**ACADEMIC REGULATIONS**

**COURSE STRUCTURE**

**AND**

**detailed syllabus**

for

**B.Tech Four Year Degree Course**

**(A-18 III & IV year)**

in

**MECHANICAL engineering**

**(ME)**

(Applicable for the batches admitted from 2018-2022)



**SREENIDHI INSTITUTE OF SCIENCE and TECHNOLOGY**

**(An Autonomous Institution approved by Ugc and affiliated to JNTUH)**

(Accredited by NAAC with ‘A’ Grade and Accredited by NBA of AICTE)

Yamnampet, Ghatkesar, Malkajigiri Medchal District -501 301.

**December, 2020**

**DEPARTMENT OF MECHANICAL ENGINEERING**

###### VISION OF THE DEPARTMENT

To emerge as a renowned center in Mechanical Engineering by following the best practices in teaching, learning and research

###### MISSION OF THE DEPARTMENT

1. Provide good academic environment for pursuing high quality undergraduate, Post graduate and Doctoral programmes in mechanical engineering that will prepare our graduates for outstanding professional careers
2. Provide service to practicing engineers, industry, government, educational and technical societies through effective engagement with these groups and by providing professional knowledge.
3. Ensure that our students are well trained in interpersonal skills, team work, professional ethics, practical industrial training and participate in professional society activities.
4. Conduct and proliferate high quality research work to students for lifetime of learning.

###### Programme Education Objectives

1. **Preparation & Learning Environment:** To prepare and provide student with an academic environment for students to excel in postgraduate programs or to succeed in industry / technical profession and the life-long learning needed for a successful professional career.
2. **Core Competence:** To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.
3. **Breadth:** To train students with good scientific and engineering breadth so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.
4. **Professionalism:** To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context.

**PROGRAM OUTCOMES (Pos) OF B.TECH MECHANICAL ENGG**

**After completion of the program of study of B. Tech in Mechanical Engineering, every student has to know the following**

**The program outcomes (POs) are listed below:**

1. Graduate will demonstrate knowledge in fundamentals of mathematics, science and engineering
2. Graduate will demonstrate an ability to identify, formulate and solve problems in key areas of Design, Production and Thermal of Mechanical Engineering discipline
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data related to various areas of Mechanical Engineering
4. Graduate will demonstrate ability in conducting investigations to solve problems using research based knowledge and methods to provide logical conclusions
5. Graduate will demonstrate skills to use modern engineering and IT tools, software's and equipment to analyze the problems in Mechanical Engineering
6. Graduate will show the understanding of impact of engineering solutions on the society to assess health, safety, legal, and social issues in Mechanical Engineering
7. Graduate will demonstrate the impact of professional engineering solutions in environmental context and to be able to respond effectively to the needs of sustainable development
8. Graduate will demonstrate the knowledge of Professional and ethical responsibilities
9. Graduate will demonstrate an ability to work effectively as an individual and as a team member/leader in multidisciplinary areas
10. Graduate will be able to critique writing samples (abstract, executive summary, project report), and oral presentations.
11. Graduate will demonstrate knowledge of management principles and apply these to manage projects in multidisciplinary environments.
12. Graduate will recognize the need of self education and ability to engage in life - long learning

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PEOs** | **Programme Outcomes** | | | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **I** |  |  |  |  |  |  |  |  |  |  |  |  |
| **II** |  |  |  |  |  |  |  |  |  |  |  |  |
| **III** |  |  |  |  |  |  |  |  |  |  |  |  |
| **IV** |  |  |  |  |  |  |  |  |  |  |  |  |

**ACADEMIC REGULATIONS**

**FOR B.TECH. REGULAR STUDENTS**

**WITH EFFECT FROM**

**THE ACADEMIC YEAR 2018-19**

**(A-18)**

**1.0 Under-Graduate Degree Programme in Engineering & Technology (E&T)**

**1.1** SNIST offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) with effect from the academic year 2018-19 in the following branches of Engineering.

|  |  |
| --- | --- |
| **Sl. No.** | **Branch** |
|  | Civil Engineering |
|  | Electrical and Electronics Engineering |
|  | Mechanical Engineering |
|  | Electronics and Communication Engineering |
|  | Computer Science and Engineering |
|  | Information Technology |
|  | Electronics and Computer Engineering |

**1.2. Credits (Semester system for B.Tech year)**

The existing credit system of giving one credit for a lecture hour/ tutorial hour per week and giving 0.5 credit for every hour of practical and drawing shall be continued in these regulations also.

**2.0 Eligibility for admission**

**2.1** Admission to the Under graduate courses merit rank obtained by graduate programs shall be made either on the basis of the rank of the candidate in entrance test conducted by the Telangana State Government (EAMCET) or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time. However admissions under Management / NRI Category shall be made on the relevant orders issued by Govt. of Telangana from time to time.

**2.2** The medium of instruction for the entire under graduate programme of study in E&T will be **English** only.

**3.0 B.Tech. Programme structure**

**3.1** A student after securing admission shall pursue the under graduate programme in B.Tech. in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. However, the student can take two more years for appearing the examinations to clear the backlog subjects.

In the First year it is structured to provide 39 credits and the credits in II , III and IV years should not exceed 127 credits as per AICTE model curriculum for the B.Tech. programme. Each student shall secure 166 credits (with CGPA >5) required for the completion of the undergraduate programme and Award of B.Tech Degree.

Each student shall secure 166 total credits (with CGPA ≥ 5) for the completion of the under graduate programme for the award of the B.Tech. degree. However, any revision made in this regard and approved by the Academic Council of the college by Parent University shall be implemented from the date of the revision.

**3.2 UGC/AICTE** specified definitions/ descriptions are adopted appropriately for various terms and abbreviations stated below.

**3.2.1 Semester scheme**

Each under graduate programme is of 4 academic years (8 semesters) with the academic year being divided into two semesters of 22 weeks ( 90 instructional days) each, each semester having - ‘Continuous Internal Evaluation (CIE)’ and ‘Semester End Examination (SEE)’.

Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated curriculum / course structure as suggested by AICTE are followed.

**3.2.2 Credit courses**

* A student in a semester has to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.
* One credit for one hour/ week offered in the entire semester for theory lecture (L) / Tutorial (T) courses.
* One credit for two hours/ week offered in the entire semester for laboratory/ practical (P) courses.
* The orientation program recommended by AICTE in the model curriculum consisting of courses like **Mandatory Induction program** for 3 weeks i.e. Human Values and Ethics in higher education.
* However there will be an end examination and will also reflect in the Memo of Marks. The grading will be as follows.

|  |  |
| --- | --- |
| **% of Marks Secured in a Subject/Course** | **Letter Grade** |
| Greater than or equal to 90% | O (Outstanding) |
| 80 and less than 90% | A+ (Excellent) |
| 70 and less than 80% | A (Very Good) |
| 60 and less than 70% | B+(Good) |
| 50 and less than 60% | B (Average) |
| 40 and less than 50% | C (Pass) |
| Below 40% | F (FAIL) |
| Absent | Ab |

* Other mandatory courses i.e ., Environmental Science and Ecology, Indian standards in concerned branch also will not have credits but evaluation will be done as per the above table. A student can not obtain degree unless he / she completes all the mandatory courses.

**3.2.3 Subject Course Classification**

All subjects / courses offered for the under graduate programme in E&T (B.Tech. Degree programmes) are broadly classified as follows. The Institution has followed almost all the guidelines issued by AICTE/UGC.

The groups of the subjects shall be as given in the table given hereunder along with the credits suggested by AICTE

|  |  |  |
| --- | --- | --- |
| **Sl.**  **No.** | **Category** | **Suggested Breakup of Credits**  **(Total 160)** |
| 1 | Humanities and social sciences including Management courses | 12\* |
| 2 | Basic Science courses | 25\* |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical / mechanical / computer etc | 24\* |
| 4 | Professional core courses | 48\* |
| 5 | Professional Elective courses relevant to chosen specialization / branch | 18\* |
| 6 | Open Electives from other technical and / or emerging subjects | 18\* |
| 7 | Project work, seminar and internship in industry or elsewhere | 15\* |
| 8 | Mandatory courses (Environmental Sciences, Induction training, Indian constitution, Essence of Indian Traditional Knowledge) | (Non-credit) |
|  | Total | 160\* |

**The Academic council of the institution has approved the total number of credits to be 166**. The various groups of subjects mentioned above shall have credits suggested above with minor variations.

**4.0 Course registration**

**4.1** A ‘faculty advisor or counselor’ shall be assigned to a group of 20 students, who will advise student about the under graduate programme, its course structure and curriculum, choice/option for Professional and open Electives based on their employment potential / further studies.

**4.2** The student will progress semester after semester as the Institute is following cohort system to satisfying the conditions of promotion to the next semester.

**4.3 In the present system there shall be five subjects in each professional elective stream and three subjects in open elective stream.** A student can opt for a stream of professional/ open electives which should be submitted to the faculty advisor/ Councilor and copy of it to the Examination section through the Head of the department. A copy of it will be retained with the Head of the department/ faculty advisor / councilor and the student.

4.4. **The student can take one extra subject in each semester and can complete the program in 3 ½ years but original degree will be issued along with his / her batch mates after 4 years.**

4.5. **If a student acquires 20 credits extra than the required credits as per the regulations he will be awarded honors.**

4.6 The purpose of offering Elective Streams in both Professional and Open Electives is to facilitate the students to have a minor specialization based on their interest, so that they will have multi disciplinary exposure. Hence , a student is to take a stream of Electives in either in Professional / Open Elective. He shall not be permitted to opt for other elective subjects in other streams in subsequent semesters.

**4.7** Dropping of Electives may be permitted, only after obtaining prior approval from the faculty advisor / counselor, ‘**within a period of 15 days** from the beginning of the current semester.

**5.0 Subjects / courses to be offered**

**5.1** A typical section (or class) nominal strength for each semester shall be 60.

**5.2** A subject / course may be offered to the students, **only if** a minimum of 30 students opt for it. The maximum strength of a section is limited to 80.

**6.0 Attendance requirements:**

**6.1** A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in mandatory courses, Internship during II year, NCC / NSO and NSS) for that semester.

**6.2** Shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student’s representation with supporting evidence.

**6.3** A stipulated fee shall be payable towards condoning of shortage of attendance as decided by finance committee of SNIST from time to time.

**6.4** Shortage of attendance below 65% in aggregate shall **NO CASE** be condoned.

**6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester.**

**They get detained and their admission for that semester shall stand cancelled.**

**They will not be promoted to the next semester.** They may seek re-admission for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and / or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same semester.

**7.0 Academic requirements**

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.6.

7.1 **A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course, if student secures not less than 35% marks (24 out of 70 marks) in the semester end 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 ‘C’ grade or above in that subject / course.**

**7.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to UG mini-project and seminar, if student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student would be treated as failed, if student

(i) does not complete all the mandatory courses offered during the course

(ii) doesnot submit a report on internship mini-project, or does not make a presentation of the same before the evaluation committee as per schedule, or

(iii) does not present the seminar as required in the I year to IV year or

(iv) secures less than 40% marks in UG mini-project/ seminar evaluations.

Student may reappear once for each of the above evaluations, when they are scheduled again; if student fails in such ‘one reappearance’ evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

**7.3 Promotion Rules based upon credits**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Promotion** | **Conditions to be fulfilled** |
| 1 | First year First Semester to Second Semester | Regular course of study of first year first semester and should have satisfied the minimum requirement of attendance to appear I year I semester. |
| 2 | First year to second year first semester | i. Regular course of study of first year First and second semesters.  ii. Must have secured at least 50% of credits (19) upto first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3. | II Year I Semester to II Semester | Regular course of study of second year first semester. |
| 4 | Second year to third year first semester | i. Regular course of study of First and second semesters of second year.  ii. Must have secured at least 60% of credits (49) upto second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 5 | Third year first semester to second semester | Regular course of study of third year first semester. |
| 6 | Third year second semester to fourth year first semester | i. Regular course of study of third year second semester.  ii. Must have secured 60% of credits (79) up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 7 | Fourth year first semester to fourth year second semester | Regular course of study of fourth year first semester. |

**7.4** A student (i) shall attend for all courses / subjecs covering 166 credits as specified and listed in the course structure, (ii) fulfils all the attendance and academic requirements for 166 credits, (iii) earn all 166 credits by securing SGPA > 5.0 (in each semester), and CGPA (at the end of each successive semester) > 5.0, (iv) **passes all the mandatory courses,** to successfully complete the under graduate programme. The performance of the student in these 166 credits shall be taken into account for the calculation of ‘the final CGPA (at the end of under graduate programme), and shall be indicated in the grade card of IV year II semester.

**7.5** If a student registers for some more ‘**extra subjects’** (in the parent department or other departments / branches of Engg.) other than those listed subjects as specified in the course structure of his Department, the performances in those ‘ **extra subjects**’ will not be taken into account while calculating the SGPA and CGPA. For such ‘**extra subjects’** registered, Percentage % of 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 regulations 6 and 7.1 to 7.4 above.

**7.6** A student eligible to appear in the semester end examination for any subject / course, but absent from it or failed (thereby failing to secure **‘C’** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, CIE assessed earlier for that subject / course will be carried over, and added to the marks obtained in the supplementary examination for evaluating performance in that subject.

**7.7** A student **detained in a semester due to shortage of attendance, may be re-admitted when the same semester is offered in the subsequent academic years for the fulfillment of academic requirements**.

The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which student has been detained.

**7.8** A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.**

The academic regulations under which student has been readmitted shall be applicable to him / her.

**8.0 Evaluation - Distribution and weightage of marks**

8.1 The performance of a student in each semester shall be evaluated subject-wise for a maximum of 100 marks for a theory and 100 marks for a practical subject with 30 marks Continuous Internal Evaluations (CIE) and 70 marks for Semester End Examinatins (SEE)

In addition, Internship industry-oriented mini-project, group project, Project – I will also be evaluated for 100 marks, Project – II for 100 marks, Technical Seminar and comprehensive viva for 100 marks each.

The continuous internal evaluation for Project – I in IV year I semester shall consist of :

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Literature survey and presenting seminar at the end of 6 weeks | 10 marks |
| 2 | Report | 10 marks |
| 3 | Demonstration/presentation at the end of 14 weeks | 10 marks |
|  | **Total sessional marks** | **30 marks** |

Semester end examination - 70 marks

Pattern of external evaluation for Project – I in IV year I semester.

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Final report | 10 marks |
| 2 | Presentation | 10 marks |
| 3 | Demonstration/defence of project | 50 marks |
|  | **Total sessional marks** | **70 marks** |

The continuous internal evaluation for Project – II in IV year II semester shall consist of :

Division of marks for External Evaluation for project II – 30 Marks

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Progress of Project work and the corresponding interim report as evaluated by Project Review Committee at the end of 6 weeks | 5 marks |
| 2 | Seminar at the end of 6 weeks | 5 marks |
| 3 | Progress of Project work as evaluated by Project Review Committee at the end of 11 weeks | 5 marks |
| 4 | Seminar at the end of 11 weeks | 5 marks |
| 5 | Evaluation by Project Review Committee at the end of 15 weeks and Final Project Report | 5 marks |
| 6 | Final presentation and defence of project | 5 marks |
|  | **Total** | **30 marks** |

Division of marks for External Evaluation for project II – 70 Marks

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Final Project Report | 10 marks |
| 2 | Presentation | 20 marks |
| 3 | Demonstration / Defense of Project | 40 marks |
| 4 | **TOTAL** | **70 marks** |

8.2 For all the other theory and lab subjects the distribution of marks shall be 30 for Continuous Internal Evaluation (CIE) and 70 for the Semester End-Examination (SEE).

* 1. **Theory Subjects**

**8.3.1 Pattern for Continuous Internal Evaluation ( CIE) 30 marks**

The following procedure is to be adopted for awarding internal marks of 30 for all the B. Tech. students from the Academic Year 2018-19

The distribution of marks for continuous internal evaluation (30 marks) is shown below. Average of two Mid Tests will be taken for final award of marks.

|  |  |  |
| --- | --- | --- |
| a) | Part – A of Mid Test will have 10 questions | 5 marks |
| b) | Part – B of Mid Test will have 4 questions (1 from each unit and 4th question from any one unit or combination) and student has to answer 3 questions | 15 marks |
| c) | Part – C Mid Test Question Paper Will have 3 questions –One from each unit taken from assignment questions. Student has to answer 1 question out of 3 questions | 3 marks |
| d) | Assignment – I three questions from each unit – total of 9 questions to be submitted before first mid test  Similarly assignment – II will be given to be Submitted before Mid Test II  and average of two assignments will be considered. | 2 marks |
| e) | Attendance | 3 marks |
| f) | Class notes | 2 marks |
|  | **Total** | **30 marks** |

Three marks are assigned for each theory course for those students who put in attendance in a graded manner as given below:

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Attendance Range** | **Marks Awarded** |
| 1. | 65 % and above but less than 75% | 1 |
| 2. | 75% and above and less than 85% | 2 |
| 3. | 85% and above | 3 |

Marks for attendance shall be added to each subject based on average of attendance of all subjects put together.

If any candidate is absent in any subject or mid-term examination, and he/she wishes to improve performance, a **third mid-test** will be conducted for that student by the Institution in the entire syllabus, on the same day of Semester End Examination (SEE) for 21/2 hours. That result will be treated as III mid test and average of better two will be considered. III mid test will have Part-A (compulsory) and Part-B with essay type questions and three out of four questions are to be answered.

**b) Pattern for External Examinations - (70 marks)**

• There shall be external examination in every theory course and consists of two parts (Part-A & Part-B). The total time duration for this semester end examination will be 3 hours.

• **Part-A** shall have 20 marks, which is compulsory. It will have 10 short questions set with 2 marks each. There shall be atleast one question to each of the six units and the number of questions from any unit shall not exceed two.

• **Part-B** of the question paper shall have essay type questions for 50 marks and shall have 8 questions out of which any 5 are to be answered. At least one question must appear from each Unit. . Seventh question must have 2 to 3 bits taken from 1st, 2nd, and 3rd units and 8th question also with 2 to 3 bits taken from 4th, 5th and 6th units, such that not more than 2 questions shall be from any one unit. All the questions carry equal marks.

**8.4**  **Pattern of Evaluation for Lab subjects** - **(100 marks)**

8.4.1 For practical subjects there shall be a continuous evaluation during the semester for 30 sessional marks and 70 marks for semester end examination. Out of the 30 marks for Continuous Internal Evaluation, the distribution of marks is as follows

|  |  |  |
| --- | --- | --- |
| **S. No** | **Item** | **Marks** |
| 1. | Day to Day work | 05 marks |
| 2. | Final Record and viva | 09 marks |
| 3. | Average of two tests including viva | 05 marks |
| 4. | Lab Based Project Report viva and demo | 08 marks |
| 5. | Attendance | 03 marks |
| **Total** | | **30 marks** |

8.4.2 The semester end examination for 70 marks for the lab subjects shall be conducted by an external examiner and an internal examiner appointed by the Chief Superintendent of Examinations of the college. The marks are distributed as follows:

|  |  |  |
| --- | --- | --- |
| **S. No** | **Item** | **Marks** |
| 1. | Procedure to experiment and Tabulation | 10 marks |
| 2. | Conduct of experiment, observation, Calculation | 30 marks |
| 3. | Results including graphs, discussions and conclusion | 20 marks |
| 4. | Viva voce and Record | 10 marks |
| Total | | 70 marks |

**8.4.3 In case computer based examinations**

|  |  |  |
| --- | --- | --- |
| **S. No** | **Item** | **Marks** |
| 1. | Flow chart and algorithms | 10 marks |
| 2. | Program writing and execution | 30 marks |
| 3. | Result and conclusions | 20 marks |
| 4. | Viva voce and Record | 10 marks |
| Total | | 70 marks |

8.5 **For the subject having design and / or drawing, (such as Engineering Drawing and Machine Drawing), the distribution shall be 30 marks for internal evaluation (10 marks for day-to-day work including drawing,3 marks for home assignment work, 12 marks for average of two internal tests and 2 marks for class notes 3 marks for attendance) and 70 marks for end semester examination.**

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.

Third test facility can be availed as mentioned above (8.3.1 (i) (a) and (b)

**8.6. Technical Seminar (100 marks)**

There shall be a technical seminar evaluated for 100 marks from I year to III year I Seemester. The evaluation is purely internal and will be conducted as follows:

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Literature survey, topic and content | 10 |
| 2 | Presentation including PPT | 15 |
| 3 | Seminar Notes | 10 |
| 4 | Interaction | 05 |
| 5 | Report | 10 |
| 6 | Attendance in the seminar class | 10 |
| 7 | Punctuality in giving seminar as per Scheduled time and date | 10 |
| 8 | Mid Semester Viva (on the seminar topics completed up to the end of 9th week | 10 |
| 9 | End Semester Viva | 20 |
|  | Total | 100 Marks |

Student must secure 40% i.e. 40 marks to be successful

\* According to the syllabus approved by the Academic Council as per Board of studies recommendations

**8.7 Comprehensive Viva-voce (II-II, III-II and IV-II\*)**

There shall be comprehensive viva voce as stated above which will be evaluated for 100 marks. Out of 100 marks, 30 marks are internal and 70 marks are external.

|  |  |  |
| --- | --- | --- |
| S.No. | Description | marks |
| 1 | First mid-sessional viva at the end of 5 weeks (Internal) | 15 marks |
| 2 | Second mid-sessional viva at the end of 10 weeks (Internal) | 15 marks |
| 3 | Final viva during practical examinations (External) | 70 marks |
| 4 | Total | 100 Marks |

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\* According to the syllabus approved by the Academic Council as per Board of Studies recommendations

**8.7.2** The evaluation of comprehensive viva-voce has to be carried out by two teachers independently and average be taken.

The sessional marks awarded by the Department are not final.

They are subject to scrutiny by a committee constituted by the college and scaling is done wherever necessary.

The recommendations of the Committee are final and binding.

8.8 The laboratory records and internal test papers shall be preserved in the respective departments as per the college norms and shall be produced to the Committee of the college or any external agency like AICTE, NAAC, JNTUH, NBA etc., as and when the same are called for.

8.9. 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 III 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 IV year I semester similarly summer internship in an Industry of their specialization will be given for B.Tech II year II semester students and pursue it in the summer vacation. A report on summer internship shall be submitted and presented before the committee in III year I semester and IV year I semester. It shall be evaluated for 30 internal marks and 70 external marks. The committee consists of an external examiner, Head of the Department, supervisor of the Industrial Oriented mini project / Summer Internship and a senior faculty member of the department.

8.10 The laboratory marks and the internal marks awarded by the college are subject to scrutiny and scaling by the Departmental committees wherever necessary. In such cases, the internal and laboratory marks awarded by the department will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendation of the committee is final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the college rules and produced before the visiting committee as and when asked for.

8.11. For mandatory courses of Induction Programme (Human values, and Ethics in Higher Education), Environmental Science and Ecology, Indian Standards a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation and external examination for passing the subject / course. These marks should also be uploaded along with the internal marks of other subjects.

**9.0 Grading procedure**

9.1 Marks will be awarded to indicate the performance of student in each theory subject, laboratory / practicals, seminar, UG mini project and UG major project.

Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

**9.2** As a measure of the performance of student, a 10-point absolute grading system using the following letter grades (as per UGC / AICTE guidelines) and corresponding percentage of marks shall be followed:

|  |  |  |
| --- | --- | --- |
| **% of Marks Secured in a Subject / Course**  **(Class Intervals)** | **Letter Grade**  **(UGC Guidelines)** | **Grade Points (GP)** |
| Greater than or equal to 90% | O  (Outstanding) | 10 |
| 80% and less than 90% | A+  (Excellent) | 9 |
| 70% and less than 80% | A  (Very Good) | 8 |
| 60% and less than 70% | B+  (Good) | 7 |
| 50% and less than 60% | B  (Average) | 6 |
| 40% and less than 50% | C  (Pass) | 5 |
| Below 40% | F (FAIL) | 0 |
| Absent | Ab | 0 |

**9.3** A student obtaining ‘**F’** grade in any subject shall be deemed to have ‘**failed’** and is required to reappear as a ‘supplementary student’ in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

**9.4** A student who has not appeared for examination in any subject, ‘**Ab’** grade will be allocated in that subject, and student shall be considered ‘**failed’**. Student will be required to reappear as a ‘supplementary student’ in the semester end examination, as and when offered.

**9.5** A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

**9.6** A student earns grade point (GP) in each subject / course, on the basis of the letter grade secured in that subject / course. 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**

**9.7** The student passes the subject / course only when **GP is not less than 5 (i.e. ‘C’ grade or above)**

**9.8** The semester grade point average (SGPA) is calculated by dividing the sum of credit points (CP) 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 = { Ci Gi } / {  Ci } …. For each semester

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

where ‘**N’** is the **total** number of subjects (as specifically required and listed under the course structure of the parent department) the student has ‘**registered’** i.e., from the 1st semester onwards upto and inclusive of the 8th semester, ‘j’ is the subject indicator index (takes into account the subjects from 1 to 8 semesters), CJ is the number of credits allotted to the Jth subjects and Gj represents the grade points (GP) corresponding to the letter grade awarded for that Jth subject.

After registration and completion of the first year first semester, SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

**Illustration of calculation of SGPA**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course / Subject** | **Credits** | **Letter**  **Grade** | **Grade**  **Points** | **Credit**  **Points** |
| Course 1 | 4 | A | 8 | 4 x 8 = 32 |
| Course 2 | 4 | O | 10 | 4 x 10 = 40 |
| Course 3 | 4 | C | 5 | 4 x 5 = 20 |
| Course 4 | 3 | B | 6 | 3 x 6 = 18 |
| Course 5 | 3 | A+ | 9 | 3 x 9 = 27 |
| Course 6 | 3 | C | 5 | 3 x 5 = 15 |
|  | 21 |  |  | 152 |

SGPA = 152/21 = 7.24

**Illustration of calculation of CGPA:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course / Subject** | | **Credits** | **Letter Grade** | **Grade Points** | | **Credit points Points** |
| **I Year I Semester** | | | | | | |
| Course 1 | | 4 | A | 8 | | 4 x 8 = 32 |
| Course 2 | | 4 | A+ | 9 | | 4 x 9 = 36 |
| Course 3 | | 4 | B | 6 | | 4 x 6 = 24 |
| Course 4 | | 3 | O | 10 | | 3 x 10 = 30 |
| Course 5 | | 3 | B+ | 7 | | 3 x 7 = 21 |
| Course 6 | | 3 | A | 8 | | 3 x 8 = 24 |
| **I Year II Semester** | | | | | | |
| Course 7 | 4 | B+ | | 7 | 4 x 7 = 28 |
| Course 8 | 4 | O | | 10 | 4 x 10 = 40 |
| Course 9 | 4 | A | | 8 | 4 x 8 = 32 |
| Course 10 | 3 | B | | 6 | 3 x 6 = 18 |
| Course 11 | 3 | C | | 5 | 3 x 5 = 15 |
| Course 12 | 3 | A+ | | 9 | 3 x 9 = 27 |
| Total Credits | | = 42 |  |  | | Total Credit Points =327 |

CGPA = 327/42 = 7.79

**9.9** For merit ranking or comparison purposes or any other listing, **only** the ‘**rounded off’** values of the CGPAs will be used.

**9.10** For calculations listed in regulations 9.6 to 9.9, 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.

After passing the failed subject(s) newly secured letter grades will be taken into account for calculation of SGPA and CGPA.

However, mandatory courses will not be taken into consideration.

**10.0 Passing standards**

**10.1** A student shall be declared successful or ‘passed’ in a semester, if student secures a GP ≥ 5 (‘C’ grade or above) in every subject/course in that semester (i.e. when student gets an SGPA 5.00 at the end of that particular semester); and a student shall be declared successful or ‘passed’ in the entire under graduate programme, only when gets a CGPA 5.00 for the award of the degree as required.

**10.2** After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, and grade earned etc.), credits earned, SGPA, and CGPA.

**11.0 Declaration of results**

**11.1** Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

**11.2** For final percentage of formula may be used.

**12.0 Award of degree** marks equivalent to the computed final CGPA, the following

**% of Marks = (final CGPA – 0.5) x 10**

**12.1** A student who registers for all the specified subjects/ courses as listed in the course structure and secures the total number of credits (with CGPA >5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have ‘**qualified’** for the award of the B.Tech. degree in the chosen branch of Engineering as selected at the time of admission.

**12.2** A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

**12.3** Students with final CGPA (at the end of the under graduate programme) 8.00 and above, and fulfilling the following conditions -

(i) Should have passed all the subjects/courses in ‘**first appearance’** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should have secured a CGPA > 8.00, at the end of each of semesters, starting from first year first semester onwards.

