**ACADEMIC REGULATIONS**

**COURSE STRUCTURE**

**AND**

**detailed syllabus**

for

**B.Tech Four Year Degree Course**

**(A-17 III & IV year)**

in

**MECHANICAL engineering**

**(ME)**

(Applicable for the batches admitted from 2017-2018)



**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.

**January, 2019**

**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**

**I. 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.

**II. 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.

**III. 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.

**IV. 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:**

a) Graduate will demonstrate knowledge in fundamentals of mathematics, science and engineering

b) Graduate will demonstrate an ability to identify, formulate and solve problems in key areas of Design, Production and Thermal of Mechanical Engineering discipline

c) Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data related to various areas of Mechanical Engineering

d) Graduate will demonstrate ability in conducting investigations to solve problems using research based knowledge and methods to provide logical conclusions

e) Graduate will demonstrate skills to use modern engineering and IT tools, software's and equipment to analyze the problems in Mechanical Engineering

f) Graduate will show the understanding of impact of engineering solutions on the society to assess health, safety, legal, and social issues in Mechanical Engineering

g) 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

h) Graduate will demonstrate the knowledge of Professional and ethical responsibilities

i) Graduate will demonstrate an ability to work effectively as an individual and as a team member/leader in multidisciplinary areas

j) Graduate will be able to critique writing samples (abstract, executive summary, project report), and oral presentations.

k) Graduate will demonstrate knowledge of management principles and apply these to manage projects in multidisciplinary environments.

l) Graduate will recognize the need of self education and ability to engage in life - long learning

**ACADEMIC REGULATIONS FOR B.TECH. REGULAR STUDENTS WITH EFFECT FROM THE**

**ACADEMIC YEAR 2017-18 (A-17)**

**1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in 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 2017-18 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 |
|  | Biotechnology |

**1.2. Credits (Semester system from I year onwards)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No.** | **Type of Subject** | **Periods / Week** | **Credits** |
| 1 | Theory | 03/04 | 03/04 |
| 2 | Practical | 02/03/04 | 01/02 |
| 3 | Engineering drawing - I | 01 L/04D (I year I Sem) | 03 |
| 4 | Engineering drawing - II | 01 L/02D (I year II Sem) | 02 |
| 5 | Group Project | 03 | 02 |
| 6 | Industry oriented Mini Project | 4 weeks in summer vacation at the end of III year – II sem | 02 |
| 7 | Project Phase -I | IV year – I sem | 02 |
| 8 | Technical Paper writing and seminar | Iyear – I sem to IV year II Sem\* | 01 each |
| 9 | Project Phase – II | IV year - II Sem | 12 |
| 10 | Comprehensive Viva Voce - I | At the end of II, III, IV year - II Sem\* | 01 |

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

**2.0 Eligibility for admission**

**2.1** Admission to the under merit rank obtained by

graduate programme shall be made either on the basis of the the qualified candidate in entrance test conducted by the

Telangana State Government (EAMCET) or the University 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.

**2.2** The medium of instructions for the entire under graduate programme 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.

Each semester is structured to provide 24 credits, totaling to 192 credits for the entire

B.Tech. programme.

Each student shall secure 192 credits (with CGPA ≥ 5) required for the completion of the under graduate programme and award of the B.Tech. degree.

**3.2 UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for various

terms and abbreviations below.

**3.2.1 Semester scheme**

used in these academic regulations/ norms,

which are listed

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 by UGC and curriculum / course structure as suggested by AICTE are followed.

**3.2.2 Credit courses**

All subjects/ courses are to be registered by the student in a semester 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/ semester for theory/ lecture (L) courses.

One credit for two hours/ week/ semester for laboratory/ practical (P) courses or tutorials (T).

Courses like Environmental Science, Professional Ethics, Gender Sensitization lab and other student activities like NCC/NSO and NSS are identified as mandatory courses. These courses will not carry any credits.

**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 university has followed almost all the guidelines issued by AICTE/UGC.

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Broad Course**  **Classification** | **Course Group/ Category** | **Course Description** |
| 1 | Foundation  Courses  (FnC) | BS – Basic Sciences | Includes mathematics, physics and chemistry subjects |
| 2 | ES - Engineering  Sciences | Includes fundamental Engineering subjects |
| 3 | HS – Humanities and  Social sciences | Includes subjects related to humanities, social sciences and management |
| 4 | Core Courses  (CoC) | PC – Professional  Core | Includes core subjects related to the parent discipline/ department/ branch of Engineering. |
| 5 | Elective Courses (EℓC) | PE – Professional  Electives | Includes elective subjects related to the parent discipline/ department/ branch of Engineering. |
| 6 | OE – Open Electives | Elective subjects which include inter- disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering. |
| 7 | Core Courses | Project Work | B.Tech. project or UG project or UG major project |
| 8 | Industrial training/ Mini- project | Industrial training/ Internship/ UG Mini-project/ Mini-project |
| 9 | Seminar | Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering. |
| 10 | Minor courses | - | 1 or 2 Credit courses (subset of HS) |
| 11 | Mandatory  Courses (MC) | - | Mandatory courses  (non-credit) |

**4.0 Course registration**

**4.1** A ‘faculty advisor or counselor’ shall be assigned to a group of 15 students, who will advise student about the under graduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

**4.2** The academic section of the college invites ‘registration forms’ from students before the beginning of the semester through ‘on-line registration’, ensuring ‘date and time stamping’. The on-line registration requests for any ‘current semester’ shall be **completed before the commencement of SEEs (Semester End Examinations) of the ‘preceding semester’**.

**4.3** A student can apply for **on-line** registration, **only after** obtaining the ‘**written approval**’

from faculty advisor/counselor, which should be submitted to the college academic section

through the Head of the Department. A copy of it shall be retained

Department, faculty advisor/ counselor and the student.

with Head of the

**4.4** A student may be permitted to register for the subjects/ courses of **choice** with a total of 24 credits per semester (minimum of 20 credits and maximum of 28 credits per semester and permitted deviation of ± 17%), based on **progress** and SGPA/ CGPA, and completion of the ‘**pre-requisites’** as indicated for various subjects/ courses, in the department course structure and syllabus contents. However, a **minimum** of 20 credits per semester must be registered to ensure the ‘**studentship**’ in any semester.

**4.5** Choice for ‘additional subjects/ courses’ to reach the maximum permissible limit of 28 credits (above the typical 24 credit norm) must be clearly indicated, which needs the specific approval and signature of the faculty advisor/ counselor.

**4.6** If the student submits ambiguous choices or multiple options or erroneous entries during

**on-line** registration for

the subject(s) / course(s) under a given/ specified course group/

category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

**4.7** Subject/ course options

exercised through **on-line** registration are final and **cannot** be

changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the department, with due notification and time-framed schedule, within the **first week** after the commencement of class-work for that semester.

**4.8** Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor (subject to retaining a minimum of 20 credits), ‘**within a period of 15 days**’ from the beginning of the current semester.

**4.9 Open electives**: The students have to choose one subject each from (OE-I), (OE-II) and (OE-III) from the list of open electives given. However, the student cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

**4.10 Professional electives**: students have to choose five professional electives from the list of professional electives given. However, the students may opt for professional elective subjects offered in the related area.

