ACADEMIC REGULATIONS, COURSE STRUCTURE

and

DETAILED SYLLABUS

CHOICE BASED CREDIT SYSTEM

R21

B.Tech – Mechanical Engineering

B.Tech - Regular Four Year Degree Programme
(For batches admitted from the academic year 2021 - 2022)

Holy Mary Institute of Technology & Science

Bogaram (V), Keesara (M), Medchal (Dist) - 501 301

FOREWORD

The autonomy is conferred on Holy Mary Institute of Technology & Science by UGC, based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

Holy Mary Institute of Technology & Science is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a two decades in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the college in order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought, at appropriate time with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2021-22)
&
B. Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2022-23)

For pursuing four year Under Graduate Degree Programme of study in Engineering & Technology (UGP in E&T) offered by Holy Mary Institute of Technology & Science under Autonomous status is herein referred to as HITS (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2021-22 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Holy Mary Institute of Technology & Science (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Holy Mary Institute of Technology & Science shall be the chairman Academic Council.

1. ADMISSION

1.1. **Admission into first year of four year B. Tech. degree programmes of study in Engineering**

1.1.1. **Eligibility:**

A candidate seeking admission into the first year of four year B. Tech. degree Programmes should have:

(i) Passed either Intermediate Public Examination (I.P.E) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.

(ii) Secured a rank in the EAMCET examination conducted by TSCHE for allotment of a seat by the Convener, EAMCET, for admission.

1.1.2. **Admission Procedure:**

Admissions are made into the first year of four year B. Tech. Degree Programmes as per the stipulations of the TSCHE.

(a) Category 'A' seats are filled by the Convener, TSEAMCET.

(b) Category 'B' seats are filled by the Management.

1.2 Admission into the second year of four year B. Tech. degree Program in Engineering

1.2.1 **Eligibility**:

A candidate seeking admission under lateral entry into the II year I Semester B. Tech. degree Programmes should have passed the qualifying exam (B.Sc. Mathematics or Diploma in concerned course) and based on the rank secured by the candidate at Engineering Common Entrance Test ECET (FDH) in accordance with the instructions received from the Convener, ECET and Government of Telangana.

1.2.2 **Admission Procedure**:

Admissions are made into the II year of four year B. Tech. degree Programmes through Convener, ECET (FDH) against the sanctioned strength in each Programmes of study as lateral entry students.

2. PROGRAMMES OFFERED

Holy Mary Institute of Technology & Science, an autonomous college affiliated to JNTUH, offers the following B.Tech Programmes of study leading to the award of B. Tech degree under the autonomous scheme.

1) B.Tech. - Civil Engineering
2) B.Tech. - Computer Science and Engineering
3) B.Tech. – Computer Science and Engineering (Artificial Intelligence & Machine Learning)
4) B.Tech – Computer Science and Engineering (Data Science)
5) B.Tech – Computer Science and Engineering (IoT)
6) B.Tech – Computer Engineering (Software Engineering)
7) B.Tech. - Electronics and Communication Engineering
8) B.Tech - Electrical & Electronics Engineering
9) B.Tech. - Mechanical Engineering

The medium of instructions for the entire under graduate programme in Engineering & Technology will be English only.

3. DURATION OF THE PROGRAMMES

3.1 Normal Duration

3.1.1 B. Tech. degree programme extends over a period of four academic years leading to the Degree of Bachelor of Technology (B.Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

3.1.2 For students admitted under lateral entry scheme, B. Tech. degree programme extends over a period of three academic years leading to the Degree of Bachelor of Technology (B. Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

3.2 Maximum Duration

3.2.1 The maximum period within which a student must complete a full-time academic programme is 8 years for B. Tech. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

3.2.2 For students admitted under lateral entry scheme in B. Tech. degree programme, the maximum period within which a student must complete a full-time academic programme is 6 years. If a student fails to complete the academic programme within the maximum

duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

3.2.3 The period is reckoned from the academic year in which the student is admitted first time into the degree Programme.

4. AWARD OF B.Tech DEGREE

A student will be declared eligible for the award of the B.Tech degree if he/she fulfils the following academic regulations:

4.1 The candidate shall pursue a course of study as specified in section 3.1 and 3.2.

4.2 The candidate shall register for 160 credits and secure 160 credits (Excluding Mandatory Courses).

5. PROGRAMME STRUCTURE

5.1 UGC/AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed below.

Semester Scheme:

Each UGP is of 4 Academic Years (8 Semesters), each year divided into two Semesters of 22 weeks (≥90 working days), each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Curriculum/Course Structure as suggested by AICTE are followed.

5.1.1 The B.Tech. Programme of Holy Mary Institute of Technology & Science is Semester pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 16-18 Weeks duration with a minimum of 90 Instructional Days per Semester.

5.1.2 Credit Courses:

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

- One Credit - for One hour / Week / Semester for Theory / Lecture(L) / Tutorial)T) Courses; and
- One Credit - for Two hours/Week/Semester for Laboratory/Practical (P) Courses, Mini Project...
- Mandatory Courses Credits shall not be counted for credit requirements for award of degree. However all the mandatory courses have to be passed by the student.

5.1.3 **Course Classification:**

All Courses offered for the UGP are broadly classified as:

- **Basic Science Courses (BSC):** Includes Mathematics, Physics, Chemistry, Biology etc.
- **Engineering Science Courses (ESC):** Courses include Materials, Workshop, Basics of Electrical/Electronics/ Mechanical/Computer Science & Engineering, Engineering Graphics, Instrumentation, Engineering Mechanics, Instrumentation etc.
- **Humanities and Social Science including Management Courses (HSMC):** Courses include English, Communication skills, Management etc.
- **Professional Core Courses (PCC):** Relevant to the chosen specialization/branch.

- **Professional Elective Courses (PEC):** Relevant to the chosen specialization/ branch offered as electives.
- **Open Elective Courses (OEC):** Other technical and/or emerging subject areas offered in the College by the Departments of Engineering, Science and Humanities.
- **Mandatory Course:** Course work on peripheral subjects in a programme, wherein familiarity considered mandatory. To be included as non-Credit, Mandatory Courses, with only a pass in each required to qualify for the award of degree from the concerned institution.
- **Project Work:** and/or internship in industry or elsewhere, seminar.
- **MOOCS –** Massive Open Online Courses in a variety of disciplines available at both introductory and advanced levels, accessible from e-resources in India and abroad.

5.1.4 **Course Nomenclature:**

The Curriculum Nomenclature or Course-Structure Grouping for the each of the UGP E&T (B.Tech Degree Programme), is as listed below.

S. No	Broad Course Classification	Course Group/ Category	Course Description	Credits
1)	BSC,ESC & HSMC	BSC – Basic Sciences Courses	Includes - Mathematics, Physics and Chemistry Subjects	25
2)		ESC - Engineering Sciences Courses	Includes fundamental engineering subjects.	24
3)		HSMC – Humanities and Social Sciences including Management	Includes subjects related to Humanities, Social Sciences and Management.	12
4)	PCC	PCC – Professional Core Courses	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg.	57
5)	PEC	PEC– Professional Elective Courses	Includes Elective subjects related to the Parent Discipline / Department / Branch of Engg.	18
6)	OEC	OEC – Open Elective Courses	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline/ Department / Branch of Engg.	09
7)	PWC	Project Work	Major Project.	15
8)		Industrial Training/ Mini- Project	Industrial Training/ Internship/ Mini-Project.	
9)		Seminar	Seminar / Colloquium based on core contents related to Parent Discipline/ Department/ Branch of Engg.	
10)	MC	Mandatory Courses	Mandatory Courses (non-credit)	--
Total Credits for UGP (B. Tech.)Programme				**160**

- Minor variations as per AICTE / UGC guidelines

6. COURSE REGISTRATION

6.1 A 'Faculty Advisor or Counsellor' shall be assigned to each student, who advises him/her about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on his/her competence, progress, pre-requisites and interest.

6.2 Academic Section of the College invites 'Registration Forms' from students prior (before the beginning of the Semester), ensuring 'DATE and TIME Stamping'. The Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

6.3 A Student can apply for Registration, which includes approval from his faculty advisor, and then should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

6.4 A student may be permitted to register for his/her course of CHOICE with a Total of prescribed credits per Semester (permitted deviation being±12%), based on his PROGRESS and SGPA/CGPA, and completion of the 'PRE-REQUISITES' as indicated for various courses in the Department Course Structure and Syllabus contents.

6.5 Choice for 'additional Courses' must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Counsellor.

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

6.7 Dropping of Courses or changing of options may be permitted, ONLY AFTER obtaining prior approval from the Faculty Advisor, 'within 15 Days of Time' from the commencement of that Semester. Course Options exercised through Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices will also not be considered. However, if the 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 Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

7. COURSES TO BE OFFERED

7.1 A typical section (or class) strength for each semester shall be 60.

7.2 Courses may be offered to the Students, only if minimum of 20 students (1/3rd of the section strength) opt for it.

7.3 More than ONE TEACHER may offer the SAME SUBJECT (Lab/Practical's may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection choice for students will be based on - 'CGPA Basis Criterion' (i.e., the first focus shall be on early Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

7.4 If more entries for Registration of a Subject come into picture, then the concerned Head of the Department shall take necessary decision, whether to offer such a Subject/Course for TWO (or multiple) SECTIONS or NOT.

7.5 OPEN ELECTIVES will be offered by a department to the students of other departments.

8. B.Tech (Honours) DEGREE

A new academic programme B.Tech (Hons.) is introduced in order to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area.

8.1 B.Tech students in regular stream can opt for B.Tech (Hons.), provided they have a CGPA of 8.0 and above up to the end of IV-Semester without any history of arrears and attempting of betterment.

8.2 For B. Tech (Honors), a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). Student to opt for the courses from NPTEL/SWAYAM/Coursera/other MOOC platform as recommended by concern BOS relevant to her/his discipline through MOOCs as recommended by the BOS.

8.3 If the credits of NPTEL/ SWAYAM/ Coursera /other MOOC platform courses do not match with the existing subject the BOS will take appropriate decision.

8.4 After registering for the B.Tech (Honours) programme, if a student fails in any course he/she will not be eligible for B.Tech (Honours).

8.5 Students who have obtained “C grade” or “reappear” or “Repeat Course” / “Re Admitted” or “Detained” category in any course, including the MOOCs courses, are not eligible for B.Tech (Hons.) degree. Up to 8 semesters without any history of arrears and attempting of betterment is not eligible to get B.Tech (Hons.).

8.6 Those who opted for B. Tech (Honours) but unable to earn the required additional credits in 8 semesters or whose final CGPA is less than 8 shall automatically fall back to the B.Tech programme. However, additional course credits and the grades thus far earned by them will be shown in the grade card but not included for the CGPA.

8.7 The students have to pay the requisite fee for the additional courses.

Table: Assigned Credits

Hour/Week	Online Course Duration	Assigned Credits
2 hours / week	04 Weeks	01 Credit
3 hours / week	08 Weeks	03 Credits
3 hours / week	12 Weeks	04 Credits

9. B.Tech (Minor) DEGREE

This concept is introduced in the curriculum of all conventional B. Tech. programmes offering a major degree. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. programme. In order to earn a Minor in a discipline a student has to earn 20 extra credits by studying any five theory subjects from the programme core & professional elective courses of the minor discipline or equivalent MOOC courses available under SWAYAM platform. The list of courses to be studied either in MOOCs or conventional type will be decided by the department at the time of registration for Minor degree.

a. B.Tech students in regular stream can opt for B.Tech (Minor.), provided they have a CGPA of 8.0 and above up to the end of IV-Semester without any history of arrears and attempting of betterment.
b. Students aspiring for a Minor must register from **V**-Semester onwards and must opt for a Minor in a discipline other than the discipline he/she is registered in. However, Minor discipline registrations are not allowed before V-Semester and after VI-Semester.
c. Students will not be allowed to register and pursue more than extra two subjects in any semester.
d. Completion of a Minor discipline programme requires no addition of time to the regular Four year Bachelors' programme. i.e. Minor discipline programme should be completed by the end of final year B. Tech. program along with the major discipline.
e. A student registered for Minor in a discipline shall pass in all subjects that constitute the requirement for the Minor degree programme. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Minor degree programme.

10. ATTENDANCE REQUIREMENTS

a. A student will be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/Courses (excluding Mandatory or Non-Credit Courses) for that Semester.
b. Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student's representation with supporting evidence by following the govt. rules in vogue.
c. A stipulated fee shall be payable towards condoning of shortage of attendance.
d. Shortage of Attendance below 65% in aggregate shall in No case be condoned.
e. A student shall not be promoted to the next Semester unless he/she satisfies the attendance requirements of the current Semester. The student may seek readmission for the Semester when offered next. He / She shall not be allowed to register for the subjects of the Semester while he/she is in detention. A student detained due to shortage of attendance, will have to repeat that Semester when offered next. The academic regulations under which the student has been readmitted shall be applicable.
f. Students whose attendance is less than 75% are not entitled to get the scholarship / fee reimbursement in any case as per the TS Govt. Rules in force.

11. ACADEMIC REQUIREMENTS FOR PROMOTION/COMPLETION OF REGULAR B.TECH PROGRAMME COURSE STUDY.

11.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Course, if he secures not less than 35% marks in the End Semester Examination, and a minimum of 40% of marks in the sum Total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing P Grade or above in that Course.

11.2 A Student will not be promoted from I Year to II Year, unless he/she fulfils the Attendance and Academic Requirements and secure a Total 40% of Credits up to I Year II Semester from all the relevant regular and supplementary examinations.

11.3 A Student will not be promoted from II Year to III Year, unless he/she fulfils the Attendance and Academic Requirements and secure a Total 50% of Credits up to II Year II Semester from all the relevant regular and supplementary examinations.

11.4 A Student will not be promoted from III Year to IV Year, unless he/she fulfils the attendance and Academic Requirements and secure a Total 60% of Credits up to III Year II Semester, from all the regular and supplementary examinations.

11.5 After securing the necessary 160 Credits as specified for the successful completion of the entire UGP, resulting in 160 Credits for UGP performance evaluation, i.e., the performance of the Student in these 160 Credits shall alone be taken into account for the calculation of the final CGPA.

If a Student registers for some more 'extra courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed courses Totalling to 160 Credits as specified in the Course Structure of his/her Department, the performances in those 'extra courses' (although evaluated and graded using the same procedure as that of the required 160 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra courses' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in items 8 and 9.1-9.5.

11.6 Students who fail to earn minimum of 160 Credits as per the Course Structure, and as indicated above, within 8 Academic Years from the Date of Commencement of their I Year shall forfeit their seats in B.Tech Programme and their admissions shall stand cancelled.

When a Student is detained due to shortage of attendance/lack of credits in any Semester, he may be re-admitted into that Semester, as and when offered. However the regulations at the time of admissions hold good.

12. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

12.1 The performance of a student in each Semester shall be evaluated Course-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory. The B.Tech Project Work (Major Project) will be evaluated for 100 marks in Phase-I and 100 Marks in Phase-II.

12.2 For all Theory Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

12.3

a) For Theory Subjects (inclusive of Minor Courses), during the semester, there shall be two Continues Internal Evaluations (CIE) examinations for 3**0 marks** each. Each CIE examination consists of one subjective paper for **25 marks**, and assignment for **5 marks** for each subject. Question paper contains Two Parts (Part-A &Part-B) the distribution of marks for PART-A and PART-B will be 10 marks & 15 marks respectively for UG programme. Average of two CIE examinations will be taken as part of external assessment.

Pattern of the question paper is as follows:

PART–A

Consists of **one compulsory question** with five sub questions each carrying two mark. For the I-Mid examinations the sub question would be from first 2 ½ units and for the II-Mid examination the sub question would be from the remaining 2 ½ units.

PART-B

Consists of five questions (out of which students have to answer three questions) carrying five marks each. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question). The questions can consist of sub questions also.

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

c) First Assignment should be submitted before the commencement of the first mid-term examinations, and the Second Assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified/given by the concerned subject teacher.

d) If any candidate is absent for the CIE examinations or those who want to improve their internal marks in any subject can opt for improvement exam as and when offered. The improvement exam is a 45 minutes duration and consisting of 30 objective questions from the entire syllabus of the subject. Best marks are considered as final marks from the average of two mid examinations or improvement examination marks. The improvement can be taken after the payment of prescribed fee. There is no Internal Improvement for the courses Machine Drawing, Production Drawing, Engineering Drawing, Engineering Graphics and practical, mandatory courses.

12.4 For Practical Courses, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks, and 70 marks are assigned for Lab/Practical End Semester Examination (SEE). Out of the 30 marks for internals, day-to-day work in the laboratory shall be evaluated for 20 marks; and for the remaining 10 marks - two internal practical tests (each of 10 marks) shall be conducted by the concerned laboratory teacher and the average of the two tests is taken into account. The SEE for Practical's shall be conducted at the end of the Semester by Two Examiners appointed by the Chief Controller of Examinations in consultation with the Head of the Department.

12.5 For the Subjects having Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (10 marks for day-to-day work and 20 marks for internal tests) and 70 marks for SEE. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

12.6 Open Elective Course**:** Students can choose one open elective course (OE-I) during III-B.Tech I-semester, one (OE-II) during III-B.Tech II-semester, one (OE-III) in IV-B.Tech I-semester, and one (OE-IV) in IV-B.Tech II-semester from the list of open elective courses given. However, students cannot opt for an open elective courses offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any Semester.

12.7 There shall be an Industrial Oriented Mini Project/Summer Internship, in collaboration with an industry of their specialization. Students will register for this immediately after II year II semester examinations and pursue it during summer vacation. Industrial Oriented Mini Project/Summer Internship shall be submitted in a report form and presented before the committee in III year I semester. It shall be evaluated for 100 external marks. The committee consists of an external examiner, Head of the Department, Supervisor of the

Industrial Orientated Mini Project/Summer Internship and a senior faculty member of the department. There shall be no internal marks for Industrial Orientated Mini Project/Summer Internship.

12.8 There shall be a Comprehensive Viva (Independent Study) in III-B.Tech II-Semester and will be conducted SEE through a test or a committee consisting of One External Examiner, Head of the Department and two senior faculty members of the Department. The independent study is intended to assess the student's understanding of the subjects he/she studied during the B.Tech course of study and evaluated for 100 marks. There shall be no CIE for Comprehensive Viva.

12.9.

a) UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

b) For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project work and project supervisor shall evaluate for 100 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks in the total of the CIE.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

c) For Project Stage – II, the external examiner shall evaluate the project work for 70 marks and the project supervisor shall evaluate it for 30 marks. The topics for industrial oriented mini project and Project Stage – I shall be different from one another. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project stage – II, Chief Controller of Examinations selects an external examiner from the list of experts in the relevant branch submitted by the department HODs of the College.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

12.10. **Semester End Examination:**

a) Question paper contains 2 Parts (Part-A and Part-B) having the questions distributed equally among all units.

b) The distribution of marks for i) PART-A for 20 marks ii) PART-B for 50 marks. Pattern of the question paper is as follows:

PART–A

Consists of one question which is compulsory. The question consists of ten sub-questions one from each unit and carry 2 marks each.

PART-B

Consists of 5 questions carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question).

12.11. For Mandatory Non-Credit Courses offered in a Semester, after securing ≥ 65% attendance and has secured not less than 35% marks in the SEE, and a minimum of 40% of marks in the sum Total of the CIE and SEE taken together in such a course, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall be allotted for this courses/activities.However, for non credit courses '**Satisfactory'** or "**Unsatisfactory'** shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.12. SWAYAM: College intends to encourage the students to do a minimum of one MOOC in discipline and open elective during third year. The respective departments shall give a list of **s**tandard MOOCs providers including SWAYAM whose credentials are endorsed by the BoS. In general, MOOCs providers provide the result in percentage. In such case, specified by the college shall follow the grade table mentioned in 14.2. The Credits for MOOC(s) shall be transferred same as given for the respective discipline or open electives. In case a student fails to complete the MOOCs he/she shall re-register for the same with any of the providers from the list provided by the department. The equivalence of the courses shall be established by the department committee. Still if a student fails to clear the course/s, or in case a provider fails to offer a MOOC in any semester, then in all such cases the college shall conduct the end semester examinations for the same as per the college end semester examination pattern. The syllabi for the supplementary examinations shall be same as that of MOOCs. There shall be no internal assessment however the marks obtained out of 70 shall be scaled up to 100 marks and the respective letter grade shall be allotted. The details of MOOC(s) shall be displayed in Memorandum of Grades of a student, provided he/she submits the proof of completion of it or them to the examination branch through the Coordinator/Mentor, before the end semester examination of the particular semester.

13. AWARD OF DEGREE

After a student has satisfied the requirement prescribed for the completion of the Programme and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes Shown in Table.

Table: **Declaration of Class based on CGPA (Cumulative Grade Point Average)**

Class Awarded	Grade to be Secured
First Class with Distinction	**CGPA ≥ 8.00**
First Class	≥ 6.50 to < 8.00 CGPA
Second Class	≥ 5.50 to < 6.50 CGPA
Pass Class	≥ 5.00 to < 5.50 CGPA
FAIL	CGPA < 5

14. LETTER GRADE AND GRADE POINT

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

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

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 70% , < 80%)	A (Very Good)	8
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , < 60%)	B (above Average)	6
Below 50% but not less than 40% (≥ 40% , < 50%)	C (Average)	5
Below 40% (< 40%)	F (FAIL)	0
Absent	AB	0

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

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

14.5 In general, a student shall not be permitted to repeat any Subject/Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Subjects/Courses pertaining to that Semester, when he is detained.

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

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

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

14.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed 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 account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to that ix Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i Subject.

Illustration of Computation of SGPA Computation

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	4	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x10= 30
Course5	3	C	5	3 x 5 = 15
Course6	4	B	6	4 x 6 = 24

Thus, **SGPA =139/20 =6.95**

14.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

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

(i.e., up to and inclusive of S Semesters, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards up to and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

For CGPA Computation

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
Credits : 19.5 SGPA : 6.9	Credits : 20.5 SGPA : 7.8	Credits : 18.0 SGPA : 5.6	Credits : 19.0 SGPA : 6.0	Credits : 21.5 SGPA : 6.3	Credits : 21.5 SGPA : 8.0	Credits : 23 SGPA : 8.0	Credits : 17 SGPA : 8.0

Thus, **CGPA =** $\dfrac{19.5x6.9+20.5x7.8+18.0x5.6+19.0x6.0+21.5x6.3+21.5x8.0+23x8.0+17x8.0}{}$ = 7.10

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14.10 For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

14.11 For Calculations listed in Item 12.6–12.10, performance in failed Subjects/Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

14.12 Conversion formula for the conversion of GPA into indicative percentage is

% of marks scored = (final CGPA -0.50) x 10

15. DECLARATION OF RESULTS

Computation of SGPA and CGPA are done using the procedure listed in 12.6– 12.10.

No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given Semester.