(iii) Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in **‘FIRST CLASS WITH DISTINCTION’**, otherwise **FIRST CLASS** only.

**12.4** Students with final CGPA (at the end of the under graduate programme) ≥ 6.5 but < 8.00, shall be placed in ‘**FIRST CLASS’**.

**12.5** Students with final CGPA (at the end of the under graduate programme) ≥ 5.5 but < 6.5, shall be placed in ‘**SECOND CLASS’**.

**12.6** All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the under graduate programme) ≥ 5 but < 5.5, shall be placed in ‘**pass class**’.

**12.7** A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

**12.8** Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of ‘**university rank**’ and ‘**gold medal**’.

**13.0 Withholding of results**

**13.1** If the student has not paid the fees to the university / college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and student 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.

**14.0 Transitory regulations**

**14.1** A 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 student's first year first semester).

A student admitted in one academic regulation and he is getting readmission in some other academic regulations , the college has to offer substitute / additional subjects based on the comparison of two academic regulations. The details of substitute / additional subjects offered with the recommendations of board of studies of the concerned branch has to be given from time to time.

**15.0 Student transfers**

15.1There shall be no branch transfers after the completion of admission process.

15.2 The students seeking transfer to Sreenidhi Institute of Science and Technology ( SNIST) from various other Universities / institutions have to pass the failed subjects which are equivalent to the subjects of SNIST, and also pass the subjects of SNIST which the students have not studied at the earlier institution.

Further, though the students have passed some of the subjects at the earlier semesters of SNIST, the students have to study substitute subjects in SNIST and get sessional marks by attending 3rd mid test and paying requisite fee as per the rules.

15.3 The transferred students from other Universities/ institutions to SNIST who are on rolls to be provide one chance to write the CEE (internal marks) in the failed subjects and /or subjects not studied as per the clearance letter issued by the Institution.

15.4 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the failed subjects and /or subjects not studied, to the students transferred from other universities / institutions to SNIST who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 **Scope**

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

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

16.3 The Institution may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the date notified by the Institution.

**Academic Regulations for B.Tech.**

**(LATERAL ENTRY SCHEME)**

**w.e.f the AY 2019-20**

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

The Lateral Entry Scheme (LES) students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years failing which he will forfeit the seat.

**2.** The student shall register and secure for all the credits with CGPA ≥ 5 from II year to IV year B.Tech. programme (LES) as per the regulations for the award of B.Tech. degree. **Out of the total credits secured, the student can avail exemption up to 6 credits**, that is, one open elective subject and one professional elective subject or two professional elective subjects resulting in 160 credits for B.Tech programme performance evaluation**.**

**3.** The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

**4.** The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

**5. Promotion rules based on credits**

|  |  |  |
| --- | --- | --- |
| **S. No** | **Promotion** | **Conditions to be fulfilled** |
| 1 | Second year first semester to second year second semester | Regular course of study of second year first semester. |
| 2 | Second year second semester to third year first semester | (i) Regular course of study of second year second semester.  (ii) Must have secured at least 29 credits  out of 48 credits i.e., 60% of credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3 | Third year first semester to third year second semester | Regular course of study of third year first semester. |
| 4 | Third year second semester to fourth year first semester | (i) Regular course of study of third year second semester.  (ii) Must have secured at least 58 credits out of 96 credits i.e., 60% of credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 5 | Fourth year first semester to fourth year second semester | Regular course of study of fourth year first semester. |

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

**MALPRACTICES RULES**

**DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS**

|  |  |  |
| --- | --- | --- |
|  | **Nature of Malpractice/Improper conduct** | **Punishment** |
|  | If the student: |  |
| 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 student is appearing but has not made use of (material shall include any marks on the body of the student 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 student orally or by any other body language methods or communicates through cell phones with any student 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 students 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 student is appearing. | Expulsion from the examination hall and  cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.  The hall ticket of the student is to be cancelled and sent to the university. |
| 3. | Impersonates any other student in connection with the examination. | The student who has impersonated shall be  expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and UG major project) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation |

|  |  |  |
| --- | --- | --- |
|  |  | of the course by the student 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 student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 chief  superintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students 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 student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. |
| 9. | If student of the college, who is not a student 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 student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student 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 student has already appeared including practical examinations and UG major project 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 student has appeared including practical examinations and UG major project 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 university for further action to punishment. award suitable

**Malpractices identified by squad or special invigilators**

1. Punishments to the students as per the above guidelines.

2. Punishment for institutions: (if the squad reports that the college is encouraging malpractices)

a. A show cause notice shall be issued to the college. b. Impose a suitable fine on the college.

c. Shifting the examination centre from the college to another college for a specific period of not less than one year.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--I Year – I semester (1st Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P** | **C** | **Max. Marks** |  |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 7HC04 | Applied Physics | 3 | 1 | 0 | 4 | 30 | 70 |
| 2 | 7B103 | Engineering Mechanics | 3 | 1 | 0 | 4 | 30 | 70 |
| 3 | 7HC06 | Engineering Mathematics – I | 3 | 1 | 0 | 4 | 30 | 70 |
| 4 | 7BC02 | Engineering Graphics & Design | 1 | 0 | 4 | 3 | 30 | 70 |
| 5 | 7HC02 | English (Oral communication skills) | 1 | 0 | 0 | 1 | 30 | 70 |
| 6 | 7HC64 | Applied Physics Lab | 0 | 0 | 3 | 1.5 | 30 | 70 |
| 7 | 7HC62 | English (Oral communication skills) Lab | 0 | 0 | 2 | 1 | 30 | 70 |
| 8 | 7B191 | Technical Seminar I | 0 | 0 | 2 | 1 | 100 |  |
| 9 | 7HC20 (MC) | Human values professional Ethics in Higher Education | 3 | 0 | 0 | 0 | 30 | 70 |
|  |  | **Total** | **14** | **3** | **11** | **19.5** | **340** | **560** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--I Year – I semester (2nd Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 7HC03 | Chemistry | 3 | 1 | 0 | 4 | 30 | 70 |
| 2 | 7FC01 | Problem Solving using C | 3 | 0 | 0 | 3 | 30 | 70 |
| 3 | 7HC08 | Engineering Mathematics – II | 3 | 1 | 0 | 4 | 30 | 70 |
| 4 | 7BC01 | Workshop/ Manufacturing practices (Theory) | 1 | 0 | 0 | 1 | 30 | 70 |
| 5 | 7HC01 | English (Reading, Listening and Writing) | 1 | 0 | 0 | 1 | 30 | 70 |
| 6 | 7HC63 | Chemistry Lab | 0 | 0 | 3 | 1.5 | 30 | 70 |
| 7 | 7FC71 | Problem Solving using C Lab | 0 | 0 | 3 | 1.5 | 30 | 70 |
| 8 | 7BC61 | Workshop/ Manufacturing practices lab | 0 | 0 | 3 | 1.5 | 30 | 70 |
| 9 | 7HC61 | English lab (Reading, Listening and Writing) | 0 | 0 | 2 | 1 | 30 | 70 |
| 10 | 7B292 | Technical Seminar II | 0 | 0 | 2 | 1 | 100 |  |
|  |  | **Total** | **11** | **2** | **13** | **19.5** | **370** | **630** |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--II Year – I semester (3rd Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 7HC12 | Engineering Mathematics –III | 2 | 1 | --- | 3 | 30 | 70 |
| 2 | 7B306 | Thermodynamics | 3 | --- | --- | 3 | 30 | 70 |
| 3 | 7B307 | Mechanics of Solids | 3 | --- | --- | 3 | 30 | 70 |
| 4 | 7B308 | Materials Engineering | 3 | --- | --- | 3 | 30 | 70 |
| 5 | 7B309 | Fluid Mechanics and Hydraulic Machinery | 3 | --- | --- | 3 | 30 | 70 |
| 6 | 7B310 | Machine Drawing and Computer aided drawing Practice | 1 | --- | 4 | 3 | 30 | 70 |
| 7 | 7B362 | Metallurgy Lab & Mechanics of Solids Lab | --- | --- | 4 | 2 | 30 | 70 |
| 8 | 7B363 | Fuels and Lubricants Lab | --- | --- | 2 | 1 | 30 | 70 |
| 9 | 7B364 | Fluid Mechanics and Hydraulic Machinery Lab | --- | --- | 2 | 1 | 30 | 70 |
| 10 | 7HC21 | Environmental Science and Echology | 2 | 0 | 0 | 0 | 30 | 70 |
| 11 | 7B393 | Technical seminar-III | --- | --- | 2 | 1 | 100 |  |
|  |  | **Total** | **17** | **1** | **14** | **23** | **400** | **700** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--II Year – II Semester( 4th Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 7B411 | Manufacturing Processes | 3 | --- | --- | 3 | 30 | 70 |
| 2 | 7B412 | Applied Thermodynamics-I | 3 | --- | --- | 3 | 30 | 70 |
| 3 | 7B413 | Kinematics of Machinery | 2 | 1 | --- | 3 | 30 | 70 |
| 4 | 7AC48 | Electrical and Electronics Engineering | 2 | --- | --- | 2 | 30 | 70 |
| 5 | OE | Open Elective-I | 3 | --- | --- | 3 | 30 | 70 |
| 6 | 7ZC01 | Management Science and Financial Accounting | 2 | --- | --- | 2 | 30 | 70 |
| 7 | 7AC95 | Electrical and Electronics Engineering lab | --- | --- | 2 | 1 | 30 | 70 |
| 8 | 7B465 | Manufacturing Processes Lab | --- | --- | 2 | 1 | 30 | 70 |
| 9 | 7B494 | Technical seminar-IV | --- | --- | 2 | 1 | 100 |  |
| 10 | 7B466 | Comprehensive Viva-voce-I | --- | --- | 2 | 1 | 30 | 70 |
| 11 | \*\* | **Summer Industry Internship-I (Evaluation will be in III - I)** | --- | --- | --- | --- | --- | --- |
|  |  | **Total** | **15** | **1** | **8** | **20** | **370** | **630** |

|  |  |  |
| --- | --- | --- |
| CODE | Open Elective-I | Stream |
| 7EC01 | Data Structures | CSE & IT |
| 7GC46 | Biology for Engineers | BT |
| 7ZC22 | Basics of Entrepreneurship | **Entrepreneurship Stream-MBA** |
| 7ZC25 | Indian Polity and Economy | **Social Sciences Stream** |
| 7ZC20 | Product and Services | **Technology Entrepreneurship** |
| 7ZC05 | Banking insurance and Risk Management | **Finance Stream** |
| 7BC51 | Smart Materials | MECH |
| 7CC54 | Fundamental of Digital Circuits and Microprocessors | ECE |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--III Year – I Semester (5th Semester)** | | | | | | | | | | |
| **Sl.No** | **Course code** | | **Name of the Course** | **L** | **T** | | **P/D** | **C** | **Max. Marks** | |
|  |  | |  |  |  | |  |  | **CIE** | **SEE** |
| 1 | 7B514 | | Applied Thermodynamics-II | 3 | 1 | | --- | 4 | 30 | 70 |
| 2 | 7B515 | | Design of Machine Members-I | 3 | 1 | | --- | 4 | 30 | 70 |
| 3 | 7B516 | | Metal Cutting and Machine Tools | 3 | --- | | --- | 3 | 30 | 70 |
| 4 | 7B517 | | Dynamics of Machinery | 2 | 1 | | --- | 3 | 30 | 70 |
| 5 | OE | | Open Elective-II | 3 | --- | | --- | 3 | 30 | 70 |
| 6 | 7H518 | | Quantitative Aptitude | 1 | 1 | | --- | 2 | 30 | 70 |
| MC | 7FC20 | | Cyber Security (GRADE EVALAUTION)-MC | 2 | 0 | | 0 | 0 | 30 | 70 |
| 7 | 7B567 | | Applied Thermodynamics Lab | --- | --- | | 2 | 1 | 30 | 70 |
| 8 | 7B568 | | Machine Tools Lab | --- | --- | | 2 | 1 | 30 | 70 |
| 9 | 7B569 | | Kinematics & Dynamics of Machines Lab | --- | --- | | 2 | 1 | 30 | 70 |
| 10 | 7B595 | | Technical Seminar-V | --- | --- | | 2 | 1 | 100 |  |
| 11 | \*\* 7B570 | | **Summer Industry Internship-I (Evaluation only)** | --- | --- | | --- | 1 | 30 | 70 |
|  |  | | **Total** | **15** | **4** | | **8** | **24** | **400** | **700** |
|  |  | |  |  |  | |  |  |  |  |
| CODE | | Open Elective-II | | | | Stream | | | | |
| 7ZC23 | | Advance Entrepreneurship | | | | Entrepreneurship Stream | | | | |
| 7ZC26 | | Basics of Polity and Ecology | | | | Social Sciences Stream | | | | |
| 7ZC19 | | Entrepreneurship Project Management and Structured Finanace | | | | Finance Stream | | | | |
| 7ZC21 | | General Management And Entrepreneurship | | | | Technology Entrepreneurship | | | | |
| 7FC03 | | Python Programming | | | | IT | | | | |
| 7EC65 | | Java Programming | | | | CSE | | | | |
| 7AC46 | | Control System Engineering | | | | EEE | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--III Year – II Semester (6th Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 7B618 | Heat Transfer | 3 | 1 | --- | 4 | 30 | 70 |
| 2 | 7B619 | Design of Machine Members-II | 3 | 1 | --- | 4 | 30 | 70 |
| 3 | 7B620 | Metrology and Instrumentation | 3 | --- | --- | 3 | 30 | 70 |
| 4 | 7B621 | CAD/CAM and FEA | 3 | --- | --- | 3 | 30 | 70 |
| 5 | OE | Open Elective-III | 3 | --- | --- | 3 | 30 | 70 |
| 7 | 7H619 | Logical Reasoning | 1 | 1 | --- | 2 | 30 | 70 |
| MC |  | Artificial Intelligence (Grade Evaluation) | 2 | 0 | 0 | 0 | 30 | 70 |
| 8 | 7HC63 | Soft skills | -- | -- | 2 | 1 | 30 | 70 |
| 9 | 7B671 | CAD/CAM Lab | --- | --- | 2 | 1 | 30 | 70 |
| 10 | 7B672 | Heat Transfer Lab | --- | --- | 2 | 1 | 30 | 70 |
| 11 | 7B673 | Metrology Lab | **---** | **---** | 2 | 1 | 30 | 70 |
| 12 | 7B674 | Group Project | --- | --- | 4 | 2 | 30 | 70 |
| 13 | 7B675 | Comprehensive Viva-voce-II | --- | --- | --- | 1 | 30 | 70 |
| 14 | \*\*\* | **Summer Industry Internship-II (Evaluation will be in IV - I)** | --- | --- | --- | --- | --- | --- |
|  |  | **Total** | **18** | **3** | **12** | **26** | **360** | **840** |

|  |  |  |
| --- | --- | --- |
| CODE | Open Elective-III | Stream |
| 7FC23 | Data Base Systems | IT |
| 7ZC24 | Innovation and Design Thinking | EntrepreneurshipStream/ Technology Entrepreneurship |
| 7ZC27 | Indian history, Culture and Geography | Social Sciences Stream |
| 7ZC15 | Financial Institutions, Markets and Services | Finanace Stream |
| 7AC44 | Fundamentals of Measurements and Instrumentation | EEE |
| 7DC55 | Internet of things( IOT) | ECM / ECE |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--IV Year – I Semester (7th Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 7B722 | Robotics | 4 | --- | --- | 4 | 30 | 70 |
| 5 | 7B723 | Additive Manufacturing Processes | 4 | --- | --- | 4 | 30 | 70 |
| 4 | **PE** | **Professional Elective-I** | 3 | --- | --- | 3 | 30 | 70 |
| 6 | **PE** | **Professional Elective-II** | 3 | --- | --- | 3 | 30 | 70 |
| 6 | **PE** | **Professional Elective-III** | 3 | --- | --- | 3 | 30 | 70 |
| 8 | 7B776 | Production Drawing Practice Lab | --- | --- | 2 | 1 | 30 | 70 |
| 9 | 7B777 | Instrumentation Lab | --- | --- | 2 | 1 | 30 | 70 |
| 10 | 7B778 | CAE Lab | --- | --- | 2 | 1 | 30 | 70 |
| 11 | 7B779 | Project-I | --- | --- | 4 | 2 | 100 |  |
| 12 | \*\*\* 7B780 | **Summer Industry Internship-II (Evaluation only)** | --- | --- | --- | 1 | 30 | 70 |
|  |  | **Total** | **17** | **0** | **10** | **23** | **370** | **630** |

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| --- | --- | --- |
| **CODE** | **Professional Elective-I** | Stream |
| 7B724 | Mechatronics | Production |
| 7B725 | Design and Analysis of Experiments | Design |
| 7B726 | Operations Research | Production |
| 7B727 | Thermal Turbo machinery | Thermal |
| 7B728 | Nanotechnology | Materials |

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| **CODE** | **Professional Elective-II** | Stream |
| 7B729 | Artificial Intelligences (AI) for Mechanical Engineering | Design |
| 7B730 | Power Plant Engineering | Thermal |
| 7B731 | Production Planning and Control | Production |
| 7B732 | Advanced Materials and Processing | Materials |

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| --- | --- | --- |
| **CODE** | **Professional Elective-III** | Stream |
| 7B833 | Non-Destructive Testing Of Materials | Materials |
| 7B834 | Quality and Reliability Engineering | Production |
| 7B835 | Renewable Energy and Energy management | Thermal |
| 7B836 | Product Design | Design |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course structure for B. Tech--IV Year – II Semester (8th Semester)** | | | | | | | | |
| **Sl.No** | **Course code** | **Name of the Course** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | **PE** | **Professional Elective-IV** | 3 | --- | --- | 3 | 30 | 70 |
| 2 | **PE** | **Professional Elective –V** | 3 | --- | --- | 3 | 30 | 70 |
| 3 | 7B881 | Project-II | --- | --- | 10 | 5 | 30 | 70 |
|  |  | **Total :** | **6** | **0** | **10** | **11** | **90** | **210** |

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| --- | --- | --- |
| **CODE** | **Professional Elective-IV** | Stream |
| 7B837 | Mechanics Manufacturing Methods of Composite Materials | Production |
| 7B838 | Design & Applications of Engineering Materials | Design/Materials |
| 7B839 | Automobile Engineering | Thermal |
| 7B840 | Advanced Manufacturing Processes | Production |

|  |  |  |
| --- | --- | --- |
| **CODE** | **Professional Elective-V** | Stream |
| 7B841 | Flexible Manufacturing System & Machine Vision | Production |
| 7B842 | Design Optimization | Design |
| 7B843 | Jet propulsion and Rocket Engineering | Thermal |
| 7B844 | Computational Fluid Dynamics | Thermal |
| 7B845 | Carbon based nanostructures and their applications | Materials |

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**APPLIED THERMODYNAMICS – II**

**Code: 7B514**

**L T P/D C**

**3 1 --- 4**

**Course Objectives:**

*The main objective of the course is to offer the students fundamental knowledge of Rankin cycles,*

*Working of different boilers, working principle of different types of Turbines & Rocket engines.*

**Course Outcomes**

*After completing the subject, students will be able to:*

* *Understand steam power plants and the Rankine cycle on p-v, T-S and h-s diagrams*

*and working principles and basic design parameters of different types boilers.(CO1)*

* *Understand the function of steam nozzle, Wilson line (CO2)*
* *Understand the difference between impulse and reaction turbines, draw velocity diagrams and understand the Principle of operation of reaction turbine, features of Parsons reaction turbine and to draw the velocity diagrams for the same(CO3)*
* *Understand the working principles of different condensers and understand the gas turbine power plants (CO4)*
* *Understand the working principle of jet propulsion and rocket engines* **(CO5)**
* Understand the working of refrigeration and airconditioning (CO6)

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P0a** | **POb** | **POc** | **POd** | **POe** | **POf** | **POg** | **POh** | **POi** | **POj** | **POk** | **POl** |
| **CO1** | M | H | M | L |  |  |  |  |  |  |  |  |
| **CO2** | M | H | M | L |  |  |  |  |  |  |  |  |
| **CO3** | M | H | M | L |  |  |  |  |  |  |  |  |
| **CO4** | L | H | M | L |  |  |  |  |  |  |  |  |
| **CO5** | M | H | M | L |  |  |  |  |  |  |  |  |
| **CO6** | M | H | M | L |  |  |  |  |  |  |  |  |

**UNIT – I**

**Basic Concepts:** Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temp0erature of Heat addition, Methods to improve cycle performance – Regeneration & reheating

**Boilers :** Classification – Working principles – with sketches including H.P.Boilers –Working principles, Boiler horse power, equivalent evaporation, Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney

**UNIT – II**

**Steam Nozzles :** Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

**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**

**Steam Condensers** : Requirements of steam condensing plant – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

**Gas Turbines :** Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.

**UNIT – V**

**Jet Propulsion :** Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

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

**UNIT – VI**

**REFRIGERATION AND AIR CONDITIONING:**  
Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems (Description only) . Air conditioning system - Processes, Types and Working Principles. - Concept of RSHF, GSHF, ESHF.

**TEXT BOOKS:**

1. Thermal Engineering / R.K. Rajput / Lakshmi Publications

2. Gas Turbines – V.Ganesan /TMH

3.Refrigeration And Air Conditioning by Arora and Domkundwar-Dhanpat Rai & Co

**REFERENCES:**

1. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot

2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman

3. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**DESIGN OF MACHINE MEMBERS – I**

**Code: 7B515**

**L T P/D C**

**3 1 --- 4**

**Course Objectives:**

1. Students will learn the mechanical design process / philosophy, the need for and use of standards as part of the same, the selection of materials for mechanical design.
2. Students will learn to design mechanical components subjected to static and variable loading, apply related theories of failure to design based on strength and rigidity; and apply the concepts thereof to design of various fundamental mechanical components.

**Course Outcomes:**

*After completing the subject, students will be able to:*

* Use different theories of failure for designing machine members subjected to steady loads and fatigue loads.[CO1]
* Use different criteria of failure for designing machine members subjected to fatigue loads.[CO2]
* Develop ability to analyze, design and select shafts, keys, couplings, cotter and knuckle joints.[CO3]
* Able to analyze and design the helical coiled and leaf springs.[CO4]
* Identify the applications where Temporary (threaded and bolted) joint and permanent (riveted ) joints are used for various applications - with attention  to design requirements.[CO5]
* able to design and analyze various Welded joints [CO6]

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO2 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO3 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO4 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO5 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO6 |  | **H** | **L** | **M** |  |  |  |  |  |  |  |  |

**UNIT I: Introduction:**

Basic design process and requirements of machine design, use of standards in design, design synthesis; Engineering materials, stress-strain diagrams, mechanical properties of engineering materials; Materials selection techniques. Design for Tolerances of manufacturing.

**Design against static loading:**

Stresses due to axial loads, bending moment, torsional moment and eccentric axial loading, factor of safety, principal stresses, theories of elastic failure; Design of shafts under combined loading , Design of shafts carrying pulleys, gears etc.., Design for strength and rigidity, concept of stiffness in tension / compression, bending and torsion

**UNIT II: Design against Fluctuating Loads:**

Stress concentration & its factors, fluctuating stresses, fatigue failure, endurance limit, Soderberg, Goodman, Modified-Goodman and Gerber criterion, Fatigue design under combined stresses. Design for finite and infinite life. Shaft design against fluctuating and shock loads.

**UNIT III: Design of Keys, Couplings and Joints:**

Types of keys, Design of saddle, sunk, feather, Woodruff and Kennedy keys.

Design of couplings – Muff and Split Couplings, Flange, Flexible and Marine type of couplings.

Design of cotter joint and knuckle joint

**UNIT IV: Design of springs:**

Types of springs, terminology of helical spring, stress and deflection equations, spring materials, helical spring design against static and fluctuating loads, concentric springs, surge in springs.

Design of Leaf springs, Materials for Springs.

**UNIT V: Design of Joints -I:**

**Design of Threaded joints:** Design of bolts and nuts, locking devices, bolt of uniform strength, design of gasket joints, design of power screws and screw jack Bolted joint design with static loads and fluctuating loads, eccentrically loaded bolted joints. Design of Nuts

**Design of Riveted joints:** Types riveted joints, failures of riveted joints, design of lap and butt riveted joints, Eccentric loading of riveted joints.

**UNIT VI: Design of Joints - II:**

**Welded joints:** Types of welded joints, strength of butt and fillet joints, axially loaded symmetrical and unsymmetrical welded joints, bending moment and tensional moment, welded joints subjected to eccentric and variable loading.

**TEXTBOOKS:**

1. **Design of Machine Elements** – Third Edition / V.B.Bhandari / Tata McGraw-Hill Pub.
2. **Mechanical Engineering Design** / J.E.Shigley, C.R.Mischke / Tata McGraw-Hill Pub.
3. Materials Selection in Mechanical Design / Michael F. Ashby
4. Mechanical Design Handbook/PSG

**REFERENCE BOOKS:**

**Fundamentals of Machine Elements** / Bernard Hamrock, Steven Schmid, Bo Jacobson / Tata McGraw Hill

1. A Text of Machine Design – R S Khurmi
2. Design of machine Elements -Kulakarni

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**METAL CUTTING & MACHINE TOOLS**

**Code: 7B516**

**L T P/D C**

**3 -- --- 3**

**Course Objectives:**

To teach students the fundamental concepts of Additive Manufacturing, techniques involved and their advantages and limitations and various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

**Course Outcomes:**

After completing the subject, students will be able to:•Understand the basic metal cutting process and parameters, Forces in metal cutting ,various chips, tool materials, basic relations in metal cutting [CO1]•Understand the thermal aspects of metal cutting, tool wear, tool life, various cuttingtool materials and economic analysis of machining [CO2]•Understand the principle and working of lathe, shaping, planning, slotting machinesand Drilling machines and estimate the machining time [CO3]•Understand the principle and working of Milling machine and Broaching machine[CO4]•Understand the principle and working of Grinding machine, Lapping and Honingmachine [CO5]•Understand the principle of Jigs & Fixtures and the principles of advancedmachining processes[CO6]

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** | M | H |  | M | **L** |  |  |  |  |  |  |  |
| **2** | M | H |  | M | **L** |  |  |  |  |  |  |  |
| **3** | M | H |  | M | **L** |  |  |  |  |  |  |  |
| **4** | M | H |  | M | **L** |  |  |  |  |  |  |  |
| **5** | M | H |  | M | **L** |  |  |  |  |  |  |  |
| **6** | M | H |  | M | **L** |  |  |  |  |  |  |  |

**UNIT – I**

Metal cutting theory – Elements of cutting process, cutting speeds, feed, depth of cut, Geometry of single point tool and angles, Orthogonal and Oblique machining, Mechanism of Chip formation-shear angle relation, types of chips, Velocity relationship, chip breakers-types, Mechanics of orthogonal cutting –Merchant’s Force diagram-derivations of forces, stress and strain in chip, Work done in cutting, Horsepower calculation, Popular metal cutting theories-Ernst & merchant and Lee & Shaffler - Problems

**UNIT – II**

Sources of heat in metal cutting, Failure of cutting tool and Tool wear, Tool life-Taylor’s Equation- Problems, Factors effecting tool life, Cutting Fluids-Functions, qualities, types, Machinability, Machinability index, Cutting tool materials-properties and types, Economics of machining – Tool life for minimum cost and maximum production – Problems

**UNIT – III**

Lathe – Principle of working, types of lathe, Parts of Lathe, specification of lathe, Lathe operations, Taper turning & thread turning-estimation of machining time

Shaping - Principal parts, Principles of working – Quick return mechanisms, operations performed, machining time calculations. Planing and slotting machines –Principle of working, operations performed and comparison wrt shaper

Drilling – type of drilling machines, parts of radial drilling machines, various hole making operations –Elements & angles of twist drill – estimation of Machining time

**UNIT – IV**

Milling machine – Principle of working, Milling methods–Up & Down Milling, Various Milling operations, Geometry of End milling cutter, Indexing heads, Indexing Methods: direct, plain, differential and angular indexing Problems – estimation of Machining time in milling.

Broaching -Types-Classification-Broach elements-Advantages-Limitations.

**UNIT –V**

Grinding machine – cutting action – classification of grinding machines – cylindrical and surface grinding machine –Different types of abrasives and bonds, symbolic representation of bonds, grit, grade and structure, method of Specifying grinding wheel and selection of a grinding wheel, Loading and glazing of grinding wheels, Truing and Dressing the grinding wheels, Lapping, Honing and burnishing – principle, methods and applications

**UNIT - VI**

Jigs and fixtures- Differences, Need, Elements of Jigs & Fixtures, Main Principles of location and clamping: 3-2-1 location principle – Types of Locating and clamping devices, Types of Jigs and Fixtures.

Unconventional Machining: Principles of working and applications of USM, AJM, EDM, ECM, LBM and EBM.

