage machines, tunnel boring machines (TBM)

MODULE-III **[6 Periods]**

PART-A:

Design of Tunnels: Rock conditions, RMR, Q-system, RSR, rock mass behaviour, stress strain behaviour, and stress analysis oftunnels.

PART-B: **[6 Periods]**

Maintenance: Dewatering, ventilation and illumination drivages tunnels.

MODULE-IV **[12 Periods]**

Stresses and displacements associated with excavating tunnels, Ground control or treatment in tunneling and drivages. Design of Supports of Tunnels; Steel supports, rock enforcements, new Australian tunneling methods (NATM)

MODULE-V **[12 Periods]**

Numerical techniques: Introductory use of FLAC, PLAXIS etc.(Finite element model, finite difference model, boundary element model, prediction of stress and deformation around tunnels)

TEXT BOOKS:

1. Tunneling and Underground Construction Techniques, Richards Lee. Bullock, Proceedings 1981 Rapid Excavation and Tunneli Conference, San Francisco, California,

2. Hand Book of Mining and Tunnelling Machinery, Stack Barbara – John Wiley & Sons.

REFERENCE BOOKS:

1. Rock Tunneling with Steel Supports, R.V. Proctor, T.L. White,1961
2. Modern Trends in Tunneling and Blast Design John Johansen C.F. Mathiesen, John Johansen publishing.

COURSE OUTCOME:

Student gets knowledge about design of tunnels, Stresses and displacements associated with excavatingtunnels, Use of FLAC, PLAXIS etc

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Course Code: 50H08 **Credits: 3**

INTRODUTION INTERPRETATION OF LITERATURE AND ANALYTICAL WRITING
(Open Elective)

Objectives:

- To determine how well the students can develop a compelling argument in writing for an academic audience.
- To involve them in critical thinking and persuasive writing exercises.
- To develop effective writing skills -to analyze , to evaluate the data and ideas for making sense
- Encourage students to learn strategies for becoming accurate readers and critical analysts.
- To help learners understand their abilities and strengths while laying a road map towards their career goals.

Introduction:

Developing Analytical writing skills through interpretation of literature and enabling the students to think critically. It assesses the ability to articulate and support complex ideas , construct and evaluate arguments and sustain a focused and coherent discussion. Interpreting the text triggers the students' analytical and critical thinking skills while expanding their outlook.

Methodology :

- Giving them exercises pertaining to translation of their thoughts into words.
- Giving them vocabulary exercises in different contexts.
- Find supporting evidence.
- Make an outline

MODULE – I:

Introduction to interpretation skills

- Interpretation in different settings
- Interpretation of Literature
- Understanding the main ideas in the text
- Vocabulary by Theme

From the short novel: Animal Farm: George Orwell

MODULE – II:

Critical Reading

- Introduction
- The Theme
- Figurative language and characterization
- Interpreter's role and ethics
- Interpretation of story.
- Interpretation of characters
- Animal characters
- Human characters
- Key events
- Things
- Places

MODULE- III:

Critical Writing

- Introduction
- The Theme
- Figurative language and characterization
- Interpreter's role and ethics
- Interpretation of story.

- Interpretation of characters
- Animal characters
- Human characters
- Key events
- Things
- Places

From the short novel: Animal Farm: George Orwell

MODULE – IV:

Analytical writing:

- Responding to various situations
- Entering into the role and responding
- Analyze an issue
- Analyze an Argument
- Verbal Reasoning
- Interpretive Reports.
  From the short novel : Animal Farm : George Orwell

MODULE –V:

Approaches to literary Criticism

Formalist Criticism
Biographical Criticism
Historical Criticism
Gender Criticism
Psychological Criticism
Sociological Criticism
Reader-Response Criticism
Mythological Criticism
Deconstructionist Criticism

REFERENCE BOOKS:

GRE by CliffsTestPrep-7th edition
GRE Exam- A Comprehensive Program
MacMilan edition- Glossary of English Literary terms by – M H Abraham
Interpreting Literature- A Myth and a Reality- GD Barche

COURSE OUTCOME:

After completion of this course, the students will able to:

1. Students are capable of critical thinking and analytical writing.
2. Learners would get real life experiences through interpretation of literature.
3. Students learn strategies for becoming accurate readers and critical analysts
4. Students are capable of logical thinking towards social, political, economical, legal and technological issues.
5. They are capable of drawing their career vision and mission independently.