16. WITH HOLDING OF RESULTS

If the student has not paid fees to College at any stage, or has pending dues against his name due to any reason what so ever, or if any case of indiscipline is pending against him, the result of such student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

17. REVALUATION

Students shall be permitted for revaluation after the declaration of end Semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

18. SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even Semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write sometimes one or two examinations per day.

ADVANCED SUPPLEMENTARY EXAMINATION

Advanced supplementary examinations will be conducted for IV year II Semester after announcement of regular results.

19. TRANSCRIPTS

After successful completion of prerequisite credits for the award of degree a Transcript containing performance of all academic years will be issued as a final record. Duplicate PC, CMM & Transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

20. RULES OF DISCIPLINE

20.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of controller of Examination for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

20.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that course(s) and grading is done accordingly.

20.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).

20.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Examiner is final.

21. MALPRACTICE PREVENTION COMMITTEE

A malpractice prevention committee shall be constituted to examine and punish the students who involve in malpractice / indiscipline in examinations. The committee shall consist of:

a) Controller of examinations - Chairman
b) Addl. Controller of examinations.- Member Convenor
c) Subject expert - member
d) Head of the department of which the student belongs to. - Member
e) The invigilator concerned - member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

22. TRANSITORY REGULATIONS

Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be), and same Professional Electives/Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his I Year I Semester).

23. AMENDMENTS TO REGULATIONS

The Academic Council of Holy Mary Institute of Technology & Science reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

There shall be no Branch transfers after the completion of Admission Process. Transfer of student is permitted subjected to the rules and regulations of TSCHE (TE Department) and JNTUH in vogue.

The College shall have its own Annual Graduation Day for the award of Degrees issued by the College/University.

Institute will award Medals to the outstanding students who complete the entire course in the first attempt within the stipulated time.

i) Where the words “he”, “him”, “his”, occur in the write-up of regulations, they include “she”, “her”.
ii) Where the words “Subject” or “Subjects”, occur in these regulations, they also imply “Course” or “Courses”.
iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

Academic Regulations for B. Tech. (Lateral Entry Scheme) (Effective for the students getting admitted into II year from the Academic Year 2022-2023 on wards)

1. The Students have to acquire 120 credits from II to IV year of B.Tech Programme (Regular) for the award of the degree.
2. Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.
3. The same attendance regulations are to be adopted as that of B. Tech. (Regular)

Promotion Rule:

A Student will not be promoted from III Year to IV Year, unless he/she fulfils the Attendance and Academic Requirements and (i) secures a Total of 60% Credits up to III Year II Semester, from all the regular and supplementary examinations.

Award of Class:

After the student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes: The marks obtained for 120 credits will be considered for the calculation of CGPA and award of class shall be shown separately.

Table: **Declaration of Class based on CGPA (Cumulative Grade Point Average)**

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA ≥ 8.00
First Class	≥ 6.50 to < 8.00 CGPA
Second Class	≥ 5.50 to < 6.50 CGPA
Pass Class	≥ 5.00 to < 5.50 CGPA
FAIL	CGPA < 5

All other regulations as applicable for B. Tech. Four-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme).

MALPRACTICES RULES - DISCIPLINARY ACTION FOR /IMPROPER CONDUCT IN EXAMINATIONS

S. No	Nature of Malpractices / Improper Conduct	Punishment
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 subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject 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 the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
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 subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course 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 subject.
6	Refuses to obey the orders of the Addl. Controller of examinations / 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 addl. Controller of examinations 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 addl. Controller of examinations, 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 subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. 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 subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that Semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

COURSE STRUCTURE

Dept. of Mechanical Engineering

I B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1MA101BS	Linear Algebra and Calculus	BSC	3	1	-	4	30	70	100
A1CH102BS	Engineering Chemistry	BSC	3	1	-	4	30	70	100
A1ES105HS	English for Effective Communication	HSMC	2	-	-	2	30	70	100
A1CS106ES	Programming for Problem Solving	ESC	3	-	-	3	30	70	100
A1CH110BS	Engineering Chemistry Lab	BSC	-	-	3	1.5	30	70	100
A1EN113HS	English Language and Communication Skills Lab	HSMC	-	-	3	1.5	30	70	100
A1CS114ES	Programming for Problem Solving Lab	ESC	-	-	4	2	30	70	100
A1ME117ES	Social Innovation	ESC	-	-	3	1.5	30	70	100
Total			**11**	**2**	**13**	**19.5**	**240**	**560**	**800**
A1ME101MC	Technical Seminar-I	MC	-	-	2	-	100	-	100

I B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1MA201BS	Ordinary Differential Equations and Advanced Calculus	BSC	3	1	-	4	30	70	100
A1PH203BS	Engineering Physics	BSC	3	1	-	4	30	70	100
A1ME208ES	Engineering Graphics	ESC	1	-	4	3	30	70	100
A1ME209ES	Engineering Mechanics	ESC	3	1	-	4	30	70	100
A1PH211BS	Engineering Physics Lab	BSC	-	-	3	1.5	30	70	100
A1ME216ES	Workshop Manufacturing Practice	ESC	1	-	4	3	30	70	100
A1ME201PW	Engineering Exploration	PWC	-	-	2	1	30	70	100
Total			**11**	**3**	**13**	**20.5**	**210**	**490**	**700**
A1ME202MC	Technical Seminar- II	MC	-	-	2	-	100	-	100

II B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1MA301BS	Probability and Statistics and Numerical methods	BSC	3	1	-	4	30	70	100
A1ME302PC	Mechanics of Solids	PCC	3	-	-	3	30	70	100
A1ME303PC	Metallurgy & Material Science	PCC	3	-	-	3	30	70	100
A1ME304PC	Production Technology	PCC	3	-	-	3	30	70	100
A1ME305PC	Principles of Thermodynamics	PCC	3	-	-	3	30	70	100
A1ME306PC	Production Technology Lab	PCC	-	-	2	1	30	70	100
A1ME307PC	Mechanics of Solids Lab	PCC	-	-	2	1	30	70	100
A1ME308PC	Metallurgy & Material Science & Lab	PCC	-	-	2	1	30	70	100
Total			**15**	**1**	**6**	**19**	**240**	**560**	**800**
A1ME303MC	Environmental Studies	MC	3	-	-	-	100	-	100
A1ME304MC	Universal Human Values & Professional Ethics	MC	2	-	-	-	100	-	100

II B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1EE401ES	Basic Electrical and Electronics Engineering	ESC	3	-	-	3	30	70	100
A1ME402PC	Kinematics of Machinery	PCC	3	-	-	3	30	70	100
A1ME403PC	Thermal Engineering-I	PCC	3	-	-	3	30	70	100
A1ME404PC	Fluid Mechanics and Hydraulic Machines	PCC	3	-	-	3	30	70	100
A1ME405PC	Design of Machine Elements-I	PCC	3	-	-	3	30	70	100
A1ME406PC	Machine Drawing	PCC	1	-	2	1	30	70	100
A1ME407PC	Fluid Mechanics and Hydraulic Machines Lab	PCC	-	-	2	1	30	70	100
A1EE408ES	Basic Electrical and Electronics Engineering Lab	ESC	-	-	2	1	30	70	100
Total			**16**	**-**	**6**	**18**	**240**	**560**	**800**
A1ME405MC	Gender Sensitization	MC	-	-	2	-	100	-	100

III B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1ME501PC	Dynamics of Machinery	PCC	3	1	-	4	30	70	100
A1ME502PC	Metrology and Machine Tools	PCC	3	-	-	3	30	70	100
A1ME503PC	Thermal Engineering-II	PCC	3	-	-	3	30	70	100
A1ME504PC	Design of Machine Elements-II	PCC	3	-	-	3	30	70	100
AIME505HS	Business Economics & Financial Analysis	HSMC	3	-	-	3	30	70	100
A1ME506PC	Metrology and Machine Tools Lab	PCC	-	-	3	1.5	30	70	100
A1ME507PC	Thermal Engineering Lab	PCC	-	-	3	1.5	30	70	100
A1ME508PC	Theory of Machines lab	PCC	-	-	3	1.5	30	70	100
A1ME509PW	Internship/Mini Project	PWC	-	-	-	2	-	100	100
Total			**15**	**1**	**9**	**22.5**	**240**	**660**	**900**
MOOC's (B.Tech Hon's Degree)									
A1ME506MC	Constitution of India	MC	2	-	-	-	100	-	100

III B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1ME601PC	Heat Transfer	PCC	3	-	-	3	30	70	100
A1ME602PC	CAD/ CAM	PCC	3	-	-	3	30	70	100
A1ME603PC	Finite Element Method	PEC	3	1	-	4	30	70	100
	Professional Elective-I	PEC	3	-	-	3	30	70	100
	Open Elective-I	OEC	3	-	-	3	30	70	100
A1ME604PC	Heat Transfer Lab	PCC	-	-	3	1.5	30	70	100
A1ME605PC	CAD/CAM & Simulation Lab	PCC	-	-	2	1	30	70	100
A1EN606HS	Advanced English Communication Skills Lab	HSMC	-	-	2	1	30	70	100
A1ME607PW	Comprehensive Viva	PWC	-	-	-	1	-	100	100
Total			**15**	**1**	**7**	**20.5**	**240**	**660**	**900**
	MOOC's (B.Tech Hon's Degree)								
A1ME607MC	Essence of India Traditional Knowledge	MC	2	-	-	-	100	-	100

IV B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A1ME701PC	Composite Materials	PCC	3	1	-	4	30	70	100
A1ME702PC	Instrumentation and Control System	PCC	3	1	-	4	30	70	100
	Professional Elective-II	PEC	3	-	-	3	30	70	100
	Professional Elective-III	PEC	3	-	-	3	30	70	100
	Open Elective-II	OEC	3	-	-	3	30	70	100
A1ME703PC	Instrumentation and Control Systems Lab	PCC	-	-	4	2	30	70	100
A1ME704PW	Project Phase -I	PWC	-	-	8	4	100	-	100
Total			**15**	**2**	**12**	**23**	**280**	**420**	**700**
MOOC's (B.Tech Hon's Degree)									

IV B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
	Professional Elective-IV	PEC	3	-	-	3	30	70	100
	Professional Elective-V	PEC	3	-	-	3	30	70	100
	Open Elective-III	OEC	3	-	-	3	30	70	100
A1ME801PW	Project Phase-II	PWC	-	-	16	8	30	70	100
Total			**9**	**-**	**16**	**17**	**120**	**280**	**400**
MOOC's (B.Tech Hon's Degree)									

Total No. of Credits: 160

PROFESSIONAL ELECTIVES			
PE-I		**PE-II**	
A1ME601PE	Automotive Engineering	A1ME705PE	CNC Technology
A1ME602PE	Renewable Energy Sources	A1ME706PE	Automation In Manufacturing
A1ME603PE	Refrigeration and Air Conditioning	A1ME707PE	Industrial Robotics
A1ME604PE	Power Plant Engineering	A1ME708PE	Flexible Manufacturing Systems
PE-III		**PE-IV**	
A1ME709PE	Industrial Engineering	A1ME813PE	Additive Manufacturing
A1ME710PE	Operations Research	A1ME814PE	Unconventional Machining Processes
A1ME711PE	Total Quality Management	A1ME815PE	Product Design and Process Planning
A1ME712PE	Product Life Cycle	A1ME816PE	Design For Manufacturing
PE-V			
A1ME817PE	Nano Technology		
A1ME818PE	Tribology		
A1ME819PE	Mechatronics		
A1ME820PE	Mechanical Vibrations		

MANDATORY COURSES	
A1ME101MC	Technical Seminar-I
A1ME202MC	Technical Seminar- II
A1ME303MC	Environmental Studies
A1ME304MC	Universal Human Values & Professional Ethics
A1ME405MC	Gender Sensitization
A1ME506MC	Constitution of India
A1ME607MC	Essence of India Traditional Knowledge

OPEN ELECTIVES				
S. No.	**Name of the Department Offering Open Electives**	**Open Elective – I (Semester – VI)**	**Open Elective – II (Semester – VII)**	**Open Elective – III (Semester – VIII)**
1	Civil Engg.	**A1CE601OE**	**A1CE703OE**	**A1CE805OE**
		Engineering Materials For Sustainability	Environmental Engineering	Green Building Technologies
		A1CE602OE	**A1CE704OE**	**A1CE806OE**
		Disaster Preparedness & Planning Management	Construction Engineering And Management	Air Pollution and Control
2	Computer Science and Engg.	**A1CS601OE**	**A1CS703OE**	**A1CS805OE**
		Java Programming	Operating Systems	Linux Programming
		A1CS602OE	**A1CS704OE**	**A1CS806OE**
		Database Management Systems	Cyber Security	R Programming
3	Electrical and Electronics Engg.	**A1EE601OE**	**A1EE703OE**	**A1EE805OE**
		Energy Storage Systems	Electrical Safety Practices for Industry	Modern Trends in Electrical Energy
		A1EE602OE	**A1EE704OE**	**A1EE806OE**
		Renewable Energy Sources	Basics of Power Plant Engineering	Energy from Waste
4	Electronics and Communication Engg.	**A1EC601OE**	**A1EC703OE**	**A1EC805OE**
		Principles of Communications	Fiber Optic Communications	Embedded Networking
		A1EC602OE	**A1EC704OE**	**A1EC806OE**
		Electronic Measuring Instruments	Mobile Communication and Networks	Satellite Communication
5	Mechanical Engg.	**A1ME601OE**	**A1ME703OE**	**A1ME805OE**
		Mechatronics	Composite Materials	Total Quality Management
		A1ME602OE	**A1ME704OE**	**A1ME806OE**
		Additive Manufacturing	Industrial Robotics	Renewable Energy Sources
6	CSE(Artificial Intelligence and Machine Learning)	**AIAM601OE**	**A1AM703OE**	**A1AM805OE**
		Computational Complexity	Introduction To Machine Learning	Cognitive Computing
		AIAM602OE	**A1AM704OE**	**A1AM806OE**
		Computer Networks	Green Computing	Software Process and Project Management
7	CSE(Data Science)	**A1DS601OE**	**A1DS703OE**	**A1DS805OE**
		Data Warehousing and Data Mining	Python Programming	Image Analytics
		A1DS602OE	**A1DS704OE**	**A1DS806OE**
		Artificial Intelligence	Text Analytics and Natural Language Processing	Data Science Ethics

8	CSE(IoT)	**A1IO601OE**	**A1IO703OE**	**A1IO805OE**
		Sensor and Devices	IoT for Architects	IoT System Design
		A1IO602OE	**A1IO704OE**	**A1IO806OE**
		IoT Sensor and Technologies	Python for IoT	Internet of Medical Things
9	CSE(Software Engineering) Civil Engg.	**A1SE601OE**	**A1SE703OE**	**A1SE805OE**
		Introduction to C++	JAVA Programming	Scripting Language
		A1SE602OE	**A1SE704OE**	**A1SE806OE**
		Principles of Software Engineering	Software Testing Methodology	Software Quality Management

***Open Elective –** Students should take Open Electives from List of Open Electives Offered by Other Departments / Branches Only

Ex: - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

DETAILED SYLLABUS

I-YEAR (I-SEMESTER)

LINEAR ALGEBRA AND CALCULUS

I-B.TECH I-SEMESTER
Course Code: A1MA101BS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

To learn

1. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
3. Methods of solving the differential equations of first order.
4. Evaluation of improper integrals using Beta and Gamma functions.
5. Partial differentiation and finding maxima and minima of function of two and three variables.

COURSE OUTCOMES:

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

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations.
2. Find the Eigen values and Eigen vectors and reduce the quadratic form to canonical form using orthogonal transformations.
3. Identify whether the given differential equation of first order is exact or not.
4. Solve the applications on the mean value theorems and evaluate the improper integrals using Beta and Gamma functions.
5. Find the extreme values of functions of two variables with/ without constraints.

UNIT-I MATRICES

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; Orthogonal matrices; Unitary Matrices; Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; Solving system of Homogeneous and Non-Homogeneous equations. Gauss elimination method; Gauss Seidel Iteration Method.

UNIT –II EIGEN VALUES AND EIGEN VECTORS

Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of the Quadratic Forms; Reduction of Quadratic form to Canonical forms by Orthogonal Transformation.

UNIT-III FIRST ORDER ORDINARY DIFFERENTIAL EQUATION

Exact,linear and Bernoulli's equations: Orthogonal Trajectories (in Cartesian and polar coordinates) Newton's law of cooling, Law of natural growth and decay, Equations not of first degree: Equations solvable for p, Equations solvable for y, Equations solvable for x and Clairaut's type.

UNIT –IV CALCULUS

Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series . Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-V MULTIVARIABLE CALCULUS

Definitions of Limit and continuity. Partial Differentiation; Euler's Theorem; Total derivative; Jacobian; Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

REFERENCE BOOKS:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010

ENGINEERING CHEMISTRY

I-B.TECH I-SEMESTER
Course Code: A1CH102BS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

1. To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand & remember the technology based on them.
2. Able to understand the concepts of hardness & analyze hardness of water.
3. To acquire the knowledge of electrochemistry & corrosion
4. To acquire the skills pertaining to spectroscopy and able to evaluate the structure of organic compounds.
5. To impart the knowledge of stereochemistry and synthesis of Aspirin & Paracetamol

COURSE OUTCOMES: Student must be able to

1. Evaluate the MOELD of N_2, O_2 & F_2.
2. Analyze hardness of water.
3. Apply electrochemistry concepts to solve the problem of corrosion.
4. Evaluate the structure of Organic compounds by using spectroscopy.
5. Synthesize Organic medicines like Paracetamol & Aspirin & predict the structure based on stereochemistry.

UNIT - I: MOLECULAR STRUCTURE AND THEORIES OF BONDING

Atomic and Molecular orbitals, Linear Combination of Atomic orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams (MOELD) of N2, O2 and F2 molecules. Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries, Band structure of solids and effect of doping on conductance.

UNIT - II: WATER AND ITS TREATMENT

Introduction – Hardness of water Causes of hardness - Types of hardness: temporary and permanent, expression and units of hardness .Estimation of hardness of water by complex metric method, Potable water and its specifications, Steps involved in treatment of water – Disinfection of water by chlorination and ozonisation.

Boiler Troubles-Priming and Foaming, Caustic Embrittlement, Boiler Corrosion, Sludge and Scale formation Boiler feed water and its treatment – Calgon conditioning, Phosphate conditioning and Colloidal conditioning, External treatment of water – Ion exchange process, Desalination of water – Reverse osmosis, Numerical problems.

UNIT - III: ELECTROCHEMISTRY AND CORROSION

Electro chemical cells – electrode potential, standard electrode potential, Types of electrodes – Calomel, Quinhydrone and glass electrode, Determination of pH of a solution by using quinhydrone and glass electrode.

Measurement of emf of a cell (solution), Electrochemical series and its applications. Numerical problems. Potentiometric titrations, Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery, Lithium ion battery) &Fuel cells-Hydrogen-Oxygen fuel cell. Corrosion: Causes and effects of corrosion

Theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods. Surface coatings – metallic coatings – methods of application. Electroless plating of Nickel.

UNIT - IV: STEREOCHEMISTRY, REACTION MECHANISM AND SYNTHESIS OF DRUG MOLECULES

Introduction to representation of 3-dimensional structures, Structural and stereoisomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity and Absolute configuration. Conformation analysis of n- butane. Organic reactions: Types of Fissions, Types of reagents &types of reactions Substitution reactions: Nucleophilic substitution reactions: Mechanism of SN1, SN2 reactions. Addition reactions: Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions.Grignard additions on carbonyl compounds. Elimination reactions: Dehydro halogenation of alkyl halides. Saytzeff rule. Oxidation reactions: Oxidation of alcohols using KMnO4 and chromic acid. Reduction reactions: Reduction of carbonyl compounds using LiAlH4 & NaBH4. Hydroboration of olefins. Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

UNIT - V: INTRODUCTION OF SPECTROSCOPY, SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Principles of spectroscopy, Classification of spectra (UV-VIS,IR,NMR, Raman spectra, etc), Selection rules and applications of electronic spectroscopy. Vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift. Introduction to Magnetic resonance imaging.

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TEXT BOOKS:

1. Physical Chemistry, by P.W. Atkins
2. Engineering Chemistry by P.C.Jain & M.Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell
4. Organic Chemistry: Structure and Function by K.P.C. Volhardt and N.E.Schore, 5th Edition.
5. University Chemistry, by B.M. Mahan, Pearson IV Edition.
6. Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan

REFERENCE BOOKS:

1. Organic chemistry by Morryson and Boyd
2. Organinc Chemistry by Y.R. Sharma.

ENGLISH FOR EFFECTIVE COMMUNICATION

I-B.TECH I-SEMESTER **L T P C**
Course Code: A1EN105HS **2 0 0 2**

INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures.

COURSE OBJECTIVES:

1. Improve language proficiency with emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Apply the theoretical and practical components of English syllabus to study academic subjects more effectively and critically.
3. Analyze a variety of texts and interpret them to demonstrate in writing or speech.
4. Write clearly and creatively, and adjust writing style appropriately to the content, the context, and nature of the subject.
5. Develop language components to communicate effectively in formal and informal situations.

COURSE OUTCOMES: Students should be able to:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Generate dialogues for various situations.

UNIT –I: 'THE RAMAN EFFECT' FROM THE PRESCRIBED TEXTBOOK 'ENGLISH FOR ENGINEERS' PUBLISHED BY CAMBRIDGE UNIVERSITY PRESS.

Vocabulary: The Concept of Word Formation --The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading.
Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for writing precisely – Paragraph writing – Types, Structures and Features of a Paragraph – Creating Coherence-Organizing Principles of Paragraphs in documents.

UNIT –II: 'ANCIENT ARCHITECTURE IN INDIA' FROM THE PRESCRIBED TEXTBOOK 'ENGLISH FOR ENGINEERS' PUBLISHED BY CAMBRIDGE UNIVERSITY PRESS.

Vocabulary: Synonyms and Antonyms.
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-Writing Formal Letters, E.g. Letter of Complaint, Letter of Requisition, and Job Application with Resume.

UNIT –III: 'ENERGY: ALTERNATIVE SOURCES' FROM THE PRESCRIBED TEXT BOOK 'ENGLISH FOR ENGINEERS AND TECHNOLOGISTS' TEXT BOOK- ORIENT BLACK SWAN.

Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives- Words from Foreign Languages and their Use in English
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-skills of Reading-Skimming and Scanning
Writing: Nature and Style of Sensible Writing- Defining- Describing Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT –IV: 'WHAT SHOULD YOU BE EATING' FROM THE PRESCRIBED TEXTBOOK 'ENGLISH FOR ENGINEERS' PUBLISHED BY CAMBRIDGE UNIVERSITY PRESS.

Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading
Writing: Writing Practices--Writing Introduction and Conclusion - Essay Writing-Précis Writing.

UNIT –V: 'GOOD MANNERS' BY J C HILLS FROM FLUENCY IN ENGLISH – A COURSE BOOK FOR ENGINEERING STUDENTS

Vocabulary: Technical Vocabulary and their usage
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice.
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports -Writing a Report.