**TEXT BOOKS:**

1. A course in Workshop Technology Vol II (Machine tools) – B.S.Raghu Vamshi – Dhanpat Rai & Co.

2. Production Technology by R.K. Jain and S.C. Gupta.

**REFERENCES:**

1. Manufacturing Science, Amithabha Ghosh and Mallik, Affiliated East West Press

Production Engineeing / P.C.Sharma / S.Chand & Co

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**DYNAMICS OF MACHINERY**

**Code: 7B517**

**L T P/D C**

2 **1 -- 3**

**Course Objectives**

*The main objective of this course is intended to cover the field of engineering theory, analysis, design and practice that is generally described as dynamics of machinery.*

**Course Outcomes**

*After completing the subject, students will be able to*

* *Understand the phenomenon of friction and in developing different applications like, brakes, clutches and dynamometers etc. [CO1]*
* *Understand the effect of precession motion on the stability of moving vehicles. [CO2]*
* *Understand and development of speed controlling devices like flywheel. [CO3]*
* *Understand how to control speed in engines or turbines by governors. [CO4]*
* *Understand how to balance different systems, machines and engines. [CO5]*
* *Understand how to do analysis of different vibrating systems. [CO6]*

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** | M | H | H | M |  |  |  |  |  |  |  |  |
| **2** |  | H | H | M |  |  |  |  |  |  |  |  |
| **3** |  | H | H | M |  |  |  |  |  |  |  |  |
| **4** |  | H | H | M |  |  |  |  |  |  |  |  |
| **5** |  | H | H | M |  |  |  |  |  |  |  |  |
| **6** | M | H | H | M |  |  |  |  |  |  |  |  |

**UNIT – I: FRICTION, CLUTCHES, BRAKES & DYNOMOMETERS:**

**FRICTION**: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis : lubricated surfaces, boundary friction, film lubrication.

**CLUTCHES:** Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

**BRAKES AND DYNAMOMETERS:** Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operations.

**UNIT – II**

**GYROSCOPIC AND PRECESSIONAL MOTION:**

Static and dynamic force analysis of planar mechanisms.

Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

**UNIT –III**

**TURNING MOMENT DIAGRAM AND FLY WHEELS:**

Dynamics of Reciprocating Parts,Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design.

**UNIT-IV**

**GOVERNERS:**

Watt, Porter and Proell governors. Spring loaded governors – Hartnell and hartung with auxiliary springs. Sensitiveness, isochronism and hunting. Quality and stability of governors.

**UNIT – V**

**BALANCING:**

**Balancing of rotating masses:** Single plane and multiple mass systems – Multi mass in different parallel planes.

**Balancing of Reciprocating Masses:** Primary, Secondary, and higher balancing of reciprocating masses.Analytical and graphical methods. Unbalanced forces and couples – examination of “V” multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing – Hammer blow, Swaying couple, variation of tractive efforts. Field balancing.

**UNIT – VI**

**VIBRATION:** Introduction, Definitions, Types of vibrations, Natural frequency,Free longitudinal vibrations, Spring –rotor systems. Equation of motion , Energy methods, Free & forced damped vibrations, Vibration Isolation & Transmissibility, Transverse vibrations Whirling of shafts, critical speeds, Dunkerleys method .Torsional vibrations, two and three rotor systems. Multi rotor system – Amplitude ratios

**TEXT BOOKS:**

1. Theory of machines and mechanisms-vicker, Shigley

2. Theory of Machines / S.S Rattan/ McGraw Hill Publ.

**REFERENCES:**

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**ADVANCED ENTREPRENEURSHIP**

**(Open Elective-II)**

**Code: 7ZC23**

**L T P/D C**

**3 - - 3**

**Course Objective:** The course is designed to impart the necessary managerial skills and tactics required for an emerging Entrepreneur for the Engineering students to enhance their prospects as an Entrepreneur.

**Course Outcomes:**

1. The Students’ gain knowledge on the stages of Startup and the turbulence environment it undergoes and the stages related to growth of the Startup.
2. The Students are exposed to the various business models and critically evaluating the effectiveness of the business models.
3. The students understand the method of business traction and the need of customer relationship management.
4. The students understand the various channels of revenue building and exploration of new revenue avenues.
5. The students understand the need of sales planning and sales management and also financial modeling
6. The students are exposed to the legal implications effecting the company’s prospects and the issues related to intellectual property rights.

***Mapping of Course Outcomes with Program Outcomes:***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  |  |  |  |  |  |  |  |  | **H** | ***M*** |
| CO2 |  |  |  |  |  |  |  |  |  |  | **H** | ***M*** |
| CO3 |  |  |  |  |  |  |  |  |  |  | **H** | ***M*** |
| CO4 |  |  |  |  |  |  |  |  |  |  | **H** | ***M*** |
| CO5 |  |  |  |  |  |  |  |  |  |  | **H** | ***M*** |
| CO6 |  |  |  |  |  |  |  |  |  |  | **H** | ***M*** |

**Unit – I Orientation to Growth:**

Stages of a Startup Company, Infant Mortality of Startup’s, Sustaining the Phase of Launching, Entrepreneurial Propensity, Locus of Control, First Generation Entrepreneur, Growth Opportunities, Diversification and Expansion of Business, Growth Assessment, SWOT Analysis, Growth strategies adopted by ideal startup, Ansoff Growth Matrix, Six ways of Adjacencies for Growth. Case Study of Nike

**Unit - II - Expanding Customer Base:**

Customer Segmentation: Division of Market into Segments, Evaluating the profitability of Segments. Developing Business Model in relation to the current customers. Changing customer segments and revisit of business models. Evaluation of Business Models for new customer segments. Critical evaluation of business models Old Vs New. Risk of changing the Business Models. Analyzing the scalability of business model using Break Even Analysis.

**Unit- III - Traction of Business:**

Meaning of Business Traction, Business Traction Process, and Metrics to Measure Business Traction, Customer Retention, Customer Churning, Relationship Business, Customer Life Time Value, Identifying the unnecessary moves in business traction. Traction of Business using Bull’s-eye framework. Measuring the effectiveness of selected channels. Budgeting and Planning.

**Unit- IV - Growing Revenues:**

Identifying Growing Revenues, stabilizing growing revenues, Developing additional revenues (licensing and franchising). Exploring New channels and Partnerships for growth revenues. Evaluating the Growth streams based on longevity. Lean Startup Canvas.

**Unit V - Sales Planning & Financial Modeling:**

Understanding the consumer buying decision behavior, setting sales plans, sales targets, Art of pitching the sales, Selling process, Building a professional sales team , Sales Management. Price Sensitivity of the market. Optimization of cost and operational expenses. Financial modeling of the Venture, Assessment of competitors and Peer’s financial models.

**Unit –VI - Support System:**

Legal Management in Startups: Issues and Legal constraints effecting the business. Need for professional services: Legal consultancy and Accounting. Need for proper documentation for fool-proof administration of business. Intellectual Property rights and their importance. Business Mentoring, role of experts in managing business.

**References:**

* Entrepreneurship Rajeev Roy “” oxford ,2012

Entrepreneurship Development Khanka, ,S.Chand 2012

* Small Scale industries and Entrepreneurship Vasanth Desai “Himalya publishing 2012
* Robert Hisrich et al “enterpreneruship TMH 2012
* Entrepreneurship Development Khanka, ,S.Chand 2012
* Entrepreneurship Development B.Janikairam and M Rizwana

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**BASICS OF POLITY AND ECOLOGY**

**(Open Elective-II)**

**Code: 7ZC26**

**L T P/D C**

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**Course Objectives:**

To provide basic knowledge relating to the Indian Polity and Ecology, thus making the students appreciate the current aspects related to both polity and ecology.

**Course Outcomes:**

1. Gain knowledge relating to the Indian Constitution and the Preamble to the Constitution.
2. Gain knowledge relating to the fundamental rights and duties of the Indian citizens and the directive principles of state policy.
3. Students will learn about the federal structure and judiciary of India.
4. Comprehend knowledge relating to the conservation of the environment.
5. Learn about bio-diversity and climatic changes occurring in the environment.
6. Know about the international treaties, conventions and organizations active in the field of environmental protection.
7. ***Mapping of Course Outcomes with Program Outcomes:***

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| CO6 |  |  |  |  |  | **H** | ***M*** |  |  |  |  |  |

**Unit 1: Introduction to Salient Features of Constitution**

Significance of the Constitution, Distinction between Written and Unwritten Constitution, Composition of the Constituent Assembly and the role and objectives of the Drafting Committee, Main features and the nature of the Constitution of India. Preamble to the Constitution and its relevance; Basic principles of Preamble and their reflection in the constitutional provisions.

**Unit 2: Fundamental Rights, Duties and Directive Principles of State Policy**

Fundamental Rights and Duties of Citizens- Importance of Rights and Duties, Dignity of an individual, Safeguards against deprivation of life and personal liberty; Writs for the protection of Fundamental Rights; Meaning of Directive Principles of State Policy, Classification of the Directive Principles, Role of Directive Principles, Role of Directive Principles in the establishment of economic and social democracy.

**Unit 3: Government and Judiciary**

Legislative, financial and judicial powers of the President; Appointment of Prime Minister and constitution of Council of Ministers; Powers and functions of Prime Minister; Individual and collective responsibility; Powers and discretionary powers of the Governor; Appointment of the Chief Minister, Formation of the Council of Ministers; Powers and jurisdiction of the Supreme Court and High Courts of India.

**Unit 4: Ecology and Environment**

Environment-Origin, Evolution of Environment and its uses by Humans; Degradation of Natural Environment, Principles of Ecology; Composition and various types of Ecosystem; International Solar Alliance.

**Unit 5: Bio-diversity and Climate Change**

Classification of Biodiversity, Biodiversity loss, Methods of biodiversity conservation, Conservation of Natural Resources such as Soil, Land, Water and Energy. Sustainable Development and Cleaner Technology. Green house effect and Global Warming, Strategies to cope with Green House Effect, Desertification, Depletion of ozone layer.

**Unit 6: International Treaties, Conventions & Organizations:**

Indian Board for Wildlife (IBW). United Nations Environmental Programme (UNEP), United Nations Framework Convention for Climate Change (UNFCCC). International Union for conservation of Nature and National Resources (IUCN), World Wide Fund for Nature (WWF).Montreal Protocol (1987), Kyoto Protocol (1997), Paris Agreement (2016).

**References:**

* Indian Polity - M. Laxmikanth, 5th Edition, McGraw Hill Education, Chennai
* Environment And Ecology A Complete Guide for Civil Services Preliminary and Main Examinations – R. Rajgopalan, 2017, Oakbridge Publishing Pvt. Limited.
* Introduction to Constitution of India – Dr. Durga Das Basu, 22nd Edition, 2015, LexisNexis
* Our Constitution – Subhash C Kashyap, 5th Edition, 2015, National Book Trust, India
* Environment and Ecology – Anil Kumar De and Arnab Kumar De, 2009, New Age International (P) Limited.
* ICSE Environment Education for Class X – Dr. M.P. Mishra , 2009, S.Chand and Company

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**ENTREPRENEURSHIP, PROJECT MANAGEMENT AND STRUCTURED FINANCE**

**(Open Elective-II)**

**Code: 7ZC19**

**L T P/D C**

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**Course Objective:** The objective of the course is to make students understand the nature of Entrepreneurship, its importance and to create an awareness regarding the systematic planning and implementation of projects; highlight the components of structured finance and establish a framework of CMBS with respect to Servicing Agreements

**Course Outcomes:**

1. Students will understand the nature of Entrepreneurship and its importance
2. Will gain knowledge regarding project, its life cycle and organization
3. Will gain knowledge relating to project formulation and implementation
4. Comprehend the components of structured finance
5. Establish a framework of CMBS
6. Students will gain knowledge relating to the CRE Servicing

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**UNIT I**

**CONCEPTS OF ENTREPRENEURSHIP:** Definition of Entrepreneurship, Evolution of Entrepreneurship, Classification of Entrepreneurs**,** Characteristics of Entrepreneur**,** Selection of Product and the means required for starting an enterprise, Financing and Financial incentives available, Success rate of entrepreneurs – a case study.

**UNIT-II**

**BASICS OF PROJECT MANAGEMENT:** Concept and characteristics of a project - types of projects - Objectives of project management - Project Organizational structure - Project life cycle - Challenges and problems of project management - Qualities & functions of a project manager.

**UNIT III**

**PROJECT FORMULATION AND IMPLEMENTATION:** Generation of Project Ideas; Monitoring the environment; Preliminary Screening of Projects; Feasibility study; Project Selection. Detailed Project Report: Market, Technical, Financial and Economic aspects. Pre-requisites for Successful Project Implementation; Control of in-progress Projects (Gantt chart, PERT, CPM); Project Risk Management Process, Post-audit; Abandonment Analysis

**UNIT-IV**

**INTRODUCTION TO STRUCTURED FINANCE**: Term Loans, Bonds/Debentures, Types of debentures, Issue of debt instruments. Structured Finance: Evolution, Securitization process, characteristics, and structured finance products (ABS, CDO, MBS, CDS)

**UNIT-V**

**COMMERCIAL MORTAGAGE LOAN BASICS**: Definition and characteristics of CMBS, CMBS Vs other Mortgage Backed Securities, CMBS three level perspective: property level, loan level, bond level; Life cycle of commercial real estate loans – Loan cycle, Key players in loan cycle; Property types and characteristics, property performance.

**UNIT-V1**

**BASICS OF CRE SERVICING:** Introduction to servicing, Role of the Servicer, Servicing approaches, Influence of technology, Ethics in commercial servicing, Servicing – sources of income, Overview of servicing agreements, Pooling & Servicing agreement, Sub servicing agreement.

**References:**

* H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.
* Jeffrey K. Pinto “Project Management”, 2nd edition, Pearson
* Dhandapani Alagiri “Structured Finance – Concepts & Perspectives”, ICFAI University press.
* Projects by Prasanna Chandra, McGraw-Hill Publishing Co. Ltd
* Project Management: Systems approach to Planning Scheduling and Controlling, H. Kerzner.
* The Complete Real Estate Documents by Mazyar M. Hedayat, John J. Oleary
* The Fundamentals of Listing and Selling Commercial Real Estate - By Keim K. Loren (Author)

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**GENERAL MANAGEMENT AND ENTREPRENEURSHIP**

**(Open Elective-II)**

**Code: 7ZC21**

**L T P/D C**

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**Course Objective:** The course is designed to impart the necessary managerial skills and tactics required for an emerging Entrepreneur for the Engineering students to enhance their career prospects and ambitions of starting a new Enterprise.

**Pre-requisites**: This course shall require a student to have knowledge in Managerial Economics and Financial analysis, Management Science, Operations management**.**

**Course Outcomes:**

1. Describe the necessary managerial skills and tactics required for an emerging Entrepreneur.
2. Distinguish various methods for business process and product development
3. Demonstrate the skills required for the project planning, implementing and controlling
4. Outline the legal aspects and applying for Intellectual Property Rights
5. Illustrate the various sources of finance for venturing a business project.
6. Designing production plant and quality management system.

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**UNIT I**

**INTRODUCTION TO MANAGEMENT AND ENTREPRENEURSHIP:** Changing Face of Management-Entrepreneurship, Modern Management with Entrepreneurial Orientation.. Meaning of Entrepreneurship. Benefits and Drawbacks of Entrepreneurship Reasons feeding the Entrepreneurial fire. Understanding Entrepreneurship as a Process. Multiple roles of Entrepreneur: Intrapreneur, Inventor, Coordinator, Manager and Controller. Psychological and behavioral aspects of First-Generation Entrepreneur. Case Studies

**UNIT II**

**PROCESS DEVELOPMENT AND INNOVATION PROJECT MANAGEMENT:** Business Process Model, Value chain for Manufacturing industries and Service Industries. Frugal Innovation. Creativity process in developing Innovation.. Types of New Products, Forecasting of New Products, Stages in the New Product Development, Prototype building and pitching Going ahead with ideas, killing the ideas through Stage Gate Models, pitching of full fledged idea. Choosing the Start-Up Team.

**UNIT III**

**PROJECT MANAGEMENT AND FEASIBILITY REPORT:** Project Inception, Project Implementation, and Project control. Analyzing the project by employing capital budgeting techniques, Risk Management, tools and techniques. Methods of Appraising the Project. Industry Analysis pertaining to the Product, Competitive Analysis and Market analysis. Preparation of feasibility report, Contents of Feasibility Report. Exercise to write an effective Feasibility report. Case Studies.

**UNIT IV**

**PROTECTION OF IDEAS AND MECHANISM:** Exposure to intellectual property rights to the entrepreneur in the Indian and the World context. Registration process for Patents, Copyrights, Trademarks, Geographical indicators. Legal Framework in administration of Intellectual property rights. Meaning of Infringement, consequences of Infringement. Cases on Infringement. Case Studies.

**UNIT V**

**VENTURE FINANCING AND ISSUES RELATED TO PRICING:** Meaning of Venture Capitalist, Process of Venture Capital, Seed Funding, First Phase Funding, Second Phase Funding and Final Phase funding. Cost analysis, Preparation of standard costing, Finalizing the output, fixing the pricing based on market structure, Monopoly, oligopoly market structures and marketing pricing practices for attracting customers. Case Studies

**UNIT VI**

**MANUFACTURING AND QUALITY MANAGEMENT:** Plant Layout, Process and Product Layout, Service Factory. Introduction to Quality Circles, Quality inspection, ISO Certification, process of certification and exposure to the entrepreneurs of the need for certification. Quality certification for Manufacturing industrial. Case Studies

**References:**

* "Projects: Planning, Analysis, Selection, Financing, Implementation, and Review", Prasanna Chandra, TMH, New Delhi, 2012
* "Project Management", Jeffrey K. Pinto, Pearson, 2011
* Small Scale industries and Entrepreneurship Vasanth Desai “Himalya publishing 2012
* Innovation by Design", Gerald H. (Gus) Gaynor, AMACOM {American Management Association), NYC, 2002
* Entrepreneurship Rajeev Roy “” oxford ,2012
* Fundamentals of Entrepreneurship Nandan H,

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**PYTHON PROGRAMMING**

**(Open Elective-II)**

**Code: 7FC03**

**L T P/D C**

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**Course Objectives:-**

After taking this course, you should be able to:

Use Python interactively, execute a Python script at the shell prompt, use Python types, expressions, and None, use string literals and string type, use Python statements (if...elif..else, for, pass, continue, . . . ), understand the difference between expressions and statements, understand assignment semantics, write and call a simple function., utilize high-level data types such as lists and dictionaries, understand the difference between mutable and immutable types, write a simple class and access methods and attributes, import and utilize a module, read from and write to a text file.

**Course Outcomes:**

CO1: Gains exposure towards Python versions and their specifications.

CO2: Build programs using primitive data types.

CO3: Write applications that include functions, modules, packages along with respective exceptional handling mechanism.

CO4: Writes applications using OO features of Python

CO5: Write applications using Files.

CO6: Hands on exposure on NumPy/Tkinter/Plotpy modules.

***Mapping of Course Outcomes with Program Outcomes:***

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**Unit -I** :

**Introduction to Python:** History, Features, Modes of Execution, Setting up path, working with Python Basic Syntax, Variable and Data Types, Operators. Conditional Statements (If, If- else, Nested if-else) Looping (for, While Nested loops) Control Statements (Break, Continue, Pass).

**Input-Output:** Printing on screen, Reading data from keyboard, Opening and closing file

**Unit-II:**

**Functions:** Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

**String Manipulation**: Accessing Strings, Basic Operations, String slices, Function and Methods

**Lists:** Accessing list, Operations, Working with lists Function and Methods

**Tuple:** Accessing tuples, Operations, Working.

**Dictionaries:** Accessing values in dictionaries, working with dictionaries, Properties Functions and Methods.

**Unit-III:**

**Modules:** Importing module, Math module, Random module, Packages

**Exception Handling:** Exception, Exception Handling, Except clause, Try? Finally clause User Defined Exceptions

**Unit-IV:**

**Python- OOPs concept:** Class and object, Attributes, Inheritance, Overloading Overriding, Data hiding.

**Regular expressions**: Match function, Search function, Matching VS Searching, Modifiers Patterns.

**Unit -V**: Introduction to Files, File Handling, Working with File Structure, Directories, Handling Directories

**Unit -VI:** Case Study with NumPy/PlotPy/SciPy/GUI Programming, Introduction, Tkinter programming, Tkinter widgets

**TEXT BOOK:**

1. [Apress]-Beginning Python. From Novice to Professional, 2nd ed. - [Hetland] (2008)

**Reference books:**

1. Introduction to Computation and Programming using Python, Revised and Expanded Edition, John V. Guttag, The MIT Press.

2. Programming Python, Fourth Edition by Mark Lutz, O'Relly

3. Python Programming using problem solving approach, Reema Thareja, Oxford Higher Education.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**JAVA PROGRAMMING**

**(Open Elective-II)**

**Code:** **7EC65**

**L T P/D C**

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**Course Objective:**

Understand the concepts of Object oriented programming of Java. Write the programs and execute using OOP principles such as garbage collection, overloading methods, constructors, recursion, string handling, StringTokenizer, inheritance and its types, packages, multithreading and threads.

**Course Outcomes:**

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

1. Understand the concept of OOP as well as the purpose and usage of principles of inheritance, Identify classes, objects, members of a class and the relationships among them needed for a speciﬁc problem.
2. Understand and implement concepts of polymorphism, encapsulation and method overloading.
3. Create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identiﬁers, automatic documentation through comments)
4. Students understand and implement error exception handling and multi-threading.
5. Understand the advantages of GUI over CUI and write GUI programs
6. Students learn to create GUI and write programs for event-handling using various user interface components on applets.

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**UNIT-I**

History of Java, Java buzzwords, datatypes, variables, simple java program,scope and life time of variables,operators, expressions, control statements, type conversion and costing, arrays,, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, overloading methods and constructors, string handling, StringTokenizer.

**UNIT-II**

Inheritance –Definition ,single inheritance , benefits of inheritance, Member access rules, super class, polymorphism- method overriding, Dynamic method dispatch, using final with inheritance, abstract class, Base class object.

**UNIT-III**

Interfaces : definition, variables and methods in interfaces , differences between classes and interfaces, usage of implements and extends keyword, uses of interfaces.

Packages: Definition, types of packages, Creating and importing a user defined package.

Applications using interface

Applications using packages

**UNIT-IV**

Exception handling -exception definition, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating user defined exceptions.

Multi-Threading:-Thread definition, types of multitasking, uses of multitasking, thread life cycle, creating threads using Thread class and Runnable interface, synchronizing threads, daemon thread.

Applications of multithreading.

**UNIT-V**

Advantages of GUI over CUI ,The AWT class hierarchy, Component, Frame, user interface components- labels, button, scrollbars, text components, check box, check box groups, choices, lists panels – scrollpane, menubar, graphics, layout, managers –boarder, grid, flow and card layouts.

Applications: developing calculator, developing feedback form, developing biodata.

**UNIT-VI**

Event handling: Delegation event model, closing a Frame, mouse and keyboard events, Adapter classes.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Applications: Developing of simple advertisements.

**TEXT BOOKS**

1. Java; the complete reference, 6th editon, Herbert schildt, TMH.

2. Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.

**REFERENCES**

1. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, seventh Edition, Pearson Education.

2. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell,Seventh Edition, Pearson Education

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Control System Engineering**

**(Open Elective-II)**

**Code: 7AC46**

**L T P/D C**

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**Course Objective:** Course Objective is to Study the principles of system modeling, system analysis and feedback control and use them to design and evaluate feedback control systems with desired performance;

**Course Outcomes:**

Students able to understand

1. Learn basic concepts of control systems.
2. Study about time response analysis.
3. Learn basic concepts of stability and root locus method.
4. Study about frequency response analysis.
5. Learn basic concepts stability analysis in frequency domain.
6. Learn fundamentals of state space analysis.

***Mapping of Course Outcomes with Program Outcomes:***

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**UNIT – I INTRODUCTION:**

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions – Translational and Rotational mechanical systems

**Transfer function representation:**

Transfer Function of Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason’s gain formula.

**UNIT-II TIME RESPONSE ANALYSIS:**

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems, PID controllers.

**UNIT – III STABILITY ANALYSIS IN S-DOMAIN:**

The concept of stability – Routh’s stability criterion – qualitative stability and conditional stability – limitations of Routh’s stability.

**Root Locus Technique:** The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

**UNIT – IV FREQUENCY RESPONSE ANALYSIS:**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

**UNIT – V STABILITY ANALYSIS IN FREQUENCY DOMAIN:**

Polar Plots-Nyquist Plots-Stability Analysis.

**CLASSICAL CONTROL DESIGN TECHNIQUES:** Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain.

**UNIT – VI STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS:**

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties.

**TEXT BOOKS:**

1. Automatic Control Systems 8th edition –B. C. Kuo 2003– John wiley and sons.

2. Control Systems Engineering – I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.

**REFERENCES:**

1. Modern Control Engineering – Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

2. Control Systems – N.K.Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.

3. Control Systems Engg. – NISE 3rd Edition – John wiley.

4. “Modeling & Control of Dynamic Systems” – Narciso F. Macia George J. Thaler, Thomson Publishers.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Introduction to VLSI & Embedded System**

**(Open Elective-II)**

**Code: 7CC38**

**L T P/D C**

**3 -- -- 3**

***Course Objectives:***

*The objectives of this course are*

* *To provide basic knowledge in embedded system design using Embedded C.*
* *To introduce syntax, lexical conventions, data types and memory related to Verilog HDL.*
* *To design, test and implementation of thedigital hardware using various modeling styles.*

***Course Outcomes****: After studying this course, the students will be able to*

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| *CO1* | *Understand levels of design description, concurrency, simulation and synthesis.* |
| *CO2* | *Apply language constructs, data types, operators available in verilog HDL.* |
| *CO3* | *Design combinational logic and sequential logic in gate level modeling.* |
| *CO4* | *Demonstrate the use of development software for a particular application and choosing appropriate OS.* |
| *CO5* | *Understanding and building basic embedded system using 8051.Understanding its design* |
| *CO6* | *Design of embedded systems and implementation of switch reading.* |

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO4 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO5 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO6 |  |  |  |  |  |  |  |  |  |  |  |  |

**UNIT – I:**

**LANGUAGE CONSTRUCTS AND CONVENTIONS:** Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. Verilog Module structure.

**UNIT – II**

**MODELING AT DATA FLOW LEVEL:**Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

**BEHAVIORAL MODELING:**Introduction, Initial Construct, Always Construct, Assignments with delays, Blocking and Non blocking Assignments

**UNIT – III**

**MODELING AT DATA FLOW LEVEL:**Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

**BEHAVIORAL MODELING:**Introduction, Initial Construct, Always Construct, Assignments with delays, Blocking and Non blocking Assignments

**UNIT – IV**

**Programming Embedded Systems in C**

Introduction ,What is an embedded system, Which processor should you use, Which programming language should you use, Which operating system should you use, How do you develop embedded software, Conclusions

**UNIT – V**

**The 8051 Architecture:** Architecture of 8051 Micro controller, Memory Organization. Special Function Registers. Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts.

**UNIT – VI**

**Reading Switches**

Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version),

**Adding Structure to the Code**

Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the ‘Hello Embedded World’ example, Example: Restructuring the goat-counting example, Further examples, Conclusions

**TEXT BOOKS:**

1. T.R. Padmanabhan and B. Bala Tripura Sundari, Design through Verilog HDL – WSE, 2004 IEEE Press.
2. Embedded C - Michael J. Pont, 2nd Ed., Pearson Education, 2008

**REFERENCE BOOKS:**

1. J. Bhaskar, A Verilog Primier, BSP, 2003.
2. PICmicro MCU C-An introduction to programming, The Microchip PIC in CCS C - Nigel Gardner

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**QUANTITATIVE APTITUDE**

**Code: 7H518**

**L T P/D C**

**1 1 -- 2**

**Course objectives:** By learning Quantitative Aptitude, student learns the techniques to solve all the problems in his real life..It can improve the numerical ability. The quicker methods are useful to solve the problems within the time and it is helpful in his duties. Student can use Quantitative Aptitude in everyday life to figure out mathematically. Student can improve his mental capacity. It helps in sharpening their minds.

**Course Outcomes**: After completion of this course students will be able to solve

1. The questions given on testing divisibility, prime number and questions of HCF and LCM .
2. The questions given on averages, percentage and profit and loss.
3. The questions given on ratio and proportion.
4. The questions given on simple and compound interest.
5. The questions given on time and work, time and distance.
6. The questions given on mensuration and data sufficiency.