**5.0 Subjects/ courses to be offered**

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

**5.2** A subject/ course may be offered to the students, **only if** a minimum of 20 students (1/3 of the section strength) opt for it. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

**5.3** More than **one faculty member** may offer the **same subject** in any semester. However, selection of choice for students will be based on - ‘**first come first serve** basis and CGPA criterion’ (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

**5.4** If more entries for registration of a subject come into picture, then the Head of Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

**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 Environmental Science, Professional Ethics, Gender

Sensitization Lab, NCC/NSO and NSS) for that semester.

**6.2** Shortage of attendance in aggregate up to 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.

**6.4** Shortage of attendance below 65% in aggregate shall in **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 registration for that semester shall stand cancelled. They will not be promoted to the**

**next semester.** They may seek re-registration 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 (26 out

of 75 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 submit a report on UG mini-project, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required in the IV year I Semester, or (iii) 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**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Promotion** | **Conditions to be fulfilled** |
| 1 | First year first semester to first year second semester | Regular course of study of first year first semester. |
| 2 | First year second semester to second year first semester | i. Regular course of study of first year second semester.  ii. Must have secured at least 24 credits out of 48 credits i.e., 50% of credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3. | Second year first semester to second year second semester | Regular course of study of second year first semester. |
| 4 | 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 58 credits out of 96 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. |
| 5 | Third year first semester to third year 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 at least 86 credits out of 144 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. |
| 7 | Fourth year first semester to fourth year second semester | Regular course of study of fourth year first semester. |

**7.4** A student shall register for all subjects covering 192 credits as specified and listed in the

course structure, fulfills

all the attendance and academic requirements for 192 credits,

‘earn all 192 credits’ by securing SGPA 5.0 (in each semester) and CGPA (at the end of each successive semester) 5.0 to successfully complete the under graduate programme.

**7.5** After securing the necessary 192 credits as specified for the successful completion of the entire under graduate programme, the student can avail exemption of two subjects up to 6 credits, that is, one open elective and one professional elective subject or two professional elective subjects for optional drop out from these 192 credits earned; resulting in 186 credits for under graduate programme performance evaluation, i.e., the performance of the student in these 186 credits shall alone be taken into account for the calculation of

‘the final CGPA (at the end of under graduate programme, which takes the SGPA of the IV year II semester into account)’ , and shall be indicated in the grade card of IV year II semester. However, the performance of student in the earlier individual semesters, with the corresponding SGPA and CGPA for which grade cards have already been given will not be altered.

**7.6** If a student registers for some more ‘**extra subjects’** (in the parent department or other departments/branches of engg.) other than those listed subjects totaling to 192 credits as

specified in the course

structure of his department, the performances

in those ‘ **extra**

**subjects**’ (although evaluated and graded using the same procedure as that of the required

192 credits) will not be taken into account while calculating the SGPA and CGPA. For such ‘**extra subjects’** registered, % 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 – 7.5 above.

**7.7** A student eligible to appear in the end semester 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 to be obtained in the SEE supplementary examination for evaluating performance in that subject.

**7.8** A student **detained in a semester due to shortage of attendance, may be re-admitted when the same semester is offered in the next academic year for 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.

**7.9** 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.

**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. In addition, industry-oriented mini-project, group project, Project Phase –I will also be evaluated for 100 marks, Project Phase – II for 200 marks, Technical Paper writing and Seminar and comprehensive viva for 100 marks each.

8.2 For all the subjects the distribution of marks shall be 25 for Continuous Internal Evaluation (CIE) and 75 for the Semester End-Examination (SEE).

**8.3 Theory Subjects**

1. **Pattern for Continuous Internal Evaluation** 
   1. **Subjects except Foreign languages (16+5+4=25 Marks)**

* There shall be two mid session examinations in every theory course. 16 **marks** are earmarked for each mid session examination. The marks shall be awarded considering the average of two mid session examination marks in each course. If any candidate is absent for any subject in a mid test and/or wishes to improve the performance, a Third Mid test will be conducted for the Student by the College in the entire syllabus on the same day of the main examination on payment fee as decided by the finance committee of SNIST. The result will be treated equal to Third mid test and average of better two tests will be considered. Each mid test will have compulsory questions without choice and long answer questions as detailed in the following paragraphs.
* The mid test is conducted for 64 marks reduced to 16 marks, test is for two hours duration consisting of two parts, i.e. Part ‘A’, and Part ‘B’.
* **Part–A:** Part Ashall have no choice and will have four short answer questions set for 16marks and reduced to 4 marks.
* **Part–B:** Part B of the question paper shall have subjective type questions set for 48 **marks** reduced to 12 marks and shall have 4 questions out of which 3 are to be answered. At least one question must appear from each unit and fourth question must be with 3 bits each bit from one unit
* Each Mid session examination in theory subjects will be restricted to three units, out of the total of 6 units of syllabus, i.e. Mid test – I will be on Units 1 to 3, Mid test – II will be on Units 4 to 6.
* Two assignments shall be given for a total weightage of 5 marks. Assignment-I is to be submitted before the first mid examination for award of 2 marks and for assignment-II which is to be submitted before the second mid test, for award of 2 marks. Students will be given back the assignment before mid session examinations. One mark is allotted for class notes which are to be signed by concerned teacher every fortnight.
* Five marks for each theory course shall be given 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 up to 82% | 2 |
| 3. | More than 82% and up to 90% | 3 |
| 4 | More than 90% | 4 |

* Marks for attendance shall be added to each subject based on average of attendance of all subjects put together.
* Award of final sessional marks: Attendance, average marks of two assignments, marks for class notes and mid-examination marks shall be added and the total marks are awarded as final sessional marks.

**(ii) Foreign languages**

|  |  |
| --- | --- |
| 2 written tests (Average of two to be taken) | 12 marks |
| Oral Comprehension | 04 marks |
| Assignment & Class notes | 05 marks |
| Attendance | 04 marks |

**b) Pattern for External Examinations (75 marks)**

* There shall be external examination in every theory course it shall 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 25 marks, which is compulsory. It will have 10 short questions out of which 5 questions are set with 3 marks each and another 5 questions are set with 2 marks
* Part-B of the question paper shall have subjective type questions for 50 marks and shall have 8 questions out of which 5 are to be answered. At least one question must appear from each Unit. . Seventh question must have 2 to 3 bits taking from 1st, 2nd, and 3rd units and 8th question also with 2 to 3 bits taken from 4th, 5th and 6th units. And not more than 2 questions from any one unit. All the questions carry equal marks.

**iv.** **Pattern of Evaluation for Lab subjects** **(100 marks)**

For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 75 marks for semester end examination. Out of the 25 marks for Continuous Internal Evaluation, the distribution is as follows

|  |  |  |
| --- | --- | --- |
| 1. | Day to Day work | 05 marks |
| 2. | Final Record and viva | 05 marks |
| 3. | Average of two tests including viva | 05 marks |
| 4. | Lab Based Project Report viva and demo | 06 marks |
| 6. | Attendance | 04 marks |
| Total | | 25 marks |

The semester end examination for 75 marks 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:

|  |  |  |
| --- | --- | --- |
| 1. | Procedure to experiment and calculation | 15 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 | | 75 marks |

**In case computer based examinations**

|  |  |  |
| --- | --- | --- |
| 1. | Flow chart and algorithms | 15 marks |
| 2. | Program writing and execution | 30 marks |
| 3. | Result and conclusions | 20 marks |
| 4. | Viva voce and Record | 10 marks |
| Total | | 75 marks |

8.5 For the subject having design and/or drawing, (such as Engineering Drawing I, Engineering Drawing II and Machine Drawing), the distribution shall be 25 marks for internal evaluation (10 marks for day-to-day work including drawing, home assignment work, 10 marks for average of two internal tests and 5 marks for attendance) and 75 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 (5.3 (a) 1)

8.6 Group Project (25+75=100 Marks) – This can be Inter disciplinary

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 teacher(s) and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also. There will be 100 marks in total with 25 marks of Continuous Internal Evaluation.