TEXT BOOKS:

1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers Cambridge University Press
2. Department of Humanities and Sciences, (2016) – Anna University - English for Engineers and Technologists –Orient BlackSwan
3. J.C.Hill, (2016) Fluency in English- A Course book for Engineering students- Orient BlackSwan

REFERENCE BOOKS:

1. Swan, M. (2016). Practical English Usage Oxford University Press
2. Kumar, S and Lata, P.(2018). Communication Skills Oxford University Press
3. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well Harper Resource Book
5. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press
6. Exercises in Spoken English. Parts I –III CIEFL, Hyderabad. Oxford University Press

PROGRAMMING FOR PROBLEM SOLVING

I-B.TECH I-SEMESTER

L	T	P	C
3	0	0	3

Course Code: A1CS106ES

COURSE OBJECTIVES

1. To impart knowledge about problem solving and algorithmic thinking.
2. To familiarize with the syntax and semantics of C programming language.
3. To learn the usage of structured programming approach in solving problems.
4. To use arrays, pointers, strings and structures in solving problems.
5. To understand how to solve problems related to matrices, Searching and sorting.

COURSE OUTCOMES

1. At the end of the course, student will be able to:
2. Apply algorithmic thinking to understand, define and solve problems
3. Develop computer programs using programing constructs and control structures
4. Decompose a problem into functions to develop modular reusable code.
5. Use arrays, pointers, strings and structures to formulate algorithms and programs.
6. Use files to perform read and write operations.

UNIT – I: INTRODUCTION - PROBLEM SOLVING AND ALGORITHMIC THINKING

Introduction to Computer System, Types of memories, Application and System Software, Problem Solving and Algorithmic Thinking Overview – Problem Definition, logical reasoning, Algorithm definition, practical examples, properties, representation, flowchart, algorithms vs programs.

Algorithmic Thinking – Constituents of algorithms - Sequence, Selection and Repetition, input- output; Computation – expressions, logic; Problem Understanding and Analysis – problem definition, variables, name binding, data organization: lists, arrays etc. algorithms to programs.

UNIT – II: OPERATORS, EXPRESSIONS AND CONTROL STRUCTURES

Introduction to C language: Structure of C programs, C tokens, data types, data inputs, output statements, Operators, precedence and associativity, evaluation of expressions, type conversions in expressions.

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.

UNIT - III: ARRAYS AND FUNCTIONS

Arrays: Concepts, one dimensional array, declaration and initialization of one-dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays, Basic Searching Algorithms: Linear and Binary search

Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, call by reference, passing arrays to functions, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Towers of Hanoi etc.

UNIT - IV: STRINGS AND POINTERS

Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.

Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, functions returning pointers, Dynamic memory allocation.

UNIT – V: STRUCTURES AND FILE HANDLING

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, self-referential structures, unions, typedef, enumerations.
File handling: command line arguments, File modes, basic file operations read, write and append, example programs.

TEXT BOOKS:

1. Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Byron Gottfried, “Programming with C”, Schaum's Outlines Series, McGraw Hill Education, 3rdedition, 2017.

REFERENCE BOOKS:

1. W. Kernighan Brian, Dennis M. Ritchie, “The C Programming Language”, PHI Learning, 2nd Edition, 1988.
2. Yashavant Kanetkar, “Exploring C”, BPB Publishers, 2nd Edition, 2003.
3. Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014.
4. R. S. Bichkar, “Programming with C”, Universities Press, 2nd Edition, 2012.
5. Dey Pradeep, Manas Ghosh, “Computer Fundamentals and Programming in C”, Oxford University Press, 2nd Edition, 2006.
6. Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Computational_thinking
2. https://nptel.ac.in/courses/106/104/106104128/
3. https://en.cppreference.com/w/c/language
4. https://www.learn-c.org/

E-TEXT BOOKS:

1. https://slidelegend.com/queue/computational-thinking-for-the-modern-problem-solver_59d6f01e1723ddb0c7a0df47.html
2. http://flowgorithm.altervista.org/#elf_l1_Lw
3. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm

MOOC COURSE:

1. https://www.coursera.org/learn/computational-thinking-problem-solving
2. https://onlinecourses.nptel.ac.in/noc18_cs33/preview
3. https://www.alison.com/courses/Introduction-to-Programming-in-c
4. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm

ENGINEERING CHEMISTRY LAB

I-B.TECH I-SEMESTER **L T P C**

Course Code: A1CH110BS **0 0 3 1.5**

COURSE OBJECTIVES:

The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

1. Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
2. To determine the rate of corrosion of different metals
3. The measurement of physical properties like adsorption and viscosity.
4. To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.
5. To determine the acid content by Potentiometry.

COURSE OUTCOMES: The experiments will make the student must able to:

1. Analyze the hardness and chloride content in water.
2. Estimate rate corrosion of different metals.
3. Determine physical properties like adsorption and viscosity.
4. Calculate Rf values of some organic molecules by TLC technique.
5. Determine the acid content in the given sample by using potentiometer.

LIST OF EXPERIMENTS:

I. Conductometry

1. Estimation of an HCl by Conductometric titrations
2. Estimation of Acetic acid by Conductometric titrations

II. Potentiometry:

3. Estimation of HCl by Potentiometric titrations
4. Estimation of Fe2+ by Potentiometry using KMnO4

III. Complexometry:

5. Determination of total hardness of water by complexometric method using EDTA

IV. Argentometry:

6. Determination of chloride content of water by Argentometry

V. Rate of corrosion:

7. Measurement of rate of acid corrosion of different metals

VI. Water Quality Parameters (Analytical Chemistry):

8. Determination of BOD & COD

VII. Saponification

9. Determination of acid value of coconut oil

VIII. Partition Coefficient:

10. Determination of partition coefficient of acetic acid between n-butanol and water.

IX. Chromatography

11. Thin layer chromatography calculation of Rf values. egseparation of ortho and para nitro Phenols

X. Colligative properties

12. Determination of viscosity of castor oil and ground nut oil by using Ostwald's viscometer.
13. Determination of surface tension of a give liquid using stalagnometer.

XI. Synthesis

14. Synthesis of Aspirin and Paracetamol.

REFERENCE BOOKS:

1. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi)
2. An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi)
3. Vogel's text book of practical organic chemistry 5th edition
4. Text book on Experiments and calculations in Engineering chemistry – S.S. Dara

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

I-B.TECH I-SEMESTER | **L T P C**
Course Code: A1EN113HS | **0 0 3 1.5**

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

COURSE OBJECTIVES:

1. Facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
2. Enhance English language skills, communication skills and to practice soft skills.
3. Improve fluency and pronunciation intelligibility by providing an opportunity for practice in speaking.
4. Train students in different interview and public speaking skills such as JAM, debate, role play, group discussion etc.
5. Instill confidence and make them competent enough to express fluently and neutralize their mother tongue influence.

COURSE OUTCOMES: Students will be able to

1. Recognize differences among various accents and speak with neutralized accent.
2. Neutralization of accent for intelligibility
3. Take part in group activities.
4. Speaking skills with clarity and confidence which in turn enhances their employability
5. Generate dialogues for various situations.

English Language and Communication Skills Lab (ELCS) shall have two parts:
a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab

LISTENING SKILLS

Objectives

1. To enable students develop their listening skills 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 recognize them and find the distinction between different sounds, to be able to mark stress and recognize 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 involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
   - Oral practice: Just A Minute (JAM) Sessions
   - Describing objects/situations/people
   - Role play – Individual/Group activities

Exercise – I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Communication at Work Place- Spoken vs. Written language.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II

CALL Lab:

Understand: Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III

CALL Lab:

Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.

ICS Lab:

Understand: How to make Formal Presentations.
Practice: Formal Presentations.

Exercise – IV

CALL Lab:

Understand: Listening for General Details.
Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks.
Practice: Making a Short Speech – Extempore.

Exercise – V

CALL Lab:

Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Interview Skills.
Practice: Mock Interviews.

PROGRAMMING FOR PROBLEM SOLVING LAB

L	T	P	C
0	0	4	2

I-B.TECH I-SEMESTER
Course Code: A1CS114ES

COURSE OBJECTIVES

1. To be familiarize with flowgorithm to solve simple problems
2. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
3. To develop modular, reusable and readable C Programs using the concepts like functions, arrays, strings pointers and structures.

COURSE OUTCOMES

1. At the end of the course, student will be able to
2. Solve simple mathematical problems using Flowgorithm.
3. Correct syntax errors as reported by the compilers and logical errors encountered at run time
4. Develop programs by using decision making and looping constructs.
5. Implement real time applications using the concept of array, pointers, functions and structures.
6. Solve real world problems using matrices, searching and sorting

WEEK – 1:

a) Installation and working of Flowgorithm Software.
b) Write and implement basic arithmetic operations using Flowgorithm – sum, average, product, difference, quotient and remainder of given numbers etc.

WEEK – 2:

a) Draw a flowchart to calculate area of Shapes (Square, Rectangle, Circle and Triangle).
b) Draw a flowchart to find the sum of individual digits of a 3 digit number.
c) Draw a flowchart to convert days into years, weeks and days.
d) Draw a flowchart to read input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored.

WEEK – 3:

a) Draw a flowchart to find roots of a quadratic equation.
b) Draw a flowchart to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd
c) Draw a flowchart to check whether the triangle is equilateral, isosceles or scalene triangle

WEEK – 4:

a) Write a C program to swap values of two variables with and without using third variable.
b) Write a C program to enter temperature in Celsius and convert it into Fahrenheit.
c) Write a C program to calculate Simple and Compound Interest.
d) Write a C program to calculate s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

WEEK – 5:

a) Write a C program to find largest and smallest of given numbers.
b) Write a C program which takes two integer operands and one operator form the user(+,-,*,/,% use switch)

c) Write a program to compute grade of students using if else adder. The grades are assigned as followed:

marks<50	F
50≤marks< 60	C
60≤marks<70	B
70≤marks	B+
80≤marks<90	A
90≤mars≤ 100	A+

WEEK – 6:

a) Write a C program to find Sum of individual digits of given integer
b) Write a C program to generate first n terms of Fibonacci series
c) Write a C program to generate prime numbers between 1 and n
d) Write a C Program to find the Sum of Series SUM=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!
e) Write a C program to generate Pascal's triangle.
f) Write a C program to generate pyramid of numbers.

```
1
1   3   1
1   3   5   3   1
```

WEEK – 7:

a) Write a C Program to implement following searching methods
   I. Binary Search
   II. Linear Search

b) Write a C program to find largest and smallest number in a list of integers

c) Write a C program
   I. To add two matrices
   II. To multiply two matrices

d) Write a C program to find Transpose of a given matrix

WEEK – 8:

a) Write a C program to find the factorial of a given integer using functions
b) Write a C program to find GCD of given integers using functions
c) Write a C Program to find the power of a given number using functions

WEEK – 9:

a) Write a C Program to find binary equivalent of a given decimal number using recursive functions.
b) Write a C Program to print Fibonacci sequence using recursive functions.
c) Write a C Program to find LCM of 3 given numbers using recursive functions

WEEK – 10:

a) Write a C program using functions to
b) Insert a sub string into a given main string from a given position
c) Delete n characters from a given position in a string
d) Write a C program to determine if given string is palindrome or not

WEEK – 11:

a) Write a C program to print 2-D array using pointers
b) Write a C program to allocate memory dynamically using memory allocation functions (malloc, calloc, realloc, free)

WEEK – 12:

I. Write a C Program using functions to
   a) Reading a complex number
   b) Writing a complex number
   c) Add two complex numbers
   d) Multiply two complex numbers
   e) Note: represent complex number using structure

II. Write a C program to read employee details employee number, employee name, basic salary, hra and da of n employees using structures and print employee number, employee name and gross salary of n employees.

TEXT BOOKS:

1. Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Yashavant Kanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition, 2012.

REFERENCE BOOKS:

1. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018
2. King KN, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
3. Kochan Stephen G, "Programming in C: A Complete Introduction to the C Programming Language", Sam's Publishers, 3rd Edition, 2004.
4. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994.

WEB REFERENCES:

1. http://www.flowgorithm.org/documentation/
2. http://www.sanfoundry.com/c-programming-examples
3. http://www.geeksforgeeks.org/c
4. http://www.cprogramming.com/tutorial/c

SOCIAL INNOVATION

I-B.TECH I-SEMESTER
Course Code: A1ME117ES

L	T	P	C
0	0	3	1.5

COURSE DESCRIPTION:

Course Overview:

Social Innovation is an open-ended course to develop social connectedness in engineering students through social awareness and social consciousness. This can be done through live field exposure along with faculty led conceptual presentations, real case reviews, self-study assignments, literature and field survey. Through this course, the students are expected to use their engineering knowledge to provide innovative solutions to existing social problems. This course also develops critical thinking ability among the students to develop sustainable solutions.

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Develop awareness on social issues faced by local regions.
2. Identify the mind set of human Race and interpret the societal issues as simple, complicated, and complex problems.
3. Identify the need statement along with its main causes and effects.
4. Develop an innovative and sustainable solution for social issues by thinking critically and creatively.

COURSE SYLLABUS

MODULE-1

Introduction to Social Innovation: Core definitions, core elements and common features of social innovation, a typology of social innovation, awakening social consciousness.

MODULE-2

Create Mindsets and Wicked Problems: Seven mindsets – Empathy, Optimism, Iteration, Creative confidence, making it, embracing ambiguity, learning from failures. Distinguish between simple, complicated, and complex problems; describe the characteristics of wicked problems, breakdown a given problem by unpacking its complexity.

MODULE-3

Critical and Creative Thinking for Social Innovation: Definition, engineering thinking and learning, distinguish between creativity and innovation. Models of Creative thinking. [Appreciative Inquiry (AI), Asset Based Community Development (ABCD) and Concept of Bricolage.]

MODULE-4

Process of Social Innovation: Community study, develop questionnaire, identifying the causes of a particular problem.

MODULE-5

Process of Social Innovation: Identify needs, record your learning's.

MODULE-6

Process of Social Innovation: Generate ideas, select promising ideas, prototyping, and testing.

MODULE-7

Social Innovation across Four Sectors - The non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors.

MODULE-8

Stages of Innovation: Social organizations and enterprises, social movements, social software and open source methods, common patterns of success and failure.

TEXT BOOKS:

1. Robin Murray, Julie Caulier-Grice, Geoff Mulgan, "The open book of social innovation: Ways to Design, Develop and Grow Social Innovation", The Young Foundation, 2010.
2. Julie Caulier-Grice, Anna Davies, Robert Patrick & Will Norman, The Young Foundation (2012) Social Innovation Overview: A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission – 7th Framework Programme, Brussels: European Commission, DG Research.

REFERENCE BOOKS:

1. Geoff Mulgan, "Social Innovation: What it is, Why it matters and How it can be accelerated", The Young Foundation, 2007.
2. Asset Based Community Development (ABCD) Model. http://www.nurturedevelopment.org/asset-based-community-development.
3. Diana Whitney & Amanda Trosten-Bloom, "The Power of Appreciative inquiry – A Practical Guide to Positive Change", 2nd Edition, Berrett-Koehler Publishers, Inc, 2010.

I-YEAR (II-SEMESTER)

ORDINARY DIFFERENTIAL EQUATIONS & ADVANCED CALCULUS

L	T	P	C
3	1	0	4

I-B.TECH II-SEMESTER
Course Code: A1MA201BS

COURSE OBJECTIVES:

The students would be able to learn

1. Different methods of solving the differential equations of higher order.
2. Concept, properties of Laplace transforms and Solving ordinary differential equations using Laplace transforms techniques.
3. Evaluation of multiple integrals and their applications.
4. The physical quantities involved in engineering field related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

COURSE OUTCOMES:

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

1. Solve higher differential equation and apply the concept of differential equation to real world problems.
2. Use the Laplace Transform techniques for solving ODE's.
3. Evaluate the multiple integrals and apply the concept to find areas, volumes.
4. Evaluate the line, surface and volume integrals and converting them from one to another.
5. Apply Green, Gauss, and Stokes theorem to the integrals.

UNIT –I ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, $e^{ax}(x)$ and $x\ V(x)$; method of Variation of parameters; Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation .Application to Electrical circuits.

UNIT –II LAPLACE TRANSFORMS

Laplace Transform of standard functions; first shifting theorem, Second shifting theorem: Laplace transforms of functions when they are multiplied and divided by t. Laplace transforms of derivatives and integrals of function; Evaluation of integrals by Laplace transforms; Laplace transforms of Specific functions (Unit step function, Unit impulsive function); Laplace transform of Periodic functions.

Inverse Laplace transform by different methods, Convolution theorem (without Proof), Solving ODEs by Laplace Transform method.

UNIT –III MULTIVARIABLE CALCULUS (INTEGRATION)

Evaluation of Double Integrals (Cartesian and polar coordinates); Change of order of integration (only Cartesian form); Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals.

Applications: Areas (by double integrals) and Volumes (by double integrals and triple integrals).

UNIT –IV VECTOR DIFFERENTIATION

Vector point functions and Scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-V VECTOR INTEGRATION

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes theorems (statement &their verification)

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint,

REFERENCE BOOKS:

1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
3. Advance engineering mathematics by RK Jain & S.R.K.Iyengar 3rd edition Narosa publishing house Delhi.

ENGINEERING PHYSICS

I-B.TECH II-SEMESTER
Course Code: A1PH203BS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

1. The course aims at making students to understand the concepts in Mechanics and explaining the Newton's laws in different coordinate systems.
2. Students will be able to distinguish the various types of Harmonic Oscillations and can correlate the fundamental properties of the waves in one dimension.
3. To make the students to widen the conceptual understanding of the fundamental principles of optics like interference and diffraction.
4. To impart the knowledge of Lasers and optical fibers along with their applications.
5. To make the students acquire the knowledge of Nanoscience and synthesis of nanomaterials.

COURSE OUTCOMES: Upon graduation, the students will have:

1. Knowledge in the concepts of mechanics and Newton's laws in different coordinate systems relevant to engineering and converting ideas into technology.
2. Understand the concepts of simple, damped and forced harmonic oscillators and compare the different types of harmonic oscillations.
3. Understand the various properties of optics and analyze the optical Phenomena's like interference and diffraction.
4. Compare different kinds of lasers and optical fibers for various applications such as communication, manufacturing and so on.
5. Knowledge of Nanotechnology which eventually lead to new innovations and improvements

UNIT-I: INTRODUCTION TO MECHANICS

Transformation of scalars and vectors under Rotation transformation, Forces in Nature, Newton's laws and its completeness in describing particle motion, Form invariance of Newton's second law, Solving Newton's equations of motion in polar coordinates, cylindrical and spherical coordinates, concepts on constraints and friction including problems.

UNIT-II: WAVES AND HARMONIC OSCILLATIONS

Simple harmonic oscillators, phasor representation, Damped harmonic oscillator: heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor, Steady state motion of forced harmonic oscillator, Electrical and mechanical analogy for simple harmonic oscillator, The transverse wave equation of a vibrating string, Harmonic waves, Reflection and transmission of waves at a boundary, Impedance matching, Standing waves and their Eigen frequencies, Acoustic waves.

UNIT-III: WAVE OPTICS

Huygen's principle, Superposition of waves, Interference of light by division of wave front and division of amplitude, Young's double slit experiment, Newton's rings, Michelson's interferometer, Diffraction of light, Fraunhofer diffraction from a single slit and circular aperture, Diffraction grating and its resolving power.

UNIT-IV: LASERS AND FIBRE OPTICS

Introduction to interaction of radiation with matter, Coherence, Characteristics of LASER, Principle and working of Laser, Einstein coefficients, Population inversion, Pumping, Types of Lasers: Ruby laser, Carbon dioxide (CO_2) laser, He-Ne laser, Applications of laser. Fibre Optics: Introduction, Optical fibre as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, Applications of optical fibres.

UNIT-V: NANO TECHNOLOGY

Introduction to Nanoscience, Nanoscale, Nanobehavior, Properties and Types of nano materials, Synthesis of nanomaterials by Top-down method and Bottom-up method, Ball milling method, Physical vapour deposition method (PVD),Sol-gel synthesis, Chemical vapor deposition method, X-Ray diffraction (XRD), Scanning Electron Microscopy(SEM), Transmission Electron microscopy(TEM), Carbon nanotubes, Applications of nanomaterials in industry.

TEXT BOOKS:

1. Engineering Mechanics, 2nd ed.- MK Harbola, Cengage Learning
2. I. G. Main, “Vibrations and waves in physics’, 3rd Edn, Cambridge University Press, 2018.
4. Ajoy Ghatak, “Optics”, McGraw Hill Education, 2012
5. Engineering Physics by D.R. Joshi, McGraw Hill
6. Fundamentals of Acoustics, Kinster and Frey, John Wiley and Sons.
7. Nanomaterials, nanotechnologies and design, Michael F. Ashby

REFERENCE BOOKS:

1. H. J. Pain, “The physics of vibrations and waves”, Wiley, 2006
2. O. Svelto, “Principles of Lasers”
3. “Introduction to Mechanics”, M.K.Verma, Universities Press
4. Engineering Physics , Dr.M.N. Avadhanulu , Dr.P.G.K. Shirsagar –S Chand
5. Nanotechnology, Er. Rakesh Rathi, S. Chand Publications
6. Nanotechnology, Rishabh Anand

ENGINEERING GRAPHICS

I-B.TECH II-SEMESTER
Course Code: A1ME208ES

L	T	P	C
1	0	4	3

COURSE OBJECTIVES

1. To provide basic concepts in engineering drawing.
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw sectional views and pictorial views of solids.

COURSE OUTCOMES

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

1. Preparing working drawings to communicate the ideas and information.
2. Read, understand and interpret engineering drawings.

UNIT-I INTRODUCTION

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales –Plain & Diagonal

UNIT -II PROJECTIONS

Projections of Points, Lines and Planes: Principles of Orthographic Projections –Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. —Auxiliary Planes.