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** | **H** |  |  |  |  |  |  |  |  |  |  |  |
| **2** | H |  |  |  |  |  |  |  |  |  |  |  |
| **3** | H |  |  |  |  |  |  |  |  |  |  |  |
| **4** | H |  |  |  |  |  |  |  |  |  |  |  |
| **5** | H |  |  |  |  |  |  |  |  |  |  |  |
| **6** | H |  |  |  |  |  |  |  |  |  |  |  |

**Unit I**

Number System: Test for Divisibility, Test of prime number, Division and Remainder – HCF and LCM of Numbers - Fractions.

**Unit II**

Average: Average of different groups, Replacement of some of the items - Percentage - Profit and Loss.

**Unit III**

Ratio and Proportion: Properties of Ratio, Comparison of Ratios, Useful Simple Results on Proportion – Partnership and Share.

**Unit IV**

Simple Interest: Effect of change of P, R and T on Simple Interest - Compound Interest: Conversion Period, Difference between Compound Interest and Simple Interest.

**Unit V**

Time and Work- Pipes and Cisterns, Time and Distance- Problems on Trains- Boats and Streams, Allegation or Mixtures.

**Unit VI**

Mensuration: Area of Plane Figures, Volume and Surface Area of Solid Figures.

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graphs.

**Text Books:**

1. Quantitative Aptitude by R.S.Agarwal

2. Quantitative Aptitude by Abhijit Guha

3. Quantitative Aptitude for Competitive Examinations, U.Mohan Rao, Scitech Publication.

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Cyber Security**

**Code: 7FC20**

**L T P/D C**

**2 0 0 0**

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**Prerequisite : Nil**

**Course Objectives:**

* To familiarize with network security, network security threats, security services, and countermeasures.
* To be aware of computer security and Internet security.
* To study the defensive techniques against these attacks.
* To familiarize with cyber forensics.
* To be aware of cyber crime related to mobile and laptop etc.
* To acquire knowledge relating to Cyberspace laws and Cyber crimes.
* To understand ethical laws of computer for different countries, Offences under the Cyberspace and Internet in India.

**Course Outcomes:**

**At the end of this course the student will be able to**

1. The students will be able to understand cyber-attacks, types of cybercrimes.
2. Realize the importance of cyber security and various forms of cyber attacks and countermeasures.
3. Get familiar of cyber forensics.
4. Get familiar with obscenity and pornography in cyber space and understand the violation of Right of privacy on Internet.
5. Cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.
6. Elucidate the various chapters of the IT Act 2008, power of Central and State Government to make rules under IT Act 2008.

**UNIT-I: Introduction to cyber Security**

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc.,

**UNIT-II: Cyber Forensics:**

Introduction to cyber forensic, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

**UNIT-III: Cybercrime: Mobile and Wireless Devices:**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

**UNIT-IV: Cyber Security: Organizational Implications:**

Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

**Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT-V: Privacy Issues:**

Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

**UNIT-VI: Cyberspace and the Law &Miscellaneous provisions of IT Act.**

Introduction to Cyber Security Regulations, International Law. The INDIAN Cyberspace, National Cyber Security Policy. Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threats.

Other offences under the Information Technology Act in India, The role of Electronic Evidence and miscellaneous provisions of the IT Act.2008.

**Cybercrime: Examples and Mini-Cases**

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TEXT BOOKS:**

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

1. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

**REFERENCE BOOKS:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

3. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)”, 2ndEdition, O’ Reilly Media, 2006.

4. Wenbo Mao, “Modern Cryptography – Theory and Practice”, Pearson Education, New Delhi, 2006.

5. Cyberspace and Cybersecurity, George Kostopoulos, Auerbach Publications, 2012.

6. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, Second Edition, Albert Marcella, Jr., Doug Menendez, Auerbach Publications, 2007.

7. Cyber Laws and IT Protection, Harish Chander, PHI, 2013

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**APPLIED THERMODYNAMICS LAB**

**Code: 7B567**

**L T P/D C**

**-- -- 2 1**

**Course Objectives:**

To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process. to apply the thermodynamic concepts into various thermal application like I.C Engines, Steam turbines, compressors and Refrigeration and Air Conditioning systems.

*After completing the subject, students will be able to conduct:*

1. Performance test on air compressor will make the student to analyze the performance of the compressor**(CO1)**
2. Disassembly and assembly of I.C engine and Valve timing diagram will make the student understand the internal components and their functionality and study of boilers**(CO2)**
3. Heat balance test and performance of four stroke single cylinder diesel engine and will make the student understand have the energy supplied to the engine **(CO3)**
4. Vapour compression Refrigeration system and Air conditioning system will make the student understand the components and working of a refrigeration cycle**(CO4)**
5. computerized IC engine and variable compression ratio engine performance will make the student understand have the energy supplied to the engine in distributed in a cycle.**(CO5)**
6. Performance of four stroke petrol engine and Morse test will make the student understand have the energy supplied to the engine**.(CO6)**

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** | M | M | H | L |  |  |  |  |  |  |  |  |
| **2** | L | L | H | L |  |  |  |  |  |  |  |  |
| **3** | M | M | H | L |  |  |  |  |  |  |  |  |
| **4** | M | M | H | L |  |  |  |  |  |  |  |  |
| **5** | M | M | H | L | **M** |  |  |  |  |  |  |  |
| **6** | M | M | H | L |  |  |  |  |  |  |  |  |

**LIST OF EXPERIMENTS**

**Note:** Minimum of 10 experiments to be performed

1. Two stage reciprocating compressor: performance test
2. Valve timing diagram of four stroke single cylinder diesel engine
3. Disassembly and assembly of diesel engine
4. Performance test on diesel engine
5. Performance test on four stroke petrol engine
6. Heat balance test on diesel engine
7. Morse test on four cylinder four stroke petrol engine
8. Study of boilers
9. Vapour compression refrigerator
10. Air conditioning
11. Computer based single cylinder diesel engine eddy current dynamometer

**LIST OF EQUIPMENT**

1. Cut Section of Four Stroke Diesel Engine
2. Four Stroke Single Cylinder Diesel Engine Dis-Assembly and Assembly
3. Four Stroke Multi Cylinder Petrol Engine
4. Four Stroke Single Cylinder Diesel Engine
5. Four Stroke Single Cylinder Petrol Engine
6. Single Acting two Stage Reciprocating Air Compressor
7. Models of IC Engines and Boilers
8. Computerized single cylinder Diesel Engine Test Rig
9. Refrigeration tutor, 1/3 HP Capacity
10. Air Conditioner Trainer - Duct type

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**MACHINE TOOLS LAB**

**Code: 7B568**

**L T P/D C**

**-- -- 2 1**

**Course Objectives:**

This course gives students the opportunity to obtain skills in machine shop operations under the supervision of qualified machine shop personnel. They also understand the safety aspects of handling machines and work effectively with others and conduct themselves ethically and responsibly in a machine shop context

**Course Outcomes:**

After completing the Laboratory, students will be able to:

**CO-1:** Make simple products using lathe and covering various machining operations as per drawing

**CO-2:** Produce jobs as per drawing using shaper, Planer and Slotter machines

**CO-3:** Understand the principle and working of Drilling machine and conduct various machining  
operations as per drawing

**CO-4:** Work on Tool & Cutter Grinding, Milling machine and conduct various machining operations as per drawing

**CO-5:** Perform surface grinding operation and conduct alignment test on lathe and drilling machines

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** | M |  | H |  | M |  |  |  | M |  |  |  |
| **2** | M |  | H |  | M |  |  |  | M |  |  |  |
| **3** | M |  | H |  | M |  |  |  | M |  |  |  |
| **4** | M |  | H |  | M |  |  |  | M |  |  |  |
| **5** | M |  | H |  | M |  |  |  | M |  |  |  |

**List of Experiments**

1. Introduction to General purpose machine tools - Lathe, Drilling machine, Milling machine, Shaper and Grinding machines
2. Study and usage of measuring and inspection tools used in Machine tool laboratory: – Vernier caliper, micrometers, height gauge, V-block, surface plate, Bore gauges, Pitch gauges, straight edges, dial gauge, plug and ring gauges, slip gauges, tool maker’s microscope.
3. Lathe Operations-I: Facing, Plain turning, Step turning, Taper turning and Chamfering
4. Lathe Operations-II: Thread cutting, Grooving and Knurling
5. Drilling Operations-I: Drilling, Boring, Reaming
6. Drilling Operations-II: Counter boring, Counter sinking and Tapping
7. Shaping Operations: Machining of V-Block
8. Milling Operations
9. Surface Grinding Operations
10. Tool and Cutter Grinder: Grinding of Tool angles of single point cutting tool
11. Machine tool alignment test on Lathe
12. Machine tool alignment test on Drilling machine

**LIST OF EQUIPMENT**

1. Lathe machines
2. Surface Grinding Machine
3. Tool & Cutter Grinding Machine
4. Centerless Grinding Machine
5. Bench Grinding Machine
6. Shaping Machine
7. Slotting machine
8. Metal Planing machine
9. Vertical Milling Machine
10. Radial Drilling machine
11. Spirit level
12. Mandrel
13. Height Gauge
14. Drill Tool Dynamometer
15. Lathe Tool Dynamometer

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**Kinematics & Dynamics of Machines Lab**

**Code:7B569**

**L T P/D C**

**--- --- 2 1**

**Course Objective:**

To expose practical knowledge in kinematics and dynamics of planar mechanism and vibrations.

**Course Outcomes: -**

*After completing the Laboratory, students will be able to:*

1. Understand the concept of vibrations, able to calculate the acceleration due to gravity and stiffness of the spring.
2. Understand concept of radius of gyration
3. Draw the displacement diagram of cam and follower and study the characteristics of governor
4. Understand the torsional vibrations
5. Understand the gyroscopic effects and balancing of rotating masses
6. Understand the pressure distribution in a journal bearing and critical speeds of shafts.

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | M |  | H |  |  |  |  |  |  |  |  |  |
| CO2 | M |  | H |  |  |  |  |  |  |  |  |  |
| CO3 | L |  | H |  |  |  |  |  |  |  |  |  |
| CO4 | M |  | H |  |  |  |  |  |  |  |  |  |
| CO5 | M |  | H |  |  |  |  |  |  |  |  |  |
| CO6 | M |  | H |  |  |  |  |  |  |  |  |  |

**List of Experiments**

1. Evaluate the acceleration due to gravity with the help of simple pendulum
2. Calculate the radius of gyration of the given bar treating that as a compound pendulum
3. Draw the displacement diagram for the Cam and Follower
4. Find the modulus of rigidity for the given shaft
5. Verity the gyroscopic couple using motorized gyroscope
6. Study the pressure distribution of a Journal Bearing
7. Identify the stiffness of the given spring
8. Obtain the radius of gyration of a given bar using the Bifilar Suspension
9. Create the characteristic curves for the Hartnell Governor
10. Measure the modulus of rigidity of the given shaft
11. Examine the different fundamental frequencies of the given shaft
12. Estimate the required balancing mass using a rotating balancing

**Syllabus for B. Tech. III Year I semester**

**Mechanical Engineering**

**TECHNICAL SEMINAR-V**

**Code: 7B595**

**L T P/D C**

--- --- **2 1**

**Course Objectives:**

To promote and develop presentation skills in a variety of on-going technical advances in order to enrich their academic experience. And to set the stage for future recruitment by potential employers

**Course Outcomes:**

1) An ability to utilize technical resources

2) An ability to write technical documents and give oral presentations related to the work completed.

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** |  |  |  |  |  |  |  | **M** |  | **H** |  | **H** |
| **2** |  |  |  |  |  |  |  | **M** |  | **H** |  | **H** |
| **3** |  |  |  |  |  |  |  | **M** |  | **H** |  | **H** |
| **4** |  |  |  |  |  |  |  | **M** |  | **H** |  | **H** |
| **5** |  |  |  |  |  |  |  | **M** |  | **H** |  | **H** |
| **6** |  |  |  |  |  |  |  | **M** |  | **H** |  | **H** |

**Procedure**:

1. Seminar in-charges shall highlight the significance of Technical Seminar in the first two sessions and enlighten the students on the utility of these seminars.

2. The slots, titles shall be decided upfront and seminar In-charge shall take signatures from students.

1. The same sheet shall be affixed in the respective classrooms and seminar register.
2. If any student fails to present his/her seminar on the given slot, to genuine reasons, they may be asked to present in the subsequent slot / week.
3. Progress of the seminars needs to be reviewed by the concerned HOD once in 15 days.
4. The evaluation for Technical Seminars has to be informed to students and displayed in the classrooms.
5. Report and presentation must contain topic, introduction, explanation, diagrams, tables, applications and conclusions.

**Distribution of Marks**

|  |  |
| --- | --- |
| Day to day progress of the work | 15 marks |
| Final report and viva | 15 marks |
| Level of content | 20 marks |
| Presentation | 20 marks |
| Discussion & Involvement | 20 marks |
| Attendance | 10 marks |
| Total | 100 Marks |

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**HEAT TRANSFER**

**Code: 7B618**

**L T P/D C**

**3 1 -- 4**

**COURSE OBJECTIVE:**

To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

**COURSE OUTCOMES**:

After completing the subject, students will be able:

1. To demonstrate basic knowledge of heat transfer by understanding: differences between conduction, convection and radiation; Students shall be able to formulate basic differential equations for heat transfer; Students must able to understand the importance of thermal conductivity of materials.
2. To deal with problems like conduction through walls and composite walls; critical radius of insulation; heat transfer in fins; Transient heat transfer.
3. To Calculate of heat transfer coefficient; overall heat transfer coefficient; log-mean temperature differences.
4. To differentiate forced and natural convection problems correlations; and demonstrate the use of Biot, Nusselt, Reynolds, Grashof, Rayleigh and Prandtl numbers; basic radiative heat transfer, basic principles of mass transfer.
5. To make the students capable of employing the heat transfer principles during phase change processes in heat exchangers; To bring in confidence to apply the principles in industrial appliances and machinery like Power Plants, Heat Exchangers, coolers etc
6. To understand basic principles of radiation heat transfer and radiation heat exchange between surfaces.

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | H | H | M | L |  |  |  |  |  |  |  |  |
| CO2 | H | H | M | L |  |  |  |  |  |  |  |  |
| CO3 | H | H | M | L |  |  |  |  |  |  |  |  |
| CO4 | H | H | M | L |  |  |  |  |  |  |  |  |
| CO5 | H | H | M | L |  |  |  |  |  |  |  |  |
| CO6 | H | H | M | L |  |  |  |  |  |  |  |  |

**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.

**UNIT – II**

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 – overall heat transfer coefficient – electrical analogy – Critical radius of insulation

**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 - Chart solutions of transient conduction systems- Concept of Functional Body

**UNIT – III**

**Convective Heat Transfer :** Classification of systems based on causation of flow, condition of flow, 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.

**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 – 1V**

**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.

**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.

**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 VI**

**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. Fundamentals of Engg. Heat and Mass Transfer / R.C.SACHDEVA / New Age International

**REFERENCE BOOKS:**

1. Heat Transfer / HOLMAN/TMH
2. Fundamentals Of Engineering Heat And MassTransfer - R. C. Sachdeva/ New Age
3. Heat Transfer – P.K.Nag/ TMH
4. Heat and Mass Transfer – R.K. Rajput – S.Chand& Company Ltd.
5. Heat and Mass Transfer-Kondandaraman

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**DESIGN OF MACHINE MEMBERS-II**

**Code: 7B619**

**L T P/D C**

**3 1 -- 4**

**Course Objectives:**

1. Students will understand the concepts associated with design of bearings, engine parts, gears, and cylindrical pressure vessels.
2. Students will understand the significance and apply statistical methods to design simple machine members.

**Course Outcomes:**

A student achieving a passing grade in this course will be able to:

* Design bearings and select appropriate bearings using bearing catalogs.[CO1]
* design parts of internal combustion engine[CO2]
* derive design expression for spur and bevel gears [CO3]
* design helical and worm gears [CO4]
* gain skills to design various pressure vessels.[CO5]
* Learn the application of statistical mathematics for machine design subject.[CO6]

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| **2** |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
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| **5** |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| **6** |  | **H** | **L** | **M** |  |  |  |  |  |  |  |  |

**UNIT I: Design of Bearings:**

**Sliding Contact Bearings:** Classification of bearings, Design Hydrodynamic bearimgs.basic modes of lubrication, Petroff’s equation, McKee equation, bearing design, selection of parameters, Design of Hydrostatic bearings. Selection bearing materials and lubricating oil

**Rolling contact bearings:**

Types of rolling contact bearings, Design of ball and roller bearings. static load carrying capacity, dynamic load carrying capacity, equivalent bearing load, load-life relationship, load factors, bearing reliability ,selection of bearing from manufactories catalogues.

**UNIT II: Design of I.C. Engine parts:**

Introduction of I.C.Engine**,** Design of Cylinder, piston, Piston rings, Piston pin, connecting rod & its ends and crank shaft. Material selection.

**UNIT III: Design of Gears-I**

**Spur Gears:** Classification of gears, gear terminology, undercutting, gear tooth failures; Force analysis; Strength analysis: bending strength (Lewis equation), beam and wear strength of gear tooth, checking for dynamic (Buckingham equation) and wear considerations; design procedure for spur gears (estimation of module, centre distance, face width etc).

**Beval Gears:** Classification, Terminology, Design calculations, Force Analysis.

**UNIT IV: Design of gears-II**

**Helical Gears**: Introduction, terms of helical gears, formative no.of teath, proportion of helical gears, Design equations of helical gears. design procedure for helical gears (estimation of module, centre distance, face width etc).

**Worm Gears:** Terminology, Design of Worm and gear, Heat Dessipation calculations, Effeceincy of worm gear. Force analysis.

**UNIT V: Design of Cylinders and Pressure Vessels:**

Thin and thick cylinders under internal and external pressures; Design of cylinders: Lame’s equation, Clavarino’s and Birnie’s equations, Barlow’s equation. Compound cylinders; thin spherical vessels; Design of end closures of thick and thin cylinder.

**UNIT VI: Statistical Considerations in Design:**

Frequency distribution, frequency curves, measures of central tendency and dispersion, probability distribution, Normal curve, design and natural tolerances; Probabilistic aspects of variations in geometry of machine elements, material properties, external loading and initial / boundary conditions, probabilistic approach to design, reliability. Introduction to failure analysis and design of simple machine elements when uncertainities modeled with mean and standard deviations.

**TEXTBOOKS:**

1. **Design of Machine Elements** – Third Edition / V.B.Bhandari / Tata McGraw-Hill Pub.
2. **Mechanical Engineering Design** / J.E.Shigley, C.R.Mischke / Tata McGraw-Hill Pub.

**REFERENCE BOOKS:**

1. **Fundamentals of Machine Elements** / Bernard Hamrock, Steven Schmid, Bo Jacobson / Tata McGraw Hill
2. Probabilistic Mechanical Design / Edward B. Haugen
3. A Text Book of Machine Design -Kurmi

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**METROLOGY AND INSTRUMENTATION**

**Code: 7B620**

**L T P/D C**

**3 -- -- 3**

**Course Objectives:**

**The objectives of the course are to** provide required knowledge for mechanical measurements

The course exposes the students to the principles of measurement, gauges

**Course Outcomes:**

*After completing the subject, students will be able to :*

* Understand the concept limits,fits,and tolerances and their practical applications,different linear measurements and angular measuring instruments.
* Understand and design the limit gauges, evaluate surface roughness & its measurement
* Understand screw threads and gear metrology and application of interferometry to flatness measurement
* Understand the features of basic measurement system and various static and dynamic characteristics of instruments
* Understand the principle of various instruments to measure pressure and temperature
* Understand the principle of various instruments to measure the displacement, force, torque and vibrations

***Mapping of Course Outcomes with Program Outcomes:***

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| CO1 | H | H | H | M |  |  |  | M |  |  |  | L |
| CO2 | H | M | M | M |  |  |  |  |  |  |  | L |
| CO3 | H | L | M | M |  |  |  |  |  |  |  | L |
| CO4 | H | M | H | L |  |  |  |  |  |  |  | L |
| CO5 | H | L | H | M |  |  |  |  |  |  |  | L |
| CO6 | H | H | H | H |  | M |  |  |  |  |  | L |

**A. METROLOGY :**

**UNIT – I**

**Systems of limits and fits:** Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly, Indian standard system-Problems

**Linear Measurement:** Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

**Measurement Of Angles And Tapers:** Bevel protractor, angle slip Gauges, spirit levels, Sine bar, rollers and spheres used to determine the tapers, problems.

**UNIT – II**

**Limit Gauges:** Taylor’s principle – Design of go and No go gauges, plug, ring, snap, gap gauges, Problems.

**Optical Measuring Instruments:** Tool maker’s microscope and its uses

**Surface Roughness Measurement:** Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S Values, Rz value, Methods of measurement of surface finish-profilograph, Talysurf, Problems

**UNIT- III**

**Screw Thread Measurement:** Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch.

**Gear Measurement:** Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

**B. INSTRUMENTATION:**

**UNIT – IV**

**Introduction and Basic principles of Measurement** – Measurement systems, Generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics, Sources of error, Classification and elimination of error.

**UNIT – V**

**Measurement of Pressure:** Units – classification – different principles used. Manometers, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mc leod pressure gauge.

**Measurement of Temperature:** Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

**UNIT – VI**

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

**Measurement of Force And Torque -** Elastic force meters, load cells, Torsion meters, Strain gauge Rosettes.

**Measurement of Acceleration and Vibration:** Different simple instruments – Principles of Seismic instruments – Vibro meter and accelerometer using this principle.

**TEXT BOOKS:**

1. Engineering Metrology / I C Gupta./ Danpath Rai

2. Engineering Metrology / R.K. Jain / Khanna Publishers

3. Measurement Systems: Applications and Design by D.S Kumar.

4. Mechanical Measurements / BeckWith, Marangoni,Linehard, PHI / PE

**REFERENCES:**

1. Production Engineering/P.C.Sharma

2. Measurement systems: Application and Design, Doeblin Earnest. O. Adaptation by Manik and

Dhanesh/ TMH

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**CAD/CAM** **and FEA**

**Code: 7B621**

**L T P/D C**

**3 --- --- 3**

**Course Objectives:**

The general objectives of the course are to enable the students to

* 1. Understand the basic fundamentals of computer aided design and manufacturing.
  2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse and different geometric modelling techniques like solid modelling, surface modelling, feature based modelling.
  3. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control.
  4. To provide the fundamental concepts of the theory of the principles finite element method and formulate 2D design problems into FEA.
  5. To introduce basic aspects of finite element technology in symmetric and axi symmetric solid design problems.

**COURSE OUTCOMES**:

At the end of the course the students shall be able to:

* 1. Identify the importance of CAD/CAM in modern manufacturing systems and explain the hardware used for CAD/CAM systems.
  2. Describe different geometric modelling techniques to represent the surface and solid models and transformation of geometric entities using transformation matrices
  3. Asses the difference between conventional and NC technologies and develop part programs for manufacturing simple components
  4. Formulate mechanical problems such as trusses and beams into finite elements
  5. Understand the basic terminologies of finite element method and able to derive finite element equilibrium equations for 1D finite element problems.
  6. Derive finite element equation for 2D and axi-symmetric, isoperimetric problems and structural dynamic problems in engineering applications.

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 | M | M | H |  | L |  |  |  |  |  |  |  |
| CO3 | M | M | H |  | L |  |  |  |  |  |  |  |
| CO4 | H | H |  | H |  |  |  |  |  |  |  |  |
| CO5 | H | H |  | H |  |  |  |  |  |  |  |  |
| CO6 | H | H |  | H |  |  |  |  |  |  |  |  |

**UNIT – I**

**Design Process:** Design criteria, Alternative solutions, Alternative design Computer Aided Design.

Geometric Modeling: Wire frame entities and their definition, interpolation and approximation curves.

Concept of parametric and non-parametric representation of a circle and helix curves. Properties of

splines. Synthetic curves: Parametric representation, continuity, properties and characteristics of cubic Spline, Bezier, and B-spline curves. Concept of NURBS

**UNIT – II**

**Surface Modeling:** Analytic surfaces: definitions of planar, surface of revolution, Tabulated cylinder.

synthetic surfaces: Cubic and Bezier surfaces. Solid Modeling: C-rep and B-rep approaches. Design Applications: Mass property calculations, Mechanical tolerancing, and Design Review. 2D Transformations and their Mathematics: Translation, Scaling and Rotation about arbitrary points, shearing and Reflection ,Homogeneous representations, and concatenation.

**UNIT – III**

**Numerical control:** NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools,

features of Machining center, turning center. CNC Part Programming: fundamentals of manual part

programming methods and Computer Aided Part Programming. Group Technology: Part family, coding and classification. Computer Aided Processes Planning: Retrieval type and Generative type. Computer Aided Quality Control: Contact and Non-contact inspection methods, computer aided testing.

**UNIT – IV**

**Introduction to Finite Element Method** for Solving field problems. Stress and equilibrium, Boundary

conditions. Strain-Displacement and Stress-Strain relations. One dimensional problem: Finite element

modeling coordinates and shapes functions, potential energy approach: Assembly of Global stiffness

matrix and load vector, Finite element equations, Treatment of boundary conditions, Quadratic shape

functions, analysis of 1D problems with bar element

**UNIT – V**

**Analysis of trusses:** Analysis of Plane trusses, local and global coordinate systems, direction cosines,

stiffness matrix, Stress calculation, temperature effects. **Analysis of simple Beams:** Element stiffness

matrix for two nodes. Finite element modeling for two dimensional stress analysis with constant strain

triangle.

**UNIT – VI**

**Finite element modeling of axi-symmetric solids**: subjected to axi-symmetric loading with triangular elements. Two dimensional four nodded iso-parametric elements and numerical integration and Gaussian Quadrature. **Dynamic Analysis:** Formulation of finite element model, element matrices, Evaluation of Eigen Values and Eigen vectors for a stepped bar. Convergence requirements Introduction to Finite Element Analysis Software.

**TEXT BOOK:**

1. CAD / CAM A Zimmers &amp; P.Groover/PE/PHI

2. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH

3.Tirupathi R-Chandrupatla: “Introduction to finite elements in engineering”, PHI publishers

4.Singiresu S.Rao -The finite element methods in Engineering , BH, Elsevier publishers

**REFERENCES:**

1. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson

2. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson

3. David V.Hutton “Fundamentals of finite elements analysis

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Data Base Systems**

**(Open Elective - III)**

**Code: 7FC23**

**L T P/D C**

**3 - - 3**

**Course Outcomes:**

* Students will learn basics of databases and understand the architecture of database management systems.
* Students will learn about good database design techniques and database theories behind.
* Understand conceptual database designs, and functional dependencies and normalization.
* Students will understand the Mathematical foundation for relational databases.
* Student will be able to understand concept of Constraints, Views and will be able to create dynamic databases.
* Learn transaction management, concurrency controls.

***Mapping of Course Outcomes with Program Outcomes:***

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**Unit – I** Introduction to Databases and Transactions What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management

**Unit- II** Data Models The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.

**Unit-III** Database Design ,ER-Diagram and Unified Modeling Language Database design and ER Model: Overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd’s rules, Relational Schemas, Introduction to UML Relational database model: Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).

**Unit- IV** Relational Algebra and Calculus Relational algebra: introduction, Selection and

projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.

**Unit- V** Constraints, Views and SQL What is constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.

**Unit-VI** Transaction management and Concurrency control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.

**TEXT BOOKS:**

A Silberschatz, H Korth, S Sudarshan, “Database System and Concepts”, fifth Edition McGraw-Hill , Rob, Coronel, “Database Systems”, Seventh Edition, Cengage Le

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Innovation and Design Thinking**

**(Open Elective-III)**

**Code: 7ZC24**

**L T P/D C**

**3 - - 3**

**Course Objective:** The objective of the course is to make students understand the nature of Innovation, creativity and IPRs, and to motivate the student to start his/her own enterprise with innovative skills.

**Course Outcomes:**

1. The students gain the knowledge on the inputs required for innovation and also gain familiarity on Entrepreneurship.
2. The students will get exposure on creative methods of ideation and the importance of protecting the ideas.
3. The students gain knowledge on design thinking and types of thinking.
4. The students gain familiarity on emerging technologies like Internet of things (IOT).
5. The students understand the process of building the startup.
6. The students gain knowledge on various startup funding and also to branding building for the startup.

***Mapping of Course Outcomes with Program Outcomes:***

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**Unit – I: Introduction to Innovation: -** Meaningof Innovation, Difference between innovation and invention, Difference between Innovation and Creativity, Need to be Creative , Importance of Innovation, Innovation as a Competitive Advantage, Innovation Continuum, Innovation Cycle, Disruptive Innovation, , Breakthrough innovations and its consequences on the society, Challenges in Innovation.