**The continuous internal evaluation shall consist of:**

|  |  |
| --- | --- |
| Day to day work | 10 marks |
| Report | 05 marks |
| Demonstration / presentation | 10 marks |
| Total sessional marks | 25 marks |
| Semester End Examination | 75 Marks |

The semester end examination will be carried out by a committee consisting of an external examiner, Head of the department or his nominee, a senior faculty member and the supervisor for 75 marks.

Student shall be deemed to have satisfied the requirement for the subject concerned, if the student secures not less than 35% marks in the semester end examination and minimum of 40% of marks in the sum total of the Continuous Internal Evaluation and semester end examination taken together.

**8.7 Industry oriented mini project (25+75=100 Marks)**

There shall be an industry-oriented mini-Project in their specialization that may be carried out in collaboration with an industry / R & D organization / Academic Institution, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated during IV year I Semester. The industry oriented mini project shall be evaluated for a total of 100 marks with 25 marks for internal assessment and 75 marks for semester end examination. The mini project must be submitted in report form and should be presented before a committee, consisting of an external examiner, Head of the department or his nominee, a senior faculty member of the department and supervisor of the mini project when IV year I semester end examinations are carried out.

**The pattern of Continuous Internal Evaluation** is as follows:

|  |  |
| --- | --- |
| Work in progress as evaluated by internal guide | 5 marks |
| Work in progress as evaluated by External guide | 5 marks |
| Report | 5 marks |
| Seminar presentation and defense of project | 10 marks |
| Total | 25 marks |

If the mini project is conducted within the college, the work in progress is evaluated by the supervisor for 10 marks.

**Student shall be deemed to have satisfied, if the student secures not less than 35% marks in the semester end examination and minimum of 40% of marks in the sum total of the Continuous Internal Evaluation and end examination taken together.**

**8.8. Project Phase -I (25+75=100 Marks)**

A project Phase I in fourth year first semester will be evaluated for 100 marks as follows. This is aimed at the students to identify and show progress in a project on which they are likely to continue for their project in final year second semester.

The Continuous Internal Evaluation shall consist of:

|  |  |
| --- | --- |
| Literature survey and presenting  seminar at the end of 6 weeks | 10 marks |
| Report | 05 marks |
| Demonstration / presentation  at the end of 12 weeks | 10 marks |
| Total sessionals marks | 25 marks |

Semester End Examination 75 marks

**Pattern of external evaluation for project Phase – I.**

|  |  |
| --- | --- |
| Final Project Report | 15 marks |
| Presentation | 10 marks |
| Demonstration / Defense of Project | 50 Marks |
| **Total** | **75 marks** |

**There shall be end semester evaluation in project phase – I. Student must secure 40% marks i.e. 30 marks out of 75 marks to be successful.**

**8.9. Project Phase – II (50+150=200 Marks)**

Out of total 200 marks for project work (in the final year second semester), 50 marks shall be for Continuous Internal Evaluation and 150 marks for the External Evaluation at the end of the Semester.

**The pattern of Continuous Internal Evaluation is as follows:**

**Division of marks for internal assessment – 50 marks**

|  |  |
| --- | --- |
| Progress of Project work and the corresponding interim report  as evaluated by internal guides at the end of 5 weeks | 05 marks |
| Seminar at the end of 5 weeks | 05 marks |
| Progress of Project work as evaluated by guides at the end of 10 weeks | 05 marks |
| Seminar at the end of 10 weeks | 05 marks |
| Evaluation by the Guides ( at the end of 15 weeks) | 10 marks |
| Final Project Report | 05 marks |
| Final presentation and defense of the project | 15 marks |
| Total | 50 marks |

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.

If the project is carried out internally the marks supposed to be given by external guide will be given by internal guide himself.

**Division of Marks for External Evaluation – 150 Marks**

**Pattern of External Evaluation for Project Phase -II**

|  |  |
| --- | --- |
| Final Project Report | 30 marks |
| Presentation | 20 marks |
| Demonstration / Defense of Project | 100 Marks |
| **Total** | **150 marks** |

Student shall be deemed to have satisfied, if the student secures not less than 35% marks in the semester end examination and minimum of 40% of marks in the sum total of the Continuous Internal Evaluation and semester end examination taken together. i.e 80 marks to be successful in this subject.

**8.10. Technical Paper writing & Seminars I to VIII (100 Marks) each**

There shall be a technical Paper writing &seminar evaluated for 100 marks in every Semester from I year I Sem to IV year II Sem\*. The evaluation is purely internal and will be conducted as follows:

Content : 20 marks

Presentation including PPT : 20 marks

Seminar Notes : 10 marks

Interaction : 10 marks

Report : 25 marks

Attendance : 10 marks

Punctuality : 05 marks

Total **100 marks**

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

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

**8.11 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, 50 marks are internal and 50 marks are external. The evaluation is purely internal and will be conducted by a committee consisting of Head of the Department or his nominee and two senior teachers.

|  |  |
| --- | --- |
| First mid-sessional viva at the end of 5 weeks (Internal) | 25 marks |
| Second mid-sessional viva at the end of 10 weeks (Internal) | 25 marks |
| Final viva during practical examinations (External) | 50 marks |
| Total | 100 Marks |

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

**8.12** The evaluation 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. 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 NBA etc. as and when the same are called for.

**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 grade shall be given.

together) as specified in item 8 above, a corresponding letter

**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** |
| 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 5 (‘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

where ‘i’ is the subject indicator index (takes into account all subjects in a semester), ‘N’

is the no. of subjects ‘**registered’** for the semester (as specifically required and listed

under the course structure of the parent department), Ci the no. of credits allotted to the

ith subject, and Gi represents the grade points (GP) corresponding to the letter grade awarded for that ith subject, and Gi represents the grade points (GP) corresponding to the letter grade awarded for that ith subject.

**9.9** The cumulative grade point average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the

ratio of the total credit points secured by a student in all registered courses in all semesters, and the total number of credits registered in all semesters, and the total number of credits registered in all the semesters. CGPA is rounded off to two decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula.

**CGPA =** { Cj Gj } / {  Cj } …. For all S semesters registered

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

where ‘**M’** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has ‘**registered’** i.e., from the 1st semester onwards up to and inclusive of the 8th semester, ‘j’ is the subject indicator index (takes into account a subjects from 1 to 8 semesters), CJ is the no. 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** |
| **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

**9.10** For merit ranking or comparison purposes or any other listing, **only** the ‘**rounded off’**

values of the CGPAs will be used.

**9.11** 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 required number of 192 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 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’.

**12.4** Students with final CGPA (at the end of the under graduate programme) 6.50 but <

8.00, shall be placed in ‘**first class’**.

**12.5** Students with final CGPA (at the end of the under graduate programme) 5.50 but <

6.50, 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) 5.00 but < 5.50, 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).

**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 Sc. & Tech. 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.

15.3 The transferred students from other Universities/institutions to SNIST who are on rolls to be provide one chance to write the CBT (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 nternal 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 interpretation. 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.