UNIT -III PROJECTION OF SOLIDS

Projection of Solids and Sectioned Solids:Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

UNIT -IV DEVELOPMENT OF LATERAL SURFACES

Development of Lateral Surfaces: Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT-V ISOMETRIC PROJECTIONS

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions

Introduction to CAD: For Internal Evaluation Weightage only):

Introduction to CAD Software Package Commands. - Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package

TEXT BOOKS

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS

1. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

ENGINEERING MECHANICS

I-B.TECH II-SEMESTER
Course Code: A1ME209ES

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

1. Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
2. Perform analysis of bodies lying on rough surfaces.
3. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
4. Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
5. Explain the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

COURSE OUTCOMES

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

1. Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT-I INTRODUCTION TO ENGINEERING MECHANICS - FORCE SYSTEMS

Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT -II FRICTION

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;
Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications

UNIT -III MOMENT OF INERTIA

Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem
Mass Moment of Inertia: Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies

UNIT -IV DYNAMICS

Review of particle dynamics-Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates).Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-V KINETICS OF RIGID BODIES

Kinetics of Rigid Bodies -Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

TEXT BOOKS

1. Shamesand Rao (2006),Engineering Mechanics, Pearson Education
2. Reddy Vijay KumarK. and. Suresh Kumar (2010), Singer's Engineering Mechanics – Statics &Dynamics

REFERENCE BOOKS

1. Timoshenko S.P and Young D.H., "Engineering Mechanics", McGra Hill International Edition, 1983.
2. Andrew Pytel, JaanKiusalaas, "Engineering Mechanics", Cengage Learning, 2014.
3. Beer F.P & Johnston E.R Jr. Vector, "Mechanics for Engineers", TMH, 2004.
4. Hibbeler R.C & Ashok Gupta, "Engineering Mechanics", Pearson Education, 2010.
5. Tayal A.K., "Engineering Mechanics – Statics & Dynamics", Umesh Publications, 2011.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2008.
7. Meriam. J. L., "Engineering Mechanics", Volume-II Dynamics, John Wiley & Sons, 2008

ENGINEERING PHYSICS LAB

I-B.TECH II-SEMESTER
Course Code: A1PH211BS

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

1. To generate stationary waves using Melde's apparatus and determine the rigidity modulus of the given wire.
2. To determine the spring constant by understanding the oscillations of the coupled oscillator.
3. To discuss the various properties of light like interference and diffraction and determine the related parameters of light by using different optical experiments.
4. To develop skills to impart practical knowledge in real time solution of various optoelectronic devices like LED and LASER.
5. To explain about the electrical resonance by using the LCR circuit.

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

1. Recall the different types of waves and observe their propagation and determine the rigidity modulus of the given wire.
2. Estimate the strength of materials and choose the appropriate material.
3. Analyze the various properties of light and determine the related parameters of light.
4. Compare the bending losses of optical fibers at various working areas and recall the applications ofoptical fibers.
5. Discuss the working of electronic components and built the circuits by selecting the appropriate components.

LIST OF EXPERIMENTS:

1. **Melde's experiment:** To determine the frequency of a vibrating bar or turning fork using Melde's arrangement.
2. **Torsional pendulum:** To determine the rigidity modulus of the material of the given wire using torsional pendulum.
3. **Coupled Oscillator:** To determine the spring constant by single coupled oscillator.
4. **Newton's rings:** To determine the radius of curvature of the lens by forming Newton's rings.
5. **Diffraction grating:** To determine the number of lines per inch of the grating.
6. **Dispersive power:** To determine the dispersive power of prism by using spectrometer.
7. **Laser:** To study the characteristics of LASER sources.
8. **Optical fibre:** To determine the bending losses of Optical fibres.
9. **Optical fibre:** To determine the Numerical aperture of a given fibre.
10. **LCR Circuit:** To determine quality factor and resonant frequency of LCR circuit.

Note: Any 8 experiments are to be performed

REFERENCE BOOKS:

1. Engineering Physics Lab Manual by Dr.Y. Aparna&Dr.K.Venkateswarao (V.G.S.Book links).
2. Physics practical manual, Lorven Publications.

WORKSHOP MANUFACTURING PRACTICE

I-B.TECH II-SEMESTER
Course Code: A1ME216ES

L	T	P	C
1	0	4	3

COURSE OBJECTIVES:

The course should enable the students:

1. To Study of different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function, use and application of different working tools, equipment and machines.
6. To study commonly used carpentry joints.
7. To have practical exposure to various welding and joining processes.
8. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

COURSE OUTCOMES:

By the end of the course students will be able:

1. Study and practice on machine tools and their operations
2. Practiceonmanufacturingofcomponentsusingworkshoptradesincludingpluming, fitting, carpentry, foundry, house wiring and welding.
3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
4. Apply basic electrical engineering knowledge for house wiring practice.

LIST OF EXPERIMENTS

I. TRADES FOREXERCISES:

At least two exercises from each trade:

Experiment-1 Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
Experiment-2 Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
Experiment-3 Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
Experiment-4 Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
Experiment-5 Welding Practice – (Arc Welding & Gas Welding)
Experiment-6 House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
Experiment-7 Black Smithy – (Round to Square, Fan Hook and S-Hook)

II. TRADES FOR DEMONSTRATION &EXPOSURE:

Experiment-1 Plumbing, Machine Shop, Metal Cutting
Experiment-2 Power tools in construction and Wood Working

REFERENCE BOOKS:

1. Workshop Practice /B. L. Juneja /Cengage
2. Workshop Manual / K. Venugopal /Anuradha.
3. Work shop Manual - P. Kannaiah/ K. L. Narayana/SciTech
4. Workshop Manual / Venkat Reddy/BSP

ENGINEERING EXPLORATION

L	T	P	C
0	0	2	1

I-B.TECH II-SEMESTER
Course Code: A1ME201PW

COURSE DESCRIPTION:

Course Overview:

This Course provides an opportunity for freshman students to learn in new ecosystem and is one of the unique outcomes of innovative education ecosystem in digital era of our nation. The focus of this course is on Engineering Design Process, Problem Solving, and Multi-disciplinary skills, Ethics and Data Acquisition and Analysis. This course is co-designed and co-taught by faculty members drawn from multiple engineering disciplines; it follows Project Based Learning (PBL) pedagogy with need statements covering broad themes of environmental, educational, smart appliances, smart agriculture, industrial needs etc. are used by students to carve out problem definitions by linking Sustainable Development Goals defined by United Nation. Students work in teams to solve identified problems and serves as a platform for peer learning and push students in Multi-disciplinary design thinking in first year itself.

COURSE OUTCOMES:

By the end of the course students will be able to:

1. Compare and contrast the contributions of different types of engineers in the development of a product, process, or system.
2. Apply the common engineering design process to solve complex problems and arrive at viable solution.
3. Explore various contemporary software and hardware tools to provide solutions for the problems.
4. Apply skills needed for successful teamwork including the basics of project management and written and oral communication.
5. Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

LIST OFACTIVITIES

Week-1

Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

Week-2

Engineering Design Process: Design Cycle, Multidisciplinary facet of design, Importance of analysis in engineering design, general analysis procedure, generation of multiple solution, decision matrix, Concepts of reverse engineering and general mechatronics system.

Week-3

Introduction to Open-source platforms: Open-source hardware & software tools, Development (Arduino) of Programming (Tinker CAD Tools) and its Essentials, Introduction to Sensors, Transducers and Actuators and its interfacing with Open-Source H/W & S/W tools.

Week-4

Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers.

Week-5

Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment.

Week-6

Project Management& Tools: Introduction, Significance of teamwork, Importance of communication in engineering profession, Checklist, Timeline, Gantt Chart, Significance of documentation.

LABORATORY EQUIPMENT/SOFTWARE/TOOLS REQUIRED

1. Open-source Hardware: Microchip ATmega328P (UNO/NANO/MEGA).
2. I/O Peripherals: LCD, Keypad, DC/Servo Motor, Switch, 7-Segment LED modules, GSM, GPS etc.
3. Sensor Tool Kit: Digital RED/WHITE/GREEN/BLUE Light Module, IR, Analog Sound, Soil Moisture, LM35 Analog Linear Temperature, MQ7 Analog Carbon Monoxide etc.
4. Open-source Software: Arduino IDE Version 1.8.5.

TEXT BOOKS:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and Design, Academic Press, 3rd edition, 2012.
2. Byron Francis, Arduino: The Complete Beginner's Guide, Create space Independent Publishers, 2016.
3. M. Govindarajan, S. Natarajan& V. S. Senthil Kumar, Engineering Ethics, 1st Edition, Phi Learning, 2009.

REFERENCE BOOKS:

1. NeerparajRai, Arduino Projects for Engineers, 1st edition, BPB Publications, 2016.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, 2nd Edition, McGraw-Hill Education, 2016.
3. W. Richard Bowen, Engineering Ethics – Outline of an aspirational approach, Springer London.

II-YEAR (I-SEMESTER)

PROBABILITY AND STATISTICS & NUMERICAL METHODS

II-B.Tech (I Semester) **L T P C**
Course Code: A1MA301BS **3 1 0 4**

PRE-REQUISITES: Mathematical Knowledge at pre-university level

COURSE OBJECTIVES: To learn

1. The basic ideas of probability and random variables .
2. Discuss various discrete and continuous probability distributions and their properties.
3. The statistical methods of studying data samples.
4. Various methods to the find roots of an equation. Concept of finite differences and to estimate the value for the given data using interpolation.
5. Evaluation of integrals using numerical techniques and solving ordinary differential equations using numerical techniques.

COURSE OUTCOMES: After learning the contents of this paper the student must be able to

1. Formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
2. Understand the concept of discrete and continuous probability distributions.
3. Analyze the Testing of hypothesis.
4. Find the root of a given equation and estimate the value for the given data using interpolation.
5. Find the numerical solutions for a given ODE's and evaluation of integrals by Numerical techniques.

UNIT - I: BASIC PROBABILITY

Probability, Sample space, Probability of an Event, Conditional probability, Multiplicative theorem(without proof), Independent events and Bayes' theorem.
Random variables: Discrete random variable, Probability distribution function, Continuous random variable, Probability density function, Expectation and Variance of Random Variables.

UNIT - II: PROBABILITY DISTRIBUTIONS

Binomial distribution, Poisson distribution, Evaluation of Statistical parameters for these distributions, Poisson approximation to the binomial distribution. Fitting of Binomial and Poisson distributions .Normal distribution, Properties and Evaluation of statistical parameters for Normal distribution.

UNIT - III: TESTING OF HYPOTHESIS

Test of significance: Basic of testing of Hypothesis. Null and alternate Hypothesis, Types of errors, Level of significance, Critical region.
Large sample test for Single proportion, Difference of proportions, Single mean, Difference of means; Small sample tests: Test for single mean, Difference of means and test for ratio of variances.

UNIT – IV NUMERICAL METHODS – I

Solution of polynomial and transcendental equations – Bisection method, Iteration Method, Newton-Raphson method and Regula -Falsi method. Finite differences- forward differences- backward differences-central differences-symbolic relations and separation of symbols; Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae; Lagrange's method of interpolation.

UNIT – V NUMERICAL METHODS – II

Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations: Taylor's series; Picard's method; Euler and modified Euler's methods; Runge-Kutta method of fourth order.

TEXT BOOKS:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Fundamentals of Mathematical Statistics, Khanna Publications, S. C. Gupta and V. K. Kapoor.

REFERENCE BOOKS:

1. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

MECHANICS OF SOLIDS

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME302PC **3 0 0 3**

PRE-REQUISITES: Nil

COURSE OBJECTIVES: The objectives of this course are to

a. Impart knowledge in stress and strain developed in a simple body and composite members under simple and complex load conditions
b. Make them to learn how to determine the magnitude of biaxal stresses in inclined plane under different directions of loading using analytical and Mohr's circle methods
c. Learn how to draw shear and bending moments diagrams for different types of beams under different load conditions
d. Provide knowledge in determining the bending moment and shear forces at different points in cross section of the beams under different loading conditions.
e. Explore the power transmission of both solid and hollow shafts under the different loading conditions and analyse the stability of columns with various end conditions

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

a. Explain the stresses and strains and calculate the stresses and strains induced in simple and composite bars under different load conditions.
b. Determine the magnitude of biaxial stresses in inclined plane under different directions of loadings
c. Draw the shear force and bending moment diagrams of beams subjected to various loading conditions
d. Calculate the bending moment and shear forces at different layers in cross section of beams under various loading conditions
e. Design the solid and hollow shaft under different loading conditions and compare them power transmission efficiency

UNIT – I

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Compound Stresses: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Thin and Thick Cylinder: stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation) (Compound cylinders not included)

UNIT – III

Bending Moment and Shear Force in Beams: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – IV

Bending and Shear Stresses in Beams: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections. Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT - V

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: T/J = q/r = Nθ/L – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Elastic Stability of Columns: Introduction to columns, Euler's theory for axially loaded elastic long columns, derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

TEXT BOOKS:

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH
5. Mechanics of materials, S.I units, Ferdinand Beer & Russell Johnston, TATA McGrawHill – 1st edition 2003

REFERENCE BOOKS:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd. 6. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
6. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.

METALLURGY AND MATERIAL SCIENCE

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME303PC **3 0 0 3**

PRE-REQUISITES: Engineering Physics

COURSE OBJECTIVES: The objectives of this course are to

a. Understand the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
b. provide a detailed interpretation of equilibrium phase diagrams
c. gain knowledge in structure, properties of various ferrous, nonferrous and alloying materials and their engineering applications
d. impart knowledge in various heat treatment processes of ferrous materials coupled with their improvement in mechanical properties
e. Explore the various heat treatment processes of non-ferrous materials coupled with their improvement in mechanical properties

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

a. Explain the correlation between the internal structure and mechanical properties of materials and methods to enhance their mechanical integrity including with failure criteria.
b. Understand equilibrium diagrams coupled with changes in micro-constituents and properties
c. Demonstrate the structure, properties of various ferrous, nonferrous and alloying materials and their potential in engineering applications
d. Experiment the various heat treatment processes of ferrous materials coupled with their improvement in mechanical properties
e. Discuss the heat treatment processes of non-ferrous materials coupled with their improvement in mechanical properties

UNIT – I

Structure of Crystalline Solids: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. Introduction to composite materials.

UNIT – II

Cooling curves and Phase Diagrams: Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron

UNIT – III

Ferrous and Non-ferrous Materials: Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys (Brass, bronze and cupro-nickel)- Aluminium and Al-Cu – Mg alloys- Titanium alloys.

UNIT –IV

Heat treatment of Ferrous Materials: Annealing, Normalising, Hardening, Tempering and Spheroid sing, Isothermal transformation diagrams for Fe-C alloys and microstructures development. Special metals and alloys- Super alloys managing steels.

UNIT – V

Heat Treatment of Non-ferrous Materials: Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening, Cryogenic treatment of alloys. Special metals and alloys- Super alloys maraging steels.

TEXT BOOKS:

1. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
2. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
3. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.
4. Physical Metallurgy principles by Reed-Hill
5. Introduction to Physical Metallurgy / Sidney H. Avener. - Design Data book
6. Material Science and Metallurgy/Kodgire.

REFERENCE BOOKS:

1. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
2. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

PRODUCTION TECHNOLOGY

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME304PC **3 0 0 3**

PRE-REQUISITES: Nil

COURSE OBJECTIVES: The objectives of this course are to

a. Impart knowledge in mould components, types, casting processes and their defects
b. Learn them different types forming processes, mechanism, applications and estimation of force and power requirements
c. Understand the principles, tools and methods of forging, extrusion and High Energy Rate Forming Processes coupled with engineering applications
d. Impart knowledge in fabrications processes, cost estimation and engineering applications
e. Provide knowledge in mechanism of welding processes, structural changes and defects identifications by destructive and non-destructive processes

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

a. Explain the different mould components, types, casting processes coupled with defects and their engineering applications
b. Discuss the different types forming processes, mechanism, applications and to estimate the energy requirements
c. Demonstrate the principles, tools and methods of forging, extrusion and High Energy Rate Forming Processes and their engineering applications
d. Explain the fabrications processes, cost estimation and engineering applications
e. Explore the mechanism of welding processes, structural changes and defects identifications by destructive and non-destructive processes

UNIT – I

Casting Processes: Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design. Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Solidification of casting – Solidification of pure metal, Directional Solidification.

UNIT – II

Forming Processes: Hot working, cold working, strain hardening, recovery, recrystallization and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bending and deep drawing. Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types – wire drawing and Tube drawing –. Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – III

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion –Impact extrusion – Extruding equipment – Tube extrusion, Hydrostatic extrusion. Forces in extrusion

High Energy Rate Forming Processes: Limitations, Principles of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad Forming

UNIT – IV

Fabrication Processes

Welding: Classification – Types of welds and welded joints; Welding electrodes and its types, Welding Positions - Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding, Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, Friction Stir Welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing

UNIT – V

Weld Metallurgical Aspects and plastic Processes

Solidification and structure of welds, Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

Plastic Processes: Processing of Plastics: Types of Plastics, Properties, applications and their processing methods. Moulding Equipment: Injection moulding - Injection moulding, Blow moulding

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao Vol.1 & 2 / Mc Graw Hill
2. Manufacturing Engineering & Technology / SeropeKalpakjian / Steven R. Schmid / Pearson

REFERENCE BOOKS:

1. Metal Casting / T.V Ramana Rao / New Age
2. Production Technology / G. Thirupathi Reddy / Scitech
3. Manufacturing Processes/ J.P. Kaushish / PHI Publications

PRINCIPLES OF THERMODYNAMICS

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME305PC **3 0 0 3**

PRE-REQUISITE: Engineering Chemistry and Physics

COURSE OBJECTIVES: The objectives of this course are to

a. Understand the basics of thermodynamics and their significance
b. Impart the knowledge in Laws of thermodynamics and their applications in heat engines
c. Make them to learn characteristics and properties of pure substances and various thermodynamics processes
d. Explore the thermodynamic properties of humid air and their applications in HVAC
e. Highlight the heat power cycle and refrigeration cycle and determine their efficiency and COP respectively

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

a. Define the basics of thermodynamics and their significance in heat power engineering
b. Explain Laws of thermodynamics and their applications in heat engines
c. Understand the characteristics and properties of pure substances and various thermodynamics processes
d. Discuss the thermodynamic properties of humid air and their applications in HVAC
e. Explain the various heat power cycle and refrigeration cycle and determine their efficiency and COP respectively

TABLES/CODES: Steam Tables and Mollier Chart, Refrigeration Tables

UNIT – I

Fundamental Concepts and Definitions: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

UNIT - II

Laws of Thermodynamics: PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics

UNIT – III

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

Perfect Gas Laws: Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

UNIT - IV

Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables, Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier's Equation – Psychrometric chart.

UNIT - V

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

Refrigeration Cycles:

Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS:

1. Engineering Thermodynamics / PK Nag / McGraw Hill
2. Thermodynamics for Engineers / Kenneth A. Kroos, Merle C. Potter/ Cengage

REFERENCE BOOKS:

1. Engineering Thermodynamics / Chattopadhyay/ Oxford
2. Engineering Thermodynamics / Rogers / Pearson

PRODUCTION TECHNOLOGY LAB

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME306PC **0 0 2 1**

PRE-REQUISITES: Production Technology

COURSE OBJECTIVES:

a. Know about the basic Physical, Chemical Properties of materials
b. Explain why some material(s) are better to be used in a product for given design requirements Learn the basic operation of various manufacturing processes
c. Learn how various products are made using traditional, non-traditional, or Electronics manufacturing processes
d. Design simple process plans for parts and products
e. Understand how process conditions are set for optimization of production
f. Learn how CNC machines work
g. Write and execute CNC machining programs to cut parts on a milling machine
h. Measure a given manufactured part to evaluate its size, tolerances and surface finish Design and fabricate a simple product

COURSE OUTCOMES:

a. Understanding the properties of moulding sands and pattern making.
b. Fabricate joints using gas welding and arc welding.
c. Evaluate the quality of welded joints.
d. Basic idea of press working tools and performs moulding studies on plastics.

Minimum of 12 Exercises need to be performed

I. Metal Casting Lab:

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

II. Welding Lab:

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises

III. Mechanical Press Working:

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

IV. Processing of Plastics

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

MECHANICS OF SOLIDS LAB

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME307PC **0 0 2 1**

PRE-REQUISITES: Mechanics of solids & Physics

COURSE OBJECTIVES: The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanic's course.

The students will advance the students' development of the following broad capabilities:

a. Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviours due to different types of loading will be discussed.
b. Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
c. Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
d. Students will understand how to calculate normal and shear stresses on any cross-section of a beam.

COURSE OUTCOMES

a. Analyse the behaviour of the solid bodies subjected to various types of loading.
b. Apply knowledge of materials and structural elements to the analysis of simple structures.
c. Undertake problem identification, formulation and solution using a range of analytical methods
d. Analyse and interpret laboratory data relating to behaviour of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
e. Expectation and capacity to undertake lifelong learning.

LIST OF EXPERIMENTS:

1. Direct tension test
2. Bending test on Simple supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test/ Rockwell hardness test
6. Test on springs
7. Izod Impact test/ Charpy Impact test

METALLURGY AND MATERIALS SCIENCE LAB

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME308PC **0 0 2 1**

COURSE OBJECTIVES: The objectives of this course are to

a. Impart skills to observe the different crystal structures and their influence in properties of materials.
b. Provide exposure to observe Microstructure of pure metals and alloying elements
c. Learn them to observe the Microstructures of Cast Irons.
d. Offer hand on training them to observe Microstructures of Non-Ferrous alloys.
e. Conduct Jominy End Quench Test to determine Hardenability of steels

COURSE OUTCOMES: Student will be able to:

a. Experimentally explore the different crystal structures and their influence in properties of materials.
b. Prepare and observe the Microstructure of pure metals and alloying elements
c. Prepare and observe the Microstructures of Cast Irons.
d. Study of the Microstructures of Non-Ferrous alloys.
e. Determine Hardenability of steels by Conduct Jominy End Quench Test

LIST OF EXPERIMENTS:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
4. Study of the Microstructure of Cast Irons.
5. Study of the Microstructure of Non-Ferrous alloys.
6. Hardenability of steels by Jominy End Quench Test.

ENVIRONMENTAL STUDIES

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME303MC **3 0 0 0**

COURSE OBJECTIVES:

1. Understanding the importance of ecological balance for sustainable development.
2. Acquire the knowledge of importance of natural resources & apply conservation techniques.
3. Analyzing the importance of Biodiversity.
4. Estimate the impacts of Environmental pollution, developmental activities and mitigation measures.
5. Evaluation of the environmental policies and regulations.

COURSE OUTCOMES:

1. Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles.
2. Able to apply the conservation methods of natural resources.
3. Able to analyze the conservation techniques of biodiversity.
4. Able to apply pollution control methods.
5. Able **to** understand and apply environmental regulations which in turn helps in sustainable development.

UNIT-I: ECOSYSTEMS

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio-magnification.

UNIT-II: NATURAL RESOURCES: CLASSIFICATION OF RESOURCES

Living and Non-Living 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, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT-III: BIODIVERSITY AND BIOTIC RESOURCES

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES

Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary. Concepts of bioremediation.

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion andOzone depleting substances (ODS).Deforestation and desertification. International conventions /Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT-V ENVIRONMENTAL POLICY, LEGISLATION & EIA

Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. Overview on Impacts of air, water, biological and Socio-economical aspects.Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building,

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

II-B.Tech (I Semester) **L T P C**
Course Code: A1ME304MC **2 0 0 0**

PRE-REQUISITES: Nil

COURSE OBJECTIVES: This introductory course input is intended

a. To help the students appreciate the essential to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
b. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature. Thus, this course is intended to provide a much-needed orientational input in value education to the young enquiring minds.
d. To inculcate the learning capabilities and communication skills among the students
e. To motivate them to understand the life force following with enhancement of bio-magnetic energy in body
f. To explore the essence of Morals, Ethics, Values and Social responsibilities for successful life.