**Unit – II: Creative Thinking : -** Types of Creative Thinking, Creative Thinking Process, Components of Creativity, Characteristics of a Creative Mindset, New product ideas, Idea generation methods, Principles of Idea Generation, Difference between Idea Generation and Brainstorming, Killing the ideas through Stage Gate Models, Process of Reverse Thinking.Intellectual Property Rights, Importance of IPR, Role of WIPO, Case Studies on Patents and Infringement of Rights.

**Unit – III: Design Thinking & Liberal Art: -** Concept of Design Thinking, Difference between Designer and Scientist, Stages of Design Thinking, Difference between Convergent Thinking and Divergent Thinking. Definition of Liberal Art and its Importance of Liberal Art , Role of Art and Culture to Innovate Business.

**Unit – IV: Emerging Technologies: -** Meaning of Internet of Things, Components of IoT, Benefits of IoT, Types of Product – Service hybrid, examples of IoT enabled Innovations, Impact of IoT on Business, Future of IoT. Case Study on IoT.Innovation Leadership &Network: - Leadership, Skills and Characteristics of an Innovation Leadership, Meaning of Innovation Network, Significant of Innovation Network, Define Social Media Analysis, Steps to Build an Innovation Network.

**Unit –V Building Startup**

Kelly Johnsons KISS Principle, Road map for building a startup, identify, analyze and evaluate

funding, advantages of crowd funding. Pricing strategies.Determining factors for Monetizing Innovation, Process of Monetization, Fixing the price of an Innovative Project.Detailed study on market potential, pitfalls andNegative effects of Monetizing innovation.Reasons for failure of Monetization of Innovation.

**Unit-VI Startup Funding & Branding**

Sources of funding: Bootstrapping, Angel Investors, Crowd funding, Venture capitalists, Advantages of crowd funding, Schemes of Government through Startup India, role of Institutional support and Commercial Banks. Introduction to branding a startup and developing branding strategies.

**References:**

* Peter Drucker (1993), “Innovation and Entrepreneurship”, Hyper Business Book.
* C.K. Prahalad, M.S. Krishnan, The new age of Innovation – TATA McGRAW-HILL     Edition 2008.
* “Innovation by Design", Gerald H. (Gus) Gaynor, AMACOM {American Management Association), NYC, 2002
  + Bholanath Dutta: Entrepreneurship – Text and cases, Excel, 2009.
  + Vasanth Desai: Entrepreneurship, HPH, 2009
  + Barringer: Entrepreneurship, Pearson, 2009.
  + H. Nandan: Fundamentals of Entrepreneurship, PHI, 2009.
* John M Nicholas “Project Management for Business and Technology” Prentice Hall of India Pvt. Ltd.
  + Stay Hungry Stay Foolish, Rashmi Bansal and published by IIM., Ahmedabad

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Indian History, Geography & Culture**

**(Open Elective-III)**

Code: 7ZC27

**L T P/D C**

**3 - - 3**

**Course Objectives**: To equip the students with necessary knowledge relating to Indian History Geography and Culture

**Course outcomes:**

CO1: To appreciate and understand our Indian History, Culture and Indian heritage.

CO2: To understand earth evolution and world climatic change.

CO3: To understand India Oceanography.

CO4: Able to enhance and understand Indian monsoons, Indian agriculture.

CO5: To understand secularism of our country.

CO6: To appreciate and understand the social reformers who brought revolutionary changes in

Indian society.

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 |  |  |  |  |  | **H** | **M** |  |  |  |  |  |
| CO3 |  |  |  |  |  | **H** | **M** |  |  |  |  |  |
| CO4 |  |  |  |  |  | **H** | **M** |  |  |  |  |  |
| CO5 |  |  |  |  |  | **H** | **M** |  |  |  |  |  |
| CO6 |  |  |  |  |  | **H** | **M** |  |  |  |  |  |

**Unit I ANCIENT INDIAN HISTORY:** Fundamental Unity of Indian Harappan and Vedic Civilization – Evolution of Caste System – Jainism and Buddhism – Gandhara Art., Political unification of India under Mauryas and Guptas, Historical evolution of Satavahanas., Contribution of Pallavas and Cholas to Art – Chola Administrative Systems .

**Unit II** **GEO MORPHOLOGY AND CLIMATOLOGY:** The Origin and Evolution of the Earth, Interior of the Earth, Distribution of Oceans and Continents , Minerals and Rocks, Geomorphic Processes, Landforms and their Evolution Composition and Structure of Atmosphere, Solar Radiation, Heat Balance and Temperature. Atmospheric Circulation and Weather Systems, World Climate and Climate Change

**Unit III OCEANOGRAPHY:** Water (Oceans), Movements of Ocean Water, Physical features of India viz., The Mountains in the North, The Northern Plains, The Peninsular Plateau, The Great Indian Desert, The Coast; and The Islands.

**Unit IV PHYSICAL FEATURES OF INDIA AND INDIA’S MONSOON:** India’s monsoon., Winter, Summer(pre-monsoon),rainy (monsoon),autumn (post-monsoon)., Indian Agriculture, Agriculture and colonialism, Indian Agriculture after Independence Major crops and yields, Horticulture, Organic farming.

**Unit V MEDIEVAL INDIA AND CULTURE:** Influence of Islam on Indian Culture – The Sufi, Bhakthi and Vishnavite movements, Historical Achievements of Vijayanagara Rulers., Contribution of Shershah and Akbar to the evolution of administration system in India – Cultural Development under Mughals.

**Unit VI MODERN INDIA:** Western Impact on India – Introduction of Western Education – Social and Cultural awakening and social reform movements – Raja Rama Mohan Roy – Dayananda Saraswathi – Theosophical Society – Ramakrishna Paramahamsa and Vivekananda – Iswara Chandra Vidyasagar and Veeresalingam – Emancipaition of women and struggle against Caste. Rise of Indian Nationalism – Mahatma Gandhi – Non Violence and Satyagraha – Eradication of untouchability – Legacy of British rule.

**ESSENTIAL READINGS:**

* Sharma .R.S., (2011).Indian Ancient past.,Oxford Publications.
* Nitin Singhaniya.,(2017). Indian Culture and Heritage., Publisher: Mcgraw TestPrep., Second Edition.
* Certificate of Physical and Human Geography,Goh Cheng Leong,Oxford University Press.
* Bipin Chandra.(2000). India’s Struggle for Independence., Penguin Global Publishers
* Saveendra Singh: Physical Geograpghy.,Prayag Pustak Bhavan ISBN-10: 8186539298. Edition : 1st Edition Number of Pages : 641 Pages Publication : Year 2006.

**SUGGESTED READINGS:**

* Majumdar, R. C. et al. *An Advanced History of India* London: Macmillan. 1960. [ISBN 0-333-90298-X](http://en.citizendium.org/wiki/Special:BookSources/033390298X)
* Basham, A.L. : The wonder that was India ,New York: Grove Press, 1954. (OUP, Madras 1983)
* Basham, A.L. : Cultural heritage of India , Vols.I to IV ,Oxford University Press, Delhi, 1975.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**FINANCIAL INSTITUTIONS, MARKETS AND SERVICES**

**(Open Elective-III)**

**Code: 7ZC15**

**L T P/D C**

**3 - - 3**

**Course Objective:** The objective of the course is to provide to students an understanding of Financial Markets, the major Institutions involved and the Services offered within this framework.

**Course Outcomes:**

1. 1.This unit enables the students to understand the financial structure and the financial sector reforms after 1991.
2. The unit gives the exposure on the role of RBI and the Regulating and credit policies adopted by the RBI.
3. The students get awareness on the role of Non-Banking financial institutions and the role of financial institutions in India.
4. The unit educates the students to know the role of regulatory bodies like SEBI and also to know the capital and money market instruments
5. The unit equips the students to understand about the asset fund based financial services
6. The students will get exposure about the investment banking and merchant banking.

***Mapping of Course Outcomes with Program Outcomes:***

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| CO3 |  |  |  |  |  |  |  |  |  |  | H | M |
| CO4 |  |  |  |  |  |  |  |  |  |  | H | M |
| CO5 |  |  |  |  |  |  |  |  |  |  | H | M |
| CO6 |  |  |  |  |  |  |  |  |  |  | H | M |

**UNIT I**

**INTRODUCTION:** The structure of financial system, Equilibrium in financial markets, Indicators of Financial Development, Financial system and Economic Development, Financial Sector Reforms after 1991.

**UNIT II**

**BANKING INSTITUTIONS**: Structure and Comparative performance, Functions and Role of RBI, Competition, Interest rates, Spread; Bank Capital Adequacy norms; Banking Innovations – BPLR to Base rate, Core Banking System, Financial Inclusion, Current rates: Policy rates, Reserve Ratios, Exchange rates, Lending/ Deposit rates.

**UNIT III**

**NON BANKING FINANCIAL INSTITUTIONS:** Structure and functioning of Unit Trust of India and Mutual Funds, Growth of Indian Mutual funds and their Regulation, Role of AMFI. Performance of Non-Statutory Financial Organizations: IFCI, IRBI, NABARD, SIDBI and SFCs.

**UNIT IV**

**FINANCIAL AND SECURITIES MARKETS**: -, Role and functions of SEBI, Structure and functions of Call Money Market, Government Securities Market – T-bills Market, Commercial Bills Market, Commercial paper and Certificate of Deposits; Securities Market – Organization and Structure, Listing, Trading and Settlement, SEBI and Regulation of Primary and Secondary Markets.

**UNIT V**

**ASSET/FUND BASED FINANCIAL SERVICES:** Lease Finance, Consumer Credit and Hire purchase Finance, Factoring - Definition, Functions, Advantages, Evaluation, Forfeiting, Bills Discounting, Housing Finance, Venture Capital Financing. Fee-based Advisory services: Stock Broking, Credit Rating.

**UNIT VI**

**INVESTMENT BANKING AND MERCHANT BANKING**:

Investment Banking: Introduction, Functions and Activities, Underwriting, Banker to an Issue, Debenture Trustees and Portfolio managers, Challenges faced by Investment Bankers.

Merchant Banking: Definition, Merchant Banks Vs Commercial Banks, Services of Merchant Banks.

**ESSENTIAL READINGS:**

* L.M. Bhole: Financial Institutions and Markets, TMH, 2009.
* E. Gordon, K. Natarajan: Financial Markets and Services, Himalaya Publishing House, 2013.
* Vasant Desai: Financial Markets and Financial Services, Himalaya,2009

**SUGGESTED READINGS:**

* Pathak: Indian Financial Systems, Pearson, 2009
* M.Y. Khan: Financial Services, TMH, 2009.
* S. Gurusamy: Financial Services and System, Cengage,2009
* Justin Paul and Padmalatha Suresh: Management of Banking and Financial Services, Pearson, 2009.
* Gomez, Financial Markets, Institutions and Financial Services, PHI, 2012.
* R M Srivatsava: Dynamics of Financial Markets and Institutions in India, Excel, 2013.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Fundamentals of Measurements and Instrumentation**

(Open Elective-III)

Code: 7AC44

**L T P/D C**

**3 -- -- 3**

**Course Objective:**

The basic principles of all measuring instruments and in measurement of electrical and non-electrical parameters viz., Resistance, Inductance, Capacitance, voltage, current Power factor, Power, Energy, Strain, Temperature, Torque, Displacement etc. and the different types of electrical and non electrical transducers. It introduces the different signal analyzers and oscilloscopes.

**Course Outcomes**

The student should be able to

1. Understand the principle of operation of different types of instruments viz., PMMC, moving iron type of instruments, the required characteristics of an instrument in general. The student demonstrates the ability to compensate for the errors in the instruments and to extend the range of the instruments.
2. Demonstrates the knowledge of Potential and Current transformers; the errors in them and the effect of having an open/short in the secondary circuits; Understand the principle of operation of Dynamometer and Moving-iron type of Power factor meters.
3. Comprehends the principle of operation of dynamometer type of Wattmeter and Induction type of Energy meter; use the wattmeter to measure the Active and Reactive power and demonstrates the ability to extend the range of them.
4. Identify and use different techniques of measurement of Resistance, Inductance and Capacitance values.
5. Understand the principle of operation of Different type of digital voltmeters, wave analyzers, spectrum analyzers and Cathode ray Oscilloscope.
6. Demonstrates the ability in characterizing the different types of transducers and uses them to measure Strain, Gauge Sensitivity, Displacement, Velocity, Acceleration, Force, Torque and Temperature.

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  | H | M |  |  |  |  |  |  | L |  |
| CO2 |  |  | H | M |  |  |  |  |  |  | L |  |
| CO3 |  |  | H | M |  |  |  |  |  |  | L |  |
| CO4 |  |  | H | M |  |  |  |  |  |  | L |  |
| CO5 |  |  | H | M |  |  |  |  |  |  | L |  |
| CO6 |  |  | H | M |  |  |  |  |  |  | L |  |

**UNIT-I MEASURING INSTRUMENTS- INSTRUMENT TRANSFORMERS:**

Significance of Measurement, static characteristic of system- Linearity, Sensitivity, Precision, Accuracy - Classification - Deflecting, Control and Damping torques, Ammeters and Voltmeters, PMMC, Moving iron type instruments, Expression for the Deflecting torque and Control torque, Errors and Compensations, Extension of range using Shunts and Series resistance.

**UNIT –II: INSTRUMENT TRANSFORMERS**

Introduction, advantages, burden of instrument transformer, Current Transformer - errors in current transformer, Effect of secondary open circuit, Potential transformer- errors in potential transformer, Testing of current transformers with silsbee’s method.

Power Factor Meters: Type of P.F. Meters, Dynamometer and Moving iron type, 1- ph and 3-ph meters.

**UNIT –III MEASUREMENT OF POWER& ENERGY:**

Single phase dynamometer wattmeter-LPF and UPF-Double element and three element dynamometer wattmeter, Expression for deflecting and control torques, Extension of range of wattmeter using instrument transformers, Measurement of active and reactive powers in balanced and unbalanced systems, Single phase induction type energy meter, Driving and braking torques, Testing by phantom loading, Three phase energy meter .

**UNIT - IV MEASUREMENT OF RESISTANCE - MAGNETIC MEASUREMENTS- A.C. BRIDGES:**

Principle and operation of D.C. Crompton’s potentiometer, Standardization, Measurement of unknown resistance, current, voltage. Method of measuring low- Medium and High resistance, sensitivity of Wheatstone’s bridge, Carey Foster’s bridge, Kelvin’s double bridge for measuring low resistance, Measurement of high resistance, loss of charge method, Measurement of inductance, Quality Factor, Maxwell’s bridge, Hay’s bridge, Anderson’s bridge, Owen’s bridge. Measurement of capacitance and loss angle, Desauty Bridge, Wien’s bridge, Schering Bridge.

**UNIT-V DIGITAL VOLTMETERS- SIGNAL ANALYZERS- CRO:**

Digital voltmeters, Successive approximation, Ramp, Dual slope integration continuous balance type, Wave Analyzers, Frequency selective analyzers, Heterodyne, Application of Wave analyzers, Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, Spectral displays, Q meter and RMS voltmeters . CRO- Cathode Ray Tube (CRT), Screens, Probes, Applications of CRO, Measurement of frequency and phase using CRO, Block diagram.

**UNIT-VI MEASUREMENT OF NON-ELECTRICAL QUANTITIES:**

Transducers - Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers, Principle operation of Resistor, Inductor, LVDT and Capacitor transducers, LVDT Applications, Strain gauge and its principle of operation, Guage factor- Thermistors, Thermocouples, Piezo electric transducers, Photovoltaic, Photo conductive cells. Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Acceleration, Force, Torque, Measurement of Temperature.

**TEXT BOOKS:**

1. Electrical Measurements and measuring Instruments – E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing.

2. Transducers and Instrumentation– D.V.S Murthy, Prentice Hall of India, 2nd Edition.

3. A course in Electrical and Electronic Measurements and Instrumentation -A.K. Sawhney, Dhanpatrai & Co. 18th Edition.

**REFERENCE BOOKS:**

1. Measurements Systems, Applications and Design – D O Doeblin- Tata MC Graw-Hill.

2. Principles of Measurement and Instrumentation – A.S Morris, Pearson /Prentice Hall of India.

3. Electronic Instrumentation- H.S.Kalsi Tata MC Graw – Hill Edition, 3rd Edition.

4. Modern Electronic Instrumentation and Measurement techniques – A.D Helfrick and W.D.Cooper, Pearson/Prentice Hall of India.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Internet of things( IOT)**

(Open Elective-III)

Code: 7DC55

**L T P/D C**

**3 -- -- 3**

***Course Objectives: The student will learn about***

1. *Terminology, technology and applications of IoT*

*2. IoT system management using M2M (machine to machine) with necessary protocols*

*3. Python Scripting Language preferred for many IoT applications*

*4. Raspberry PI as a hardware platform for IoT sensor interfacing*

*5. Implementation of web based services for IoT with case studies*

***Course Outcomes: After completing this course, student shall be able to***

1. *Identify the implementation layers of an IoT application system*
2. *Summarize the characteristics and challenges of designing SDN and NFV*
3. *Describe the management of an IoT system using necessary protocols*
4. *Design, Develop and Illustrate IoT applications using Raspberry PI platform and Python Scripting*
5. *Implement web based services on IoT devices*
6. *Design new projects using Raspberry PI*

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO2 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  |  |  |  |  |  |  |  |  |  |
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| CO6 |  |  |  |  |  |  |  |  |  |  |  |  |

**UNIT I: Introduction to Internet of Things**

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies like Wireless Sensor Networks, Cloud Computing, Big data analytics, and Communication protocols, Embedded Systems, IoT Levels and Templates

**UNIT II: IoT and M2M**

Software defined networks, network function virtualization, difference between SDN and NFV for IoT; Basics of IoT System Management with NETCOZF-YANG (Block Diagrams)

**UNIT III: Developing IoT**

**IoT Design Methodology** – The 10 steps design methodology; **Logical design using Python:** Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, date/time operations, Python packages of interest for IoT

**UNIT IV:** **IoT Physical Devices and Endpoints**

**Raspberry PI** – Introduction to Raspberry PI and its Interfaces (serial, SPI, I2C) **Programming** – Python programming with Raspberry PI – Controlling Input / output (Interfacing with LED and LDR).

**UNIT V:** **IoT Physical Servers and Cloud Offerings**

Cloud concepts (IaaS, PaaS, Saas), Introduction to Cloud Storage models and communication APIs – WAMP, Xively; Python web application framework with Django, Designing a RESTful web API

**UNIT VI: Case Studies Illustrating IoT Design**

***Home Automation*** – Smart Lighting, Home intrusion detection, ***Cities*** – Smart parking, ***Environment*** – Weather monitoring system, Weather reporting bot, Air pollution monitoring, Forest fire detection, ***Agriculture*** – Smart irrigation, ***Productivity applications*** – IoT printer

**TEXT BOOKS:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**LOGICAL REASONING**

**Code: 7H619**

**L T P/D C**

**1 1 - 2**

**Course objectives:** By learning logical reasoning

1. Students can improve their mental capacity.
2. Students acquire ability to arrive at answers and solutions in a logical way.
3. Logical reasoning is helpful in sharpening their minds.
4. Student can draw conclusions, based on the facts and evidences after a casual and rational analysis in his real life problems.
5. Logical reasoning measures the mental capacity of the students.

**Course Outcomes:** After completion of this course students will be able to solve

1. The questions given on series completion and analogy.
2. The questions given on odd one out in classification and coding and decoding.
3. The questions given on blood relations.
4. The questions given on directions and Arithmetical reasoning.
5. The questions given on Venn diagrams, cubes and dice. .
6. The questions given on clocks and calendar.

**Mapping of Course Outcomes with Program Outcomes:**

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|  | **P0a** | **POb** | **POc** | **POd** | **POe** | **POf** | **POg** | **POh** | **POi** | **POj** | **POk** | **POl** |
| **CO1** | **H** |  |  |  |  |  |  |  |  |  |  | **M** |
| **CO2** | **H** |  |  |  |  |  |  |  |  |  |  | **M** |
| **CO3** | **H** |  |  |  |  |  |  |  |  |  |  | **M** |
| **CO4** | **H** |  |  |  |  |  |  |  |  |  |  | **M** |
| **CO5** | **H** |  |  |  |  |  |  |  |  |  |  | **M** |
| **CO6** | **H** |  |  |  |  |  |  |  |  |  |  | **M** |

**Unit – I**

Series Completion: Number Series, Alphabet Series, Alpha – Numeric Series.

Analogy: Completing the Analogous Pair, Simple Analogy, Choosing the Analogous pair, Double Analogy, Word Analogy, and Number Analogy.

**Unit – II**

Classification / Odd One Out: Word Classification, Number Classification, Letter Classification.

Coding – Decoding: Letter Coding, Number Coding, Matrix Coding, Substitution, Deciphering Message Word Codes, Jumbled Coding.

**Unit – III**

Blood Relations: Deciphering Jumbled up Descriptions, Relation Puzzle – Direction sense test.

Number, Ranking & Time Sequence Test – Arithmetical Reasoning – Mathematical Operations.

**Unit – IV**

Data Sufficiency: Problems in which a question on any topic such as Coding – Decoding,

Blood Relations, Directions, Arithmetical Reasoning etc.

Puzzle Test: Classification Type Questions, Seating Arrangements Comparison Type Questions, Sequential Order of Things, Selection Based on given conditions, Family – Based Puzzles, Jumbled Problems.

**Unit – V**

Assertions and Reason – Logical Venn Diagrams – Alpha Numeric Sequence Puzzle.

Cubes and Dice – Analytical Reasoning

**Unit – VI**

Logical Deduction: Logic, Statement – Arguments, Statement – Assumptions, Statement – Conclusions, Deriving Conclusions from Passages.

Clocks & Calendar.

**Text Book:** Verbal and Non Verbal Reasoning by R.S.Agarwal**.**

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Artificial Intelligence**

**Code:**

**L T P/D C**

**2 - - 0**

**Course Objective:**

To learn the distinction between optimal reasoning Vs. human like reasoning. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities. To learn different knowledge representation techniques. To understand the applications of AI, namely game playing, theorem proving, and machine learning

**COUR****SE OUTCOMES:**

1. Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
2. Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
3. Learn different knowledge representation techniques.
4. Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
5. Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
6. Analyze Supervised Learning Vs. Learning DecisionTrees

**UNIT - I**

Introduction to AI, Intelligent Agents, Problem-Solving Agents, Searching for Solutions, Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

**UNIT-II**

Games, Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

**UNIT-III**

Representation, Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. **Knowledge Representation:** Ontological Engineering, Categories and Objects, Events.

**UNIT-IV**

Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

**UNIT-V**

Acting under Uncertainty, Basic Probability Notation Bayes’ Rule and Its Use, Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

**Unit-VI**

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees.

**TEXT BOOKS**:

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

**REFERENCES:**

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight(TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, PearsonEducation.
3. Artificial Intelligence, Shivani Goel, PearsonEducation.
4. Artificial Intelligence and Expert systems – Patterson, PearsonEducation

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

Soft Skills and Technical Communication

**(Common for all braches)**

**Code: 7HC74**

**L T P/D C**

**-- -- 2 1**

Course Objectives:

To enable the students to

* Understand corporate social responsibility
* Attend and succeed in Interviews
* Understand the nuances of Corporate Culture
* Attain the confidence to take up any given professional assignment

Course outcomes:

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  |  |  |  |  |  | **H** | **M** | **L** |  |  |
| CO2 |  |  |  |  |  |  |  | **H** | **M** | **L** |  |  |
| CO3 |  |  |  |  |  |  |  | **H** | **M** | **L** |  |  |
| CO4 |  |  |  |  |  |  |  | **H** | **M** | **L** |  |  |
| CO5 |  |  |  |  |  |  |  | **H** | **M** | **L** |  |  |
| CO6 |  |  |  |  |  |  |  | **H** | **M** | **L** |  |  |

**To enable students to**

* **make a self-assessment**
* **enhance their soft skills and behavioral patterns**
* **equip themselves with the required skillset for their career advancement**
* **develop interpersonal communication skills**
* **participate in group tasks and use effective language skills in interviews**
* **overcome stress and enhance employability quotient**

Unit 1: Know Yourself – SWOT / SWOC Analysis

1. Introduction: Importance of knowing yourself
2. Meaning of SWOT / SWOC
3. SWOT / SWOC analysis
4. Benefits of SWOT / SWOC analysis
5. SWOT / SWOC grid

Emotional Intelligence

1. Nature and significance of Emotional Intelligence

2. Five basic competencies of Emotional Intelligence according to Goleman:

a. Self-awareness b. Self regulation c. Motivation d. Empathy

e. Social skills.

3. Strategies to enhance Emotional Intelligence

Unit 2:**Soft Skills-I**

1. Introduction to Soft skills
2. Definition of Soft Skills. Difference between Soft Skills and Hard Skills
3. Importance of Soft Skills
4. **Positive Attitude:** Meaning; Difference between Attitude and Behavior
5. Attitude Building
6. Need for developing Positive Attitude

**Goal Setting**

1.The purpose of Goal setting

2.Types of Goals

3. How to set SMART goals

**Time Management**

1.Need and Importance of Time Management

2. Scheduling and Prioritizing tasks

3. Identifying major time wasters

Unit 3:**Soft Skills-II**

**Team work and Team Dynamics**

* 1. Introduction
  2. Team Vs Group
  3. Stages of team building
  4. Characteristics of an effective team, role of a team leader

**Problem Solving**

1.Definition

2. Skill sets in Problem solving

3. Steps in solving problems

**Decision Making**

1. Decision making: Definition, Importance of Decision Making.
2. Decision Making process

Unit 4: Technical Communication

* + 1. Definition and importance of Technical Communication
    2. Types of Technical Communication
    3. Report writing: Significance, types, steps, layout and Mechanism
    4. Review of technical articles.

Unit 5: Etiquette and Stress Management

1. Etiquette: Introduction and classification
2. Work place etiquette
3. Strategies to handle Stress

Unit 6:**Résumé Writing andInterview Skills**

**Résumé: Introduction**

1.Types of Résumé

2.Difference among Bio-data, Curriculum Vitaé and Résumé

3.Resume writing: Purpose and Design

4. Tips to write a winning Resume.

5. Cover letter

**Interview Skills**

1. Meaning and purpose of an Interview
2. Types of interviews (Face to Face / Panel Interviews/Telephonic interviews etc.)
3. Interview Preparation techniques
4. Common mistakes
5. Dress code at an interview
6. FAQs in HR Interview
7. Mock Interviews

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**Suggested reading:**

1. SOFT SKILLS *– Dr. K. Alex, S.Chand publications*
2. SOFT SKILLS *– Meenakshi Raman*
3. Technical communication*- Meenakshi Raman and Sangeetha Sharma (Oxford Publications)*
4. Advanced Technical communication *- Kavita Tyagi and Padma Mistri*
5. Developing Speaking-Listening Skills in English (With CD)
6. Basic Communication Skills For Technology- *Andrea J Rutherfoord- Pearson*
7. Developing Communication Skills- *Krishna Mohan- Macmillan*
8. Written Communication Skills- *Michael Hatton-iste*

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**CAD/CAM LAB**

**Code: 7B671**

**L T P/D C**

**-- -- 2 1**

**Course Objectives:**

Upon completion of this course the students will be able to

• Execute steps required for modeling 3D objects by using protrusion, cut, sweep, extrude commands

• Convert 3D solid models into 2D drawing-different views, sections

• Use isometric views and dimensioning of part models

• Machine simple components on CNC machines • Use CAM software to generate NC code

**Course Outcomes**

After completing the subject, students will be able to:

1. Draw computer Aided 2D drawings to solve design and manufacturing problems using CAD CAM principles.

2. Acquire skills of developing geometric modeling of 3D components

3. Developing assemblies different machine elements and import and export CAD models one software to anther software

4. Learn skills of writing CNC part programming.

5. Understand how to machine simple components on CNC lathe and CNC mill

6. Understand how to simulate the articulated robot and Fabricate simple components on 3D printing machine

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | M | M | H |  | H |  |  |  |  |  |  |  |
| CO2 | M | M | H |  | H |  |  |  |  |  |  |  |
| CO3 | M | M | H |  | H |  |  |  |  |  |  |  |
| CO4 | M | M | H |  | H |  |  |  |  |  |  |  |
| CO5 | M | M | H |  | H |  |  |  |  |  |  |  |
| CO6 | M | M | H |  | H |  |  |  |  |  |  |  |

**List of Experiments:**

1. Generation of various 2D Drawings (Minimum of five exercises

2. Three Dimensional Modeling of simple components (Minimum of five exercises)

3. 3D Modeling and Assembly of Flange Coupling

4. Developing Assembly from part models of the Plummer block components.

5. Developing Assembly from part models of the Bench vice assembly components.

6. Developing Assembly of Press tool assembly.

7. Simulation of Tool path for CNC Lathe Operations.

8. Simulation of Tool path for CNC Mill Operations.

9. Machining of Simple Components on CNC Lathe.

10. Machining of Simple Components on CNC Mill.

11. Demo of Articulated Robot.

12. Demo of 3D-Printing machine.

**LIST OF EQUIPMENT**

CNC Lathe

CNC Mill

6 Axis Robot

3d Printer

CATIA Discover V5 (25 Nos))

PRO-E / Creo University plus (Perpetual)

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**HEAT TRANSFER LAB**

**Code: 7B672**

**L T P/D C**

**--- --- 2 1**

**Course Objectives**

Through this course, students will study about the various heat transfer processes, so as to train the students practically to utilize this knowledge in heat transfer related industries

**Course Outcomes**

*After completing the subject, students will be able to*

1. Compute the thermal conductivity of a given material rod and composite wall understand the physical significance of the thermal conductivity of the given material insulating powder. **(CO1)**

2. To calculate thermal conductivity of lagged pipe and insulating powder under given conditions. **(CO2)**

3. To compute the forced ad free convection heat transfer coefficients under given conditions from fundamentals. **(CO3)**

4. Able to calculate LMTD for parallel flow and counter flow heat exchangers and overall heat transfer coefficient. and pinfin apparatus. **(CO4)**

5. Should be able to calculate the emissivity of a given surface and to calculate Stefan-Boltzmann’s constant experimentally. **(CO5)**

6. Understand the phenomena of pool boiling and to draw the boiling curve by showing different phases of boiling. and study the heat pipe **(CO6)**

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | M | M | H | L |  |  |  |  |  |  |  |  |
| CO2 | M | M | H | L |  |  |  |  |  |  |  |  |
| CO3 | M | M | H | L |  |  |  |  |  |  |  |  |
| CO4 | M | M | H | L |  |  |  |  |  |  |  |  |
| CO5 | M | M | H | L |  |  |  |  |  |  |  |  |
| CO6 | L | M | H | L |  |  |  |  |  |  |  |  |

**List of Experiments**

1. Composite Slab Apparatus – Overall heat transfer co-efficient.

2. Heat transfer through lagged pipe.

3. Heat Transfer through a Concentric Sphere

4. Thermal Conductivity of given metal rod.

5. Heat transfer in pin-fin

6. Experiment on Transient Heat Conduction

7. Heat transfer in forced convection apparatus.

8. Heat transfer in natural convection

9. Parallel and counter flow heat exchanger.

10. Emissivity apparatus.

11. Stefan Boltzman Apparatus.

12. Heat transfer in drop and film wise condensation.

13. Critical Heat flux apparatus.

14. Study of heat pipe and its demonstration.

**LIST OF EQUIPMENT**

1. Emmisivity Measurement Apparatus
2. Heat Transfer Through Lagged Pipe
3. Heat Transfer in Natural Convection
4. Heat Transfer in forced convection
5. Heat Transfer Composite wall
6. Parallel and counter flow Heat exchanger
7. Stefan Boltzman Apparatus
8. Thermal Conductivity of Metal Rod
9. Thermal Conductivity of insulating powder
10. Condensation in Drop wise Film wise forms
11. Critical Heat Flux Apparatus
12. Heat Transfer from Pin Fin Apparatus
13. Heat Pipe Apparatus
14. Transient Heat Conduction Apparatus

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Metrology Lab**

**Code: 7B673**

**L T P/D C**

**--- --- 2 1**

**Course Objective:**

The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements.