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Course Code: 50H09 **Credits: 3**

BUSINESS COMMUNICATION
(Open Elective)

Objectives

- To upgrade the learner's communication and presentation skills and to make the student'scompetent in communication at an advanced level.
- To groom the learners' personality
- To make the students self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills

Introduction

Effective communication and interpersonal skills are crucial to increase employment opportunities and to compete successfully in the Global market. The real key to the effectiveness of professionals is their ability to put their domain knowledge into effective practice. Every employer today, looks for an extra edge in their employees. The rapid change in the corporate world asks for proper communication skills in almost all kinds of fields. This course is designed to enhance overall communication skills and soft skills amongst the learners including "How to win interviews". The course content for Business Communication and Soft Skills has been developed keeping in mind the standard of Indian students and the industry requirements.

MODULE – I:Communication skills

Types of communication-Oral, aural and written, reading-Word Power-Vocabulary-technical vocabulary, Rate of speech- pitch, tone-clarity of voice.

MODULE – II:Conversation skills

Informal and Formal conversation, Verbal and Non-verbal communication.Barriers to effective communication- Kinesics

MODULE – III: Reading skills

Types of reading –reading for facts, guessing meaning from context, strategies of reading-scanning, skimming, inferring meaning, critical reading,.

MODULE – IV: Writing and compositionII

Letter-writing-business letters-pro forma culture-format-style-effectiveness, promptness-Analysis of sample letters collected from industry-email, fax, Essay writing-nuances of essay writing, types of essays.

MODULE – V: E- Correspondence

e mail, etiquette, characteristics and types of social correspondence -advantages and disadvantage.

REFERENCE BOOKS:

1. Essentials of Business Communication, Rajendra Pal S KorlahaHi: Sultan Chand & Sons, New Delhi.
2. Basic Communication Skills for Technology, Andrew J.Rutherford: Pearson Education Asia, Patparganj, New Delhi-92.
3. Advanced Communication skills, V.Prasad, Atma Ram Publications, and New Delhi.
4. Raymond V.Lesikav; John D.Pettit Jr.; Business Communication: Theory & application, All India Traveler Bookseller, New Delhi-51
5. Business Cimmunication, RK Madhukar, Vikas Publishing House Pvt Ltd

6. K.R. Laxminarayana: English for Technical Communication-Vols.1 and 2.SCITECH Publications (India) Pvt.Ltd. T.Nagar, Chennai-6000 017
7. Edmond H. Weiss: Writing Remedies: Practical Exercises for Technical Writing, Universities Press, and Hyderabad.
8. Cliffs test Prep for GRE and TOFFEL: Computer Based, IDG Books. India (P) Ltd.New Delhi-002.
9. How to build a better vocabulary – Nurnberg Maxwell & Morris Rosenblum: Grand Central Publishing.
10. How to read better and faster: Norman Lewis, W.R. Goyal Publishers, New Delhi.

COURSE OUTCOME:

- The learner will understand the importance of non-verbal signals in communication.
- The learner will be confident to participate in business meetings
- The learner will be encouraged in all- round development by focusing on soft skills
- The learner will be aware of importance of soft skills in the real time situations.

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Course Code: 50H10 **Credits: 3**

WORLD LITERATURES

(Open Elective)

Objectives:

- The undergraduates need to know about the societies across the globe to understand their society better, and this course aims at bringing awareness about the societies across the globe.
- The students need to understand the cultures of different nations as they are going to enter into global careers and understanding these cultures of different nations will help them to cope with the culture shock.

Module I

African literature

- **Wole Soyinka**
  Dedication (poem)
- **Chinua Achebe**
  A Mother in a Refugee Camp.(poem)
- **OyetSisto Ocean**
  In the Plantation (short story)
- **David Oyuke**
  Of days and nights of old (short story)

Module-II

Australian Literature

- **Christopher Kelen**
  Dark between Empires (poem)
- **Henry Lawson**
  Sons of the South (poem)
- **Ryan O'Neill**
  It's a Tuesday Morning(short story)
- **Linda Heuring**
  Roommates (Short Story)

Module III

American Literature

- **Robert Frost**
  A Late Walk (poem)
- **Maya Angelou**
  Caged Bird (poem)
- **Stephen Crane**
  A Dark Brown Dog(Short Story)
- **Mark Twain**
  A True Story –word to word as I heard It (Short Story)