COURSE OUTCOMES: Student will be able to

a. Learns Being a human, understands human values and purpose of education
b. Understands the importance of different harmony levels needed.
c. Understand Self and being in the current moment are the sources of happiness.
d. Improves Learning capabilities and communication skills.
e. Understands and appreciate the importance of personality development and yoga for a holistic life.
f. Understands the essence of Morals, Ethics, Values and Social responsibilities for successful life.

UNIT – I

Introduction to Human Values: The current status of an individual, at the level of Individual, Family, Society and Nature. Basis of Human Beings' Conduct, Desire – Aim, Objective and Purpose. Rationale of Success. Role of Education - Sanskar. Definition of Human aspiration, Human Conduct, Human Being – Physical Facility and Relationships, Right. Understanding for Human Being, Achievement of Prosperity.

UNIT – II

Understanding Harmony and Human Being: Understanding the co-existence of human being, Different Harmony levels –Harmony in the Human Being, Harmony in the Family, Harmony in the Society and Harmony in Nature / Existence. Understanding the Relationships, Harmony in the Family, Feelings in Relationship: Trust, Respect, Affection, Care Guidance, Reverence, Glory, Gratitude and Love.

UNIT – III

The Cycle of Happiness: Meaning of Happiness and Unhappiness, Sources of Happiness, Self-Investigation, Five Dimensions of Human order – Education, Health, Production, Justice and Exchange. Harmony at the Individual Level and Family level, Concerns at Individual, Family and Nature level. Different approach of People behaviour – Active, Reactive and Proactive. Resource depletion, Global Warming, Pollution, Harmony in Nature.

UNIT – IV

Improving Learning Capabilities: Principles of learning, Study skills and E- Learning, listening skills, Soft skills and Employability skills, Effective Reading and Reviewing, Reading Comprehension, Textbook Reading strategies, Effective Communication in English, Test taking strategies.

UNIT – V

Personality Development: Self Development, Goal Setting, Motivation, Time Management, Positive Attitude, Building Self Confidence, Decision Making, The Discovery Wheel, Some attributes of a good personality, Memory Management, Interpersonal Skills, Importance of Yoga and Meditation.

TEXT BOOK

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

REFERENCES BOOKS

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth –Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.

II-YEAR (II-SEMESTER)

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

II-B.Tech (II Semester) **L T P C**
Course Code: A1EE401ES **3 0 0 3**

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

The course should enable the students to:

1. Develop fundamentals, including Ohm's law, Kirchhoff's laws and be able to solve for currents, voltages and power in electrical circuits.
2. Develop EMF equation and analyze the operation of DC Machines.
3. Analyze the working principle of Transformer.
4. Discuss the operation of AC Machines.
5. Analyze the operation of PN junction diode and rectifiers.
6. Discuss the operation and characteristics of Transistors

COURSE OUTCOMES:

Upon graduation:

1. Analyze and solve for current values in resistive circuits with independent sources.
2. Analyze the working of DC machines and solve the numerical problems
3. Analyze the working of AC electrical machines and solve the numerical problems.
4. Analyze the V-I characteristics of PN – junction diode and describe the operation Of rectifiers.
5. Analyze the different configurations of Transistors and obtain its characteristics

UNIT I ELECTRICAL CIRCUITS

Basic definitions-Ohm's Law, types of elements, types of sources, Kirchhoff's Laws – simple problems. Series & parallel resistive networks with DC excitation star to delta and delta to star transformations. Norton's, Thevenin's theorems

UNIT II D.C. MACHINES

Principle of Operation of DC Motor, types of DC motor, Torque equation & Losses and problems. DC Generator construction and working Principle, EMF Equation types of generators and problems.

UNIT III A.C. MACHINES

Working principle and Construction of transformer, Emf Equation & problems, Principle operation of 3-phase induction motor, slip and torque Equation, Torque –slip Characteristics & problems, principle Operation of 3-phase Alternator, Emf Equation of Alternator & problems.

UNIT IV DIODE AND ITS CHARACTERISTICS

PN JUNCTION DIODE: Operation of PN junction Diode: forward bias and reverse bias, Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics. Rectifiers, Half wave, Full wave and bridge Rectifiers –capacitor filters, inductor filters.

UNIT V TRANSISTORS

Bipolar Junction Transistor and its types, Transistor as an Amplifier CB, CE, CC Configurations comparison of transistor configurations, the operating point FETs: J-FET, MOSFET,V-I characterises, MOSFET as a switch

TEXT BOOKS:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshaiah TMH.
2. Electronic Devices and circuits by J.Millman, C.C.Halkias and SatyabrataJit 2ed.,
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th Edition

REFERENCE BOOKS:

1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

KINEMATICS OF MACHINERY

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME402PC **3 0 0 3**

PREREQUISITES: Basic principles of Mechanics

COURSE OBJECTIVES: The objectives of this course are to

a. Identify and enumerate different mechanisms with basic understanding of motion and machine.
b. Understand and Analyse velocity and acceleration by different graphical methods.
c. Impart knowledge in kinetics of Straight-line motion mechanisms, steering gears and Hook Joint.
d. Make them to understand the different types of cam and followers and drawing cam profile
e. Inculcate the knowledge in construction, operation and applications of gears and gear trains

COURSE OUTCOMES: Student will be able to:

a. Understand the different mechanisms and their inversion and applications
b. Determine velocity and acceleration of the links in kinematics chain by different graphical methods.
c. Explain the kinetics of Straight-line motion mechanisms, steering gears and Hook Joint and engineering applications.
d. Understand the different types of cam and followers and to draw the cam profile with respect to follower motion
e. Demonstrate the construction, operation and applications of gears and gear trains

UNIT – I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Kinematic Chains and Inversions: Inversion – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT – II

Velocity and Acceleration Analysis of Mechanisms: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration, Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs.

Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint –velocity ratio – application – problems.

UNIT – IV

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 and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V

Toothed Gears: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding, Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/ Oxford
2. Theory of Machines / S. S. Rattan / Mc Graw Hill Publishers.

REFERENCE BOOKS:

1. Theory of Machines / Sadhu Singh / Pearson.
2. Theory of Machines / Thomas Bevan/CBS.

THERMAL ENGINEERING – I

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME403PC **3 0 0 3**

PRE-REQUISITE: Principles of Thermodynamics

COURSE OBJECTIVES: The objectives of this course are to

a. Impart knowledge in principle, construction, operation and air-standard efficiency of SI and CI engines
b. Make them to learn mechanism of combustion of Combustion in S.I. Engines & C.I. Engines and related terminologies
c. Enumerate the performance analysis of IC engines and to determine the various power & efficiency
d. Provide knowledge in construction, performance, minimum work requirement of various types of compressors in engineering field
e. Understand the operating cycles, efficiency, performance parameters and methods to enhance efficiency of gas turbines.

COURSE OUTCOMES: Student will be able to:

a. Demonstrate the principle, construction, operation and air-standard efficiency of SI and CI engines
b. Discuss the mechanism of combustion of IC engines and related terminologies
c. Calculate the various power and efficiency of IC engines
d. Explain the construction, performance, minimum work requirement of various types of compressors
e. Define the operating cycles, efficiency and performance parameters of gas turbines and analyse the methods to enhance efficiency of gas turbines.

UNIT – I

Actual cycles and I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburettor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT – II

Combustion in S.I. Engines & C.I. Engines

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating

UNIT - III

I.C Engine Testing and Performance: Terminologies, performance parameters - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, torque, brake power, dynamometer working & types. Determination of brake power, frictional power, indicated power and mechanical efficiency – volumetric efficiency – MEP – Performance test – Heat balance test - Morse Test.

Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

UNIT – IV

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

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.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

UNIT – V

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle – Closed Cycle and Open Cycle for Gas Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency – Work Ratio and Optimum Pressure Ration for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle, Regeneration, Intercooling and Reheating – Closed and Semi-Closed Cycle

TEXT BOOKS:

1. I.C. Engines / V. Ganesan / Mc Graw Hill
2. Thermal Engineering / Mahesh M Rathore / Mc Graw Hill

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists / Eastop / Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / Wiley Eastern
3. Internal Combustion Engines Fundamentals – John B. Heywood – McGraw Hill Ed.

FLUID MECHANICS AND HYDRAULIC MACHINES

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME404PC **3 0 0 3**

PRE-REQUISITES: Engineering Mechanics

COURSE OBJECTIVES: The objectives of this course are to

a. Determine the momentum exerted by jets impact on vanes with power developed
b. Analyse the power generated and efficiency of the turbine and pumps by conduct performance test
c. Determine the error involved in orifice and venturimeter by conduct calibration test
d. Determine the friction factor in given pipe using given laminar flow
e. Analyse loss head in pipe due to sudden contraction
f. Analyse total head at all point in the pipe using Bernoulli's theorem

COURSE OUTCOMES: Student will be able to:

a. Analyse the impulse generated by jet impinged on the vanes of turbines
b. Determine the power generated and efficiency of the turbine and pumps by conduct performance test
c. Determine the error involved in orifice and venturi meter by conduct calibration test
d. Determine the friction factor in given pipe using given laminar flow
e. Explore the loss head in pipe due to sudden contraction
f. Analyse total head at all point in the pipe using Bernoulli's theorem

UNIT - I

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

UNIT - II

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.
Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT - III

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.
Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

UNIT - IV

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

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

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.

UNIT - V

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

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

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

DESIGN OF MACHINE ELEMENTS-I

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME405PC **3 0 0 3**

Note: Design Data books are permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

PRE-REQUISITES: Engineering Mechanics, Mechanics of Solids, Manufacturing Processes, Metallurgy and Materials Science.

COURSE OBJECTIVES: The objectives of this course are to

a. Understand the conventional representation of of materials, common machine elements and parts such a as screws, nuts, bolts, keys, gears, webs, ribs
b. Draw the front view and dimension the Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
c. Draw the orthographic views of various temporary joints.
d. Draw the orthographic views of riveted joint, shaft coupling and different types of bearings
e. Draw the assembled view of various machine components with some scale ratio

COURSE OUTCOMES: Student will be able to:

a. Explain the conventional representation of materials, common machine elements and parts such a as screws, nuts, bolts, keys, gears, webs, ribs
b. Draw the front view and dimension the Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
c. Draw the orthographic views of various temporary joints.
d. Draw the orthographic views of riveted joint, shaft coupling and different types of bearings
e. Draw the assembled view of various machine components with some scale ratio

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection – Manufacturing consideration in design. Tolerances and fits –BIS codes of steels.

Design for Static Strength: Simple stresses – Combined stresses – Torsional and Bending 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.

UNIT – II

Design for Variable Stresses in Members: Stress concentration–Theoretical stress Concentration factor– Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber's curve– Goodman's line– Soderberg's line.

UNIT – III

Riveted, Welded and Threaded Fasteners: Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints-eccentrically loaded riveted joints.

Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading.

Threaded Fasteners- Design of bolts with pre-stresses – Design of joints under eccentric loading – locking devices – bolts of uniform strength.

UNIT – IV

Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.

Power Screws: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw.

UNIT – V

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. - Gaskets and seals (stationary & rotary)

Shaft Couplings: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings.

TEXT BOOKS:

1. Design of Machine Elements / V. Bhandari / Mc Graw Hill
2. Machine Design / Jindal / Pearson

REFERENCE BOOKS:

1. Design of Machine Elements / V. M. Faires / Macmillan
2. Design of Machine Elements-I / Kannaiah, M.H / New Age

MACHINE DRAWING

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME406PC **1 0 2 1**

PRE-REQUISITES: Engineering graphics

COURSE OBJECTIVES: To familiarize with the standard conventions for different materials and machine parts in working drawings. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.

COURSE OUTCOMES:

a. Preparation of engineering and working drawings with dimensions and bill of material during
b. Design and development. Developing assembly drawings using part drawings of machine components.
c. Conventional representation of materials, common machine elements and parts such a as screws, nuts, bolts, keys, gears, webs, ribs.
d. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
e. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centres, curved and tapered features.
f. Title boxes, their size, location and details - common abbreviations and their liberal usage
g. Types of Drawings – working drawings for machine parts.

Drawing of Machine Elements and simple parts:

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

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Riveted joints for plates
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

Assembly Drawings:

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

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block, Fuel Injector
4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

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

TEXT BOOKS:

1. Machine Drawing / N.D. Bhatt / Charotar
2. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson

REFERENCE BOOKS:

1. Machine Drawing by / Bhattacharyya / Oxford
2. Machine Drawing / Ajeet Singh / Mc Graw Hill

FLUID MECHANICS AND HYDRAULIC MACHINES LAB

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME407PC **0 0 2 1**

PRE-REQUISITES: Engineering Physics

COURSE OBJECTIVES:

a. To understand the basic principles of fluid mechanics.
b. To identify various types of flows.
c. To understand boundary layer concepts and flow through pipes.
d. To evaluate the performance of hydraulic turbines.
e. To understand the functioning and characteristic curves of pumps.

COURSE OUTCOMES:

a. Able to explain the effect of fluid properties on a flow system.
b. Able to identify type of fluid flow patterns and describe continuity equation.
c. To analyse a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
d. To select and analyse an appropriate turbine with reference to given situation in power plants.
e. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
f. Able to demonstrate boundary layer concepts

LIST OF EXPERIMENTS:

1. Impact of jets 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 Venturi meter.
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.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

II-B.Tech (II Semester) **L T P C**

Course Code: A1EE408ES **0 0 2 1**

PRE-REQUISITES: No

COURSE OBJECTIVES:

The course should enable the students to:

1. Develop fundamentals, including Ohm's law, Kirchhoff's laws and be able to solve for currents, voltages and power in electrical circuits.
2. Develop EMF equation and analyze the operation of DC Machines.
3. Analyze the working principle of Transformer.
4. Discuss the operation of AC Machines.
5. Analyze the operation of PN junction diode and rectifiers.
6. Discuss the operation and characteristics of Transistors

COURSE OUTCOMES:

By the end of the course students will be able:

1. Analyze and solve for current values in resistive circuits with independent sources.
2. Analyze the working of DC machines and solve the numerical problems.
3. Analyze the working of AC electrical machines and solve the numerical problems.
4. Analyze the V-I characteristics of PN – junction diode and describe the operation of rectifiers
5. Analyze the different configurations of Transistors and obtain its characteristics

LIST OF EXPERIMENTS

PART-A (Electrical Engineering):

Experiment-1 Verification of Norton's, Thevenin's theorems

Experiment-2 Verification of KVL and KCL

Experiment-3 Brake test on DC shunt motor.

Experiment-4 Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working as motor and generator).

Experiment-5 O.C and S.C test on single phase transformer (predetermination of Efficiency and regulation at given power factor

Experiment-6 Brake test on 3- phase induction motor (determination of performance Characteristics).

Experiment-7 No-Load Characteristics of a Three-phase Alternator

PART-B (Electronics Engineering)

Experiment-8 Study and operation of (i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.

Experiment-9 PN Junction diode characteristics

Experiment-10 Zener diode characteristics and Zener as voltage Regulator

Experiment-11 Input & Output characteristics of Transistor in CB, CE & CC configuration

Experiment-12 Full Wave Rectifier with & without filters

TEXT BOOKS:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshaiah TMH.
2. Electronic Devices and circuits by J.Millman, C.C.Halkias and SatyabrataJit 2ed.,
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th Edition

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1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

GENDER SENSITIZATION

II-B.Tech (II Semester) **L T P C**
Course Code: A1ME405MC **0 0 2 0**

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

a. To develop students' sensibility with regard to issues of gender in contemporary India.
b. To provide a critical perspective on the socialization of men and women.
c. To introduce students to information about some key biological aspects of genders.
d. To expose the students to debates on the politics and economics of work.
e. To help students reflect critically on gender violence.
f. To expose students to more egalitarian interactions between men and women.

COURSE OUTCOMES:

a. Students will have developed a better understanding of important issues related to gender in contemporary India.
b. 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.
c. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
d. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
e. Men and women students and professionals will be better equipped to work and live together as equals.
f. Students will develop a sense of appreciation of women in all walks of life.
g. 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.

UNIT - I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men- Preparing for Womanhood. Growing up Male. First lessons in caste.

UNIT – II: GENDER ROLES AND RELATIONS

Two or Many - Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

UNIT – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. Gender Development Issues-Gender. Governance and Sustainable. Development-Gender and Human Rights-Gender and Mainstreaming.

UNIT – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*

Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives.

Thinking about Sexual Violence Blaming the Victim- "I Fought for my Life…."

UNIT – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals.

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks. The Brave Heart.

TEXT BOOKS

1. Towards a World of Equals: A bilingual Textbook on Gender, A Suneetha -etall

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-Indian-women work
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 and 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.

III-YEAR (I-SEMESTER)

DYNAMICS OF MACHINERY

III-B.Tech (I Semester) **L T P C**
Course Code: A1ME501PC **3 1 0 4**

PRE-REQUISITE: Kinematics of Machinery

COURSE OBJECTIVES: The objectives of this course are to

a. Equip the student with fundamental knowledge of dynamic and static forces analysis of machine tools and power transmitted by belt drives.
b. Develop the knowledge of analytical and graphical methods for balancing of rotary and reciprocating masses.
c. Impart knowledge in types of vibrations, related terminologies and whirling of shaft.
d. Make them to understand the friction and its applications in operation of clutches.
e. Impart the knowledge in construction, operation and applications of gyroscope and governors

COURSE OUTCOMES: Upon successful completion of this course the student should be able to:

a. Analyse the static and dynamic forces in machine tools and estimate power transmission by belt drives.
b. Demonstrate the analytical and graphical methods for balancing of rotary and reciprocating masses.
c. Discuss the types of vibrations, related terminologies and whirling of shaft.
d. Understand the friction and its applications in operation of clutches.
e. Explore the construction, operation and applications of gyroscope and governors.

UNIT – I

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D.Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

Belt Drives: Belt drives: Flat & V belt drives, ratio of belt tensions, centrifugal tension, and power transmitted.

UNIT – II

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of "V" and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – III

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

UNIT – IV

Friction: Pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches.

Brakes and Dynamometers: Types of brakes: Simple block brake, band and block brake internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – V

Mechanisms for Control

Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

TEXT BOOKS:

1. Theory of Machines /S.S.Rattan / Mc Graw Hill.
2. Theory of Machines /Sadhu Singh/ Pearson

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms/Joseph E. Shigley / Oxford
2. Theory of Machines / Rao,J.S& R.V. Duggipati/ New Age

METROLOGY AND MACHINE TOOLS

III-B.Tech (I Semester) **L T P C**
Course Code: A1ME502PC **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES: The objectives of this course are to

a. Impart the knowledge in Limits, fits and tolerances and significance in measurements.
b. Learn them in surface roughness measurements and measuring instruments.
c. Impart the fundamental in aspects of the metal cutting principles and operation of various machine tools.
d. Learn them construction and operation of various drilling and boring machines.
e. Discuss the construction and operation of milling, grinding and machine tools for finishing processes

COURSE OUTCOMES: At the end of the course, the student would be able to

a. Understand the Limits, fits and tolerances and their significance in measurements.
b. Discuss the various surface roughness measurements and measuring instruments.
c. Understand the metal cutting principles and operation of various lathe.
d. Comprehend the construction and operation of various drilling and boring machines.
e. Explain the construction and operation of milling, grinding and machine tools for finishing processes

UNIT – I

Systems of Limits, Fits, Tolerance: Limits, fits and tolerances- Types of Fits - Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly. Errors in Screw threads, measurement of effective diameter, angle of thread and thread pitch.
Limit Gauges: Taylor's principle, Design of GO and NO-GO gauges, Measurement of angles using Bevel protractor and Sine bar. Measurement of flatness using straight edges, surface plates, optical flat and auto collimator.

UNIT – II

Surface Roughness Measurements: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement;
Machine Tool Alignment: Tests on lathe, milling and drilling machines.
Coordinate Measuring Machines: Types and Applications of CMM.

UNIT – III

Metal Cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Engine lathe – Principle of working, types of lathe, specifications. Taper turning, –Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

UNIT – IV

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

UNIT – V

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing. Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations

TEXT BOOKS:

1. Machine Tool Practices/ Kibbe, Johne. Neely, T. White, Rolando O. Meyer/ Pearson
2. Engineering Metrology/ R.K. Jain/ Khanna Publishers.

REFERENCE BOOKS:

1. Principles of Machine Tools, Bhattacharyya A and Sen.G.C / New Central Book Agency.
2. Fundamentals of Dimensional Metrology / Connie Dotson / Thomson
3. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd / McGraw Hill
4. Principles of Engineering Metrology/ Rega Rajendra/ Jaico Publishers.
5. Metrology and Measurement/ Bewoor& Kulkarni/ Tata Mc Graw Hill

THERMAL ENGINEERING - II

III-B.Tech (I Semester) **L T P C**

Course Code: A1ME503PC **3 0 0 3**

Note: Steam and refrigeration Tables are permitted

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVES: The objectives of this course are to:

a. Make the students to understand the Rankine cycles and improve the performance of cycles.
b. Impart knowledge in thermodynamic analysis of various types of nozzles, condition for maximum discharge and criteria to decide nozzle shape.
c. Learn them in construction and working principle of impulse and reaction turbine
d. Study the performance of gas turbines and methods to improve the same
e. Discuss the vapour compression and absorption refrigeration systems and measurement of CoP.

COURSE OUTCOMES: At the end of the course, the student should be able to

a. Explain the Rankine cycle and methods to improve the performance of cycles
b. Discuss the thermodynamic analysis of various types of nozzles, condition for maximum discharge and criteria to decide nozzle shape
c. Demonstrate the construction and working principle of impulse and reaction turbine
d. Explore the performance of gas turbines and methods to improve the same
e. Analyse the vapour compression and absorption refrigeration systems and measurement of CoP.

UNIT – I

Steam Power Cycle: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

UNIT – II

Steam Nozzles: Stagnation Properties- Function of nozzle – Applications and 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.

UNIT – III

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.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction –Velocity diagram – Parson's reaction turbine – Condition for maximum efficiency.

UNIT - IV

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- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT – V

Refrigeration Cycle: Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Vapour absorption refrigeration system

TEXT BOOKS:

1. Thermal Engineering / Mahesh M Rathore/ Mc Graw Hill
2. Gas Turbines – V. Ganesan /Mc Graw Hill

REFERENCE BOOKS:

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/ Pearson
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/ PHI
3. Thermal Engineering/ Rajput/ Lakshmi Publications

DESIGN OF MACHINE ELEMENTS-II

III- B. Tech (I Semester) **L T P C**
Course Code: A1ME504PC **3 0 0 3**

Note: Design Data Book is permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

PRE-REQUISITES: Study of engineering mechanics, design of machine elements-I and theory of machines.