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 2018-19**

**1. Eligibility for award of**

**B. Tech. Degree (LES)**

The 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 for 144 credits and secure 144 credits with CGPA ≥ 5 from II

year to IV year B.Tech. programme (LES) for the award of B.Tech. degree. **Out of the**

**144 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 138 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 rule**

|  |  |  |
| --- | --- | --- |
| **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. |

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|  |  |  |
| --- | --- | --- |
| 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. |

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**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 award suitable to punishment**

**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.

\* \* \* \* \*

**SREENIDHI INSTITUTE OF SCIENCE and TECHNOLOGY (AUTONOMOUS)**

**B.Tech. (Mechanical Engineering)**

**A17-COURSE STRUCTURE (2017-201****8)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **I Year – I Semester** | | | |  |  |  |
| **S.No.** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 6H101 | English-I | 2 | --- | --- | 2 | 25 | 75 |
| 2 | 6H111 | Engineering Mathematics-I | 3 | 1 | --- | 3 | 25 | 75 |
| 3 | 6H121 | Engineering Physics-I | 3 | 1 | --- | 3 | 25 | 75 |
| 4 | 6H131 | Engineering Chemistry | 2 | 1 | --- | 2 | 25 | 75 |
| 5 | 6F101 | Computer Programming | 3 | 1 | --- | 3 | 25 | 75 |
| 6 | **6B101** | **Engineering Drawing-I** | 1 | 1 | 4 | 3 | 25 | 75 |
| 7 | 6H171 | English Language and Communication Skills Lab | --- | --- | 2 | 1 | 25 | 75 |
| 8 | 6H181 | Engineering Physics Lab – I | --- | --- | 2 | 1 | 25 | 75 |
| 9 | 6H186 | Engineering Chemistry Lab | --- | --- | 2 | 1 | 25 | 75 |
| 10 | 6F171 | C- Programming Lab | --- | --- | 4 | 2 | 25 | 75 |
| 11 | **6B171** | **Engineering Workshop – I** | --- | --- | 2 | 1 | 25 | 75 |
| 12 | 6F172 | IT Workshop – I | --- | --- | 2 | 1 | 25 | 75 |
| 13 | **6B191** | **Seminar on Current Affairs Technical Topic** |  |  | 2 | 1 | 100 | -- |
| **Total** | | | **14** | **5** | **20** | **24** | **400** | **900** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **I Year – II Semester** | | | |  |  |  |
| **S.No.** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 | 6H202 | English-II | 2 | 2 | ---- | 2 | 25 | 75 |
| 2 | 6H213 | Engineering Mathematics-II | 3 | 1 | --- | 3 | 25 | 75 |
| 3 | 6E201 | Data Structures | 3 | 1 | --- | 3 | 25 | 75 |
| 4 | **6B202** | **Engineering Drawing-II** | 1 | 1 | 2 | 2 | 25 | 75 |
| 5 | 6H232 | Environmental and applied chemistry | 2 | 1 | --- | 2 | 25 | 75 |
| 6 | **6B203** | **Engineering Mechanics** | 3 | 1 | --- | 3 | 25 | 75 |
| 7 | 6H224 | Applied Physics -II | 3 | 1 | --- | 3 | 25 | 75 |
| 8 | 6ZC03 | Gender sensitization, Values and Ethics and Yoga | 1 | 1 | --- | 1 | 25 | 75 |
| 9 | 6E271 | Data Structures Lab (C, C++) | --- | --- | 4 | 2 | 25 | 75 |
| 10 | **6B272** | **Engineering Workshop-II** | --- | --- | 2 | 1 | 25 | 75 |
| 11 | 6H282 | Applied Physics Lab | --- | --- | 2 | 1 | 25 | 75 |
| 12 | 6B292 | Seminar on Science and its impact/ Technical topic | --- | --- | 2 | 1 | 100 | --- |
| **Total** | | | **18** | **9** | **12** | **24** | **375** | **825** |

Note: All End Examinations (Theory and Practical) are of **Three** hours duration.

**T – Tutorial L- Theory P/D – Practical/Drawing**

**C- Credits CIE- Continuous Internal Evaluation SEE – Semester End Evaluation**

**II Year – I Semester**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **II Year – I Semester** | | | |  |  |  |
| **S.No.** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
|  |  |  |  |  |  |  | **INT** | **EXT** |
| 1 | 6H373 | Functional and Communicative English | 1 | 2 | -- | **1** | 25 | 75 |
| 2 | 6H316 | Engineering Mathematics –III | 3 | 1 | --- | 3 | 25 | 75 |
| 3 | 6ZC01 | Managerial Economics and Financial Analysis | 2 | 1 | --- | 2 | 25 | 75 |
| 4 | 6B305 | Thermodynamics | 3 | 1 | --- | 3 | 25 | 75 |
| 5 | 6B306 | Mechanics of Solids | 3 | 1 | --- | 3 | 25 | 75 |
| 6 | 6B307 | Metallurgy and Material Science | 3 | 1 | --- | 3 | 25 | 75 |
| 7 | 6BC08 | Fluid Mechanics and Hydraulic Machinery | 3 | 1 | --- | 3 | 25 | 75 |
| 8 | 6B373 | Fluid Mechanics and Hydraulic Machinery Lab | --- | --- | 3 | 2 | 25 | 75 |
| 9 | 6B374 | Fuels and Lubricants Lab |  |  | 2 | 1 | 25 | 75 |
| 10 | 6B375 | Metallurgy Lab | --- | --- | 2 | 1 | 25 | 75 |
| 11 | 6B376 | Mechanics of Solids Lab | --- | --- | 2 | 1 | 25 | 75 |
| 12 | 6B393 | Seminar on Technology/ and its impact Technical topic |  |  | 2 | 1 | 100 | -- |
| **Total** | | | **18** | **8** | **11** | **24** | **375** | **825** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **II Year – II Semester** | | | |  |  |  |
| **S.No.** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max. Marks** | |
| **1** | 6H416 | Probability and Statistics | 3 | 1 | --- | 3 | 25 | 75 |
| 2 | 6B409 | Applied Thermodynamics-I | 3 | 1 | --- | 3 | 25 | 75 |
| **3** | 6B410 | Manufacturing processes | 3 | 1 | --- | 3 | 25 | 75 |
| 4 | 6AC48 | Elements of Electrical and Electronics Engineering | 2 | 2 | --- | 2 | 25 | 75 |
| **5** |  | **Open Elective-I** | 2 | 1 | -- | 2 | 25 | 75 |
| 6 | 6B412 | *Machine Drawing and Computer aided drawing* | 1 | 2 | 4 | 3 | 25 | 75 |
| **7** | 6EC70 | Java Programming | 2 | 2 | - | 2 | 25 | 75 |
| 8 | 6B477 | Manufacturing Processes Lab | --- | --- | 3 | 2 | 25 | 75 |
| **9** | 6AC95 | Electrical and Electronics Engineering Lab | --- | --- | 2 | 1 | 25 | 75 |
| 10 | 6EC74 | Java Programming Lab |  |  | 2 | 1 | 25 | 75 |
| **11** | 6B478 | Comprehensive Viva-voce-I | --- | --- | --- | 1 | 50 | 50 |
| 12 | 6B494 | Technical seminar |  |  | 2 | 1 | 100 | -- |
| **Total** | | | **16** | **10** | **13** | **24** | **400** | **800** |

|  |  |  |
| --- | --- | --- |
| **Open Elective-I** | | **Streams** |
| 6FC32 | Data Base Systems | CSC |
| 6GC46 | Applied Biology | BT |
| 6FC04 | Banking operations, Insurance and Risk Management | MBA |
| **6BC61** | **Smart Materials** | MECH |
| 6DC52 | Embreded Systems | ECM |
| 6HC51 | Basic Spanish Language | language |

Note: All End Examinations (Theory and Practical) are of **Three** hours duration.