Module IV

European Literature

- **Herta Muller**
  "Gri" (fragment) (poem)
- **William Wordsworth**
  I Wandered Lonely As A Cloud (Poem)
- **Grazia Deledda**
  The Portrait of a Country woman (Short Story)
- **Guy de Maupassant**

Miss Harriet(Short Story)

Module V

Asian Literature

- **Gieve Patel**
  How Do You Withstand, Body(poem)
- **Amrita Pritam**
  Empty Space(poem)
- **Mahasweta Devi**
  Our Non-veg Cow (short story)
- **Basil Fernando**
  Albert the Murderer (short story)

References:

Africa's Best Stories: An Anthology of Africa's Best Short Stories :ChimamandaNgoziAdichie, Wole Soyinka, E. C. OsonduStoryAfrica.inc, America, 2010
Our Non-veg Cow and Other Stories MahāśvetāDebī, Seagull Books, 1998
Original Short Stories of Maupassant by Guy de Maupassant The Floating Press, 2014

Unspeakable Women: Selected Short Stories Written by Italian Women during Fascism by Robin Pickering-Iazzi:The Feminist Press, New York, 1993

www.naosite.lb.nagasaki-u.ac.jp/dspace/bitstream/.../keieikeizai70_03_08.pdf
www.poetryfoundation.org
www.bigbridge.org/BB17/**poetry**/indian**poetry**anthology/**Gieve_Patel**.html
www.romanianstudies.org/.../**poetry**-in-translation
www.poemhunter.com
www.americanliterature.com
www.fishpublishing.com/**short-stories**-to-read-online.php
www.theliftedbrow.com/post/.../an-australian-**short-story**-by-**ryan-oneill**
www.universeof**poetry**.org/australia.shtml
www.famouspoetsandpoems.com › Poets › Wole Soyinka
www.goodreads.com
www.africanwriterstrust.org

COURSE OUTCOME:

- The students would have learnt about the literatures of different nations and continents.
- The students are aware of the cultures of different societies of the world and are ready to cope with the culture shock they might experience when set to work in global environment.

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Course Code: 50B23 **Credits: 3**

B.Tech
ADVANCED OPTIMIZATION TECHNIQUES
(Open Elective)

Objectives:

- To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems
- To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
- To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

MODULE- I: Single Variable Non-Linear Unconstrained Optimition: **[8Periods]**
One dimensionalOptimization Methods:- Uni-modal function, elimination method, Fibonacci method, golden section method, interpolation methods- quadratic method.

MODULE – II: Multi Variable Non-Linear Unconstrained Optimization: **[8 Periods]**
Direct search method –Univariant Method – pattern search methods – Powell's – Hook – Jeeves search

MODULE – III: Geometric Programming:
Polynomials – arithmetic – geometric inequality – unconstrainedG.P
Dynamic Programming: **[8 Periods]**
Multistage decision process, principles of optimality, examples,conversion of final problem to an initial value problem, application of dynamic programming, production inventory.

MODULE IV: Linear Programming: **[8Periods]**
Formulation – Sensivity analysis. Change in the constraints, costcoefficients, coefficients of the constraints, addition and deletion of variable, constraints. Simulation – Introduction

MODULE V
Stochastic Programming: **[8 Periods]**
Basic concepts of probability theory, random variables –distributions – mean, variance, Correlation, co variance, joint probability distribution – stochastic linear, dynamic programming.

TEXT BOOKS:

1. S.S Rao / **Optimization theory & Applications** / New Age International/4th Edition/2009.
2. Kasan & Kumar / **Introductory to operation research** /Springar/2004.
3. M.C Joshi / **Optimization Techniques theory and practice**/K.M Moudgalya/ Narosa Publications/2004.

REFERENCE BOOKS:

1. H.A. Taha / **Operation Research** /TMH/8th Edition/2011
2. R.L Rardin / **Optimization in operations research** /3rd Edition/1998.
3. Benugundu & Chandraputla / **Optimization Techniques** /Person Asia/2nd Edition/2014

COURSE OUTCOME:

- By the end of the course student will be able to develop models of optimization
- By the end of the course the student should have developed the skills to consider real-world problems and determine whether or not linear programming is an appropriate modeling framework.
- Solve the models for their optimal solutions; interpret the models' solutions and infer solutions to the real-world problems.

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Course Code: 50B24 **Credits: 3**

MATHEMATICAL MODELLING
(Open Elective)

Course Objectives:

- The objective of the course is to introduce mathematical modeling of engineering problems.
- The construction and analysis of mathematical models inspired by real life problems.
- The course will present several modelling techniques and the means to analyze the resulting systems.