COURSE OBJECTIVES: The objectives of this course are to:

a. Gain knowledge about designing the sliding contact bearings.
b. Gain knowledge about designing the rolling contact bearings.
c. Gain knowledge about designing the engine parts.
d. Gain knowledge about designing the mechanical springs.
e. Design the components using the data available in design data books.

COURSE OUTCOMES: At the end of the course, the student should be able to

a. Knowledge about journal bearing design using different empirical relations.
b. Estimation of life of rolling element bearings and their selection for given service conditions.
c. Impart design aspects on different engine parts.
d. Understand the different designing terms on gears
e. Acquaintance with design of the components as per the standard, recommended procedures which is essential in design and development of machinery in industry.

UNIT – I

Sliding contact bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.

UNIT – II

Rolling contact bearings: Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

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UNIT – III

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston – Construction, Design and proportions of piston.

UNIT – IV

Mechanical Springs: Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Design of co-axial springs, Design of leaf springs.

Belts & Pulleys: Transmission of power by Belt and Rope Drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives.

UNIT – V

Gears: Spur gears& Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for wear.

TEXT BOOKS:

1. Design of Machine Elements / Spotts/ Pearson.
2. Machine Design / Pandya & Shah / Charothar.

REFERENCE BOOKS:

1. Design of Machine Elements-II / Kannaiah / New Age
2. Design of Machine Elements / Sharma and Purohit/PHI
3. Design Data Book/ P.V. Ramana Murti & M. Vidyasagar/ B.S. Publications
4. Design Data Handbook/ S. Md. Jalaludeen/ Anuradha Publishers

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

III- B. Tech (I Semester) **L T P C**
Course Code: A1ME505HS **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES: The objectives of this course are to:

a. To learn the basic Business types, impact of the Economy on Business and specifically.
b. To acquire knowledge in different types of demands, forecasting of demand and supply analysis.
c. To study the production &cost analysis of the products and their market strategy
d. To expose in financial management of the production organization.
e. To gain the knowledge in financial analysis through various ratios.

COURSE OUTCOMES: At the end of the course, the student should be able to

a. Understand the various Forms of Business and the impact of economic variables on the Business.
b. Explore the various types of demand, method to forecast, different supply methods,
c. Analysis the different types of production, Cost estimation, Market Structure, and Pricing of the manufacturing products.
d. Explain the financial management of the production organization.
e. Demonstrate the financial analysis through various ratios

UNIT – I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

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UNIT – III

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT – IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT – V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012

REFERENCE BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S.N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013

METROLOGY AND MACHINE TOOLS LAB

III-B.Tech (I Semester) **L T P C**

Course Code: A1ME506PC **0 0 3 1.5**

PREREQUISITES: Theoretical exposure to Metrology and machine tools.

COURSE OBJECTIVES: The objectives of this course are to:

a. Impart knowledge in working principle, calibration and operation of various measuring instruments.
b. Offers hand on experience on linear and angular measurements using various measuring instruments with good accuracy and precision
c. Provide training in surface roughness measurement using Tally surf and comparator
d. Offer training in thread measurements by 2-wire and 3-wire methods
e. Impart hands on experience in lathe, drilling, shaping, milling, slotting, grinding and tool and cutter grinding machines operation.

COURSE OUTCOMES: At the end of the course, the student should be able to

a. Demonstrate the working principle, calibration and operation of various measuring instruments
b. Measure linear dimensions and angular dimensions using different measuring instruments with desired accuracy.
c. Determine the surface roughness of given surface using Tally Surf etc.
d. Measure thread parameters by 2-wire and 3-wire methods
e. Perform turning, drilling, shaping, milling, slotting, grinding operation using requisite machine tools.

LIST OF EXPERIMENTS:

1. Measurement of lengths, heights, diameters by vernier callipers, micrometres.
2. Measurement of Diameter of bores by internal micrometres and dial bore indicators.
3. Use of gear teeth vernier callipers for checking the chordal addendum and chordal height of the spur gear.
4. Angle and taper measurements by bevel protractor and sine bars.
5. Thread measurement by 2-wire and 3-wire methods.
6. Surface roughness measurement by Tally Surf.
7. Use of mechanical comparator
8. Step turning on lathe machine
9. Taper turning on lathe machine
10. Thread cutting and knurling on lathe machine (2 exercises)
11. Measurement of cutting forces on lathe
12. Machining of holes using Drilling and boring machines.
13. Gear cutting on the Milling machine
14. Grinding of Tool angles using Cylindrical / Surface Grinding

THERMAL ENGINEERING LAB

III-B.Tech (I Semester) **L T P C**

Course Code: A1ME507PC **0 0 3 1.5**

PRE-REQUISITE: Thermodynamics & Thermal Engineering - I

COURSE OBJECTIVES: The objectives of this course are to

a. Impart skills to draw Engines valve and port timing diagrams of IC engines by experimentally.
b. Offers hand on training in conducting performance test, morse and retardation tests in IC engine (4 - stroke diesel engines)
c. Make them to prepare the heat balance for CI/SI engines
d. Equip them to determine Volumetric efficiency of Air – Compressor Unit by experimentally
e. Impart knowledge in boilers and offer training in Dis-assembly / Assembly of Engines

COURSE OUTCOMES: At the end of the course, the student should be able to

a. Draw the valve and port timing diagrams of IC engines by experimentally.
b. Evaluating the performance characteristics of IC engines by conducting performance test, morse and retardation tests
c. Explore the performance of CI/SI engines by prepare heat balance sheet
d. Determine the Volumetric efficiency of Air – Compressor Unit by experimentally
e. Understand the construction & operation of various boilers

LIST OF EXPERIMENTS (Minimum of 10 experiments are to be conducted)

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

THEORY OF MACHINES LAB

III-B.Tech (I Semester) **L T P C**

Course Code: A1ME508PC **0 0 3 1.5**

PRE-REQUISITE: Kinematics of Machinery

COURSE OBJECTIVES: The objectives of this course are to

a. Determine the balancing of masses of rotating and reciprocating machine elements
b. Understand the working principles of gyroscope and governors
c. Equip them to determine the critical speed of whirling shaft
d. Impart skills to determine the vibration parameters of vibrating bodies under different conditions
e. Provide training to determine the power lost due to friction in Journal bearing

COURSE OUTCOMES: Upon successful completion of this lab, students should be able to:

a. Demonstrate the balancing of masses of rotating and reciprocating machine elements
b. Determine the performance characteristics of governors
c. Demonstrate the critical speed of whirling shaft by experimentally
d. Discuss the vibration parameters of vibrating bodies under given conditions
e. Explore the power lost due to friction in Journal bearing by experimentally

LIST OF EXPERIMENTS: (Minimum of 10 experiments are to be conducted)

1. To determine the state of balance of machines for primary and secondary forces
2. To determine the frequency of torsional vibration of a given rod
3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor
4. Find the motion of the follower if the given profile of the cam
5. The balance masses statically and dynamically for single rotating mass systems
6. Determine the critical speed of a given shaft for different n-conditions
7. For a simple pendulum determine time period and its natural frequency
8. For a compound pendulum determine time period and its natural frequency
9. Determine the effect of gyroscope for different motions
10. Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
11. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
12. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems

CONSTITUTION OF INDIA

III-B.Tech (I Semester) **L T P C**
Course Code: A1ME506MC **2 0 0 0**

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of ndia and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest courts in the world".

COURSE CONTENT

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

III-YEAR (II-SEMESTER)

HEAT TRANSFER

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME601PC **3 0 0 3**

Note: Heat Transfer Data Book is permitted.

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVES: The objectives of this course are to

a. Understand the modes of heat transfer and conduction heat transfer
b. Equip the students to estimate the heat transmission through the one-dimensional heat conduction
c. Import knowledge in different methods in convective heat transfer.
d. Discuss the internal Flows, free convection and heat exchanger.
e. Deal the mechanism of Heat Transfer with Phase Change

COURSE OUTCOMES: At the end of this course, student will be able to

a. Discuss the modes of heat transfer and conduction heat transfer
b. Explain the estimate the heat transmission through the one-dimensional heat conduction
c. Explore the different methods in convective heat transfer.
d. Enumerate the internal Flows, free convection and heat exchanger.
e. Analyse the mechanism of Heat Transfer with Phase Change

UNIT – I

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

Conduction Heat Transfer: Fourier rate equation – General 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

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

UNIT – II

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

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

UNIT – III

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 – Integral Method as approximate method -Application of Von Karman Integral Momentum Equation for flat plate with different velocity profiles.

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

UNIT – IV

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.

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

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT - V

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

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.

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, 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. Heat and Mass Transfer – Dixit /Mc Graw Hill
2. Heat and Mass Transfer / Altamush Siddiqui/ Cengage

REFERENCE BOOKS:

1. Essential Heat Transfer - Christopher A Long / Pearson
2. Heat Transfer –Ghoshdastidar / Oxford

CAD & CAM

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME602PC **3 0 0 3**

PRE-REQUISITES: Design of Machine Elements and Production Technology

COURSE OBJECTIVES: The objectives of this course are to

a. Impart fundamental knowledge to students in the latest technological topics on Computer Aided Design and geometric modelling.
b. Discuss surface and solid modelling techniques.
c. provide guidance to students for NC Control Production Systems and programming.
d. Understand group technology, CAPP, and Computer aided manufacturing resource planning.
e. Study of FMS, Computer aided quality control and CIM

COURSE OUTCOMES: At the end of this course, student will be able to

a. Discuss the latest technological topics on Computer Aided Design and geometric modelling.
b. Explain the surface and solid modelling techniques.
c. Explore the NC Control Production Systems and programming.
d. Describe the group technology, CAPP, and Computer aided manufacturing resource planning.
e. Analyse the FMS, Computer aided quality control and CIM

UNIT – I

Fundamentals of CAD/ CAM, Application of computers for Design and Manufacturing, Benefits of CAD/ CAM - Computer peripherals for CAD/ CAM, Design workstation, Graphic terminal, CAD/ CAM software-definition of system software and application software, CAD/ CAM database and structure.

Geometric Modelling: Wire frame modelling, wire frame entities, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT - II

Surface Modelling: Algebraic and geometric form, Parametric space of surface, Blending functions, parameterization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.

Computer Aided Process Planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer Aided Manufacturing Resource Planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning

UNIT – V

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM Concepts and Applications / Alavala / PHI
2. CAD/CAM Principles and Applications / P. N. Rao / Mc Graw Hill

REFERENCE BOOKS:

1. CAD/CAM/ Groover M.P/ Pearson
2. CAD/CAM/CIM/ Radhakrishnan and Subramanian / New Age

FINITE ELEMENT METHODS

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME603PC **3 1 0 4**

PRE-REQUISITES: Mechanics of Solids

COURSE OBJECTIVE: The objectives of this course are to

a. Impart the basic knowledge in FEA.
b. Learn them in materials models for structural materials soils and interfaces/joints.
c. Mould them in modeling the various engineering systems and soils-structure interaction.
d. Explain them importance of interfaces and joints on the behavior of engineering systems.
e. Make them to aware about implementation of materials model in FEM and applications

COURSE OUTCOMES: At the end of this course, student will be able to

a. Understand the various FEA methods.
b. Analyze the trusses and beams under various loading using FEM.
c. Explain the modeling of various engineering systems.
d. Demonstrate the heat transfer analysis of engineering systems.
e. Implement the materials model in FEM and applications.

UNIT – I

Introduction to Finite Element Methods: General Procedure – Engineering Applications – Stress and Equilibrium, Strain–Displacement relations. Stress–strain relations: Finite Elements: 1-Dimensional, 2 – Dimensional, 3-Dimensional & Interpotation Elements

One Dimensional Problem: 1-D Linear and 1-D Quadratic Elements - Finite element modeling, Coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – II

Analysis of Trusses: Derivation of Stiffness Matrix for Plane Truss, Displacement of Stress Calculations.

Analysis of Beams: Element stiffness matrix for two nodes, two degrees of freedom per node beam element, Load Vector, Deflection.

UNIT – III

Finite element modeling of two-dimensional stress analysis with constant strain angles and treatment of boundary conditions, Estimation of Load Vector, Stresses

Finite element modeling of Axe-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four nodded Isoperimetric elements and numerical integration.

UNIT – IV

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two-dimensional analysis of thin plate.

UNIT – V

Dynamic Analysis: Formulation of finite element model, element – Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss and beam.

Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation. Techniques such as semi-automatic and fully Automatic use of software such as ANSYS, ABAQUS, NASTRAN using Hexahedral and Tetrahedral Elements.

TEXT BOOKS:

1. Finite Element Methods: Basic Concepts and applications/Alavala/PHI
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu/Pearson

REFERENCE BOOKS:

1. An Introduction to the Finite Element Method / J. N. Reddy/ Mc GrawHill
2. Finite Element Analysis / SS Bhavikatti / NewAge
3. Finite Element Method/ Dixit/Cengage

AUTOMOTIVE ENGINEERING
(Professional Elective- I)

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME601PE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES: The course objectives are to

a. Make the students to understand the Fuel System and C.I. Engines
b. Offer the knowledge in Cooling, Electrical and Ignition Systems
c. Calibration of Transmission and Suspension Systems
d. Analysis of Braking and Steering Systems
e. Learn them to understand the Emissions from of Automobiles and IC Engines

COURSE OUTCOME:

a. Understand the various vehicle classification and its layouts.
b. Demonstrate the different types of suspension systems.
c. Understand the functions of different types of clutches and brakes.
d. Explain the types of gear boxes and transmission systems.
e. Discuss the steering requirements and types of front axle.

UNIT - I

Introduction: Layout of automobile – introduction chassis and body components. Types of Automobile engines. – Power unit – Introduction to engine lubrication – engine servicing **Fuel System:** S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump –filters – carburetor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. Fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction to CRDI and TDI Systems.

UNIT - II

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

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser, and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

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.

UNIT - III

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, constant mesh, synchro mesh gear boxes, epicycle gear box, over drive torque converter. Propeller shaft – Hutch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and Tires.

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

UNIT - IV

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

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT - V

Emissions 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, Hydrogen as a fuel for IC Engines. - Their merits and demerits. Standard Vehicle maintenance practice.

TEXT BOOKS:

1. Automobile Engineering / William HCrouse
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

REFERENCE BOOKS:

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics /Heitner
3. Automotive Engineering / Newton Steeds &Garrett
4. Automotive Engines /Srinivasan
5. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International

RENEWABLE ENERGY SOURCES
(Professional Elective – I)

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME602PE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES:
a. To explain the concepts of Non-renewable and renewable energy systems
b. Outline utilization of renewable energy sources for both domestic and industrial applications
c. Analyze the environmental and cost economics of renewable energy sources in comparison with fossil fuels.
d. Calibration of Biogas and Biomass energy
e. Concept of Ocean Energy and Geothermal Energy

COURSE OUTCOMES:
a. Understanding of renewable energy sources
b. Knowledge of working principle of various energy systems
c. Capability to carry out basic design of renewable energy systems
d. Discuss the applications of Biogas and Biomass energy in the society
e. Explain the Concept of Ocean Energy and Geothermal Energy

UNIT-I
Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non- renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II
Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III
Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV
Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermos chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programmed in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

Small hydro Power Plant: Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

Geothermal Energy: Geothermal power plants, various types, hot springs and steam ejection.

TEXT BOOKS:

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.

REFERENCE BOOKS:

1. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi,2012
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

REFRIGERATION AND AIR CONDITIONING
(Professional Elective - I)

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME603PE **3 0 0 3**

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVES: The course objectives are to

a. Learn them Construction and operation of Air Refrigeration systems
b. Offer the knowledge of Construction and operation Vapor compression refrigeration
c. Understanding the function of System Components
d. Make them to understand the construction and operation of Vapor Absorption System and Steam Jet Refrigeration System
e. Expose them in design of Air Conditioning and Refrigeration systems

COURSE OUTCOMES: At the end of the course students are able to

a. Demonstrate the Construction and operation of Air Refrigeration systems
b. Discuss the Construction and operation Vapor compression refrigeration
c. Explain the function of System Components
d. Enumerate the construction and operation of Vapor Absorption System and Steam Jet Refrigeration System
e. Explain the design of Air Conditioning and Refrigeration systems

UNIT – I

Introduction to Refrigeration: - Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycle of refrigeration.

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts- Air systems – Application of Air Refrigeration, Justification – Types of systems –Problems.

UNIT – II

Vapor compression refrigeration– working principle and essential components of the plant– Simple Vapor 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–Problems.

UNIT - III

System Components: Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – classification – Working Principles. Evaporators – classification – Working Principles. Expansion devices – Types – Working Principles. Refrigerants – Desirable properties – common refrigerants used – Nomenclature – Ozone Depletion – Global Warming – Azeotropes and Zoetrope's.

UNIT – IV

Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system – Li – Br system. Principle of operation Three Fluid absorption system, salient features.

Steam Jet Refrigeration System – Working Principle and Basic Components Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hirsch tube.

UNIT – V

Introduction to Air Conditioning: Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers. Heat Pump – Heat sources – different heat pump circuits – Applications.

TEXT BOOKS:

1. Refrigeration and Air conditioning / CP Arora / Mc Graw Hill.
2. Refrigeration and Air-Conditioning / RC Aora /PHI.

POWER PLANT ENGINEERING
(Professional Elective – I)

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME604PE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES:

a. Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
b. A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
c. Awareness of the economic, environmental, and regulatory issues related to power generation.
d. Analysis of the performance of condensers and steam turbines
e. Evaluate the performance of gas turbines

COURSE OUTCOMES:

a. Understand the concept of Rankine cycle.
b. Understand working of boilers including water tube, fire tube and high pressure boilers and determine efficiencies.
c. Analyze the flow of steam through nozzles
d. Evaluate the performance of condensers and steam turbines
e. Evaluate the performance of gas turbines

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipment's, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

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.

UNIT – II

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.

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.

Direct Energy Conversion: Solar energy, Fuel cells, thermal electric and thermal ionic, MHD generation.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Poundage – classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

Power from Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.
Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V

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. Power Plant Engineering/ P. K. Nag / Mc Graw Hill
2. Power Plant Engineering / Hegde /Pearson.

REFERENCES BOOKS:

1. Power Plant Engineering / Gupta /PHI
2. Power Plant Engineering / A K Raja / Newage

MECHATRONICS
(Open Elective - I)

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME601OE **3 0 0 3**

PRE-REQUISITES: Basic Electronics Engineering

COURSE OBJECTIVES: The objectives of this course are to

a. Expand an ability to identify, formulate, and solve engineering problems
b. Develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
c. Enlarge an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
d. Extend and study the concept of programmable logic controller.
e. Increase and study the concept of programmable motion controller

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

a. Understand the ability to identify, formulate, and solve engineering problems
b. Appreciate the ability to design a system, component, or process to meet desired needs within realistic constraints.
c. Comprehend the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
d. Recognize the concept of programmable logic controller.
e. Realize the concept of programmable motion controller

UNIT – I

Introduction: Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

Signal Conditioning: Introduction – Hardware - Digital I/O, Analog input – ADC, resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass, high pass, notch filtering

UNIT – II

Precision Mechanical Systems: Modern CNC Machines – Design aspects in machine structures, guide ways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

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

UNIT – III

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.

Microcontrollers Overview: 8051 Microcontroller, microprocessor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming – Assembly, C (LED Blinking, Voltage measurement using ADC)

UNIT – IV

Programmable Logic Controllers: Basic Structure - Programming: Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT – V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analyzing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & 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 , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/Pearson.
2. Introduction to Mechatronics / Appukuttan/Oxford

REFERENCE BOOKS:

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. “Designing Intelligent Machines”. Open University, London.

ADDITIVE MANUFACTURING
(Open Elective - I)

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME602OE **3 0 0 3**

PRE-REQUISITES: Production Technology

COURSE OBJECTIVES:

a. To understand the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.
b. To classify various types of Additive Manufacturing Processes and know their working principle, advantages, limitations etc.
c. To have a holistic view of various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.
d. Explain and summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
e. Explain and summarize typical rapid tooling processes for quick batch production of plastic and metal parts

COURSE OUTCOMES:

a. Describe various CAD issues for 3D printing and rapid prototyping and related operations for STL model manipulation.
b. Formulate and solve typical problems on reverse engineering for surface reconstruction from physical prototype models through digitizing and spline-based surface fitting.
c. Formulate and solve typical problems on reverse engineering for surface reconstruction from digitized mesh models through topological modelling and subdivision surface fitting.
d. Discuss the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
e. Explore the typical rapid tooling processes for quick batch production of plastic and metal parts.

UNIT - I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages, and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

UNIT - II

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid

Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT - III

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Kelton process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using3DP

UNIT - IV

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL files Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid

Prototyping Software's: Features of various RP software's like Magic's, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT - V

RP Applications: Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

TEXT BOOKS:

1. Rapid prototyping; Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific Publications
2. Rapid Manufacturing /D.T. Pham and S.S.Dimov/Springer

REFERENCE BOOKS:

1. Terry Wohlers, Wholers Report 2000, Wohlers Associates Rapid Prototyping and Manufacturing/Paul F.Jacobs/ASME

HEAT TRANSFER LAB

III-B.Tech (II Semester) **L T P C**

Course Code: A1ME604PC **0 0 3 1.5**

PRE-REQUISITES: Thermal Engineering Lab

COURSE OBJECTIVES: The objectives of this course are to

a. Understand the various steady state conduction experiments to estimate thermal conductivity of different materials.
b. Analyse Perform transient heat conduction experiment
c. Discuss the heat transfer coefficients in forced convection, free convection, condensation and correlate with theoretical values
d. Study of temperature along the length of the pin fin under forced and free convection
e. Analyse the radiation experiments: Determine surface emissivity of a test plate and Stefan-Boltzmann's constant and compare with theoretical value

COURSE OUTCOMES: At the end of the lab sessions, the student will be able to

a. Perform steady state conduction experiments to estimate thermal conductivity of different materials
b. Perform transient heat conduction experiment
c. Estimate heat transfer coefficients in forced convection, free convection, condensation and correlate with theoretical values
d. Observe the variation of temperature along the length of the pin fin under forced and free convection
e. Determine surface emissivity of a test plate and Stefan- Boltzmann's constant and compare with theoretical value

Minimum twelve experiments from the following:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction 7. Heat transfer in forced convection apparatus.
7. Heat transfer in natural convection 9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

CAD/ CAM AND SIMULATION LAB

III-B.Tech (II Semester) **L T P C**
Course Code: A1ME605PC **0 0 2 1**

PRE-REQUISITES: Engineering Graphics, Machine drawing.