**T – Tutorial L- Theory P/D – Practical/Drawing**

**C- Credits CIE- Continuous Internal Evaluation SEE – Semester End Evaluation**

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|  |  | **III Year – I Semester** | | | | |  |  |  |  |
| **S.No.** | **Subject Code** | **Subject** | | **L** | **T** | **P/D** | **C** | **Max. Marks** | |  |
|  |  |  | |  |  |  |  | **CIE** | **SEE** |  |
| 1 | 6B513 | Operations Research | | 3 | 1 | --- | 3 | 25 | 75 |  |
| 2 | 6B514 | Kinematics of Machinery | | 3 | 1 | --- | 3 | 25 | 75 |  |
| 3 | 6B515 | Metal Cutting and Machine Tools | | 3 | 1 | --- | 3 | 25 | 75 |  |
| 4 | 6B516 | Applied Thermodynamics-II | | 3 | 1 | --- | 3 | 25 | 75 |  |
| 5 | 6B517 | Design of Machine Members-I | | 3 | 1 | --- | 3 | 25 | 75 |  |
| 6 |  | **Open Elective-II** | | 2 | 1 | --- | 2 | 25 | 75 |  |
| 7 | 6H576 | Quantitative Aptitude | | -- | -- | 2 | 1 | 25 | 75 |  |
| 8 | **6B579** | Group Project | | --- | --- | 2 | 1 | 25 | 75 |  |
| 9 | 6B580 | Applied Thermodynamics Lab | | --- | --- | 3 | 2 | 25 | 75 |  |
| 10 | 6B581 | Machine Tools Lab | | --- | --- | 3 | 2 | 25 | 75 |  |
| 11 | 6B595 | Technology review and seminar-I | | --- | --- | 2 | 1 | 100 | --- |  |
| **Total** | | | | **17** | **6** | **12** | **24** | **350** | **750** |  |
|  |  |  | |  |  |  |  |  |  |  |
|  | **Open Elective-II** | | | **Stream** | | | |  |  |  |
|  | **6ZC24** | | **Innovation and Design Thinking** | **Entrepreneurship Stream/Technology Entrepreneurship** | | | |  |  |  |
|  | **6ZC26** | | **Basics of Polity and Eology** | **Social Sciences Stream** | | | |  |  |  |
|  | **6ZC19** | | **Entrepreneurship, Project Management and Structured Finanace** | **Finanace Stream** | | | |  |  |  |
|  | 6EC67 | | Operating Sytems Concepts | CSE | | | |  |  |  |
|  | 6GC47 | | Fundamentals of Bio Informatics | B.T | | | |  |  |  |
|  | 6CC55 | | Communication Engineering | ECE | | | |  |  |  |
|  | 6AC46 | | Control Systems Engineering | EEE | | | |  |  |  |
|  | 6EC26 | | SAP-I: SAP ABVP Workbench Fundamentals | CSE | | | |  |  |  |
|  | 6DC52 | | EMBEDDED SYSTEMS | ECM | | | |  |  |  |
|  | 6DC55 | | Internet of things( IOT) | ECM | | | |  |  |  |

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|  |  | | **III Year – II Semester** |  | |  |  |  | |  |  |  |
| **S.No.** | **Subject Code** | | **Subject** | **L** | | **T** | **P/D** | **C** | | **Max. Marks** |  |  |
|  |  | |  |  | |  |  |  | | **CIE** | **SEE** |  |
| **1** | 6B619 | | Design of Machine Members-II | 2 | | 2 | --- | 2 | | 25 | 75 |  |
| 2 | 6B620 | | Heat Transfer | 3 | | 1 | --- | 3 | | 25 | 75 |  |
| **3** | 6B621 | | CAD/CAM | 2 | | 2 | --- | 2 | | 25 | 75 |  |
| 4 | 6B622 | | Dynamics of Machinery | 3 | | 1 | --- | 3 | | 25 | 75 |  |
| **5** |  | | **Professional Elective-I** | 3 | | --- | --- | 3 | | 25 | 75 |  |
| 6 |  | | **Open Elective-III** | 2 | | 1 | --- | 2 | | 25 | 75 |  |
| **7** | 6H677 | | Logical Reasoning | -- | | -- | 2 | 1 | | 25 | 75 |  |
| 8 | 6B682 | | Comprehensive Viva-voce-II | --- | | --- | --- | 1 | | 50 | 50 |  |
| **9** | 6B683 | | Heat Transfer Lab | --- | | --- | 3 | 2 | | 25 | 75 |  |
| 10 | 6B684 | | CAD/CAM Lab | **---** | | **---** | 3 | 2 | | 25 | 75 |  |
| **11** | 6B685 | | KOM & DOM Lab | --- | | **---** | 2 | 1 | | 25 | 75 |  |
| 12 | 6HC74 | | Effective English Communication & Soft Skills | 1 | | 1 | 0 | 1 | | 100 | -- |  |
| **13** | 6B696 | | Technology review and seminar-II | -- | | --- | 2 | 1 | | 100 | -- |  |
|  |  | |  | **16** | | **8** | **12** | **24** | | **500** | **800** |  |
|  |  | |  |  | |  |  |  | |  |  |  |
| **Open Elective-III** | | | | | **Stream** | | | |
| 6GC50 | | Computational Biology | | | BT | | | |
| 6FC17 | | Data Analytics | | | IT | | | |
| 6CC44 | | Electronic Circuit Design and Analysis | | | ECE | | | |
| **6ZC23** | | **Advance Entrepreneurship** | | | **Entrepreneurship Stream** | | | |
| **6ZC27** | | **Indian history, Culture and Geography** | | | **Scoial Sciences Stream** | | | |
| **6ZC21** | | **General Management of Entrepreneurship** | | | **Technology Entrepreneurship** | | | |
| **6ZC15** | | **Finanacial Institutions, Markets and Services** | | | **Finanae Stream** | | | |
| 6EC27 | | SAP-II : SAP ABAB Workbench concepts | | | CSE& IT | | | |
| 6AC44 | | Measurements and Instrumentation | | | EEE | | | |

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| **Professional Elective-I** | | |
| 6B623 | Design and Analysis of Experiments |  |
| 6B624 | Hydraulics and Pneumatic Systems |  |
| 6B625 | Thermal Turbo machinery |  |
| 6B626 | Automobile Engineering |  |
| 6B627 | Additive Manufacturing Technologies |  |
| 6B628 | Introduction to Nanotechnology |  |