MODULE-I: Mathematical Modeling& Types of models using Ordinary Differential Equations of First Order:
Mathematical Model, types of Mathematical models, Procedure of modeling, Linear Growth and Decay Models, Non-Linear Growth and Decay Models, Mathematical Modeling in Dynamics Through Ordinary Differential Equations of First Order,

MODULE-II: Mathematical Modeling through Systems of Ordinary Differential Equations of the First Order
Mathematical Modeling in Population Dynamics, Mathematical Modelling in Economics Through Systems of Ordinary Differential Equations of First Order, Mathematical Models in Medicine, Mathematical Modelling in Dynamics Through Systems of OrdinaryDifferential Equations of First Order.

MODUELE-III: Mathematical Modelling Through Ordinary Differential Equations of Second Order
Mathematical Modeling of Planetary Motions, Mathematical Modeling of Circular Motion and Motion of Statellites, Mathematical Modeling Through Linear Differential Equations of Second Order, Miscellaneous Mathematical Models Through Ordinary Differential Equations of the Second Order.

MODULE-IV: Mathematical Modeling Through Difference Equations
The Need for Mathematical Modelling Through Difference Equations: Some Simple Models, Basic Theory of Linear Difference Equations with Constant Coefficients, Mathematical Modelling Through Difference Equations in Economics and Finance, Mathematical Modelling Through Difference Equations in Population Dynamics and Genetics, Mathematical Modelling Through Difference Equations in Probability Theory, Related problems.

MODULE-V: Mathematical Modeling through Partial Differential Equations
Motivation of Partial Differential Equations Models,: First Method of Getting PDE Models, Momentum Balance Equations: The Second Method of Obtaining Partial Differential Equation Models, Variational Principles: Third Method of Obtaining Partial Differential Equation Models, Probability Generating Function, Fourth Method of Obtaining Partial Differential Equation Models, Model for Traffic Flow on a Highway, Nature of Partial Differential Equations, Initial and Boundary Conditions.

TEXT BOOKS:

1. Edward A. Bender..An Introduction to Mathematical Modeling.
2. A. C. Fowler..Mathematical Models in Applied Sciences, Cambridge University Press.
3. J. N. Kapoor..Mathematical Modeling, Wiley eastern limited.
4. S.M. Ross ..Simulation, India Elsevier Publication.
5. A.M.Law and W.D.Kelton.. Simulation Modeling and Analysis, T.M.H. Edition.

6. Numerical Solutions of Differential Equations by M.K.Jain, Wiley Eastern Ltd.

COURSE OUTCOME:

- Types of models (static, discrete time, continuous time, stochastic) with case studies chosen from population dynamics and other fields can to be determined.
- Identify the most important processes governing the problem (theoretical assumptions)
- Identify the state variables (quantities studied)
- Identify the basic principles that govern the state variables (physical laws, interactions)
- Express mathematically these principles in terms of state variables (choice of formalism)

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Course Code: 50B25 **Credits: 3**

DIFFERENTIAL EQUATIONS AND DYNAMICAL SYSTEMS
(Open Elective)

Objectives:

- The aim is to give a self contained introduction to the field of or- dinary differential equations with emphasis on the dynamical systems point.
- The objective of this course is to provide the student with an understanding of the ... Apply techniques of Nonlinear ODE and Dynamical Systems to

MODULE-I : Linear Systems , Uncoupled Linear Systems , Diagonalization , Exponentials of Operators , Linear Systems .

MODULE-II: Complex Eigen values, Multiple Eigen values, Jordan Forms , Stability Theory Non homogeneous Linear Systems.

MODULE-III: The Stable Manifold Stability and Liapunov Functions , Saddles, Nodes, Foci and Centers Global Theory, Dynamical Systems and Global Existence Theorems .

MODULE-IV: Limit Sets and Attractors, The Stable Manifold Theorem for Periodic , Global Phase Portraits and Separatrix Configurations Structural Stability , Higher Codimension Bifurcations at Non hyperbolic Equilibrium Points.

MODULE-V: Hopf Bifurcations and Bifurcations of Limit Cycles from a Multiple Focus Bifurcation , Finite Co -dimension Bifurcations in the Class of Bounded Quadratic Systems.

TEXT BOOKS:

1) Lawrence Perko, Springer Publications , Third edition ,Texts in Applied Mathematics.
2) Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers, 10th Edition, Reprint 2010.