COURSE OBJECTIVES: The objectives of this course are to

a. Develop Auto LISP programs for drawing machine elements.
b. Develop codes for analytical and synthetic curves.
c. Draw machine elements in sketcher, part and assembly modes.
d. Generate automated tool paths and G-codes for machining components.
e. Validate DXF, IGES and STEP formats for exchange of CAD files

COURSE OUTCOMES: At the end of the lab sessions, the student will be able to

a. Model the various machine components using Auto CAD, Pro-E and Idea etc.
b. Explain the codes for analytical and synthetic curves.
c. Draw the machine elements in sketcher, part and assembly modes.
d. Generate automated tool paths and G-codes for machining components.
e. Validate DXF, IGES and STEP formats for exchange of CAD files

Note: conduct any TEN exercises from the list given below:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modelling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modelling and Assembly Modelling. Study of various standard Translators. Design of simple components.
3. Development of process sheets for various components based on Tooling and Machines.
4. Development of manufacturing defects and tool management systems.
5. Study of various post processors used in NC Machines.
6. Development of NC code for free form and sculptured surfaces using CAM software.
7. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.

Simulation lab

2. Bars of constant cross section area, tapered cross section area and stepped bar, Multipoint Constraints, Temperature Stresses in 1D Bars
3. Trusses
4. Beams – Simply supported, cantilever beams with UDL, beams with varying load etc
5. Stress analysis of a rectangular plate with a circular hole subjected to both axial and bending
6. Thermal Analysis – 2D problem with conduction and convection Boundary conditions.

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

III-B.Tech (II Semester) **L T P C**
Course Code: A1EN606HS **0 0 2 1**

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context. The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

COURSE OBJECTIVES:

1. To provide students with a wide range of vocabulary to enable them to take language tests for higher education and employment
2. To assist students acquire effective and adequate presentation skills
3. To improve communication skills of students by making them participate in different language activities
4. To prepare students for facing interviews self-assuredly.
5. To help students to develop an awareness in studies about the significance of silent reading and comprehension.

COURSE OUTCOMES: Students will be able to

1. State meanings, synonyms, antonyms, analogies, idioms, phrases, one-word substitutes, word roots, prefixes and suffixes for words in general.
2. Present and interpret data on select topics using pre-existing slides.
3. Collect data extensively on a social issue and make it public for the sake of enlightening populace.
4. Contribute proactively and extrapolate in group discussions.
5. Make impromptu speeches.

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary -** Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.

3. **Activities on Writing Skills** – Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing.

4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc.

5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2 nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCE BOOKS:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008. 6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
6. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
7. Job Hunting by Colm Downes, Cambridge University Press 2008.
8. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

COMPREHENSIVE VIVA VOCE

III-B.Tech (II Semester) **L T P C**

Course Code: A1ME607PW **0 0 0 1**

PRE-REQUISITES: Mechanical Engineering Subjects

COURSE OBJECTIVES:

The objective of the comprehension exam is to attain an understanding of the concepts of simultaneous manufacturing systems including materials, fabrication process, product and process control, manufacturing with computer and quality management.

1. The students work in groups and solve different types of problems/ activities given to them.
2. The activities given to the students should be real time like problems in industries chosen by a team of faculty members of the concerned department.
3. A minimum of three small problems have to be solved by each group of students
4. The evaluation is based on continuous assessment by group of faculty members constituted by the professor in-charge of the course.

COURSE OUTCOMES: Recall, recognize, visualize, illustrate, demonstrate, criticize and appraise the aspects of mechanical engineering systems and the interaction among them.

EXAMINATION: Every student will be required to undergo comprehensive viva- voce at the end of II semester of B.Tech Programme. The duration of the viva will range from 15-30 min. The examination committee will be constituted by the HoD and consist of at least three faculty.

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

III-B.Tech I(I Semester) **L T P C**
Course Code: A1ME607MC **2 0 0 0**

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

a. The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature
b. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
c. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system
d. To Know Indian Languages and Literature and the fine arts in India
e. To explore the Science and Scientists of Medieval and Modern India

COURSE OUTCOMES: At the end of the Course, Student will be able to:

a. Identify the concept of Traditional knowledge and its importance.
b. Explain the need and importance of protecting traditional knowledge.
c. Illustrate the various enactments related to the protection of traditional knowledge.
d. Interpret the concepts of Intellectual property to protect the traditional knowledge.
e. Explain the importance of Traditional knowledge in Agriculture and Medicine.

UNIT I

Introduction to traditional knowledge and basic structure of Indian Knowledge System: Features of Indian Traditions: Nature and Characteristics of traditional knowledge-scope and importance-kinds of traditional knowledge-traditional knowledge Vs western knowledge.

UNIT II

Philosophical Tradition and Protection of traditional knowledge: Significance of traditional knowledge protection-value of traditional knowledge in global economy-role of government to harness traditional knowledge –Various Acts regarding protection of Traditional Knowledge

UNIT III

Modern Science and Indian Knowledge System: Historical Background- the global problem today- Indian contributions to global science

UNIT IV

Yoga and Holistic Health care: Science and Spirituality in India- the need for both outer and inner sciences-yogic science

UNIT V

Indian Artistic Tradition: Visual arts and culture- the journey of Indian art from traditional to modern era
Case studies: Conduct Field Work- Collect Data- Conducting Projects-Writing Project Report.

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

REFERENCE BOOKS:

1. Sengupta, Nirmal. Traditional Knowledge in Modern India: Preservation,Promotion, Ethical Access and Benefit Sharing Mechanisms, Springer, London.2018. Print.
2. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, BharatiyaVidyaBhavan, Mumbai. 5th Edition, 2014
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
4. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, InternationalChinmayFoundation, Velliarnad, Ernakulam
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya,VidyanidhiPrakashan, Delhi 2016

IV-YEAR (I-SEMESTER)

COMPOSITE MATERIALS

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME701PC **3 1 0 4**

COURSE OBJECTIVES: The objectives of this course are to

a. Offer knowledge in types of composite, their constituents and applications
b. Impart knowledge in metal matrix composites, selection of constituents and different method of preparation
c. Make them to understand the Micro Mechanical Analysis of a Lamina
d. Learn them in Micro Mechanical Analysis of a Lamina
e. Explore the unconventional composites and their real time applications

COURSE OUTCOMES: Upon completion of this **course** the student will be able to:

a. Discuss the different types of composite, their constituents and applications
b. Enumerate the metal matrix composites, selection of constituents and different method of
c. preparation
d. Explain the Micro Mechanical Analysis of a Lamina
e. Understand the Micro Mechanical Analysis of a Lamina
f. Explore the unconventional composites and their real time applications

UNIT I

Introduction: Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Inter phases, Distribution of constituents, Characteristics and selection of Fiber Composites, laminated composites, Particulate composites, sandwich construction.

UNIT II

Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites, Spray processes - Osprey Process, Rapid solidification processing, Dispersion Processes - Stir-casting & Compo casting, Screw extrusion, Liquid- metal impregnation technique - Squeeze casting, Pressure infiltration, Lanxide process.

UNIT III

Micro Mechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Numerical problems, Assumption and limitations of micromechanical analysis, Mechanical properties, Transverse stresses, Hygeral and thermal stresses.

UNIT IV

Macro Mechanics of a Lamina: Introduction, Hooke's law for different types of materials, Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Micromechanical Analysis of Laminates- laminate codes, Classical lamination theory, stress and strain in laminate, hydrothermal stresses and strains

UNIT V

Non-conventional composites: Nano composites, Polymer clay nano composites, self-healing composites, Self-reinforced composites, bio composites, hybrid composites.

Applications: - Automobile, Aircrafts. Missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

TEXT BOOKS:

1. RoberM.Jones “Mechanics of composite Materials” McGraw Hill Kogakusha Ltd.
2. P.C.Mallik, “Fibre reinforced composites” Marcel Decker

REFERENCE BOOK:

1. Michael W,Hyer “ Stress analysis of fibre Reinforced composite materials”, McGraw Hill International
Krishnan K Chawla, “Composite material science and Engineering”, Springer

INSTRUMENTATION AND CONTROL SYSTEM

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME702PC **3 1 0 4**

PREREQUISITE: Mathematics-I, Basic of Electrical and Electronics Engineering.

COURSE OBJECTIVES: The objectives of this course are to

a. Offer the knowledge in basic principles of measurements and various transducers to measure displacement
b. Explore the measurement of temperature and low pressure using various measuring instruments
c. Make them to understand the Measurement of Level, speed and acceleration by different instruments
d. Discussing in strain and humidity measurements by instruments
e. Lean them in Elements of Control Systems

COURSE OUTCOMES: Upon completion of this **course** the student will be able to:

a. Explain the in basic principles of measurements and various transducers to measure displacement
b. Demonstrate the measurement of temperature and low pressure using various measuring instruments
c. Explore the Measurement of Level, speed and acceleration by different instruments
d. Understand the measurement of strain and humidity
e. Explain the Elements of Control Systems

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics– sources of errors, Classification and elimination of errors.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers; Calibration procedures.

UNIT – II

Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple,

RTD; Radiation Pyrometry: Optical Pyrometer; Changes in Chemical Phase: Fusible Indicators and Liquid crystals. Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, McLeod pressure gauge.

UNIT – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type Stroboscope; Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV

Stress-Strain measurements: Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems

TEXT BOOKS:

1. Principles of Industrial Instrumentation & Control Systems, - Alavala, - Cengage Learning
2. Basic Principles – Measurements (Instrumentation) & Control Systems – S. Bhaskar – Anuradha Publications.

REFERENCE BOOKS:

1. Measurement Systems: Applications & design, E. O. Doebelin, TMH
2. Instrumentation, Measurement & Analysis, B.C. Nakra& K.K. Choudhary, TMH
3. Experimental Methods for Engineers / Holman
4. Mechanical and Industrial Measurements / R. K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age International.

CNC TECHNOLOGY
(Professional Elective - II)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME705PE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES:

a. To understand the fundamental of numerical control systems
b. To understand the NC programming.
c. To understand the NC programming on CAD/CAM.
d. To understand the DNC system and its application.
e. To gain the knowledge on micro-controller.

COURSE OUTCOMES:

a. Be able to relate the fundamental of numerical control systems.
b. Be able to use NC programming.
c. Be able to use the NC programming on CAD/CAM.
d. Be able to relate the DNC system and its application.
e. Be able to impart the knowledge on micro-controller.

UNIT - I

Features of NC machines: fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, features of NC Machine tools, design consideration of NC machine tool, methods of improving machine accuracy. CNC Machine elements: machine structures - Guide ways - feed drives-spindles- spindle bearings-measuring systems- tool mentoring systems.

UNIT - II

Tooling for CNC machines: interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, and quick change tooling system, automatic head changers.
NC part programming: manual programming-Basic concepts, point to point contour programming, canned cycles, parametric programming.

UNIT - III

Computer-Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors. Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT - IV

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 processes like turning, grinding.

UNIT - V

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

TEXT BOOKS:

1. Computer Control of Manufacturing Systems/ Yoram Koren/ Mc Graw Hill
2. CNC Programming: Principles and Applications /Mattson/ Cengage

REFERENCE BOOKS:

1. Machining Tools Hand Book Vol 3/ Manfred Weck , John Wiley Mechatronics-HMT/ Mc Graw Hill .
2. Machining and CNC Technology / Michael Fitzpatrick / Mc Graw Hill.

AUTOMATION IN MANUFACTURING
(Professional Elective - II)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME706PE **3 0 0 3**

PRE-REQUISITES: Production and Mechatronics Engineering

COURSE OBJECTIVES:

a. To understand the strategies and automation
b. Concept of Automated flow lines and Analysis of Automated flow lines
c. Calibration of Assembly system and line balancing and Analysis of Automated flow lines
d. To understanding the Adaptive control systems
e. Given a range of Business process Re-engineering

COURSE OUTCOME:

a. Design and implement automated systems using pneumatics.
b. Provide hydraulic solutions for designing automated systems.
c. Devise Assembly automated systems using feeders, orienteer and escapement devices
d. Design and implement electro-pneumatic/hydraulic solutions for automated systems.
e. Apply PLC programming and implement it on PLC kits.

UNIT – I

Introduction Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automaton.

UNIT – II

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.

UNIT – III

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.

UNIT - IV

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.

UNIT – V

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. /Pearson
2. Computer control of Manufacturing Systems by Yoram Coreom / Mc Graw Hill

REFERENCE BOOKS:

1. CAD / CAM/ CIM / Radhakrishnan / NewAge
2. Advanced Manufacturing Technology/ K Vara Prasada Rao / Kanna Publications

INDUSTRIAL ROBOTICS
(Professional Elective - II)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME707PE **3 0 0 3**

PRE-REQUISITES: Kinematics of Machinery

COURSE OBJECTIVES:
a. Make the students acquainted with the theoretical aspects of Robotics
b. Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
c. Make the students to understand the importance of robots in various fields of engineering.
d. Expose the students to various robots and their operational details.
e. To integrate Robot Application in Manufacturing

COURSE OUTCOMES:
a. To understand the Components of the Industrial Robotics.
b. To analyze Motion and Manipulator Kinematics.
c. To develop Differential transformation and Trajectory planning.
d. To study Robot actuators and Feedback components:
e. To integrate Robot Application in Manufacturing.

UNIT – I
Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications.
Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT – II
Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.
Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT – III
Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.
Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line emotion.

UNIT IV
Robot actuators and Feedback components:
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT V

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. Industrial Robotics / Groover M P /Mc GrawHill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan /Pearson

REFERENCE BOOKS:

1. Robot Dynamics and Controls / Spony and Vidyasagar / JohnWiley
2. Robot Analysis and control / Asada ,Slotine / WileyInter-Science

FLEXIBLE MANUFACTURING SYSTEMS
(Professional Elective – II)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME708PE **3 0 0 3**

PRE-REQUISITES: Computer aided Manufacturing

COURSE OBJECTIVES: The course objectives are to make the students to understand the

a. Concepts of flexible manufacturing systems
b. Utilization of software to simulate the flexible manufacturing systems
c. Flexible manufacturing systems and their significance in the field of manufacturing.
d. Characteristics ofFlexible manufacturing systems
e. Preventive maintenance ofFlexible manufacturing systems

COURSE OUTCOMES:

a. Understanding of FMS and applications
b. Comprehend the working principle of flexible manufacturing systems
c. Understanding of Preventive maintenance and Artificial intelligence in design of FMS
d. Discuss the Characteristics of FMS
e. Enumerate the Preventive maintenance of FMS

UNIT- I

Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS. Knowledge based scheduling. The Development of Manufacturing systems. Pallets, Fixtures and Machines, work handling system layouts.

UNIT – II

Hierarchy of computer control. Supervisory computer. System Management, Tool Management, Simulation and Analysis in the Design of FMS.

UNIT – III

Software for simulation and database of FMS. Specification and selection, trends, application of simulation software. Simulation Modelling for FMS.

UNIT – IV

Manufacturing data systems data flow, CAD/CAM considerations. Planning FMS database, just in time characteristics, Pull method, quality small lot sizes, work station loads, close supplier ties, flexible workforce — line flow strategy. Simulation for FMS Design.

UNIT – V

Preventive maintenance. Kanban system, implementation issues. Economic justification of FMS; Artificial Intelligence in the Design of FMS

REFERENCE BOOKS:

1. Joseph Talavage, Roger G. Hannam“ Flexible Manufacturing systems in Practice (Applications, Design and simulation)” CRC Press
2. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.
3. Production System l3eyond Large Scale Production/ Talichi Ohno/ Toyota Productivity Press India Pvt. Lid.
4. Flexible Manufacturing Systems/ H K Shivanand/New Age International/2006
5. S.R.Deb “Robotics Technology and Flexible Automation” McGraw-Hill.

INDUSTRIAL ENGINEERING
(Professional Elective III)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME709PE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES:

a. To impart capability of successfully planning, controlling, and implementing projects.
b. Understand and apply the principles of math's, science, technology and engineering, involving industry relevant problems.
c. Contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective Computational approaches and systems thinking methodologies.
d. Maintain high standards of professional and ethical responsibility.
e. Flourish and work effectively in diverse, multicultural environments emphasizing the application of Teamwork and communication skills.
f. Practice life-long learning to sustain technical currency and excellence throughout one's career.

COURSE OUTCOMES:

a. Ability to apply mathematics and science in Industrial engineering.
b. Ability to design and conduct experiments, as well as to analyze and interpret data
c. Ability to identify, formulate, and solve engineering problems
d. Ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice
e. Ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment, and people.

UNIT-I INTRODUCTION HISTORY & DEVELOPMENT OF INDUSTRIAL ENGINEERING:

Productivity definition; means of increasing productivity; work study definition; productivity and work study; work of F.W. Taylor; Frank and Lillian Gilbert and their contribution, Productivity measures and its models, productivity index & productivity cycle.

UNIT-II METHOD STUDY:

Definition & basic procedure, selection of jobs, recording technique; micro motion, study; Their brigs; cyclograph and Chrono cycle-graph; principle of motion economy: design of work place layout; analysis in the form of chart; operation chart; flow process chart; flow diagram; string diagram; man machine chart; two hand chart; Simo chart.

UNIT-III WORK MEASUREMENT:

Definition, objectives, application, number of cycle to be timed, time study equipment, performance rating; allowances; number of cycle to be studied; determination of standard time; determined motion time systems. Conducting work sampling study and establishing standard time.

UNIT-IV WAGES & INCENTIVES:

Characteristics of a good wage or incentive system, method of wage payment. Concept of wage incentive schemes; financial and non-financial; Taylor differential piece rate, Halsey premium plane; Merico's multiple piece rate system. Ergonomics, work space dimension, design of work place, environmental stresses & impacts on human work.

UNIT-V VALUE ENGINEERING:

Concept of VA, VE, VE team, job plan value test, P.L.C. of product, FOST Techniques. Factory legislation: Various Act related to factory, minimum wage out, ESI Act, health provision Act, Safety act.

TEXT BOOKS:

1. M.I Khan, Industrial Engineering, New Age Publication
2. M. Telsang, Industrial Engineering and Production Management, S.Chand

REFERENCE BOOKS:

1. ILO, Bobbay, Introduction to work study, Universal Publishing Corporation
2. Mundel, Motion and time study, Prentices Hall India
3. Ralph M. Barnes, Motion and Time Study, John Wiley and sons

OPERATIONS RESEARCH
(Professional Elective – III)

IV-B.Tech (I Semester) | **L T P C**
Course Code: A1ME710PE | **3 0 0 3**

PRE-REQUISITES: Engineering Mathematics

COURSE OBJECTIVES: The course objectives are to make the students to understand the

a. Characteristics and Phases and Allocation
b. Transportation and Assignment Problems
c. Sequencing and Replacement
d. Theory of Games and Inventory
e. Waiting Lines and Dynamic Programming

COURSE OUTCOMES: The students are able to

a. Explain the Characteristics and Phases and Allocation
b. Identify the Transportation and Assignment Problems
c. Analyze the Sequencing and Replacement
d. Demonstrate the Calibration of Theory of Games and Inventory
e. Understand the Waiting Lines and Dynamic Programming

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT – III

Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines-graphical model.

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.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

Inventory: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost

UNIT – V

Waiting Lines: Introduction–Terminology-Single Channel–Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

Dynamic Programming: Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

TEXT BOOKS:

1. Operations Research / N.V.S. Raju /SMS
2. Operations Research / ACS Kumar / YesDee

REFERENCE BOOKS:

1. Operations Research /J. K. Sharma /MacMilan.
2. Operations Research /A. M. Natarajan, P. Balasub

TOTAL QUALITY MANAGEMENT
(Professional Elective - III)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME711PE **3 0 0 3**

PRE-REQUISITES: Industrial Engineering

COURSE OBJECTIVES: The course objectives are to

a. Study the Management of Process Quality.
b. Develop Customer focus and satisfaction and bench marking.
c. Make the students to understand the Integrate TQM.
d. Learn them to identified Cost of Quality management.
e. Infer the ISO9000: Universal Standards of Quality.

COURSE OUTCOMES:

a. Study Management of Process Quality.
b. Develop Customer Focus and Satisfaction and Bench Marking.
c. Integrate the Total Quality Management in the Industries
d. Identify the cost of Quality management**.**
e. Understand the ISO 9000 Documentation and services and the cost of certification implementing the system

UNIT – I

Introduction: The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems.
Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.
Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, pareto diagram, Kepner & Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third-party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOK:

1. Total Quality Management / Joel E. Ross/Taylor and Francis Limited
2. Total Quality Management/P. N.Mukherjee/PHI

REFERENCE BOOKS:

1. Beyond TQM / Robert Flood
2. Statistical Quality Control / E.L.Grant.
3. Total Quality Management: A Practical Approach/H.Lal
4. Quality Management/Kanishka Bedi/Oxford University Press/2011
5. Total Engineering Quality Management/SunilSharma/Macmillan

PRODUCT LIFE CYCLE
(Professional Elective III)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME712PE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES: The objectives of this course are to

a. Understand history, concepts and terminology of PLM
b. Analysis of functions and features of PLM/PDM
c. Comprehend the different modules offered in commercial PLM/PDM tools
d. Analysis of PLM/PDM implementation approaches
e. Understand integration of PLM/PDM with other applications

COURSE OUTCOMES:

a Demonstrate the history, concepts and terminology of PLM
b Analysis of functions and features of PLM/PDM
c Comprehend the different modules offered in commercial PLM/PDM tools
d Discuss the PLM/PDM implementation approaches
e Enumerate the integration of PLM/PDM with other applications

UNIT I

History, Concepts and Terminology of PLM : Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (CPDM), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM).PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.

UNIT II

PLM/PDM Functions and Features: User Functions –Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions – Communication and Notification, data transport, data translation, image services, system administration and application integration.

UNIT III

Details of Modules in PDM/PLM Software: Case studies based on top few commercial PLM/PDM tools

UNIT IV

Role of PLM in Industries: Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organisation, users, product or service, process performance.

UNIT V

Basics on Customisation/Integration of PDM/PLM Software: PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP

TEXT BOOKS:

1. Antti Saaksvuori and AnselmiImmonen, “Product Lifecycle Management”, Springer Publisher, 2008 (3rd Edition).
2. John Stark, “Product Lifecycle Management: 21st Century Paradigm for Product Realisation”, Springer Publisher, 2011 (2nd Edition).
3. Michael Grieves, “Product Life Cycle Management”, Tata McGraw Hill, 2006.

REFERENCE BOOKS:

1. International Journal of Product Lifecycle Management, Inderscience Publishers
2. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House Publishers, 2003.
3. John Stark, “Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question”, Springer Publisher, 2007.

COMPOSITE MATERIALS
(Open Elective – II)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME703OE **3 0 0 3**

COURSE OBJECTIVES: The objectives of this course are to

a. Offer knowledge in types of composite, their constituents and applications
b. Impart knowledge in metal matrix composites, selection of constituents and different method of preparation
c. Make them to understand the Micro Mechanical Analysis of a Lamina
d. Learn them in Micro Mechanical Analysis of a Lamina
e. Explore the unconventional composites and their real time applications

COURSE OUTCOMES: Upon completion of this **course** the student will be able to:

a. Discuss the different types of composite, their constituents and applications
b. Enumerate the metal matrix composites, selection of constituents and different method of
c. preparation
d. Explain the Micro Mechanical Analysis of a Lamina
e. Understand the Micro Mechanical Analysis of a Lamina
f. Explore the unconventional composites and their real time applications

UNIT I

Introduction: Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Inter phases, Distribution of constituents, Characteristics and selection of Fiber Composites, laminated composites, Particulate composites, sandwich construction.