**IV Year – I Semester**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  | **IV Year – I Semester** | | | |  |  |  |  |  |  |
| **S.No.** | | **Subject Code** | **Subject** | | | | **L** | **T** | **P/D** | **C** | **Max. Marks** |  |
|  | |  |  | | | |  |  |  |  | **CIE** | **SEE** |
| 1 | | 6B729 | Metrology and Instrumentation | | | | 3 | 1 | --- | 3 | 25 | 75 |
| 2 | | 6B730 | Finite Element Method | | | | 3 | 1 | --- | 3 | 25 | 75 |
| 3 | |  | Professional Elective-II | | | | 3 | --- | --- | 3 | 25 | 75 |
| 4 | |  | Professional Elective-III | | | | **3** | **--** | **---** | **3** | 25 | 75 |
| 5 | | 6GC49 | Intellectual Property Rights | | | | 1 | 1 | - | 1 | 25 | 75 |
| 6 | | 6ZC03 | Management Science | | | | 3 | --- | --- | 3 | 25 | 75 |
| 7 | | **6B786** | Project Phase-I | | | | --- | 1 | 3 | 3 | 100 | - |
| 8 | | **6B787** | Industry Oriented Mini Project | | | | --- | --- | --- | 2 | 25 | 75 |
| 9 | | 6B788 | Metrology Lab | | | | ***---*** | ***---*** | 2 | 2 | 25 | 75 |
| 10 | | 6B789 | Instrumentation Lab | | | | ***---*** | ***---*** | 2 | 2 | 25 | 75 |
| 11 | | 6B790 | Production Drawing Practice | | | | --- | 1 | 4 | 2 | 25 | 75 |
| 12 | | 6B797 | Technical Paper Writing and Seminar-I | | | | --- | --- | 2 | 1 | 100 | --- |
|  | |  | **TOTAL** | | | | **16** | **7** | **11** | **28** | **450** | **750** |
|  |  | | |  |  |

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| --- | --- |
| **Professional Elective-II** | |
| 6B731 | Rotor Dynamics |
| 6B732 | Refrigeration and Air Conditioning |
| 6B733 | Advanced Manufacturing Processes |
| 6B734 | Characterization of Nanomaterials |
| 6B735 | Quality and Reliability Engineering |

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| **Professional Elective-III** | |
| 6B736 | Design of Mechanisms |
| 6B737 | Renewable Energy Systems |
| 6B738 | Design of Press tools and Tool Design |
| 6B739 | Nano Bio-Materials |
| 6B740 | Mechatronics |

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|  |  | **IV Year – II Semester** |  |  |  |  |  |  |
| **S.No.** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max. Marks** |  |
|  |  |  |  |  |  |  | **CIE** | **SEE** |
| 1 |  | **Professional Elective - IV** | **3** | **2** | **---** | **3** | 25 | 75 |
| 2 |  | **Professional Elective - V** | **3** | **2** | **---** | **3** | 25 | 75 |
| 3 | **6B868** | Project:- Phase-II | --- | --- | 20 | 12 | **50** | **150** |
| 4 | 6B869 | Comprehensive Viva-voce-III | --- | --- | --- | 1 | **50** | **50** |
| 5 | 6B898 | Technical Paper Writing and | --- | --- | 2 | 1 | 100 | --- |
|  |  | **Total** | **6** | **4** | **22** | **20** | **250** | **350** |

**Professional Elective – IV**

|  |  |
| --- | --- |
| **Professional Elective - IV** | |
| 6B841 | Fracture Mechanics |
| 6B842 | Power Plant Engineering |
| 6BC43 | Automation and Robotics |
| 6B844 | Nanocomposites |
| 6B845 | Simulation Modeling of Manufacturing Systems |

**Professional Elective – V**

|  |  |
| --- | --- |
| **Professional Elective - V** | |
| 6B846 | Design Optimization |
| 6B847 | Jet propulsion and Rocket Engineering |
| 6B848 | Computational Fluid Dynamics |
| 6B849 | Mechanics Manufacturing Methods of Composite Materials |
| 6B850 | Flexible Manufacturing System & Machine Vision |

Note: All End Examinations (Theory and Practical) are of **Three** hours duration.

**T – Tutorial L- Theory P/D – Practical/Drawing**

**C- Credits CIE- Continuous Internal Evaluation SEE – Semester End Evaluation**

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

**Mechanical Engineering**

**OPERATIONS RESEARCH**

**Code: 6B513 L T P/D C**

**3 1 -- 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 apply dynamic programming approach for obtaining optimal solutions**

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 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 (or steps) of OR method, Types of models, applications.

**LINEAR PROGRAMMING PROBLEM**- Formulation – Graphical solution, Simplex method-Types of variables, Unbounded solution Artificial variables techniques -Two–phase method, Big-M method -Degeneracy, Duality Principle-examples

**UNIT – II**

**TRANSPORTATION PROBLEM** – Formulation – methods of finding initial solution, Optimal solution-MODI method, Special cases in TP: unbalanced, maximization case, Degeneracy.

**ASSIGNMENT PROBLEM** – Formulation – Optimal solution - Variants of Assignment Problem-Unbalanced, Maximization, 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.

**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, Definitions, Pure strategies-Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Mixed Strategies-Rectangular games without saddle points- Dominance principle – 2 X 2 games , m X 2 & 2 X n games -Graphical method.

**UNIT – V**

**WAITING LINES:** Introduction, Terminology, Structure of a queue, Calling population characteristics-size, behavior, pattern of arrivals, Kendall-Lee notation, Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

**INVENTORY :** Introduction, Inventory costs, Concept of EOQ, Single item Deterministic models without shortages and with 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

**DYNAMIC PROGRAMMING:** Introduction – Bellman’s Principle of optimality – Applications of dynamic programming- shortest path problem -capital budgeting problem –– linear programming problem.

**TEXT BOOKS:**

1. Operations research / Hira & Gupta

2. Operation Research /J.K.Sharma/MacMilan publishers.

**REFERENCES:**

1. Operations research/V.K.Kapoor

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

**Mechanical Engineering**

**KINEMATICS OF MACHINERY**

**Code: 6B514**

**L T P/D C**

3 1 --- 3

***Course Objective:***

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

**Course Outcomes**

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

* *Understand the basic concepts of mechanism, types of mechanisms and inversions difference between machine mechanism and structure. [CO 1]*
* *Understand velocity and acceleration diagram in order to evaluate the inertia forces in mechanism and machines.[CO 2]*
* *Understand the concept of steering gear mechanism, types and Hooke’s joint with respect to an automobile.[CO 3]*
* *In order to understand and design complex motions possible out of Cam’s and Followers.[CO 4]*
* *Understand the concept of toothed gears and selection different types of gear trains in order obtain required velocity ratios.[CO 5]*
* *Understand transmission power by various means like belts, rope and chains and their advantages and limitations.[CO 6].*

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

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

**UNIT – I**

**Inroduction :** Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Number, type and dimensional synthesis- definitions only.