REFERENCE BOOKS:

1. Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
2. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education.

COURSE OUTCOME:

- By the end of the course the student develops the theory of dynamical systems systematically
- The students will learn to analyze non-linear systems described for diagonalization.
- The student has knowledge of basic concepts and methods from the theory of differential equations and dynamical systems.

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Course Code: 50B20 **Credits: 3**

ADVANCED PHYSICS FOR ENGINEERS
(Open Elective)

Prerequisites: Applied Physics – I & II
Objectives: Theobjective of this course is to make the students familiar with the recent advanced concepts in physics.

Module-I: Special Theory of Relativity: [9 Periods]
Introduction, Concept of theory of relativity, Frames of reference-Inertial, non-inertial; Galilean transformation equations, Michelson-Morley experiment, Einstein theory of relativity, Lorentz transformation of space and time, Length contraction, Time dilation, Variation of mass with velocity, Relativistic relation between energy and momentum.

Module-II:Holography [9 Periods]
Introduction, Basic principle, Construction and Reconstruction of Hologram, Properties of Hologram, Types of Holograms, Applications- Holographic Interferometry, Acoustic Holography, Holographic Microscopy.

Module –III: Thin films Synthesis and Characterization
III A - Synthesis [7 Periods]
Introduction, Deposition techniques-Pulsed Laser Deposition (PLD), Spray Pyrolysis; Nucleation and growth of the thin films, properties (Mechanical, Electrical, Magnetic and Optical).

III B –Characterization [7 Periods]
X-Ray Photoelectron Spectroscopy (XPS), Energy Dispersive X-Ray Analysis (EDAX), Principles and applications of X-Ray Diffraction, Electron Diffraction, Atomic Force Microscopy.

Module-IV: Photonic Crystals [9 Periods]
Important features of photonic crystals, Presence of photonic band gap, anomalous group velocity dispersion, Micro cavity, effects in Photonic Crystals, fabrication of photonic Crystals, Dielectric mirrors and interference filters, PBC based LEDs, Photonic crystal fibers (PCFs), Photonic crystal sensing.

Module-V: Solar cell Physics [9 Periods]
Single, poly and amorphous silicon, GaAs, CdS, Cu_2S, CdTe; Origin of photovoltaic effect, Homo and hetero junction, working principle of solar cell, Evaluation of Solar cell parameters, I-V, C-V and C-f characteristics.

TEXT BOOKS / REFERENCE BOOKS:

1. R K Gaur and SL Gupta, "**Engineering Physics**" Dhanpat Rai Publications, 8th revised Edition, 2006.
2. B K Pandey and S Chaturvedi, "**Engineering Physics**" Cengage Learning India, Revised Edition, 2014.
3. R F Bun shah, "**Hand Book of Technologies for Films and coating"**, Noyes publishers, 1st Edition, 1996
4. B E A Saleh and A C Tech*, "***Fundamentals of Photonics***"*, John Wiley and Sons, New York, 1st Edition, 1993.
5. K L Chopra and S R Das, "**Thin film Solar Cells"**, Plenum press, 1st Edition 1983.
6. K Vijaya Kumar, T Sreekanth and S Chandralingam, "**Engineering Physics**" S Chand and Co 1st Edition, 2008.

COURSE OUTCOME:

After completion of the course, student will be able to:

1. Understand the concepts of special theory of relativity.
2. Analyze the basic concepts of Holography and applications.
3. How to synthesize and different methods of characterization of thin films.
4. Develop basic knowledge on the photonic crystals and solar physics and their applications

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Course Code: 50B21 **Credits: 3**

NANO MATERIALS: SYNTHESIS AND CHARACTERIZATION
(Open Elective)

Prerequisites: Applied Physics – I & II

Objectives: The objective is to provide different methods of synthesis and characterizationof nano material.

Module-I: Physical Methods [9 periods]

Bottom-up approachand Top-down approach, Inert gas condensation, Arc Discharge, lasers ablation, laser pyrolysis, ball milling, molecular beam epitaxial, and electro deposition.

Module-II: Chemical methods [8 periods]

Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis,Nano crystals of semiconductors.

Module-III: Thermal Methods

III A-Thermal Methods: **[8 periods]**

Thermolysisroute – spray pyrolysis and solved metal atom dispersion, sol-gel method solvothermal and hydrothermal routes, solution combustion synthesis, CVD method.