UNIT II

Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites, Spray processes - Osprey Process, Rapid solidification processing, Dispersion Processes - Stir-casting & Compo casting, Screw extrusion, Liquid- metal impregnation technique - Squeeze casting, Pressure infiltration, Lanxide process.

UNIT III

Micro Mechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Numerical problems, Assumption and limitations of micromechanical analysis, Mechanical properties, Transverse stresses, Hygeral and thermal stresses.

UNIT IV

Macro Mechanics of a Lamina: Introduction, Hooke's law for different types of materials, Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Micromechanical Analysis of Laminates- laminate codes, Classical lamination theory, stress and strain in laminate, hydrothermal stresses and strains

UNIT V

Non-conventional composites: Nano composites, Polymer clay nano composites, self-healing composites, Self-reinforced composites, bio composites, hybrid composites.

Applications: - Automobile, Aircrafts. Missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

TEXT BOOKS:

1. RoberM.Jones “Mechanics of composite Materials” McGraw Hill Kogakusha Ltd.
2. Michael W,Hyer “ Stress analysis of fibre Reinforced composite materials”, McGraw Hill International Krishnan K Chawla, “Composite material science and Engineering”, Springer
3. P.C.Mallik, “Fibre reinforced composites” Marcel Decker

INDUSTRIAL ROBOTICS
(Open Elective – II)

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME704OE **3 0 0 3**

PRE-REQUISITES: Kinematics of Machinery

COURSE OBJECTIVES:

a. Make the students acquainted with the theoretical aspects of Robotics
b. Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
c. Make the students to understand the importance of robots in various fields of engineering.
d. Expose the students to various robots and their operational details.
e. To integrate Robot Application in Manufacturing

COURSE OUTCOMES:

a. To understand the Components of the Industrial Robotics.
b. To analyze Motion and Manipulator Kinematics.
c. To develop Differential transformation and Trajectory planning.
d. To study Robot actuators and Feedback components:
e. To integrate Robot Application in Manufacturing.

UNIT – I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications.

Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT – II

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT – III

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line emotion.

UNIT IV

Robot actuators and Feedback components:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT V

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. Industrial Robotics / Groover M P /Mc GrawHill
2. Introduction to Industrial Robotics / Ramachandran Nagarajan /Pearson

REFERENCE BOOKS:

1. Robot Dynamics and Controls / Spony and Vidyasagar / JohnWiley
2. Robot Analysis and control / Asada ,Slotine / WileyInter-Science

INSTRUMENTATION AND CONTROL SYSTEMS LAB

IV-B.Tech (I Semester) **L T P C**
Course Code: A1ME703PC **0 0 4 2**

PRE-REQUISITES: Basic principles of Instrumentation and control systems

COURSE OBJECTIVES: The objectives of this course are to

a. Impart knowledge in calibration by primary standard and secondary standard
b. Offer training in Characterize and calibrate measuring devices
c. Equip them to Identify and analyse errors in measurements
d. Explore the measured data using regression analysis
e. Demonstrate the Measurement and control of Pressure, flow, temperature and level using SCAD systems

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

a. Impart knowledge in calibration by primary standard and secondary standard
b. Characterize and calibrate measuring devices.
c. Identify and analyze errors in measurement.
d. Analyze measured data using regression analysis.
e. Measure and control of Pressure, flow, temperature and level using SCAD systems

LIST OF EXPERIMENTS:

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 rotameter for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.
12. Measurement and control of Pressure of aprocess using SCADA system.
13. Measurement and control of level in a tank using capacitive transducer with SCADA.
14. Measurementandcontroloftemperatureofaprocessusingresistancetemperaturedetector with SCADA.
15. Measurement and control of flow of a process using SCADA systems.

IV-YEAR (II-SEMESTER)

ADDITIVE MANUFACTURING
(Professional Elective – IV)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME813PE **3 0 0 3**

PRE-REQUISITES: Production Technology

COURSE OBJECTIVES:

f. To understand the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.
g. To classify various types of Additive Manufacturing Processes and know their working principle, advantages, limitations etc.
h. To have a holistic view of various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.
i. Explain and summarize the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
j. Explain and summarize typical rapid tooling processes for quick batch production of plastic and metal parts

COURSE OUTCOMES:

f. Describe various CAD issues for 3D printing and rapid prototyping and related operations for STL model manipulation.
g. Formulate and solve typical problems on reverse engineering for surface reconstruction from physical prototype models through digitizing and spline-based surface fitting.
h. Formulate and solve typical problems on reverse engineering for surface reconstruction from digitized mesh models through topological modelling and subdivision surface fitting.
i. Discuss the principles and key characteristics of additive manufacturing technologies and commonly used 3D printing and additive manufacturing systems.
j. Explore the typical rapid tooling processes for quick batch production of plastic and metal parts.

UNIT - I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages, and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

UNIT - II

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies Solid-based Rapid

Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT - III

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Kelton process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using3DP

UNIT - IV

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL files Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid

Prototyping Software's: Features of various RP software's like Magic's, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT - V

RP Applications: Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

TEXT BOOKS:

3. Rapid prototyping; Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific Publications
4. Rapid Manufacturing /D.T. Pham and S.S.Dimov/Springer

REFERENCE BOOKS:

1. Terry Wohlers, Wholers Report 2000, Wohlers Associates Rapid Prototyping and Manufacturing/Paul F.Jacobs/ASME

UNCONVENTIONAL MACHINING PROCESSES
(Professional Elective - IV)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME814PE **3 0 0 3**

PRE-REQUISITES: Production technology, Engineering Chemistry & Modern Physics

COURSE OBJECTIVES:

a. To teach the modeling technique for machining processes
b. To teach interpretation of data for process selection
c. Teach the mechanics and thermal issues associated with chip formation
d. To teach the effects of tool geometry on machining force components and surface finish
e. Teach the machining surface finish and material removal rate

COURSE OUTCOMES:

a. Understand the basic techniques of machining processes modeling
b. Understand the mechanical aspects of orthogonal cutting mechanics
c. Understand the thermal aspects of orthogonal cutting mechanics
d. Ability to extend, through modeling techniques, the single point, multiple point and abrasive machining processes
e. Estimate the material removal rate and cutting force, in an industrially useful manner, for practical machining processes.

UNIT – I

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.

UNIT - II

Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machine: Basic principles, equipment's, process variables, and mechanics of metal removal, MRR, application and limitations.
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. Fundamentals of chemical, machining, advantages and applications.

UNIT - III

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, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – IV

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.

UNIT - V

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining – principle - mask ants - applications.

Magnetic abrasive finishing, Abrasive flow finishes, Electro stream drilling, shaped tube electrolyte machining.

TEXT BOOKS:

1. Advanced Machining Processes / VK Jain / Allied publishers
2. Modern Machining Processes - P. C. Pandey, H. S.Shan

REFERENCE BOOKS:

1. Manufacturing Engineering And Technology By Serope Kalpak jain, Pearson Publications.2001
2. Manufacturing Engineering & Technology, Kalpakjain
3. Unconventional Manufacturing Processes, Singh M.K

PRODUCT DESIGN AND PROCESS PLANNING
(Professional Elective - IV)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME815PE **3 0 0 3**

PRE-REQUISITES: Machine Design

COURSE OBJECTIVES:
a. Design and Development Process, as a means to manage the development of an idea from concept through to production.
b. Research and analysis methodologies as it pertains to the product design process, meaning, and user experience.
c. Research and analysis methodologies as it pertains to the product design process, meaning, and user experience.
d. Demonstrate and employ hand drawing and drafting principles to convey concepts.
e. Fabrication methods to build prototype models for hard-goods and soft-goods and packaging.
f. Apply, explain, and recognize basic engineering, mechanical, and technical principles.

COURSE OUTCOMES:
a. Use the Product Design and Development Process, as a means to manage the development of an idea from concept through to production.
b. Employ research and analysis methodologies as it pertains to the product design process, meaning, and user experience.
c. Apply creative process techniques in synthesizing information, problem-solving and critical thinking.
d. Demonstrate and employ hand drawing and drafting principles to convey concepts.
e. Use basic fabrication methods to build prototype models for hard-goods and soft-goods and packaging.
f. Demonstrate, apply, explain, and recognize basic engineering, mechanical, and technical principles.
g. Demonstrate, apply, explain, and recognize basic family of materials used in soft-goods and hard-goods, including sustainable materials and manufacturing processes.

UNIT-I
Product design and process design functions, selection of a right product, essential factors of product design, Morphology of design, sources of new ideas for products, evaluation of new product ideas. Product innovation procedure-Flow chart. Qualifications of product design Engineer. Criteria for success/failure of a product. Value of appearance, colors and Laws of appearance.

UNIT-II
Product reliability, Mortality Curve, Reliability systems, Manufacturing reliability and quality control. Patents: Definitions, classes of patents, applying for patents. Trademarks and copyrights. Cost and quality sensitivity of products, Elements of cost of a product, costing methods, cost reduction and cost control activities. Economic analysis, Break even analysis Charts. Value engineering in product design, creativity aspects and techniques. Procedures of value analysis – cost reduction, material and process selection.

UNIT-III
Various manufacturing processes, degree of accuracy and finish obtainable, process capability studies. Methods of improving tolerances. Basic product design rules for Casting, Forging, Machining, Sheet metal and Welding. Physical properties of engineering materials and their importance on products. Selection of plastics, rubber and ceramics for product design.

UNIT-IV

Industrial Ergonomics: Man-machine considerations, ease of maintenance. Ergonomic considerations in product design-Anthropometry, Design of controls, man-machine information exchange. Process sheet detail and their importance, advanced techniques for higher productivity. Just-in-time and Kanban System. Modern approaches to product design; quality function development, Rapid prototyping.

UNIT-V

Role of computer in product design and management of manufacturing, creation of manufacturing data base, Computer Integrated Manufacturing, communication network, production flow analysis, Group Technology, Computer Aided product design and process
Planning. Integrating product design, manufacture and production control.

TEXT BOOK:

1. Niebel, B.W., and Draper, A.B., Product Design and Process Engineering, Mc Graw Hill – Kogalkusha Ltd., Tokyo, 1974.

REFERENCE BOOK:

1. Niebel, B.W., and Draper, A.B., Product Design and Process Engineering, Mc Graw Hill – Kogalkusha Ltd., Tokyo, 1974.

DESIGN FOR MANUFACTURING
(Professional Elective - IV)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME816PE **3 0 0 3**

PRE-REQUISITES: Machine design

COURSE OBJECTIVES: The course objectives are to

a. Make them to Identify the Major Phases of Design
b. Impart knowledge in calibration of Selective Assembly and True positional theory
c. Analysis of Datum Features and Component Design
d. Characterize the Design of components with casting considerations
e. Learn them to understand the concept of forging considerations

COURSE OUTCOMES: At the end of the course students are able to

a. Describe the different types of manufacturing systems and compare their suitability for economic production of various components and products.
b. Identify factors and causing mechanisms of the defects likely to occur with different manufacturing processes in producing mechanical products and the relevant design approaches to rectify them.
c. Analyze the proper materials and manufacturing processes for designing products/components by applying the relevant principles for ease and economic production.
d. Characterize the Design of components with casting considerations
e. Enumerate the concept the Forging considerations

UNIT I

Major Phases of Design: Major phases of design, effect of material properties on design, effect of manufacturing processes on design. Material selection process- cost per unit property, weighted properties and limits on properties methods. Guidelines for design for manufacturability. Review of relationship between attainable tolerance grades and different machining processes. Process capability, mean, variance, skewness, kurtosis, process capability indices- Cp, and Cpk. Cumulative effect of tolerance- Sure fit law and truncated normal law, problems.

UNIT II

Selective Assembly: Interchangeable part manufacture and selective assembly. Deciding the number of groups -model-1: group tolerance of mating parts equal, model- 2: total and group tolerances of shaft equal. Control of axial play- introducing secondary machining operations, and laminated shims; examples.

True positional theory: Comparison between coordinate and true position method of feature location. True position tolerance- virtual size concept, floating and fixed fasteners, projected tolerance zone and functional gages. Concept of Zero true position tolerance. Simple problems on true position to learning.

UNIT III

Datum Features: Functional datum, datum for manufacturing, changing the datum; examples.

Component Design: Design features to facilitate machining: drills, milling cutters, keyways, Doweling procedures, counter sunk screws, Reduction of machined area, simplification by separation, simplification by amalgamation, Design for machinability, Design for economy, Design for clamp ability, Design for accessibility. Design for assembly

UNIT IV

Design of components with casting considerations: Pattern, mound, and parting line. Cored holes and machined holes. Identifying the possible and probable parting lines. Castings requiring special sand cores. Designing to obviates and cores.
Welding considerations: requirements and rules, redesign of components for welding; case studies.

UNIT V

Forging considerations -requirements and rules-redesign of components for forging and case studies. Design of components for powder metallurgy- requirements and rules-case studies. Design of components for injection molding- requirements and rules-case studies.

TEXT BOOKS:

1. Peck, H. "Designing for Manufacture", Pitman Publications, London, 1983.
2. Dieter, G.E. "Engineering Design: A Materials and processing Approach", McGraw Hill Co. Ltd, 2000.
3. Bralla, James G., "Handbook of Products Design for Manufacturing: A Practical Guide to Low-cost Production", McGraw Hill, New York, 1986.

REFERENCE BOOKS:

1. Eggert, R.J. "Engineering Design" Pearson Education, Inc., New Jersey, 2005.
2. Matousek, R. "Engineering Design", Blackie and Son Limited, Glasgow, 1967.
3. Kalandar Saheb, S.D and Prabhakar, O. "Engineering Design for Manufacture's 1999.
4. Trucks, H.E., "Design for Economical Production", 2nd, Mich., Dearborn, SME 1987.
5. Linberg, Roy A., "Processes and Materials of Manufacture", 4th, Allyn and Bacon, Boston, U.S.A., 1990.

NANO TECHNOLOGY
(Professional Elective –V)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME817PE **3 0 0 3**

PRE-REQUISITES: Materials science

COURSE OBJECTIVES: The objectives of this course are to equip the students to

a. Understand the history and scope of Challenges, and Future Prospects of Nanomaterials.
b. Identify the unique properties of Nano materials, effect of nano dimension in properties of materials
c. Understand the Concept of Synthesis Routes i.e Bottom up approaches for nano materials
d. Explore the tools to characterize the nanomaterials
e. Acquire the knowledge of Applications of Nanomaterials

COURSE OUTCOMES: At the end of the course, students are able to

a. Comprehend the history and scope of Challenges, and Future Prospects of Nanomaterials.
b. Explain the unique properties of Nano materials, effect of nano dimension in properties of materials
c. Discuss the Concept of Synthesis Routesi eBottom up approaches for nano materials
d. Explore the tools to characterize the nanomaterials
e. Demonstrate the applications of Nanomaterials

UNIT - I

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

UNIT - II

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystal line Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and declinations,

Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility.

Magnetic Properties: Soft magnetic nanocrystal line alloy, Permanent magnetic nanocrystal line materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT- III

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol- gel method ,Self-assembly, Top down approaches: Mechanical alloying, Nano-lithography, Consolidation of Nano powders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT - IV

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nano indentation.

UNIT - V

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nano-sensors, Nano-catalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, BaldevRaj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS:

1. Nano: The Essentials by T. Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S., S. R. Kumar, J. H.Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J.O' Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

TRIBOLOGY
(Professional Elective - V)

IV-B.Tech (II Semester) | **L T P C**
Course Code: A1ME818PE | **3 0 0 3**

PRE-REQUISITES: Fluid mechanics, Design of machine members-II

COURSE OBJECTIVES:
a. To expose the student to different types of bearings, bearing materials,
b. To understand friction characteristics and power losses in journal bearings.
c. To learn theory and concepts about different types of lubrication.
d. Characterize the Air Lubricated Bearing
e. To understanding the Types of Bearing oil Pads and Bearing materials

COURSE OUTCOMES:
a. Understanding friction characteristics in journal bearings.
b. Knowledge about different theories of lubrication to reduce friction and wear.
c. Analysis of Friction and Power Losses in Journal Bearings
d. Characterize the Air Lubricated Bearing
e. To understanding the Types of Bearing oil Pads and Bearing materials

UNIT – I
Study of various parameters: Viscosity, flow of fluids, viscosity and its variation, absolute and kinematic viscosity, temperature variation, viscosity index, determination of viscosity, different viscometers used. Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT – II
Hydrodynamic Theory of Lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro-dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti -friction bearing.

UNIT – III
Friction and Power Losses in Journal Bearings: Calibration of friction loss, friction in concentric bearings, bearing mediums, Sommer-field number, heat balance, practical consideration of journal bearing design considerations.

UNIT –IV
Air Lubricated Bearing: Advantages and disadvantages, application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Study of current concepts of boundary friction and dry friction.

UNIT - V
Types of Bearing oil Pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings.
Bearing materials: General requirements of bearing materials, types of bearing materials.

TEXT BOOKS:

1. Fundamentals of Tribology, Basu, Sen Gupta and Ahuja/PHI
2. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co.

REFERENCE BOOK:

1. Introduction to Tribology of Bearings – B.C. Majumdar/ S. Chand

MECHATRONICS
(Professional Elective - V)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME819PE **3 0 0 3**

PRE-REQUISITES: Basic Electrical and Electronics Engineering

COURSE OBJECTIVES:
a. To develop an ability to identify, formulate, and solve engineering problems
b. Develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
c. Develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
d. Given a range of Programmable Logic Controllers
e. Analysis of Programmable Motion Controllers

COURSE OUTCOMES:
a. Identifying the Signal Conditioning
b. Calibration of Precision Mechanical and Electronic Interface Systems
c. Analysis of Electromechanical Drives and Microcontrollers Overview
d. Given a range of Programmable Logic Controllers
e. Analysis of Programmable Motion Controllers

UNIT – I
Introduction: Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.
Signal Conditioning: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – II
Precision Mechanical Systems: Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.
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 /misfits

UNIT – III
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.
Microcontrollers Overview: 8051 Microcontroller, microprocessor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming – Assembly, C (LED Blinking, Voltage measurement using ADC).

UNIT – IV

Programmable Logic Controllers: Basic Structure - Programming: Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT – V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in Analyze 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 , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/Pearson.
2. Introduction to Mechatronics / Appukuttan/Oxford

REFERENCE BOOKS:

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hil “Designing Intelligent Machines”. open University, London

MECHANICAL VIBRATIONS
(Professional Elective –V)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME820PE **3 0 0 3**

PRE-REQUISITES: Engineering Mechanics

COURSE OBJECTIVES: The objectives of this course are to make the students to

a. Understand the Single degree of Freedom systems and their significance in vibration engineering
b. Acquaint the knowledge in two degree and multi degree freedom system and their application mechanical systems
c. Understand the Critical speed of rotating elements and method to determine the same
d. Influence in construction and operation of vibration measuring instruments
e. Acquire knowledge in Sound, level of sound and sound measuring instruments

COURSE OUTCOMES: At the end of the course, the students are able to

a. Understand the Single degree of Freedom systems and their significance in vibration engineering
b. Analyze the two degree and multi degree freedom system and their application mechanical systems
c. Understand the Critical speed of rotating elements and method to determine the same
d. Demonstrate the construction and operation of vibration measuring instruments
e. Explain the Sound, level of sound and sound measuring instruments

UNIT - I

Single degree of Freedom systems - I: Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility.

UNIT - II

Single degree of Freedom systems - II: Response to Non-Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT - III

Two-degree freedom systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers;

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

UNIT - IV

Continuous system: Free vibration of strings – longitudinal oscillations of bars- traverse vibrations of beams- Tensional vibrations of shafts.

Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Numerical Methods: Rayleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

UNIT - V

Sound level and subjective response to sound: Subjective response to sound, frequency dependent human response to sound, sound-pressure dependent human response, the decibel scale, relationship among sound power, sound intensity and sound pressure level, relationship between sound power level and sound intensity, relationship between sound intensity level and sound pressure level, sound measuring instruments.

TEXT BOOKS:

1. Elements of Vibration Analysis / Meirovitch/ Mc Graw Hill
2. Principles of Vibration / Benson H.Tongue/Oxford

REFERENCE BOOKS:

1. Mechanical Vibrations / SS Rao /Pearson
2. Mechanical Vibration /Rao V. Dukkipati, J Srinivas/ PHI

TOTAL QUALITY MANAGEMENT
(Open Elective –III)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME805OE **3 0 0 3**

PRE-REQUISITES: Industrial Engineering

COURSE OBJECTIVES: The course objectives are to

a. Study the Management of Process Quality.
b. Develop Customer focus and satisfaction and bench marking.
c. Make the students to understand the Integrate TQM.
d. Learn them to identified Cost of Quality management.
e. Infer the ISO9000: Universal Standards of Quality.

COURSE OUTCOMES:

a. Study Management of Process Quality.
b. Develop Customer Focus and Satisfaction and Bench Marking.
c. Integrate the Total Quality Management in the Industries
d. Identify the cost of Quality management**.**
e. Understand the ISO 9000 Documentation and services and the cost of certification implementing the system

UNIT – I

Introduction: The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems.

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, pareto diagram, Kepner & Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third-party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOKS:

1. Total Quality Management / Joel E. Ross/Taylor and Francis Limited
2. Total Quality Management/P. N.Mukherjee/PHI

REFERENCE BOOKS:

1. Beyond TQM / Robert Flood
2. Statistical Quality Control / E.L.Grant.
3. Total Quality Management: A Practical Approach/H.Lal
4. Quality Management/Kanishka Bedi/Oxford University Press/2011
5. Total Engineering Quality Management/SunilSharma/Macmillan

RENEWABLE ENERGY SOURCES
(Open Elective –III)

IV-B.Tech (II Semester) **L T P C**
Course Code: A1ME806OE **3 0 0 3**

PRE-REQUISITES: None

COURSE OBJECTIVES:

a. To explain the concepts of Non-renewable and renewable energy systems
b. Outline utilization of renewable energy sources for both domestic and industrial applications
c. Analyze the environmental and cost economics of renewable energy sources in comparison with fossil fuels.
d. Calibration of Biogas and Biomass energy
e. Concept of Ocean Energy and Geothermal Energy

COURSE OUTCOMES:

a. Understanding of renewable energy sources
b. Knowledge of working principle of various energy systems
c. Capability to carry out basic design of renewable energy systems
d. Discuss the applications of Biogas and Biomass energy in the society
e. Explain the Concept of Ocean Energy and Geothermal Energy

UNIT-I

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non- renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermos chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programmed in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

Small hydro Power Plant: Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

Geothermal Energy: Geothermal power plants, various types, hot springs and steam ejection.

TEXT BOOKS:

1. Non-Conventional Energy Sources by G.D Rai
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.

REFERENCE BOOKS:

1. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi,2012
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.