**Course Outcomes:**

Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO2 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO3 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO4 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO5 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO6 |  |  | H |  |  |  |  |  | H |  |  |  |

**LIST OF EXPERIMENTS:**

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier for checking the chordal addendum and chordal height of      spur gear.
4. Thread measurement by Two-wire/ Three-wire method
5. Tool makers microscope and its application.
6. Angle and taper measurements by Bevel protractor and Sine bar.
7. Surface roughness measurement by Taly Surf.
8. Measurement of gear parameters and thread parameters using Profile Projector
9. Measurement of alignment using Autocollimator / Roller set
10. Calibration of Micrometer and vernier caliper using slip gauges
11. Measurement of roundness of cylindrical specimen using dial indicator and V-block
12. Measurement of heights using vernier height gauge

**LIST OF EQUIPMENT**

1. Micro meters
2. Vernier caliper
3. Dial Bore guage
4. Inside Calilper 4"
5. Bevel protractor 150/300mm
6. Sine Bar ( 100mm)
7. Surface Plate (Granite)
8. Slip Gauge set (83 Pieces)
9. Dial Guage 10 mm Range
10. Gear tooth Vernier 0-26 mm
11. Three wire sets
12. Tool maker's micro scope
13. Screw thread plug Gauge Go/NOGO
14. Surface Roughness Tester
15. V-Block
16. Mechanical Comparator ( Millimess) 1 micron
17. Height Gauge
18. Profile Projector

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**Group Project**

**Code: 7B674**

**L T P/D C**

**--- --- 4 2**

**Course Objectives:**

To acquaire basic knowledge on selecting a projcet , learn related tools and enhance Design and production skills for employabilty.

**Course Outcomes:**

* Students use the concepts learned in the courses, so far, in conceptualizing, designing and executing the projects.
* Enables to apply modern tools and technologies for project works
* Inculcates an enthusiasm to use the creative ideas to execute projects to meet the current needs of the society.
* Enhances communicative skills and team work
* The students learn the ability to work as an individual with multidisciplinary approach

***Mapping of Course Outcomes with Program Outcomes:***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| **1** | H | H | H | H | H |  |  |  | M | M |  |  |
| **2** | H | H | H | H | H |  |  |  | M | M |  |  |
| **3** | H | H | H | H | H |  |  |  | M | M |  |  |
| **4** | H | H | H | H | H |  |  |  | M | M |  |  |
| **5** | H | H | H | H | H |  |  |  | M | M |  |  |
| **6** | H | H | H | H | H |  |  |  | M | M |  |  |

A group project shall be carried out by a group of students consisting of 2 to 3 in number in third year first semester. This work shall be carried out under the guidance of the teacher and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also. There will be 75 marks in total with 25 marks of internal evaluation.

The **evaluation** shall consist of:

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Literature survey and presenting seminar at the  end of 6 weeks | 10 marks |
| 2 | Report | 10 marks |
| 3 | Demonstration/presentation at the end of 14  weeks | 10 marks |
| 4 | Total sessional marks | 30 marks |

Semester end examination - 70 marks

The end examination will be carried out by a committee consisting of an external examiner, head of the department, a senior faculty member and the supervisor.

**Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**|Comprehensive Viva-voce-II**

**Code: 7B675**

**L T P/D C**

**--- --- -- 1**

**Course Objectives**

1. To enable the examiners to assess the candidate’s knowledge in his or her particular field of learning.

2. To test the student’s awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.

**Course Outcomes**

After completing the subject, students will be able to:

1. Perform well in Technical interviews
2. Apply knowledge in building their career in particular fields.
3. Enhance their communication skills and interactive-ness.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Mapping of Course Outcomes with Program Outcomes:***   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **COs** | **Programme Outcomes** | | | | | | | | | | | | | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** | | **1** | **H** |  |  |  |  |  |  |  |  | **M** |  | **M** | | **2** | **H** |  |  |  |  |  |  |  |  | **M** |  | **M** | | **3** | **H** |  |  |  |  |  |  |  |  | **M** |  | **M** | | **4** | **H** |  |  |  |  |  |  |  |  | **M** |  | **M** | | **5** | **H** |  |  |  |  |  |  |  |  | **M** |  | **M** | | **6** | **H** |  |  |  |  |  |  |  |  | **M** |  | **M** | |

There shall be comprehensive viva voce as stated above which will be evaluated for 100 marks. Out of 100 marks, 30 marks are internal and 70 marks are external.

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Description** | **Marks** |
| 1 | First mid-sessional viva at the end of 5 weeks (Internal) | 15 marks |
| 2 | Second mid-sessional viva at the end of 10 weeks  (Internal) | 15 marks |
| 3 | Final viva during practical examinations (External) | 70 marks |
| 4 | Total | 100 Marks |

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**ROBOTICS**

**Code: 7B722**

**L T P/D C**

**4 -- -- 4**

**Course Objective:**

Be able to use matrix algebra and Lie algebra for computing the kinematics of robots.

**Course Outcomes:**

* Graduates demonstrate the basic knowledge in robotic systems their classification and application areas.
* Graduates demonstrate the ability to kinematically and dynamically model any open-loop/ serial robot and study associated forward/inverse kinematics.
* Graduates demonstrate the ability to plan trajectories in the presence/absence of obstacles.
* Graduates demonstrate the ability to function on multidisciplinary robot design teams.
* Graduates learn the control system concepts and their application in robotics through linear and nonlinear control schemes.
* Graduates understand commonly used sensory and vision systems used in robotics.

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | **H** |  |  | **M** | **L** |  |  |  |  |  |  |  |
| CO2 | **H** |  |  | **M** | **L** |  |  |  |  |  |  |  |
| CO3 | **H** |  |  | **M** | **L** |  |  |  |  |  |  |  |
| CO4 | **H** |  |  | **M** | **L** |  |  |  |  |  |  |  |
| CO5 | **H** |  |  | **M** | **L** |  |  |  |  |  |  |  |
| CO6 | **H** |  |  | **M** | **L** |  |  |  |  |  |  |  |

**UNIT – I**

**Introduction:** An over view and applications of Robotics, classification by coordinate system and control system. Different types of robot actuators: pneumatic, hydraulic and electric

**UNIT – II**

**Motion Analysis and Manipulator Kinematics:** Specifications of matrices, Homogeneous transformations as applicable to rotation and translation, D-H notation, Differential transformations, Jacobians; Forward and inverse kinematics – problems.

**UNIT – III**

**Statics and Dynamics of manipulators:** Force and moment balance, Use of Jacobian, Velocity analysis, Lagrange – Euler and Newton – Euler formations for dynamics of manipulators – Problems.

**UNIT - IV**

**Trajectory Planning**: Path planning, Skew motion, joint integrated motion – straight line motion.

**UNIT - V**

**Control of Manipulators:** Introduction to control systems: open and closed loop control, transfer functions, characteristics of linear and nonlinear systems and their control schemes; model of a manipulator joint, actuator; control schemes applied in robotics: PID

**UNIT - VI**

**Robot Sensors and Vision:** Classification of sensors, sensors in robotics; introduction to machine vision, image representation and processing.

**TEXT BOOKS:**

1. Robotics and Control / Mittal R K & Nagrath I J / TMH.
2. Robotics / Fu K S/ McGraw Hill.

**REFERENCES:**

1. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons
2. Robotic Engineering / Richard D. Klafter, Prentice Hall

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**ADDITIVE MANUFACTURING PROCESSES**

**Code: 7B723**

**L T P/D C**

4 **- - 4**

**Course Objectives:**

To teach students the fundamental concepts of Additive Manufacturing, techniques involved and their advantages and limitations and various applications of these technologies in relevant fields such as mechanical, Bio-medical, Aerospace, electronics etc.

**Course Outcomes:**

1. Understand the Additive manufacturing processes and their relationship with subtractive manufacturing

2. Demonstrate comprehensive knowledge of the broad range of liquid based rapid proto type processes, devices, capabilities and materials that are available.

3. Demonstrate comprehensive knowledge of the broad range of liquid based rapid proto type processes, devices, capabilities and materials that are available.

4.apply the principles of casting in Additive manufacturing systems

5. Articulate the various tradeoffs of Additive manufacturing softwares / data format that must be made in selecting advanced/additive manufacturing processes, devices and materials to suit particular product requirements.

6.Learn various applications of additive manufacturing, such as in architecture, art, health care direct part production and mass customization

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  |  | **M** | **H** | **M** |  |  |  |  |  |  |
| CO2 |  |  |  | **M** | **H** | **M** |  |  |  |  |  |  |
| CO3 |  |  |  | **M** | **H** | **M** |  |  |  |  |  |  |
| CO4 |  |  |  | **M** | **H** | **M** |  |  |  |  |  |  |
| CO5 |  |  |  | **M** | **H** | **M** |  |  |  |  |  |  |
| CO6 |  |  |  | **M** | **H** | **M** |  |  |  |  |  |  |

**UNIT-I**

**Introduction:**

Development of AM, Fundamentals of AM, Classification of AMS, Advantages, Standards on AM, Commonly used terms, AM process chain

**UNIT-II Liquid-based Additive manufacturing Systems:** Stereo lithography Apparatus (SLA), process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, 3D bioprinting **Solid-based Additive manufacturing Systems:**, Laminated Object Manufacturing (LOM): process, working principle, Applications, Advantages and Disadvantages, Fused Deposition Modeling (FDM): working principle, Applications, Advantages and Disadvantages

**UNIT-III**

**Powder Based Additive manufacturing Systems**: Selective laser sintering (SLS): working principle, Applications, Advantages and Disadvantages, Color Jet printing, working principle, Applications, Advantages and Disadvantages, **Build time calculations –** SLA, FDM**,** Problems

**UNIT-IV**

**Additive manufacturing Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Features of various AM software’s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor. **Design for AM** – Basic Principles and Practices

**UNIT-V**

**Rapid Tooling:** Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification, Spray Metal Deposition, Silicone rubber molds, , Casting- Sand Casting ,Investment Casting, evaporative Casting

**Reverse engineering** – what is RE, Why use RE, RE Generic process, Overview of RE-Software and Hardware, CMMs-applications and types

**UNIT-VI**

**Applications and examples :** Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, Arts and Architecture. Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants and Prosthesis, Design and Production of Medical Devices, Bionic ear, dentistry

**Suggested Reading:**

1. Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping; Principles and Applications, World Scientific Publications , Third Edition, 2010.

2. Reverse Engineering: An Industrial Perspective, Springer- Verlag, 2008. ISBN: 978-1-84628-855-5.

3. Ian\_Gibson\_· David\_Rosen, Brent\_Stucker, Additive Manufacturing Technologies 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer

4. PaulF.Jacobs, Rapid Prototyping and Manufacturing ASME Press, 1996.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**MECHATRONICS**

**(Professional Elective-I)**

**Code 7B724**

**L T P/D C**

**3 -- -- 3**

**Course Objective:**

to model and analyze electrical and mechanical systems and their interconnection for engineering applications.

**Course Outcomes:**

Student

1. Able to understands the significance of integration of mechanical, electronics, control and computer engineering and also focuses the role of sensors.

2. Able to learn the complete theory of various sensors.

3. Be able to get skill to select appropriate actuators for different applications.

4. Become proficient in building linear models of mechatronics

5. Become proficient in the programming of microcontrollers.

6. Able to demonstrate PLCprogramming

***Mapping of Course Outcomes with Program Outcomes:***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | **H** | **M** | **M** | **H** |  |  |  |  |  |  |  |  |
| CO2 | **H** | **M** | **M** | **H** |  |  |  |  |  |  |  |  |
| CO3 | **H** | **M** | **M** | **H** |  |  |  |  |  |  |  |  |
| CO4 | **H** | **M** | **M** | **H** |  |  |  |  |  |  |  |  |
| CO5 | **H** | **M** | **M** | **H** |  |  |  |  |  |  |  |  |
| CO6 | **H** | **M** | **M** | **H** |  |  |  |  |  |  |  |  |

**UNIT-I**

**Introduction:** History of Mechatronics, Scope and Significance of Mechatronics systems, elements of mechatronic systems, needs and benefits of mechatronics in manufacturing Sensors: classification of sensors basic working principles, Displacement Sensor - Linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders. Strain gauges. Force/Torque – Load cells. Temperature – Thermocouple, Bimetallic Strips, Thermistor, RTD

**UNIT-II**

Accelerometers, Velocity sensors – Tachometers, Proximity and Range sensors – Eddy current sensor, ultrasonic sensor, laser interferometer transducer, Hall Effect sensor, inductive proximity switch. Light sensors – Photodiodes, phototransistors, Flow sensors – Ultrasonic sensor, laser Doppler anemometer tactile sensors – PVDF tactile sensor, micro-switch and reed switch Piezoelectric sensors, vision sensor

**UNIT-III**

Actuators: Electrical Actuators : Solenoids, relays, diodes, thyristors, triacs, BJT, FET, DC motor, Servo motor, BLDC Motor, AC Motor, stepper motors. Hydraulic & Pneumatic devices – Power supplies, valves, cylinder sequencing. Design of Hydraulic & Pneumatic circuits. Piezoelectric actuators, Shape memory alloys.

**UNIT-IV**

Basic System Models & Analysis: Modelling of one and two degrees of freedom Mechanical, Electrical, Fluid and thermal systems, Block diagram representations for these systems. Dynamic Responses of System: Transfer function, Modelling Dynamic systems, first order systems, second order systems.

**UNIT-V**

Controllers: Classification of control systems, Feed back, closed loop and open loop systems, Continuous and discrete processes, control modes, Two step Proportional, Derivative, Integral, PID controllers.

**UNIT-VI**

PLC Programming: PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming. Ladder Programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output. Application on real time industrial automation

**Reading:**

1. W. Bolton, “Mechatronics‟, 5 th edition, Addison Wesley Longman Ltd, 2010

2. Devdas Shetty & Richard Kolk “Mechatronics System Design”, 3rd edition. PWS Publishing, 2009.

3. Alciatore David G & Histand Michael B, “Introduction to Mechatronics and Measurement systems”, 4th edition, Tata McGraw Hill, 2006.

Video references: 1. <http://video_demos.colostate.edu/mechatronics>

2. http:// mechatronics.me.wisc.edu

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**DESIGN AND ANALYSIS OF EXPERIMENTS**

**(Professional Elective-I)**

Code: 7B725

**L T P/D C**

**3 - - 3**

**Course Objectives:**

This course deals with the concepts and techniques used in the design and analysis of experiments. The concepts and different models of an experimental design will be studied, leading to their statistical analysis based on linear models and appropriate graphical methods. The course also introduces the logic, application, and interpretation of analysis of variance (ANOVA) models.

**Course Outcomes:**

*After completing the subject, students will be able to*

1.Demonstrate history, role, principle and steps of experimentation

2.Apply concepts of Probability and statistics in design of experiments.

3.learn various DOE techniques

4.Develops experiment design based on Taguchi method.

5.Analyses the experimental data of various experiments.

6.Solve multi response problems using DOE approaches

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
| **1** | **H** |  |  |  |  |  |  |  |  |  |  |  |
| **2** | **H** |  |  |  |  |  |  |  |  |  |  |  |
| **3** | **H** |  |  |  |  |  |  |  |  |  |  |  |
| **4** | **H** |  |  |  |  |  |  |  |  |  |  |  |
| **5** | **H** |  |  |  |  |  |  |  |  |  |  |  |
| **6** | **H** |  |  |  |  |  |  |  |  |  |  |  |

**UNIT-1**

Review of Statistics – Normal distribution, distribution of sample means, t- distribution, F-distribution, confidence interval, hypothesis testing

Fundamentals of Experimental Design – Introduction, Experimentation, Need for statistically designed Experiments, ANOVA, Basic principles of Design, Terminology used in DOE, Steps in Experimentation, Choice of Sample size, Cause and Effect Analysis, Simple Linear regression model

**UNIT-2**

Simple Factor Experiments: Completely randomized design- the statistical model, typical data for single factor experiment, ANOVA Multi factor factorial Experiments- two factor, three factor experiments – statistical model and estimation of model parameters

**UNIT-3**

Taguchi Methods – Quality Loss function, Quality definition, Quality loss function, Nominal-the best, smaller -the better case, larger -the better case, development of orthogonal arrays, robust design- system design, parameter design, basis of taguchi methods, steps in experimentation

**UNIT-4**

Design of Experiments using orthogonal arrays – assignment of factors and interactions, linear graphs, selection and application of orthogonal arrays, data analysis from taguchi experiments – variable data with main factors and interactions

**UNIT-5**

Robust Design – Introduction, factors affecting response, objective functions in robust design, advantages of robust design, simple parameter design, relation between S?N ratio and quality loss

**UNIT-6**

Multi response optimization problems- introduction, Engineering judgement, Assignment of weights, Data Envelopment analysis based ranking method

**Text books:**

1) Applied Design of Experiments and Taguchi Methods, K . Krishnaiah, P.Shahabudeen, PHI

2) 1. Montgomery DC, Design and Analysis of Experiments, 7th Edition, John Wiley & Sons, NY, 2008.

**References:**

1) Ross PJ, Taguchi Techniques for Quality Engineering, McGraw-Hill Book Company, NY,2008.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**OPERATIONS RESEARCH**

**(Professional Elective-I)**

**CODE: 7B726**

**L T P C**

**3 -- -- 3**

**Course Objectives:**

The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.

**Course Outcomes:**

**CO1:** Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.

**CO2:** Recognize and Solve the problem of transportation involving a large number of shipping routes with least transportation cost and generate optimal assignment strategy for different situations

**CO4:** Use Johnson’s rule to create the optimal sequencing schedule for a sequencing problem and make decisions about replacing an item using replacement policy

**CO5:** Analyze the performance measures of Queing system and Calculate the EOQ for minimizing the total inventory cost

**CO6:** Apply simulation techniques for solving various types of problems and general idea development about Markov chains

* ***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | POa | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | L |  |  |  |  | H |  |  |  |  | H | M |
| CO2 | L |  |  |  |  | H |  |  |  |  | H | M |
| CO3 | L |  |  |  |  | H |  |  |  |  | H | M |
| CO4 | L |  |  |  |  | H |  |  |  |  | H | M |
| CO5 | L |  |  |  |  | H |  |  |  |  | H | M |
| CO6 | L |  |  |  |  | H |  |  |  |  | H | M |

**UNIT – I**

**INTRODUCTION:** Definition, Characteristics and Phases and Types of models, applications.

**LINEAR PROGRAMMING PROBLEM**- Formulation – Graphical solution, Simplex method-Types of variables, Unique and Multiple optimal solution, Redundancy & Degeneracy in LPP, Unbounded solution, Artificial variables techniques - Big-M method with feasible and infeasible solutions, Two–phase method, Primal to Dual formation with Duality Principle.

**UNIT – II**

**TRANSPORTATION PROBLEM** – Formulation – methods of finding initial solution (NW corner, VAM, Least cost Method) Optimal solution (Stepping stone Method, MODI method) Special cases in TP: unbalanced, Degeneracy, Restriction and maximization case.

**ASSIGNMENT PROBLEM** – Formulation – Optimal solution (Hungarian Method) - Variants of Assignment Problem-Unbalanced, Restriction, Maximization, Airlines layover case, Traveling Salesman problem.

**UNIT – III**

**SEQUENCING** – Introduction – Terminology, Assumptions, Johnson’s procedure- Processing n jobs through two machines – Processing n jobs through three machines – Processing two jobs through ‘m’ machines (Gantt Chart).

**REPLACEMENT:** Introduction – Types of failure, 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 andTerminologies, Criterion and optimal strategy – Solution of games with saddle points: Mixed Strategies-Rectangular games without saddle points, Dominance principle, Average Relational Dominance, m X 2 & 2 X n games -Graphical method and Sub Game Method, Matrix Method, Application of LPP in game theory.

**UNIT – V**

**WAITING LINES:** Introduction, Terminology, Structure of a queue, calling population characteristics-size, behavior, pattern of arrivals, Kendall-Lee notation, Queuing Models: Single Channel: Poisson arrivals: exponential service times: with finite and infinite population, Multichannel: Poisson arrivals: exponential service times with infinite population

**INVENTORY :** Introduction, Inventory costs, Concept of EOQ, Single item Deterministic models with and without shortages, Single item inventory models with one price break and multiple price breaks, Stochastic models – Instantaneous demand and no set up cost.

**UNIT – VI**

**SIMULATION:** Definition – Types of simulation – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages

Markov chains: Introduction to Markov chains, Analysis Assumptions, Input output probabilities, Applications (Only basic understanding)

**TEXT BOOKS:**

1. Operations research / Hira & Gupta

2. Operation Research /J.K.Sharma/Macmillan Publishers.

**REFERENCES:**

1. Quantitative Techniques in Management: N D Vohra, TMH

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**THERMAL TURBO MACHINERY**

**(Professional Elective-I)**

**Code 7B727**

**L T P/D C**

**3 - -- 3**

**Course Objective:**

The course aims at giving an overview of applications of applied thermodynamics. Student will focus on applications in the energy sector (steam and gas turbines for power generation).

**Course Outcomes:**

After completing the course the student will be able to:

1.Explain the compressible flow phenomena in turbomachine components

2.Understand the steady and unsteady flow phenomena in tucts.

3.Perform simple aerodynamic designs using eulers equations etc..

4.Explain the working steam turbines

5.Understand gas turbine combustor principles and challenges

6.Discuss jet propulsion technologies

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| CO2 | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| CO3 | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| CO4 | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| CO5 | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| CO6 | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |

**Unit-I**

Introduction to compressible flows: bulk modulus and coefficient of compressibility, acoustic velocity, mach number, pressure field created by a point disturbance, mach cone and mach angle. Isentropic flow through variable area devices: Energy equation for flow through nozzles and diffusers, Relations connecting stagnation and static properties-enthalpy, temperature, pressure and density. Various regimes of flow-adiabatic steady flc.v ellipse. Effect of back pressure on nozzle performance.

**Unit-II**

Flow through constant area ducts with friction (Fanno flow): Governing equation, Fanno line, Fanno relations for perfect gas, maximum length of a duct. Flow through constant area ducts with heat transfer (Rayleigh flow): Governing equation, Rayleigh line, Rayleigh relations for perfect gas, choking due to heat transfer. Types of shocks-normal, oblique and expansion. Normal shock waves : Governing equations, Prandtl-Meyer equation, Rankine-Hugoniot relations. Oblique shock waves: Relation between deflection angle and wave angle.

**Unit-III**

Definition and classification of turbo machines, Euler's equation for energy transfer. Rotodynamic compressors : General classification, comparison with positive displacement compressors. Concept of shape number-selection of impeller. Axial flow compressors: Stage velocity triangles, enthalpy-entropy diagram, Euler's work input, flow coefficient, blade loading coefficient, relations for static pressure rise in rotor, stator and stage. Stage and polytropic efficiency. Factors affecting stage pressure ratio. Degree of reaction. Surging, stalling and choking. Centrifugal compressors: Elements of a centrifugal stage, stage velocity triangles, performance of different types of impellers- forward, radial and backward swept blades. Enthalpy-entropy diagram, degree of reaction. Slip factor, actual work and stage and polytropic efficiency.

**Unit-IV**

Steam Turbines: Classification, flow over blades, impulse and reaction turbines, Pressure and velocity compounding of steam turbines. Impulse steam turbines: Velocity triangles-single and multistage De Laval turbine, effect of blade friction, axial thrust, effect of blade speed ratio on stage and blade efficiency. Partial Admission, height of turbine blades. Parson's reaction turbine: Reaction stage analysis, degree of reaction, maximum blade efficiency, representation on enthalpy-entropy diagram. Height of turbine blades.

**Unit-V**

Gas turbines : Classification and comparison of open and closed cycles. Thermodynamic Analysis of Brayton /Joule cycle. Methods to improve thermal efficiency of gas turbine cycles: inter cooling, reheat and regeneration.

**Unit-VI**

Jet Propulsion : Aircraft propulsion turbo engines: Turbo jet, turboprop, turbofan, ramjet and pulse jet engines. Propulsion performance parameters: Thrust force, thrust power and thrust specific fuel consumption. Thrust, propulsion, transmission and overall efficiencies Rocket Propulsion: Working principle, propulsion efficiency. Types of Rocket engines: Solid propellant and liquid propellant engines.

**Suggested Reading**

1. Yahya S M, " Fundamentals of compressible flow", Wiley eastern Ltd., 2003.

2. Balachnadran P, "Fundamentals of Compressible fluid dynamics", Prentice Hall of India, New Delhi, 2006.

3. Rathakrishnan E, "Gas Dynamics", Prentice Hall of India, New Delhi, 2003.

4. Mathur M L & Mehta F S, " Thermal Engineering", Jain Brothers( New Delhi), 1996.

5. Gopalakrishnan G, Prithvi Raj D, "A treatise on Turbomachines", Scitech Publications, Chennai,

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**NANOTECHNOLOGY**

**(Professional Elective-I)**

**Code 7B728**

**L T P/D C**

**3 -- -- 3**

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| **Course Objectives:** |
| The course offers an over view on nanotechnology covering synthesis, characterization and applications of nanaomaterials. |

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| **Course Outcome’s :** After studying this course the students will be able to: | |
| CO1 | Know the different approaches of synthesis of nanomaterials, gain in depth of knowledge which will be helpful to them in their career to go forward successfully in the field of nano science and nanotechnology. |
| CO2 | Learn about different physical and chemical methods for synthesis of nanomaterials. |
| CO3 | Characterization of nanomaterials by using SEM, TEM, AFM, STM. |
| CO4 | Characterization of nanomaterials by using XRD, FTIR, UV visible spectroscopy, Rama spectroscopy. |
| CO5 | Applications of carbon based nanomaterials. |
| CO6 | Applications of nanomaterials in electronics, medicine, mechanical engineering. |

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | **H** | **M** | **M** | **H** |  |  |  |  | **M** |  |  |  |
| CO2 | **H** | **M** | **M** | **H** |  |  |  |  | **M** |  |  |  |
| CO3 | **H** | **M** | **M** | **H** |  |  |  |  | **M** |  |  |  |
| CO4 | **H** | **M** | **M** | **H** |  |  |  |  | **M** |  |  |  |
| CO5 | **H** | **M** | **M** | **H** |  |  |  |  | **M** |  |  |  |
| CO6 | **H** | **M** | **M** | **H** |  |  |  |  | **M** |  |  |  |

**Unit – I :**

Introduction: Why nanoscale materials? Overview, definitions, and examples. Top-down and bottom-up approaches. Atoms, clusters and Nanomaterials Introduction, Melting point of Gold Nanocrystal, Vapour pressure of Nanocrystals.