III B: Surface Characterization [8 periods]

Scanning electron microscopy (SEM), Transmission electron microscopy (TEM).Photo luminescence Spectroscopy.

Module-IV: Compositional and structural Characterization techniques [9 periods]

X-Ray Photoelectron Spectroscopy (XPS), Energy Dispersive X-Ray Analysis(EDAX),Principles and applications of X-Ray Diffraction, Electron Diffraction, and Electron probe microanalysis(EPMA).

Module – V: Properties and Applications of Nanomaterials[8 periods]

Carbon Nano Tube (CNT) – Single-Wall Carbon Nano Tube (SWCNT), Multi-wall carbon Nano tube (MWCNT), Activated carbon, Fullerene, Graphene, Quantum wire and Quantum dots

TEXT BOOKS:

1. C N R Rao, A Muller and A K Cheetham "**The chemistry of Nanomaterials: Synthesis, Properties and Appliocations**" John Wiley, First Edition, 2004
2. Hari Singh Nalwa, "**Nanostructured Materials and Nanotechnology**", Academic Press, First Edition, 2002.

REFERENCE BOOKS:

1. Charles P Poole Jr "**Introduction to Nanotechnology**", John Willey & Sons, 1st Edition, 2003
2. C Dupas, P Houdy, M Lahmani, Nanoscience: "**Nanotechnologies andNanophysics**", Springer-Verlag Berlin Heidelberg, 1st Edition, 2007
3. Guozhong Cao, "**Nanostructures and Nanomaterials, synthesis, properties and applications***",* Imperial College Press, 1st Edition, 2004.
4. T Pradeep, "**NANO: The Essentials: Understanding Nanoscience andNanotechnology***".* Tata McGraw-HillPublishing Company Limited, Revised Edition, 2007
5. Z L Wang, "**Characterization of Nanophase Materials***"* Wiley-VCH, 1st Edition, 2000.

6. K Vijaya Kumar, T Sreekanth and S Chandralingam, "**Engineering Physics**" S Chand and Co 1st Edition, 2008.

COURSE OUTCOME:

After completion of the course, student will be able to:

1. Understand different methods of synthesis of nano materials
2. Analyze the differences in the different methods of synthesis
3. Learn different characterization techniques of nano materials.
4. Develop basic knowledge on the properties and the applications few nano materials.

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Course Code: 50B22 **Credits: 3**

NDT AND VACUUM TECHNOLOGY
(Open Elective)

Prerequisites: Applied Physics – I & II

Objectives: The objective is to provide a basic level of understanding on Non destructive testing and Vacuum technology.

Module – I: Introduction to Non destructive testing [6 periods]

Introduction, Objectives of Non destructive testing, Types of defects – Cracking, Spalling, Staining, Construction and Design defects, Honey combing, Dusting, Blistering, Rain damage.

Module – II: Methods of Non destructive Testing [10 Periods]

Liquid penetration method, Dye penetration method, Radiographic testing, Ultrasonic Inspection method, Pulse Echo method, Magnetic particle testing, Eddy current Testing.

Module – III: Introduction to Vacuum Technology and Flow meters

A: Introduction to Vacuum Technology [9 Periods]

Definition of vacuum, Degrees of vacuum and their ranges; Review of Kinetic theory of gases; Definitions of particle flux, mono layer formation time, pressure; Elementary gas transport phenomena; Knudsen's and Reynolds' numbers; Throughput, mass flow and conductance;

B: Flow meters [8 Periods]

Molar flow, Mass flow and throughput; Rota meters and chokes; differential pressure techniques;

Module – IV: Pressure gauges [8 Periods]

Classification, Direct and indirect gauges, Indirect gauges – Pirani gauge, Thermocouple gauge, Ionization gauge, hot cathode gauge, Penning gauge

Module – V: Vacuum Pumps [9 Periods]

Introduction, Pumping speed, Rotary vane pump, Turbo molecular pump, Diffusion pumps

TEXT BOOKS:

1. B K Pandey, S Chaturvedi, **"Engineering Physics"**, Cengage learning, 1st Edition, 2014
2. John. F. O'Hanlon, **"A User's guide to Vacuum technology",** Wiley, 3rd Edition, 2003

REFERENCE BOOKS:

1. M R Srinivasan, **"Physics for Engineers"**, New Age international, 1st reprint, 2007
2. R K Gaur and S L Gupta, "**Engineering Physics**", Dhanpat rai, Reprint, 2006
3. Krishna Seshan, "**Hand Book of Thin film deposition**", Noyes, 2nd Edition, 2002

COURSE OUTCOME:

After completion of the course, student will be able to:

1. Understand the concepts of NDT and Vacuum technology.
2. Learn different methods of NDT.
3. Develop basic knowledge of flow meters, pressure gauges and vacuum pumps working and their applications.