Machines & Mechanism:Classification of machines – kinematic chain – inversion of mechanism – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

**UNIT - II**

**Kinematics of Links:** Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain.

**Kinematic Analysis of Mechanisms:** Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

**Plane motion of body:** Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

**UNIT – III**

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

**Hooke’s Joint:** Single and double Hooke’s joint – Universial coupling – application – problems.

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

**UNIT –IV**

**Cams:** Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

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

**UNIT – V**

**Theory of Gearing:** Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference.

Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

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

**UNIT – VI**

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

**TEXT BOOKS:**

1. Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers

2. Theory of Machines R.S Khurmi & J.K Gupta

**REFERENCES:**

1. Theory of Machines by Thomas Bevan/ CBS

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

3. The theory of Machines /Shiegley/ Oxford.

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

**Mechanical Engineering**

**METAL CUTTING & MACHINE TOOLS**

**Code: 6B515**

**L T P/D C**

**3 1 --- 3**

***Course Objective:***

*The main objective of the course is to offer the students fundamental knowledge of metal cutting process and working principle of various conventional and unconventional machine tools*

***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 cutting tool materials and economic analysis of machining [CO2]*
* *Understand the principle and working of lathe, shaping, planning, slotting machines and 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 Honing machine [CO5]*
* *Understand the principle of Jigs & Fixtures and the principles of advanced machining processes[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** | H | H |  |  |  |  | M |  |  |  |  | L |
| **CO2** | H | H |  |  |  |  | M |  |  |  | L | L |
| **CO3** | H | H |  |  |  |  |  |  |  |  |  | L |
| **CO4** | H | H |  |  |  |  |  |  |  |  |  | L |
| **CO5** | H | M |  |  |  | M |  |  |  |  |  | L |
| **CO6** | M | M |  |  | H | M |  |  |  |  |  |  |

**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**

**APPLIED THERMODYNAMICS – II**

**Code: 6B516**

**L T P/D C**

**3 1 --- 3**

**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*
* *Understand the working principles and basic design parameters of different types boilers.*
* *Understand the function of steam nozzle, Wilson line*
* *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*
* *Understand the working principles of different condensers and understand the gas turbine power plants*
* *Understand the working principle of jet propulsion and rocket engines*

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | **P0a** | **POb** | **POc** | **POd** | **POe** | **POf** | **POg** | **POh** | **POi** | **POj** | **POk** | **POl** |
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| **CO6** | H |  | H |  | H |  |  |  |  |  | H |  |

**UNIT – I**

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

**UNIT II**

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

**UNIT – III**

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

**UNIT – IV**

**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 V**

**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 – VI**

**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.

**TEXT BOOKS:**

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

2. Gas Turbines – V.Ganesan /TMH

**REFERENCES:**

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

2. Gas Turbines / 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**

**Code: 6B517 DESIGN OF MACHINE MEMBERS – I**

**L T P/D C**

**3 1 --- 3**

**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:*

* Develop ability to analyze, design and select shafts, keys, couplings, cotter and knuckle joints, springs and temporary (threaded and bolted) and permanent (riveted and welded) joints for various applications - with attention  to strength and rigidity
* Use different theories of failure for designing machine members subjected to steady and fatigue loads.

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**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:**

1. **Fundamentals of Machine Elements** / Bernard Hamrock, Steven Schmid, Bo Jacobson / Tata McGraw Hill
2. A Text of Machine Design – R S Khurmi
3. Design of machine Elements -Kulakarni

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

**Mechanical Engineering**

**INNOVATION & DESIGN THINKING**

**(Open Elective-II)**

**Code: 6ZC24**

**L T P/D C**

2 **1 --- 2**

**(Common to all Branches)**

**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: -**

Meaning of 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 and Negative effects of Monetizing innovation. Reasons for failure of Monetization of Innovation. Schemes of Government through Startup India, role of Institutional support and Commercial Banks.

**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 I semester**

**Mechanical Engineering**

**BASICS OF POLITY AND ECOLOGY**

**(Open Elective-II)**

**Code: 6ZC26**

**(Common to all Branches)**

**L T P/D C**

**2 1 -- 2**

**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.

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

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**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: 6ZC19**

**L T P/D C**

**2 1 -- 2**

**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 II semester**

**Mechanical Engineering**

**Operating Systems Concepts**

**(Open Elective-II)**

Code: 6EC67

**L T P/D C**

**2 1 - 2**

**Course Objectives:**

1. Learn basics of operating Systems
2. Understand process management and synchronisation.
3. Learn principles of memory, I/O and file management in a secured environment.

**Course Outcomes:**

After completing the subject, students will be able to:

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| 1. Describe the basic functionalities and structure of the Operating System |
| 1. Explain the concepts and implementations of: Processes, Process Scheduling. Describe, contrast and compare various types of Operating systems like Windows and Linux. |
| 1. Comprehend the concepts of Synchronization and Deadlocks in the Operating System |
| 1. Discuss the concepts of Memory Management(Physical and Virtual memory) |
| 1. Explain the concepts of File System with regard to directory and disk management algorithms. |
| 1. Students understand the concepts of I/O systems, protection and security in a case study given |

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

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**Unit I**

Introduction to Operating System, Computer System Architecture: Single Processor System, Multiprocessor System, Clustered System, Multiprogramming System, Multitasking (Time sharing) system, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure: single structure, layered approach, micro kernels, modules.

**Unit II**

Process Management:Process concept, process scheduling, operation on processes; CPU scheduling, scheduling criteria, scheduling algorithms -First Come First Serve (FCFS), Shortest-Job-First (SJF), Priority Scheduling, Round Robin(RR), Multilevel Queue Scheduling.

Engg. Applications – Process scheduling in Windows, Linux.

**Unit III**

Process-Synchronization & Deadlocks:Critical Section Problems, semaphores; Monitors; Deadlock Characterization, methods for handling deadlocks-deadlock prevention, Avoidance & Detection; Deadlock recovery.

**Unit IV**

Memory Management:Logical & Physical Address Space, swapping, Contiguous memory allocation, Paging and Segmentation techniques, Segmentation with paging;

Virtual memory: Demand Paging, Page-Replacement Algorithms, Thrashing.

Engg. Applications – Memory management in Windows, Linux.

**Unit V**

File System:Different types of files and their access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms.

**Unit VI**

I/O Systems: I/O Hardware, Application I/O Interface, Kernel, Transforming I/O requests, Performance Issues.

Protection and Security: Goals of protection, Principles of protection, Access matrix, Access control list, Capability List. Security Attacks, Program threats.

**Text Books:**

1. Operating System Concepts by Silberchatz Galvin, 8th edition.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings,4th edition, 2001, Prentice-Hall

**References:**

1. Operating System By Peterson , 1985, AW.
2. Operating System By Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix & Windows By Colin Ritche, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems By Deitel, 1990, AWL.

Operating Systems – Advanced Concepts By Mukesh Singhal , N.G. Shivaratri, 2003, T.M.H

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

**Mechanical Engineering**

**Fundamentals of Bio Informatics**

**(Open Elective-II)**

**Code: 6GC47 L T P/D C 2 1 - 2**

**Course Objective:**

To impart knowledge on basic techniques of Bioinformatics and to provide a practical description of the tools and current trends in the field including its impact on biology, computer science engineering and information technology

**Course Outcomes:**

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| **CO:1** | Demonstrate knowledge and understanding of interdisciplinary nature of computer science , Information technology and biotechnology |
| **CO:2** | Analyze and interpret homology by using basic bioinformatics problems and their solutions |
| **CO:3** | Demonstrate the ability to solve biological problems using basic computer science Programming tools and software |
| **CO:4** | Develop the ability to identify computational problems within the living systems at molecular level |
| **CO:5** | Develop the ability to evaluate the evolutionary relationships among various organisms using Computational methods. |
| **CO:6** | Gain an understanding of working in interdisciplinary teams of biologists, biochemists, medical researchers, geneticists, and allied engineering branches. |

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**UNIT I : SCOPE OF BIOINFORMATICS and BIOLOGICAL DATABASES** History, definition, importance and applications of bioinformatics in information technology, Introduction to biological data, Organization and management of databases,Nucleotide databases (Genbank), Protein Databases(UNI PROT)

**UNIT II: SEQUENCE ALIGNMENT** Database searching, Basic concepts of sequence homology Dynamic Programming, Dot Matrix analysis, Smith-Waterman Algorithm, Neddleman-Wunsch Algorithm, Scoring matrices: PAM and BLOSUM matrices

**UNIT III**: **SEQUENCE-BASED DATABASE SEARCHES** BLAST and FASTA algorithms, various versions of basic BLAST and FASTA, Use of these methods for sequence analysis including the on-line use of the tools and interpretation of results.