**Unit – II :**

Nanomaterials Synthesis and Processing: *One Dimensional Nano-structures:*Nano wires and nano rods, Spontaneous growth: Evaporation and condensation growth, vapor-liquid-solid growth, stress induced recrystallization. Template based synthesis: Electrochemical deposition, Electro-phoretic deposition. Electrospinning and Lithography. *Two dimensional nano-structures:*

**Unit – III :**

Fundamentals of film growth. Physical vapour Depostion(PVD): Ebvaporation molecular beam epitaxy (MBE), Sputtering, Comparison of Evaporation and sputtering. Chemical Vapour Deposition (CVD): Typical chemical reactions, Reaction kinetics, transport phenomena, CVD methods, diamond like films by CVD.

Thin films: Atomic layer deposition (ALD), Pulse-Electrochemical deposition (ECD), Sol-Gel films.

**Unit – IV :**

Special Nano Materials: Carbon fullerence and nano tubes: carbon fullerness ,formation, properties and applications. Carbon nano tubes: formation and applications.

**Unit – V :**

Nanocomposites Synthesis and Processing: Introduction, Historical perspective, Different Synthesis methods of Nanocomposites- self Assembly or Bio-Mimetic processes, Film; Processing of Nanoparticles- Binding mechanisms in Nanoparticles, Dispersion of Nanoparticles, Stabilization of Nanoparticles;

**Unit – VI :**

Special nanostructured materials- Fullerenes- Magnetism and tunneling, Fullerenes films, other applications; Nanotubes- carbon Nanotubes; Onions-carbon onions, Porous silicon- Preparation methods.

Characterization of Nanomaterials using: SEM with EDS, TEM, X-ray Diffraction, Scanning Tunnelling microscope, Atomic force microscope principle and their advantages and limitations.

**Reading:**

1. Gabor L. Hornyak, H.F Tibbals, Joydeep Dutta & John J Moore, Introduction to Nanoscience and Nanotechnology, CRC Press, 2009.

2. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.

3. Guozhong Cao, Nano structures and Nano materials: Synthesis, properties and applications - Imperial College press, 2004.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**Artificial Intelligences (AI) for Mechanical Engineering**

(**Professional Elective-II)**

**Code:7B729**

**L T P/D C**

**3 - - 3**

**PREREQUISITES:**Basic Course in Probability and Linear Algebra

**Objectives:** The objective of this course is to present an overview of the principles and practices of AI to address complex real-world problems. The course is to develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of AI.

**Course Outcomes:**

1. to understand the history of AI and uninformed search Method.

2.to demonstrate informed search graphs, rule and pruning & Evaluation methods

3.to demonstrate KR and KR&R through propositional logics and FOL.

4.To learn how to use BN, BNN , MDN in decision making.

5.Learn various techniques for planning and sequential decision problem.

6.brief out the basics of ML, SL,RL and CNN.

**Mapping of Course Outcomes with Program Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course Outcomes | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | H | M |  |  | M |  |  |  |  |  |  | L |
| CO2 | H | M |  |  | M |  |  |  |  |  |  | L |
| CO3 | H | M |  |  | M |  |  |  |  |  |  | L |
| CO4 | H | M |  |  | M |  |  |  |  |  |  | L |
| CO5 | H | M |  |  | M |  |  |  |  |  |  | L |
| CO6 | H | M |  |  | M |  |  |  |  |  |  | L |

**UNIT-1 Introduction AI**

What is artificial intelligence, Dimensions of AI, Machines with True intelligence, Weak and Strong AI. History of AI.

Problem Solving by Search-I: Problem solving as state space search, Uninformed search, Heuristic search , informed search, constraint satisfaction problems.

**UNIT-2**

Problem Solving by Search-II: And OR Graphs, Hyper graph, Solution Graph,A0 \* Graph. Game playing, Grundy Game, Winning Strategy, Games Trees, Minimax Rule, MinMax Procedure, Evaluation function, TIC-TAC-TOE. alpha+ beeta Pruning.

**UNIT-3**

Introduction to knowledge representation, Data, Information, knowlegde, Knowledge representation, Hypothesis, Knowledge Representation and Reasoning, propositional logic, Propositional connectives, well formed formula, Truth table , Implication , Translating english to logic, De-Morgan law.Rules of inferences,

Knowledge representation and reasoning, first order logic, Syntax of FOL, Universal and Existential quantifiers, interfacing to first order logic, inference in first order logic, De-Morgan law. Rules for quantifiers, Negation of quantified statements, Inferences in FOL,Answer extraction.

**UNIT-4**

Reasoning under uncertainty: Handling uncertain knowledge, Basic Probability, Probability model, Random variables, Conditional Probability, Axioms of Probablity,Joint Probability, Bays' Rule. Beliaf Network, Bayesain network, Markov property, causal chain, D- Separation, Bulger Alarm example. Decision Making, Decision theory , Utility theory ,Utility functions, Decision network, DN Examples.

**UNIT-5**

Introduction to planning, Partial order plan, Fully instantiated Plan, Components of plan, Sussman Anomaly, Gold Stack planning, plan space planning, planning graph and graph plan, Practical planning and acting, sequential decision problems, making complex decisions.

**UNIT-6:** Introduction to machine learning, learning decision trees, linear regression, support vector machines, Unsupervised learning, reinforcement learning, learning in neural networks, Deep learning: A brief over review.

Text Book:

[1] Machine Learning: The new AI by Ethem Alpaydin, MIT Press, 2016

[2] The quest for Artificial Intelligence by Nils J.Nilssion, Cambridge.

[3] The fundamentals of AI :NPTEL Online Course Material / Prof. Shyamanta M Hazarika

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**POWER PLANT ENGINEERING**

**(Professional Elective-IV)**

**Code: 7B730**

**L T P C**

**3 -- -- 3**

**Course Objectives**

To understand the student present day energy demand.

To make the student to aware of components of power plants that run using conventional and nonconventional methods, factors affecting the site selection for a power plant and concept of base load plant and peak load plant .To make the student aware of Pros and Cos of various power plants. To enable the student to recognize the importance of secondary energy source.

**Course Outcomes:**

After completing the subject, students will be able to:

* Understand Concept of Steam power plant layout, Different sources of energy, Fuel handling equipments,
* Understand Types of coals, coal handling, Coal storage, ash handling systems
* Understand Concept of Diesel Power Plant, Gas turbine plant, with auxiliaries
* Understand Concept of water power, hydrological cycle, Hydrographs, pumped storage plants

and type dams and spill ways

* Understand Concept of Solar collectors, solar energy, Fuel cells, thermo electric and thermo ionic, MHD generation, Nuclear fuel and reactors
* Understand Concept of Capital cost, Different types of costs used in power plants, different types of factors

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | L | H | M |  |  |  |  |  |  |  |  |  |
| CO2 | L | H |  |  |  |  |  |  |  |  |  |  |
| CO3 | L | H | M |  |  |  |  |  |  |  |  |  |
| CO4 | L | H | M |  |  |  |  |  |  |  |  |  |
| CO5 | L | H | M |  |  |  |  |  |  |  |  |  |
| CO6 | M | H |  |  |  |  |  |  |  |  |  |  |

**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 equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

**UNIT II**

**STEAM POWER PLANT :**

COMBUSTION PROCESS : Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

**UNIT – III**

**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 comparision.

**UNIT – IV**

**HYDRO ELECTRIC POWER PLANT:** Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and

Pondage – classification of dams and spill ways.

**HYDRO PROJECTS AND PLANT:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

**UNIT V**

**POWER FROM NON-CONVENTIONAL SOURCES:** Utilization of Solar- Collectors Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

**DIRECT ENERGY CONVERSION**: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

**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 cool

ed Reactor, Radiation hazards and shielding – radioactive waste disposal.

**UNIT – VI**

**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 BOOK** :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications

**REFERENCES :**

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.

2. A Course in Power Plant Engineering: / Arora and S. Domkundwar.

3. An Introduction to Power Plant Technology / G.D. Rai.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**Production Planning and Control**

**(Professional Elective-II)**

**CODE: 7B731**

**L T P/D C**

**3 - - 3**

**Course Objectives**:

Understand the importance of Production planning & control. Learning way of carrying out various functions so as to produce right product, right quantity at right time with minimum cost.

**Course Outcomes:**

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

* Understand production systems and their characteristics to evaluate MRP and JIT systems against traditional inventory control systems.
* Analyze aggregate planning strategies.
* Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  | H |  |  |  | L |  |  |  |  | M |  |
| CO2 |  | H |  |  |  | L |  |  |  |  | M |  |
| CO3 |  | H |  |  |  | L |  |  |  |  | M |  |
| CO4 |  | H |  |  |  | L |  |  |  |  | M |  |
| CO5 |  | H |  |  |  | L |  |  |  |  | M |  |
| CO6 |  | H |  |  |  | L |  |  |  |  | M |  |

**UNIT – I:**

**Introduction**: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

**Forecasting:** Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

**UNIT – II:**

**Inventory management:** Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only.

**UNIT – III:**

**Aggregate planning –** Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

**UNIT –IV:**

**Line Balancing**: Terminology, Methods of Line Balancing, RPW method& Largest Candidate method. Routing– Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

**UNIT – V:**

**Scheduling:** Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling **–** job shop scheduling, line of balance (LOB) – objectives - steps involved.

**UNIT – VI:**

**Dispatching**: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

**Follow up**: definition – types of follow up – expediting – definition – expediting procedures-Applications of computers in planning and control.

**TEXT BOOKS:**

1. Production Planning and Control by M.Mahajan, Dhanpati rai & Co
2. Production Planning and Control by Jain & Jain, Khanna publications

**REFRENCE BOOKS:**

1. Production Planning and Control- Text & cases by SK Mukhopadhyaya, PHI.
2. Production and operations Management by R.Panneer Selvam, PHI
3. Operations Management by Chase, PHI
4. Operations Management by William J. Stevensan, MC Graw Hills.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**ADVANCED MATERIALS AND PROCESSING**

**(Professional Elective-II)**

**CODE: 7B732**

**L T P/D C**

**3 - - 3**

**Course Objective:**

To equip students with the knowledge required for processing advanced materials.

**Course Outcomes:**

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

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| CO1 | Classify manufacturing processes. |
| CO2 | Understand principles of casting and solidification. |
| CO3 | Understand manufacturing of porous powder metallurgical products. |
| CO4 | Utilize forming and processing technologies to shape metals and ceramics |

**Mapping of Course Outcomes with Program Outcomes:**

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| Course Outcomes | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO2 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO3 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO4 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO5 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO6 |  |  |  |  |  |  |  |  |  |  |  |  |

**Detailed Syllabus:**

**Unit – I :**

Advanced materials: Introduction, Advanced materials for High-tech applications, Principle, properties and application of CERMETs, Shape memory alloys, Piezoelectric ceramics, and Maraging steels.

**Unit- II :**

Processing of Metallic materials: Introduction to solidification process, single crystal and poly crystalline materials, grain growth, temperature distribution during solidification process, Zone refining, Effect of inoculation in casting of various materials, Solidification time calculation, Melting practice of steel and non ferrous materials.

**Unit- III :**

Production of MMC through compocasting, die-casting, thixocasting and squeeze casting, and their characterization, advantages, limitations and applications. 3-D Printing of engineering products, advantages, limitations and applications.

**Unit – IV :**

Powder Metallurgy techniques in processing of materials: Introduction to powder metallurgy, various processes in powder metallurgy: powder making, consolidation, sintering, CIP, HIP. Defects in P/M products, remedial measures to eliminate them. Advantages, limitations of of P/M processes. List of products produced by P/M and their applications.

**Unit- V:**

Production of composites, Processing of ceramics, Rheological behavior of composites, Characterization of composites before and after processing. Role of interface on quality and integrity of the composites. Measures to enhance the interfacial bonding.

**Unit – VI :**

Forming of metals, polymers and ceramics: Hot and cold Processing, Forming of glass, Forming of ceramics, Processing of polymers, Defect analysis of formed glass, ceramics and polymers, Characterization of ceramics.

**Reading:**

1. Michel Ashby, Materials Engineering Science Processing and Design, Butterworth-Heinemann,

2007.

2. Y. Waseda, A. Muramatsu, Yoshio Waseda, Morphology Control of Materials and Nanoparticles:

Advanced Materials Processing and Characterization, Springer, 2004.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**NON-DESTRUCTIVE TESTING OF MATERIALS**

**(Professional Elective-III)**

**CODE:7B733**

**L T P/D C**

**3 - - 3**

**Course Objective:**

To understand principles of various important Non-Destructive Testing methods and interpret results.

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

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| CO1 | Classify Non-Destructive Testing (NDT) methods. |
| CO2 | Understand principles of various NDT methods. |
| CO3 | Understand interpretation of results based on case studies. |
| CO4 | The knowledge gained from the NDT course helps understanding the manufacturing processes. |

**Mapping of Course Outcomes with Program Outcomes:**

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| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO2 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO3 | H | H | H | M | M | M |  |  |  |  | M | M |
| CO4 | H | H | H | M | M | M |  |  |  |  | M | M |

Detailed Syllabus:

**Unit – I :**

Non-Destructive testing

Definition of NDT, Visual testing, Optical testing, Acceptance criteria. Uses of NDE methods.

**Unit – II :**

Liquid penetrant test: Physical Principles, Procedure for penetrant testing, Penetrant testing methods, sensitivity, Applications and limitations. Magnetic particle testing, Ultrasonic testing: Basic properties of sound beam, Ultrasonic transducers, Inspection methods, Techniques for normal beam inspection,

**Unit-III :**

Techniques for angle beam inspection, Applications of ultrasonic testing, Advantages and limitations.

Thermography: Infrared/Thermal testing (IRT), Basic principles, Detectors and equipment, techniques, application.

**Unit-IV:**

Radiography: Basic principle, Electromagnetic radiation sources, radiographic imaging Inspection techniques, applications, limitations, typical examples. Eddy current test: Principles, instrumentation for ECT, techniques, sensitivity, advanced eddy Current test methods, applications, limitations.

**Unit – V:**

Acoustic emission: Principle of AET, Technique, instrumentation, sensitivity, applications, Acoustic emission technique for leak detection

**Unit – VI:**

Case studies: Storage tank inspection, wire rope inspection, poer plant inspection, pipe line inspection, Bridge inspection, Rail inspection, Aircraft inspection, Jet engine inspection, Standards for evaluation of welding defects, Radiographic standards for casting defects.

**Reading:**

1. Practical Non-Destructive testing- Baldev Raj, T.Jaya Kumar et.al.

2. B.Ram Prakash, ISO9000 and NDE Vol.2, interline publishing, 1993

3. NDT-Hand book

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**QUALITY AND RELIABILTY ENGINEERING**

(**Professional Elective-III)**

**CODE:7B734**

**L T P/D C**

**3 -- -- 3**

**COURSE OBJECTIVES:**

• Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability.

• Introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring

• Illustrate the basic concepts and techniques of modern reliability engineering tools.

**COURSE OUTCOMES:**

Upon completion of this course the student will be able to:

1. Attain the basic techniques of quality assessment , fundamental knowledge of statistics and probability and Use control charts

2.learn principles of DOQ design for quality.

3. Use reliability concepts to analyze for improving the process quality.

4. Describe various methods to asses reliability determination

5. Acquire basic knowledge of reliability management

6. Understand the concepts of risk management.

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  |  |  |  |  | **H** |  |  |  |  | **H** |  |
| CO2 |  |  |  |  |  | **H** |  |  |  |  | **H** |  |
| CO3 |  |  |  |  |  | **H** |  |  |  |  | **H** |  |
| CO4 |  |  |  |  |  | **H** |  |  |  |  | **H** |  |
| CO5 |  |  |  |  |  | **H** |  |  |  |  | **H** |  |
| CO6 |  |  |  |  |  | **H** |  |  |  |  | **H** |  |

**UNIT-I**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost.

Process Control for Variables and Attributes: Causes of Variation, Control Charts for Variables (Mean and Range, Mean and Standard Deviation, Cumulative Sum Control Chart), Control Chart Patterns and Corrective Actions, Control Charts for Attributes (p-chart, np-chart, c-chart, uchart), Acceptance Sampling Plans (Concepts of Producer’s and Consumer’s Risks, Types of Sampling Plans and their merits and demerits, Operating Characteristic Curve, Average Outgoing Quality Curve), Errors in Making Inferences from Control Charts (Type I and II errors)

**UNIT-II**

Designing for Quality: Introduction to Concurrent Engineering, Quality Function Deployment (QFD) and Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application

Six Sigma Fundamentals: Basic Concept, Methodology, Process Improvement Model (DMAIC) Steps (Objectives, Tools and Techniques Used), Six Sigma Organization, Six Sigma Implementation Requirements, Introduction to Lean Manufacturing

**UNIT-III**

Reliability function, failure rate, Mean time between failures (MTBF), Mean time to failure (MTTF), mortality curve, useful life availability, maintainability, system effectiveness. Introduction to probability distributions. Time to failure distributions: Exponential, normal, Gamma, Weibull; ranking of data, probability plotting techniques, Hazard plotting Concept of Bathtub Hazard Rate curve, Reliability evaluation of two-state device networks-series, parallel, k-out-of-m systems; Standby redundant systems, Reliability evaluation of three state device networks-series and parallel.

**UNIT-IV**

Reliability Determination and Prediction: Reliability Determination Methods: Network reduction technique, Path tracing technique, Decomposition technique, Delta-Star method. Advanced Reliability Evaluation Concepts: Supplementary variables technique, Interference theory, Human reliability, Common cause failures, Fault trees, Failure mode and effect analysis. Reliability Prediction Models: Series and parallel systems - RBD approach - Standby systems - m/n configuration - Application of Baye's theorem - cut and tie set method - Markov analysis - FTA - Limitations.

**UNIT-V**

Reliability Management: Reliability testing: Time acceleration factor, influence of acceleration factor in test planning, application to acceleration test, high temperature operating life acceleration model, temperature humidity bias acceleration model, temperature cycle acceleration model, vibration accelerator model, failure free accelerated test planning. Accelerated reliability growth.

**UNIT-VI**

Risk Assessment: Definition and measurement of risk - risk analysis techniques - risk reduction resources - industrial safety and risk assessment

**References Books:**

1. Grant E L, Statistical Quality Control“, McGraw-Hill.

2. Shrinath L S, Reliability Engineering” Affiliated East west press.

3. Besterfield D H, Quality Control, Prentice Hall.

4. Sharma S C, Inspection Quality Control and Reliability, Khanna Publishers.

5. Connor P.D.T.O. Practical Reliability Engineering”, John Wiley.

6. Naikan V N A Reliability Engineering and Life Testing”, PHI Learning Private Limited.

7. Prabhakar Murthy D N and Marvin R, “Product Reliability”, Springer-Verlag.

8. Dana Crowe and Alec Feinberg, Design for Reliability, CRC Press.

9. John W Priest and Jose M Sanchez, “Product Development and Design for Manufacturing – A Collaborative Approach to Producibility and Reliability”, Second Edition, Marcel Dekker.

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**RENEWABLE ENERGY AND ENERGY MANAGEMENT**

**(Professional Elective-III)**

**Code:7B735**

**L T P/D C**

**3 -- -- 3**

**COURSE OBJECTIVE:**

To enlighten students about different types of renewable energy resources available across globe and their technologies and limitations.

**COURSE OUTCOMES:**

At the successful completion of this course, the student is expected to have/be able to:

1. Recognize the ways of solar energy utilizations in terms of conversion to thermal and electrical energy.

2. Describe the challenges and problems associated with the use of Bio mass as energy as an energy source.

3. Discuss potential of technological implications in Biogas plants.

4. List and describe wind energy plants as the primary renewable energy resources and technologies.

5. Describe/illustrate basic concepts and system components of Geothermal, tidal, and wave energy

6. Learn the methods of production of Hydrogen and utilization as an energy source.

***Mapping of Course Outcomes with Program Outcomes:***

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| CO1 | **M** | **H** |  |  |  |  | **L** |  |  |  | **M** |  |
| CO2 | **M** | **H** |  |  |  |  | **L** |  |  |  | **M** |  |
| CO3 | **M** | **H** |  |  |  |  | **L** |  |  |  | **M** |  |
| CO4 | **M** | **H** |  |  |  |  | **L** |  |  |  | **M** |  |
| CO5 | **M** | **H** |  |  |  |  | **L** |  |  |  | **M** |  |
| CO6 | **M** | **H** |  |  |  |  | **L** |  |  |  | **M** |  |

**Unit-1:**

Solar Energy : Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of using solar energy –Photothermal, Photovoltaic, Photosynthesis, Present & Future Scope of Solar energy. Hybrid wind energy systems – wind + diesel power, wind + conventional grid, wind + Photovoltaic system etc.

**Unit-02:**

Biomass: Generation and utilization, Properties of biomass, Agriculture Crop & Forestry residues used as fuels. Biochemical and Thermo-chemical Conversion, Combustion, Gasification, Biomass gasifiers and types etc. Applications of Gasifiers to thermal power and Engines, Biomass as a decentralized power generation source for villages Concept of Bio-energy: Photosynthesis process, Bio-fuels, Biomass resources Bio based chemicals and materials Thermo-chemical Conversion: Pyrolysis, Combustion, Gasification, Liquification. Bio-Chemical Conversion: Aerobic and Anaerobic conversion, Fermentation etc. Bio-fuels: Importance, Production and applications. Bio-fuels: Types of Bio-fuels, Production processes and technologies, Bio fuel applications, Ethanol as a fuel for I.C. engines, Relevance with Indian Economy. 11 Bio-based Chemicals and Materials: Commercial and Industrial Products, Biomass, Feed stocks, Chemicals, Plastics, Fibres etc. Government Policy and Status of Bio fuel technologies in

**Unit-03:**

Biomethanation : Importance of biogas technology, Different Types of Biogas Plants. Aerobic and anaerobic bioconversion processes, various substrates used to produce Biogas (cow dung, human and other agricultural waste, municipal waste etc.) Individual and community biogas operated engines and their use. Removal of CO2 and H2O, Application of Biogas in domestic, industry and vehicles. Bio-hydrogen production. Isolation of methane from Biogas and packing and its utilization.

**Unit-04:**

Wind Energy: Basics & Power Analysis, Wind resource assessment, Power Conversion Technologies and applications, Wind Power estimation techniques, Principles of Aerodynamics of wind turbine blade, Various aspects of wind turbine design, Wind Turbine Generators: Induction, Synchronous machine, constant V & F and variable V & F generations, Reactive power compensation. Site Selection, Concept of wind form & project cycle, Cost economics & viability of wind farm,

**Unit-05:** Geothermal, Tide and Wave Energy: Availability of Geothermal Energy-size and Distribution, Recovery of Geothermal Energy, Various Types of Systems to use Geothermal Energy, Direct heat applications, Power Generation using Geothermal Heat, Sustainability of Geothermal Source, Status of Geothermal Technology, Economics of Geothermal Energy.

**Unit-06:** Hydrogen Energy : Hydrogen as a renewable energy source, Sources of Hydrogen, Fuel for Vehicles. Hydrogen Production: Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production. Storage of Hydrogen: Gaseous, Cryogenic and Metal hydride

Fuel Cell – Principle of working, construction and applications.

**Text Books** :

1. Biomass Renegerable Energy – D.O.hall and R.P. Overeed ( John Wiley and Sons, New york, 1987)

2. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.

3. Principles of Thermal Process : Duffie –Beckman.

4. Solar Energy Handbook: Kreith and Kreider (McGrawHill)

5. Solar Cell : Marteen A. Green 5. Solar Hydrogen Energy Systems –T. Ohta (Ed.) (Pergamon Press)

6. Hydrogen Technology for Energy – D.A.Maths (Noyes Data Corp.)

7. Handbook : Batteries and Fuel cell – Linden (Mc.Graw Hill) 8. Batteries Volume (I) and (II) – Collins

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**PRODUCT DESIGN**

**(Professional Elective-III)**

**Code: 7B736**

**L T P C**

**3 -- -- 3**

**OBJECTIVE**

The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

**OUTCOME:**

On completion of the course the student will be able to understand the integration of customer requirements in product design

• Apply structural approach to concept generation, selection and testing

• Understand various aspects of design such as industrial design, design for manufacture

• Economic analysis and product architecture

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO3 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO4 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO5 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| CO6 |  | **H** |  | **M** |  |  |  |  |  |  |  |  |

**UNIT I**

INTRODUCTION 8 Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement

**UNIT II**

CONCEPT GENERATION, SELECTION AND TESTING 10 Plan and establish product specifications. Task - Structured approaches - clarification - searchexternally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability – Concept Testing Methodologies.

**UNIT III**

PRODUCT ARCHITECTURE 8 Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

**UNIT IV**

INDUSTRIAL DESIGN 8 Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

**UNIT V**

DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 11 Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

**UNIT V**I

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research

**TEXT BOOK** 1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw –Hill International Edns.1999

**REFERENCES:**

1. Concurrent Engg./Integrated Product Development. Kemnneth Crow, DRM Associates, 6/3,ViaOlivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book

2. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992,ISBN, 1-55623-603-4

3. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing,Neyourk,NY,1991, ISBN 0-202-41639-5

4. www.me.mit/2.7444

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**PRODUCTION DRAWING PRACTICES LAB**

**Code:7B776**

**L T P/D C**

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**Course Objective:**

* *Understand the various symbols used in machine drawing.*
* *Understand the principles and requirements of various Assembly drawings.*
* *Drawing of different machine components*
* *Imagine and drawing the assembly by seeing the components given.*
* *Ability to understand the existing geometric modeling and develop a geometric modeling for a new component in design process*

**Course Outcomes:**

* *able to understands the significance symbols used in drawing.*
* *able to learn the complete requirements of various Assembly drawings.*
* *Become proficient Drawing of different machine components*
* *become proficient Imagine and drawing the assembly by seeing the components given.*
* *understand the existing geometric modeling.*
* *understand the existing new component in design process*

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 | H | H |  |  |  |  |  |  |  |  |  |  |
| CO3 | H | H |  |  |  |  |  |  |  |  |  |  |
| CO4 | H | H |  |  |  |  |  |  |  |  |  |  |
| CO5 | H | H |  |  |  |  |  |  |  |  |  |  |
| CO6 | H | H |  |  |  |  |  |  |  |  |  |  |

**UNIT – I**

Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

**UNIT – II**

**Limits and Fits:** Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

**UNIT – III**

**Form and Positional Tolerances:** Introduction and indication of the tolerances of from and position on drawings, deformation of run out and total run out and their indication.

**UNIT – IV**

**Surface roughness and its indication:** Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

Heat treatment and surface treatment symbols used on drawings.

**UNIT – V**

**Detailed and Part drawings:** Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

**UNIT – VI**

Part drawing using computer aided drafting by CAD software

**Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script,DXE AND IGES FILES.

**Text Books:**

1) Production Drawing: P.N.Reddy and T.A.Janardhan Reddy/Hi-Tech Publishers

**References:**

1) Geometric dimensioning and tolerancing-James D. Meadows/B.S. Publications.