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Course Code: 50B17 **Credits: 3**

CHEMISTRY OF ENGINEERING MATERIALS
(Open Elective)

Objectives:

The objective is to make the students know about the Concept of phase rule and alloys, phase diagrams of different systems. To give knowledge to the students regarding lubricants, abrasives, glass, ceramics, re-fractories and adhesives.To make the students to understand the basic concepts of chemistry to develop futuristic materials for high-tech applications in the area of engineering.

Module-I

PhaseRuleandalloys [periods: 10]

Phase Rule: Definition of terms : Phase, component, degree of freedom, phase rule equation. Phase diagrams – one component system- water system. Two component system Lead- Silver, cooling curves, heat treatment based on iron-carbon phase diagram - hardening, annealing and normalization.

Alloys-fabrication of alloys-Ferrous alloys-Non ferrous alloys-industrial applications.

Module-II

Lubricants,AbrasivesandAdhesives[periods: 10]

Introduction to Lubricants-Mechanism of Lubrication-classification of Lubricants-properties of lubricants-viscosity, flash and fire points, cloud and pour points,decomposition stability,saponification number. Abrasives-natural and artificial abrasives-grinding wheels-abrasive paper and cloth. Adhesives-classification -action of adhesives- factors influencing adhesive action development of adhesive strength.

Module-III

CementandConcrete [Periods:8]

Introduction-Classification of cement-natural –chemical composition of cement-portland cement-chemical reactions involved in setting and hardening of cement-additives for cement- -mortars and concretes-pre stressed concrete-post tensioning-curing-overall scenario of cement industry-Reinforced concrete constructions-testing and decaying of cement-prevention of cement decay

Module-IV

GlassCeramicsandRefractories [Periods:9]

Structure of glass-properties-Manufacturing of glass-Types of glasses-uses Ceramics-clays-methods for fabrication of ceramic ware plasticity of clays. Ceramic products-glazes. Porcelain and vitreous enamels. Requisites of a good refractory-classification, properties and applications of refractories.

Module-V

PolymersandCompositematerials [Periods:9]

Structure and properties of polymers-rubber –classification-vulcanization of rubber –preparation properties and application of Buna-S and Buna-N and Thiokol rubber.Biogradable polymers- poly vinyl acetate and poly lactic acid. Liquid crystals-Introduction-structure of liquid crystal forming compounds-classification-chemical properties-importance and applications.

REFERENCE BOOKS:

1. Engineering Chemistry by R.P. Mani,K.N. Mishra, B. Rama Devi /CENGAGE learning.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).
3. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited, New Delhi (2006).
4. Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills Publishing Company Limited, New Delhi (2004).

5. Text Book of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co Publishers, New Delhi(2006) Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.

COURSE OUTCOME:

- Ability to practice professional chemical - polymer engineering knowledge for sustainabledevelopment.
- Be able to apply core concepts in Materials Science to solve engineering problems.

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Course Code: 50B18 **Credits: 3**

NANO CHEMISTRY
(Open Elective)

Objectives:
The objective is to make the learners know about the scope of nanoscale materials and their versatile properties. To give knowledge of various instrumental techniques to the analysis the nonmaterials.To make aware of the learners of different applications of nano materials.

MODULE-I **[Periods: 8]**
NANO CHEMISTRY-I
Introduction -synthesis of nanostructure materials, Bottom-up approach and Top-down approach With examples-sol-gel method,-solvothermal and hydrothermal routes, Chemical Vapor Deposition and precipitation methods.

MODULE-II **[Periods: 9]**
NANO CHEMISTRY-II
Properties of nano materials-Electronic properties, Energy bands and gaps in semiconductors, Fermi surfaces-Optical properties- Fluorescence/luminescence, photoluminescence/fluorescence, electroluminescence, quantum dot.Magnetic properties-mechanical properties-thermal properties.

MODULE-III **[Periods: 9]**
INSTRUMENTAL ANALYSIS
Characterization techniques: Principles involved in Scanning Electron Microscopy(SEM), Electron Dispersion Spectroscopy(EDS), Transmission Electron Microscopy (TEM), Dynamic Light Scattering (DLS) and Atomic Force Microscopy(AFM) -Illustrative examples.

MODULE-IV **[Periods: 10]**
CARBON NANO TUBES AND APPLICATION
Carbon Nano structures ,types and preparation of Carbon Nano tubes.Nano structured crystals. Graphene, Carbon nano-fibers- Carbon clusters and Fullerenes- optical and telecommunication applications.Organic Nano Solar cells and its applications.

MODULE-V **[Periods: 9]**
ENVIRONMENTAL NANOTECHNOLOGY
Implications of Nanotechnology & Research needs-Nano structured Catalysts TiO2 Nano particles for Water purification- Nano membranes in Drinking water treatment and desalination, Nano membranes in Sea desalination-Nano particles for treatment of Chlorinated Organic Contaminants.

REFERENCE BOOKS:

1. Nano Technology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springer
2. Nano Technology – science, innovation and opportunity by Lynn E Foster;Prentice Hall - Pearson education.
3. Hand book of Nano structured materials; Vol I to V Bio Ethics Readings and cases by Branch.
4. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology – by T.Pradeep; Tata Mc.Graw Hill.
5. Nanotechnology: Principles and Practices – Sulabha K. Kulkarni – Capital Publishing Company
6. Specimen preparation for Transmission Electron microscopy by John & Bravmno et al, published by MRS.

COURSE OUTCOME:

- The students become aware about the synthesis of nanostructure materials.
- The learners get knowledge about the properties of nano materials and instrumental analysis.
- The students can come to know about the Carbon nano tubes, Carbon nano-fibers, nano structured Catalysts and Organic nano solar cells.

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Course Code: 50B19 **Credits: 3**

PHOTOCHEMISTRY AND SPECTROSCOPY
(Open Elective)

Objectives:
The objective is to make the students know about the impact of light on matter and the implications of it also to bring awareness to explore the consequences of light matter interaction.
To give knowledge to the learners regarding the structural identification /determination utilizing the different regions of electromagnetic spectrum.

Module -I: **Photochemistry I**: **[Periods:9]**
Introduction to photochemistry, atomic orbitals,molecular orbitals,thermal and photochemical reactions. Fundamental principles of photochemistry-Interaction of light with chemical substances.absortion spectra, electronic transition.spin multiplicity, singlet and triplet of excited state.

Module –II: **Photochemistry II**: [**Periods:8]**
Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law.Quantum efficiency – determination.Jablonski Diagram-Fluorescence and Phosphorescence. Chemiluminescence and Thermoluminescence with examples. Photosensitization.

Module –III: Absorption Spectroscopy: [Periods:10]
Introduction and importance; Principles and instrumentation; Interferences - Chemical & Spectral methods; Applications of Atomic Absorption Spectroscopy for qualitative and quantitative analysis. UV-Visible spectroscopy: principles, applications for qualitative and quantitative analysis.

Module –IV: IR Spectroscopy: [Periods:9]
Introduction- basic principles, Instrumentation. Identification of some functional groups applications for qualitative and quantitative analysis.

Module –V: Nuclear magnetic resonance spectroscopy: [Periods:9]
Introduction-basic principles , Instrumentation – chemical shift- Spin-Spin splitting- coupling constant, Spin decoupling, shift reagents. Structure determination, applications of proton NMR spectroscopy.

REFERENCES BOOKS:

1. **"Vogel's Text Book of Quantitative Chemical Analysis",** by J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, Pearson Education Pvt. Ltd., New Delhi, (**6thedition**).
2. **Organic Spectroscopy by R.C.Banwell**
3. **Organic Spectroscopy by William kemp.**
4. **R.O. Kan .Organic Photochemistry.New York :Mc Graw-Hill.**
5. **N.J Turro ,modern molecular photochemistry,**The Benjamin/comings publishing
6. **Applications of Absorption Spectroscopy of Organic Compounds"** by John R.Dyer, Prentice-Hall of India Pvt. Ltd., New Delhi (**1969**).
7. **Instrumental Methods of Analysis by** Hobart H.Willard and D.U.Merritt & J.R.J.A.Dean, C.E.S Pu8blishers and distributors.
8. **Instrumental methods of chemical analysis** – By Scoog and West .

COURSE OUTCOME:

- The students become aware about the light matter interaction.
- The learners get knowledge about the usage of UV-Visible, IR & NMR radiations for structural identification of matter.