Engineering Metrology, R.K. Jain, Khanna Publications

2) Production Drawing K.L.Narayana and P.Kannaiah /New AGE Publishers

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**INSTRUMENTATION LAB**

**Code:7B777**

**L T P/D C**

**-- -- 2 1**

**Course Objective:**

The student can learn the measurements with and calibration of instruments. They also understand the machine tool alignment test. Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

**Course Outcomes:**

Students will be able to select proper measuring instrument and know requirement of calibration, errors in measurement etc. They can perform accurate measurements

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO3 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO4 |  |  | H |  |  |  |  |  | H |  |  |  |
| CO5 |  |  | H |  |  |  |  |  | H |  |  |  |
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**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. Calibration of Load Cells

8. Study and use of a Seismic pickup for the measurement of vibration amplitude of an Engine bed at various loads.

9. Study and calibration of photo and magnetic speed pickups for the measurement of speed

10. Measurement of force using strain gauge based dynamometer

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**CAE LAB**

**Code:7B778**

**L T P/D C**

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**Course Objectives:**

Upon completion of this course the students will be able to

* Execute steps required for analysis of objects by using analysis software
* Select the suitable finite element for different types of problems
* Interpret the results finite element results with different boundary conditions
* Know the data exchange formats for importing and exporting the model
* Understand the CAE software applicability for analyzing structural and thermal problems

**Course Outcomes:**

After completing the subject, students will be able to:

1. Select appropriate finite element for solving structural and thermal problems.

2. Correlate mathematical formulation using FE method

3. Analyze Stresses and deflections of trusses and bars under static loading.

4. Analyze Stresses and deflections of thin plates subjected to in-plane loading and solids.

5. Interpret the results after model analysis and transient dynamic analysis

6. Simulate real life structural and thermal problems.

***Mapping of Course Outcomes with Program Outcomes:***

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| CO2 | M | H | H |  | H |  |  |  |  |  |  |  |
| CO3 | M | H | H |  | H |  |  |  |  |  |  |  |
| CO4 | M | H | H |  | H |  |  |  |  |  |  |  |
| CO5 | M | H | H |  | H |  |  |  |  |  |  |  |
| CO6 | M | H | H |  | H |  |  |  |  |  |  |  |

**List of Experiments:**

1. Analysis using 1D-bar elements.

2. Analysis of simple 2D Trusses

3. Analysis deflection of simple Beams

4. Evaluation of SFD and BMD of Beams with different loading conditions

5. Analysis of Plane stress problems

6. Analysis of axi-symmetric problems

7. Analysis of three dimensional FEA .

8. Modal Analysis of a Beam.

9. Harmonic Analysis of a Beam.

10. Transient Analysis of a Beam

11. Steady state Heat Transfer Analysis of a composite wall and a Fin

12. Developing a 3-D Model in a modeling software and analyzing it by importing into FEA software.

**LIST OF EQUIPMENTS & SOFTWARES:**

Software used: ANSYS

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**PROJECT -I**

**Code: 7B779**

**L T P/D C**

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**Course Objectives:**

To acquaire basic knowledge on selecting a projcet , learn related tools and enhance Design and production skills for employabilty.

**Course Outcomes:**

* Students use the concepts learned in the courses, so far, in conceptualizing, designing and executing the projects.
* Enables to apply modern tools and technologies for project works
* Inculcates an enthusiasm to use the creative ideas to execute projects to meet the current needs of the society.
* Enhances communicative skills and team work
* The students learn the ability to work as an individual with multidisciplinary approach

***Mapping of Course Outcomes with Program Outcomes:***

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| **1** | H | H | H | H | H |  |  |  | M | M |  |  |
| **2** | H | H | H | H | H |  |  |  | M | M |  |  |
| **3** | H | H | H | H | H |  |  |  | M | M |  |  |
| **4** | H | H | H | H | H |  |  |  | M | M |  |  |
| **5** | H | H | H | H | H |  |  |  | M | M |  |  |
| **6** | H | H | H | H | H |  |  |  | M | M |  |  |

The continuous internal evaluation for Project – I in IV year I semester shall consist of :

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| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Literature survey and presenting seminar at the  end of 6 weeks | 10 marks |
| 2 | Report | 10 marks |
| 3 | Demonstration/presentation at the end of 14  weeks | 10 marks |
| 4 | Total sessional marks | 30 marks |

Semester end examination - 70 Marks

marks Pattern of external evaluation for Project – I in IV year I semester.

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| **Sl.No** | **Description** | **Marks** |
| 1 | Final report | 10  marks |
| 2 | Presentation | 10  marks |
| 3 | Demonstration/defence of project | 50  marks |
| 4 | Total sessional marks | 70  marks |

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**Summer Industry Internship-II**

**Code: 7B780**

**L T P/D C**

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**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**Mechanics Manufacturing Methods of Composite Materials**

**(Professional Elective-IV)**

**Code: 7B837**

**L T P C**

**3 -- -- 3**

**Course Objective:**

to familiarize the student with the types, manufacturing processes, and applications of composite materials.

**Course Outcomes:**

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

1.Understand the concepts and applications of composite materials.

2.Analyze micro mechanical behaviour of a lamina

3.Learn matrix tranformation for stress and strain in composites

4.Analyze Elastic behavior of composites

5.Develop governing equations for bending strength evaluation in laminated plates.

6.Gains knowledge of manufacture of composites.

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| CO1 |  | **H** |  | **M** |  |  |  |  |  |  |  | **L** |
| CO2 |  | **H** |  | **M** |  |  |  |  |  |  |  | **L** |
| CO3 |  | **H** |  | **M** |  |  |  |  |  |  |  | **L** |
| CO4 |  | **H** |  | **M** |  |  |  |  |  |  |  | **L** |
| CO5 |  | **H** |  | **M** |  |  |  |  |  |  |  | **L** |
| CO6 |  | **H** |  | **M** |  |  |  |  |  |  |  | **L** |

**Unit – I**

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

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

**Unit – II**

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

**Unit – III**

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

**Unit – IV**

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

**Unit – V**

Strength of unidirectional lamina: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants. Analysis of laminated composite plates Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

**Unit – VI**

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

**Text Books:**

1. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York,975.

2. Engineering Mechanics of Composite Materials by Isaac and M.Daniel, Oxford Univ. Press, 1994.

**REFERENCES:**

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman, Wiley-Interscience, New York, 1980.

2. Analysis of Laminated Composite Structures, L. R. Calcote,Van Nostrand Rainfold, New York, 1969

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**DESIGN AND ANALYSIS OF ENGINEERING MATERIALS**

**(Professional Elective-IV)**

**Code:7B838**

**L T P/D C**

**3 - - 3**

**Course Outcomes:**

Understand the principles of materials selection and design.

Design components using appropriate attribute limits and material indices.

Establish the criteria for material qualification and acceptance.

Apply design principles for manufacturing of different engineering components.

***Mapping of Course Outcomes with Program Outcomes:***

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| **4** |  |  |  |  |  |  |  |  |  |  |  |  |
| **5** |  |  |  |  |  |  |  |  |  |  |  |  |
| **6** |  |  |  |  |  |  |  |  |  |  |  |  |

**Unit – I**

**Introduction**: The families of engineering materials. The Design process, types of design, Design tools and materials data.

**Unit – II**

**Material Selection**-The basic and case studies: Introduction and synopsis, the selection strategy, attribute limits and material indices, the selection procedure, computer-aided selection, the structural index, summary and conclusions, case studies.

**Unit – III**

**Selection of material and shape, case studies:** Introduction and synopsis, shape factors, Microscopic or Micro-structural shape factors, limits to shape efficiency, exploring and comparing structural sections,

**Unit – IV**

**material selection**

material indices that include shape, co-selecting material and shape, summary and conclusions, case studies.

**Unit – V**

**Designing Hybrid Materials and case studies:** Introduction and synopsis, filling holes in material property space, hybrids of type 1, 2, 3, 4. Summary and conclusions, case studies.

Reading: 1. G.S. Ramaswamy, “Design and Construction of Concrete Shell Roofs”, 1st Edition, CBS Publishers, 2005.

2. R. Szilard, “Theory and Analysis of Plates - Classical and Numerical Methods”, Prentice Hall, 1974.

3. Timoshenko and Krierger, “Theory of Plates and Shells”, 2nd Edition, Tata McGraw Hill, 2010.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**AUTOMOBILE ENGINEERING**

**(Professional Elective-IV)**

**Code:7B839**

**L T P/D C**

**3 - - 3**

**Course Objective:**

Make students to acquire sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods. The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

**Course Outcomes:**

After completing the subject, students will be able to:

* study of two front wheel drive, rear wheel drive and four wheel drive
* understand the fuel systems like petrol injection system and diesel injection system
* know the thermo, water, forced circulation system , study of ignition system and we can know the various emission standards
* understand about clutches, single plate clutch, multi plate clutch, wheels , tyres and differential gear box
* know the steering geometry – Ackerman steering mechanism and Davis steering mechanism toe-in, and to know the objects of suspension system

***Mapping of Course Outcomes with Program Outcomes:***

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
| **1** | **H** | **M** | **M** | **L** |  |  | **M** |  |  |  |  |  |
| **2** | **H** | **M** | **M** | **L** |  |  | **M** |  |  |  |  |  |
| **3** | **H** | **M** | **M** | **L** |  |  | **M** |  |  |  |  |  |
| **4** | **H** | **M** | **M** | **L** |  |  | **M** |  |  |  |  |  |
| **5** | **H** | **M** | **M** | **L** |  |  | **M** |  |  |  |  |  |
| **6** | **H** | **M** | **M** | **L** |  |  | **M** |  |  |  |  |  |

**UNIT – I**

**Introduction :** Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring,

**UNIT – II**

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

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

Introduction to Electric and Hybrid Vehicles – Basic Principles of working

**UNIT – III**

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

**Ignition System :** Function of an ignition system, battery ignition system, constructional

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

**Unit – IV**

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

**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 – V**

**Transmission System :** Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box , over drive torque converter.

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

**UNIT – VI**

**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.

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

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

**TEXT BOOKS:**

1. Automotive Mechanics – Vol. 1 and Vol. 2 / Kirpal Singh.

2. Automobile Engineering / William Crouse

**REFERENCES:**

1. Automotive Engineering / Newton Steeds and Garrett

2. Automotive Mechanics / G.B.S. Narang

3. Automotive Mechanics / Heitner

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**Advanced Manufacturing Processes**

**(Professional Elective-IV)**

Code:**7B840**

**L T P/D C**

**3 - - 3**

**Course Objective:**

to impart basic principles and applications related to un -conventional machining and micro&Nano fabrication techniques.

**Course Outcomes:**

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

1.Understand abrasive and electrical discharge machining processes.

2.list the advances in casting

3.learn principles and applications of electron beam, ion beam and laser hybrid welding processes.

4. apply advanced forming processes to manufacture mechanical products

5.Understand the advantageous of micro fabrication

6. realize the importance of nano fabrication.

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | M | H | H |  | L |  |  |  |  |  |  |  |
| CO2 | M | H | H |  | L |  |  |  |  |  |  |  |
| CO3 | M | H | H |  | L |  |  |  |  |  |  |  |
| CO4 | M | H | H |  | L |  |  |  |  |  |  |  |
| CO5 | M | H | H |  | L |  |  |  |  |  |  |  |
| CO6 | M | H | H |  | L |  |  |  |  |  |  |  |

**UNIT-I**

Abrasive machining and advantages and applications. Electrical discharge Machining: process parameters, applications advantages and limitations. Electro Chemical machining, Water Jet Machining.

**UNIT-II**

Stir casting, organic processes, Magnetic moulding, high pressure moulding, metal injection moulding, centrifugal casting.

**UNIT-III**

Electron beam welding and Laser beam welding: Principle, application and advantages of EBW and LBW, process parameters. Hybrid welding process and advantages and applications and surfacing.

**UNIT-IV**

Introduction forming processes, advantages ,limitations and applications, Hydro, Magnetic and High velocity forming, design for forming, welding and injection moulding, and forming of thin sections

**UNIT-V**

Microfabrication Techniques: Lithography, Thin Film Deposition and Doping, Etching and Substrate Removal, Substrate Bonding. MEMS Fabrication Techniques, Bulk Micromachining, Surface Micromachining, High- Aspect-Ratio Micromachining.

**UNIT-VI**

Nanofabrication Techniques: E-Beam and Nano-Imprint Fabrication, Epitaxy and Strain Engineering, Scanned Probe Techniques, Self-Assembly and Template Manufacturing.

**Text Books:**

1. R. S. Mishra, Friction Stir Welding and Processing, ASM International, 2007.

2. Heine, Loper and Rosenthal, “Principles of Metal Casting”, Tata McGraw-Hill, New Delhi, 2008.

3. Jain, Vijay K., Advanced Machining Process, Chapter-7 (A) Electric Discharge Machining (EDM), Allied Publishers Pvt. Ltd., New Delhi, 2004, 126-129

4. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.

5. Gabor L. Hornyak, H.F Tibbals, Joydeep Dutta & John J Moore, Introduction to Nanoscience and Nanotechnology, CRC Press, 2009

# 6. [P. C. Pandey](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22P.+C.+Pandey%22), [H. S. Shan](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22H.+S.+Shan%22) A Text book of Modern Machining Processes

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**FLEXIBLE MANUFACTURING SYSTEMS & MACHINE VISION**

(Professional Elective-V)

**Code: 7B841**

**L T P C**

**3 -- -- 3**

**Course Objective:**

To give idea of using computers and automation in the area of manufacturing to reduce manual processing and linking computers to all the manufacturing machines and increase the productivity, reduce the unnecessary costs.

**Course Outcomes:**

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

1.Understand FMS and job-shop and mass production manufacturing systems.

2.Understand processing stations and material handling systems used in FMS environments

3.Design and analyze FMS using simulation and analytical techniques.

4.Understand tool management in FMS.

5.Identify the role of computers in FMS

6.Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

***Mapping of Course Outcomes with Program Outcomes:***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 |  | H |  | M |  |  |  |  |  |  |  | L |
| CO2 |  | H |  | M |  |  |  |  |  |  |  | L |
| CO3 |  | H |  | M |  |  |  |  |  |  |  | L |
| CO4 |  | H |  | M |  |  |  |  |  |  |  | L |
| CO5 |  | H |  | M |  |  |  |  |  |  |  | L |
| CO6 |  | H |  | M |  |  |  |  |  |  |  | L |

**UNIT-I**

Understanding of FMS: Evolution of Manufacturing Systems, Definition, objective and Need, Components, Merits, Demerits and Applications of FMS

**UNIT-II**

Processing stations: Machining Centers, Turning centers, CMM, Washing/ Deburring station, etc. Different Layouts and their Salient features

**UNIT-III**

Material Handling System: An introduction, Conveyor, AGV, ASRS, Robots, etc. and their salient features.

**UNIT-IV**

Management technology: Tool Management, Configuration planning and routing, Production Planning and Control, Scheduling and control.

**UNIT-V**

Computer networks and control: Hardware, Software and database of FMS

Design of FMS: Performance Evaluation, Analytical model and Simulation model of FMS .

**UNIT-VI**

Case studies: Typical FMS problems in planning, loading, scheduling, routing and breakdown , Inspection: CMM – types – contact and non contact inspection principles - programming and operation- in cycle gauging.

**TEXT BOOKS:**

1. Groover,M.P “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India Pvt.Ltd. New Delhi 2009

2. Tempelmeier.H and Kuhn.H. “Flexible Manufacturing system: Decision support for design and operation”, John Wiley and Sons 2003.

3. Maleki A. “Flexible Manufacturing Systems: the technology and management”. Prentice Hall International –2009

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**DESIGN OPTIMIZATION**

**(Professional Elective-V)**

**Code: 7B842**

**L T P C**

**3 -- -- 3**

**Course Objective:**

Make student to apply the methods of optimization in real life situation by teaching various constrained and unconstrained problems

**Course Outcomes:**

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

*Unit I: Basics of optimization, considerations relevant to mechanical / structural systems*

*Unit II: Concepts and methods for single-variable unconstrained and constrained optimisation*

*Unit III: Concepts and methods for multi-variable unconstrained and constrained optimization*

*Unit IV: Techniques for nonlinear optimization*

*Unit V:Advanced optimization techniques*

*Unit VI: Optimisation of complex mechanical elements*

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO2 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO3 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO4 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO5 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO6 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |

**Unit – I: Introduction**

General characteristics of mechanical systems; adequate and optimum design; principles of optimization; formulation of objective function; design constraints; classification of optimisation problems; considerations in optimization: economic (cost minimisation), geometric (shape example: minimization of surface area for a given volume), material (volume minimisation, mass, weight), strength (stresses; maximization of load carrying capacity), maximization of rigidity (minimization of deflections)

**Unit – II: Single Variable Optimisation**

**Unconstrained optimisation**; classification of optimal points; optimality conditions; Direct methods: Bracketing a three-point pattern, Fibonacci’s method, Golden section method, Powell’s method; Derivative-based methods: Newton’s method, Bisection method

**Constrained optimization**: formulation, optimality conditions, necessary and sufficient conditions; design of tensile bar for maximum energy absorption capability per cycle of repeated / variable loading with space and material constraints

**Unit – III: Multi-Variable Optimisation**

**Unconstrained optimisation**; problem formulation; optimality conditions; Gradient-based methods: Steepest descent method, Conjugate gradient method, Newton’s method, Davidon-Fletcher-Powell (DFP) method, Broyden-Fletcher-Goldfarb-Shanno (BFGS) method; **Constrained optimization**: Problem formulation, Necessary conditions for optimality (equality, inequality and mix of both types of constraints), Sufficient conditions; Design of a 2-bar truss structure of different cross-sections for minimum mass; Minimum weight tubular column design to support a given load without overstressing and buckling

**Unit – IV: Nonlinear Programming**

Zoutendijk’s method of feasible directions; Interior and exterior penalty function methods; optimal design of a practical torsion bar for minimum weight; design of torsion shaft for minimum cost and minimum dynamic torque;

**Unit – V: Advanced Optimisation Topics**

Geometric Programming technique; dynamic vibration absorbers

**Unit – VI: Optimisation of complex mechanical elements**

Helical and torsional springs, minimization of structural error in four bar mechanisms for path and function generation

**TEXTBOOK:**

1. S.S.Rao, “Engineering Optimisation: Theory and Practice”, Wiley Eastern Edition
2. Kalyanamoy Deb, “Optimisation for Engineering Design Algorithms and Examples”, Prentice Hall of India

**REFERENCE BOOKS:**

1. Jasbir S. Arora, “Introduction to Optimum Design”, McGraw Hill International Edition
2. Ray C. Johnson, “Optimum Design of Mechanical Elements”, John Wiley and Sons

**Syllabus for B. Tech. IV Year I semester**

**Mechanical Engineering**

**JET PROPULSION and ROCKET ENGINEERING**

**(Professional Elective-V)**

**Code: 7B843**

**L T P C**

**3 -- -- 3**

**Course Objectives:**

*To make the student aware of various propulsion devices and use of thrust equations.*

*To make the student to know the working of Ramjet engine in detail.*

*To make the student to understand the working of rocket engine and detail study on fuels used in rocket*

. **Course Outcomes:**

After completing the subject, students will be able to:

* understand open, closed and semi closed cycle of gas turbines, thermal jet engines, classification of energy flow, trust power and propulsion efficiency
* understand essential components of turbo pro and turbo jet performance evaluation, thrust augmentation
* understand plant layout of Ramjet , principle of operation,
* understand liquid propellant Rocket engines, compassion of propulsion systems.
* understand flight mechanics, applications of trust profiles, rocket heat transfer and ablative to cooling
* understand criogenics, advanced propulsion systems, elementary treatment of Electrical Nuclear and Plasma Arc propulsion.

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | H |  | H |  |  |  |  |  |  | M |  |  |
| CO2 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  | H |  | M |  |  |  |  |  | M |  |
| CO4 | H |  | H |  | H |  |  |  |  |  | H |  |
| CO5 | H |  | H |  | H |  |  |  |  |  | H |  |
| CO6 | H |  | H |  | H |  |  |  |  |  | H |  |

**UNIT-I**

Elements of Gas Turbine theory – Thermo dynamic Cycles, open closed and semi-closed – Parameters of performances – Refinements to simple cycle

**Jet Propulsion:** Historical sketch – Reaction Principle – Essential features of propulsion devices – Thermal Jet Engines, Classification of – Energy flow, thrust, thrust power and propulsion efficiency – Need for Thermal jet engines and applications.

**UNIT – II**

**Turboprop and Turbojet** – Thermo dynamic cycles, Plant layout, essential components, principles of operation – performance evaluation – Thrust Augmentation and Thrust reversal – Contrasting with Piston Engine Propeller plant.

**UNIT – III**

**Ramjet** – Thermo dynamic Cycle, plant lay-out, essential components – Principle of operation – performance evaluation – Comparison among atmospheric thermal jet engines – elementary treatment of Scram jet and pulse jet.

**UNIT – IV**

**Rocket Engines:** Need for, applications – Basic principle of operation and parameters of performance – Classification, solid and liquid Propellant rocket engines, advantages, domains of application – Propellants – Comparison of propulsion systems.

**UNIT – V**

**Rocket technology-I:** Flight mechanics, Application Thrust Profiles, Acceleration – staging of Rockets, need for – Feed systems, injectors and expansion nozzles – Rocket heat transfer and ablative cooling

**UNIT – VI**

**Rocket technology-II** – Testing and Instrumentation – Need for Cryogenics – Advanced Propulsion Systems, elementary treatment of Electrical Nuclear and Plasma Arc Propulsion.

**TEXT BOOKS:**

1. Fundamentals of I.C. Enginers/Gill, Smith and Zierys
2. Rocket Propulsion / Sutton
3. Gas Turbines/V.Ganesan/TMH
4. Thermodynamics of Propulsion / Hill and Paterson

**REFERENCE BOOK:**

1. Gas Turbines / Cohen, Rogers and Sarvana Muttoo / Addison Wesley and Longman
2. Compresssible fluid flow by Yahya

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**COMPUTATIONAL FLUID DYANAMICS**

**(Professional Elective-V)**

**Code: 7B844**

**L T P C**

**3 -- -- 3**

**Course objective:**

**to** equip students with the knowledge base essential for application of computational fluid.

**Course Outcomes:**

After completing the subject, students will be able to:

* gain knowledge on using numerical techniques
* Understand various applied numerical methods to solve fluid flow problems
* understand and apply finite volume method to solve heat transfer problems
* know application of finite volume method and fundamentals of fluid flow modeling
* right fluid flow governing equations, momentum and energy equations apply to fluid flow problems
* gain knowledge about different algorithms

***Mapping of Course Outcomes with Program Outcomes:***

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|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| CO1 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO2 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO3 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO4 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO5 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |
| CO6 | **H** |  |  | **H** |  |  |  |  |  |  |  |  |

**UNIT-I**

**Introduction:** Computational Fluid Dynamics: What, When, and Why?, CFD Applications, Numerical vs Analytical vs Experimental, Modeling vs Experimentation, Fundamental principles of conservation, Conservation of mass, momentum: Navier-Stokes equation, Conservation of Energy,

**Classification of Partial Differential Equations and Physical Behaviour**: Mathematical classification of Partial Differential Equation, Illustrative examples of elliptic, parabolic and hyperbolic equations, Physical examples of elliptic, parabolic and hyperbolic partial differential equations

**UNIT - II**

**Finite Volume method** – Some Conceptual Basics and Illustrations through 1-D Steady State Diffusion Problems: Physical consistency, Overall balance, FV Discretization of a 1-D steady state diffusion type problem, Four basic rules for FV Discretization of 1-D steady state diffusion type problem, Source term linearization, Implementation of boundary conditions.

**UNIT - III**

**Finite Volume Discretization of Unsteady State Problems:** 1-D unsteady state diffusion problems: implicit, fully explicit and Crank-Nicholson scheme. Consequences of time-discretization in finite discretization, Consistency, Stability, Convergence, LAX Equivalence theorem, Grid independent and time independent study,

**Stability Analysis**: Stability analysis of parabolic equations (1-D unsteady state diffusion problems): FTCS (Forward time central space) scheme, CTCS scheme (Leap frog scheme), Dufort-Frankel scheme,

Stability analysis of hyperbolic equations: FTCS, FTFS, FTBS and CTCS Schemes, Stability analysis of 2nd order hyperbolic equations: CTCS scheme.

**UNIT -IV**

**Solution of Systems of Linear Algebraic Equations:** Criteria for unique solution, infinite number of solutions and no solution, Solution techniques for systems of linear algebraic equations: Tridiagonal matrix algorithm (TDMA): Thomas algorithm, Gauss Siedel method, Sufficient condition for convergence, Rate of convergence, Scarborough criteria of sufficient condition for convergence in Gauss Siedel Method, ADI(Alternating direction implicit) method.

**UNIT -V**

**Discretization of Convection-Diffusion Equations**: **A Finite Volume Approach:** Finite volume discretization of convection-diffusion problem: Central difference scheme, Upwind scheme, Exponential scheme and Hybrid scheme, Power law scheme, Generalized convection-diffusion formulation, Finite volume discretization of two-dimensional convection-diffusion problem, The concept of false diffusion, QUICK scheme.

**UNIT- VI**

**Discretization of Navier Stokes Equations:** Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocatedgrid,SIMPLEAlgorithm, SIMPLER Algorithm

**TEXT BOOK:**

**1.** Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers

2. Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.

**REFERENCES:**

1. Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications

2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**CARBON BASED NANOSTRUCTURES AND THEIR APPLICATIONS**

**(Professional Elective-V)**

**Code: 7B845**

**L T P C**

**3 -- -- 3**

**Course Objectives:**

To provide the knowledge on structural and electronic properties of carbon nanotubes, as well as the device structures and operation.

**Course Outcomes:**

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| --- | --- |
| CO1 | To investigate and formulate method to use carbon nanotubes as active components in organic electronic devices. |
| CO2 | To explore methods of synthesis to obtain SWNT with desired characteristics. |
| CO3 | To understand the dependence of the performance of the nanotubes based transistors on the nanotube bundle geometry. |
| CO4 | Apply the knowledge acquired for synthesis of CNTs by various methods. |
| CO5 | Carry out research in the areas of lithium, hydrogen adsorption and energy storage. |
| CO6 | Pursue research on nano-chip, applications leading to communications and aerospace. |

**Mapping of Course Outcomes with Program Outcomes:**

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| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | **H** |  | **H** |  |  |  |  |  |  |  | **M** |  |
| CO2 |  | **H** |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO4 |  | **H** |  |  | **M** |  |  |  |  |  |  | **M** |
| CO5 | **H** | **H** |  |  | **H** |  |  |  |  |  |  | **M** |
| CO6 | **H** | **H** | **H** |  | **H** |  |  |  |  |  |  | **M** |

Detailed Syllabus

**Unit-I:**

Carbon Nanostructures and types of Carbon Nano tubes, growth mechanisms, Mechanical reinforcements

**Unit-II:**

Solid Disordered carbon Nanostructures, Nano structured crystals.

**Unit-III:**

Electrical, Vibrational, Mechanical Properties of CNTs, optical properties and Raman Spectroscopy of CNTs

**Unit-IV:**

Carbon clusters and Fullerenes, Synthesis of CNTs by Flame, CVD, Laser and Arc processes

**Unit-V:**

Lithium and Hydrogen adsorption and storages, Fuel cell applications and energy storage, Chemical Sensors applications of CNTs,

**Unit-VI:**

Computer applications (Nano chip), optical and telecommunication applications Nano composites, silicon Nanowires, aerospace applications

**Text books:**

1. Introduction to Nanotechnology by Charles P. Poole Jr and Frank J.Owens Wiley India Pvt. Ltd.

2. Nanotechnology and Nano Electronics – Materials, devices and measurement techniques by WR Fahrner, Springer publications.

**Reference books:**

1. Encyclopaedia of Nanotechnology by M. Balakrishna rao and K. Krishna Reddy, Vol I to X

Campus books.

2. Encyclopedia of Nanotechnology by HS Nalwa

3. Nanotechnology – science, innovation and opportunity by Lynn E.Foster. Prentice Hall Pearson education.

4. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill.

**Syllabus for B. Tech. IV Year II semester**

**Mechanical Engineering**

**PROJECT -II**

**Code: 7B881**

**L T P C**

**-- -- 10 5**

Out of total 100 marks for project work (in the final year second semester), 25 marks shall be for Internal Evaluation and 75 marks for the External Evaluation at the end of the Semester.

External Evaluation of the project (viva-voce) shall be conducted by a committee appointed by the chief superintendent. The committee consists of an external examiner, HOD, a senior faculty member and internal guide.

**The continuous internal evaluation for Project – II in IV year II semester shall consist of :**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Progress of Project work and the corresponding interim report as  evaluated by Project Review Committee at the end of 6 weeks | 5 marks |
| 2 | Seminar at the end of 6 weeks | 5 marks |
| 3 | Progress of Project work as evaluated by Project Review Committee at  the end of 11 weeks | 5 marks |
| 4 | Seminar at the end of 11 weeks | 5 marks |
| 5 | Evaluation by Project Review Committee at the end of 15 weeks | 10 marks |
| 6 | Final Project Report | 5 marks |
| 7 | Final presentation and defence of project | 15 marks |
| 8 | Total | 50 marks |

**Division of marks for External Evaluation for project II – 150 Marks**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Description** | **Marks** |
| 1 | Final Project Report | 30 marks |
| 2 | Presentation | 20 marks |
| 3 | Demonstration / Defense of Project | 100 marks |
| 4 | **TOTAL** | **150 marks** |