**UNIT IV: MULTIPLE SEQUENCE ALIGNMENT** Basic concepts of various approaches for MSA algorithms (e,g. progressive, hierarchical etc.). Algorithm of CLUSTALW and its application

**UNIT V: PHYLOGENETIC ANALYSIS** Definition and description of phylogenetic trees. Distance based and character based algorithms of phylogenetic analysis

**UNIT VI: GENE AND PROTEIN STRUCTURE PREDICTION**  Introduction to Next Gen sequencing ,Biological sequence/structure, Human Genome Project, Gene structure and DNA sequences, Pattern recognition and prediction, Protein Secondary structure prediction methods, Algorithms of Chou Fasman, GOR methods. Protein homology modeling.

**TEXT BOOKS:**

1. Bioinformatics. David Mount, 2000. CSH Publications

**REFERENCES:**

1. Bioinformatics: A Machine Learning Approach P. Baldi. S. Brunak, MIT Press 1988.

2. Genomics and Proteomics-Functional and Computational aspects. Springer Publications. Editior-Sandor Suhai.

3. Bioinformatics- Methods and Protocols-Human Press. Stephen Misener, Stephen A. Krawetz.

4. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – Andreas D.Baxevanis, B.F. Francis Ouellette.

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

**Mechanical Engineering**

**Communication Engineering**

**(Open Elective-II)**

**Code: 6CC55 L T P/D C 2 1 - 2**

**Objectives:**

To provide a conceptual understanding of Basics of Communication to the students of different branches of engineering. One, must be aware of various techniques used for day to day communications.

**Course Outcomes:**

**CO1:** To understand the basics of communication system and noise as the biggest challenge for communication.

**CO2:** To learn the detailed Analog communication techniques used in today’s scenario.

**CO3:** Discriminate different types of sampling techniques required to convert an analog signal to a discretesignal.

**CO4:**  Describe different types of digital communication techniques to convert analog signal to digital .

**CO5: To study** ASK,PSK,FSK,DPSK,QPSK modulators and demodulators and error control coding .

**CO6:**.To study about different Multiple Access techniques

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

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

**Introduction to Communication Systems**

Communication system, Analog and digital signals, frequency domain representatiom of signal Channel effect, Modulation and detection, Historical review of telecommunication, Noise: External noise, internal noise,

**UNIT II**

**Analog Modulation Techniques**

Amplitude modulation: AM Theory, generation of AM, SSB techniques: Suppression of carrier, suppressionof unwanted sideband, Frequency modulation: FM Theory, noise and FM, generation of FM.

**UNIT III**

**Base Band Modulation**

Base band system, sampling theorem, Sampling and signal Re-construction, Aliasing, Types of sampling, Quantization, Pulse Analog modulation PAM,PWM,PPM

**UNIT IV**

**Digital Communication** Model of Digital Communication Systems, Advantages of digital communication systems, Digital Representation of Analog signal,PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta Modulation, T1 carrier system,shanon fano coding and Huffman coding

**UNIT V**

**DIGITAL MODULATION TECHNIQUES AND ERROR CONTROL CODING**

ASK,FSK,PSK,DPSK,QPSK modulation and demodulation techniques,Comparison of Digital modulation systems.

Linear Block Codes, Error detection and correction capabilities of Linear Block Codes Cyclic Codes: Encoding, , Decoding, Convolution Codes: Encoding, Decoding

**UNIT VI**

**MULTIPLE ACCESS TECHNIQUES**   FDMA,TDMA.CDMA DSSS-CDMA, FHSS-CDMA

**TEXT BOOKS:**

1. B. P. Lathi, *Modern Analog and Digital Communication*, 3rd Ed., Oxford University Press

2. K. Sam Shanmugham*, Digital and Analog Communication Systems*, John Wiley & Sons

3. Simon Haykin*, Digital communications* -, John Wiley, 2005

4. H. Taub and D. Schilling*, Principles of Communication Systems* –, TMH, 2003

**REFERENCES:**

John Proakis*, Digital Communications* –, TMH, 1983.

Singh & Sapre, Communication *Systems Analog & Digital* –, TMH, 2004.

Sklar: *Digital Communication*, 2nd Ed., Pearson Education

“Digital Communications”, J.S Chitode, Technical publication, Pune.

5. vGeorge Kennedy and Bernard Davis ,*Electronics & Communication System*, TMH,2nd Edition, 2004.

6.. Analog and Digital Communications, Theory and Lab work, Abhay Gandhi, Cengage Learning.

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

**Mechanical Engineering**

**Control Systems Engineering**

**(Open Elective-II)**

**Code: 6AC46 L T P/D C 2 1 - 2**

**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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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **3** | M |  | M | L | H |  | M |  |  |  |  |  |
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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**

**SAP-I: SAP ABAP Workbench Fundamentals**

**(Open Elective-II)**

**Code:6EC26 L T P/D C 2 1 - 2**

**Course Objectives:**

1. Understand the SAP NetWeaver AS fundamentals
2. Work with the ABAP Workbench tools
3. Write simple ABAP programs
4. Understand the ABAP Dictionary

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

1. To acquire through knowledge of SAP Net weaver architecture, ABAP fundamentals (like language elements, modularization, ABAP dictionary)
2. To write simple ABAP programs and reports
3. To be able to debug and analyze errors and performance of programs

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **Unit** | **Content** |
| 1 | I**ntroduction to enterprise resource planning(ERP)** |
| 1. ERP explained 2. System wide concepts 3. SAP applications and components 4. Sample end to end business process |
| 2 | **SAP Netweaver application server fundamentals** |
| 1. SAP systems and SAP applications portfolio 2. SAP Graphical User Interface and Navigation in AS ABAP systems 3. System core 4. Communication and integration technologies |
| 3 | **ABAP Work bench foundations - Part 1** |
| 1. ABAP Program processing 2. ABAP Work bench tools 3. ABAP Language basics, open SQL 4. Modularization techniques |
| 4 | **ABAP Work bench foundations - Part 2** |
| 1. Complex data objects, structures and internal tables 2. Data modeling and Data retrieval 3. Classic ABAP reports 4. Program analysis tools 5. Program calls and memory management |
| 5 | **ABAP Dictionary** |
| 1. Domains, Data elements and structures 2. Transparent tables, Pool tables and cluster tables 3. Input Checks 4. Dictionary object dependencies 5. Changes in table structure 6. Views 7. Search Helps |
| 6 | **Classical UI Programming** |
| 1. Selection Screens 2. Screens ( Dynpros) |

**Textbooks:**

* 1. ABAP Workbench Fundamentals, Part 1, SAP India
  2. ABAP Workbench Fundamentals, Part 2, SAP India

**References:**

www. training.sap.com/in/en

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

**Mechanical Engineering**

**EMBEDDED SYSTEMS**

**(Open Elective-II)**

**Code: 6DC52 L T P/D C 2 1 - 2**

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

1. *The constraints and challenges of an Embedded System design*
2. *The 8051 Architecture, Assembly Language Programming , Interfacing and Interrupt handling mechanism*
3. *Modern Embedded System Design case studies*

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

1. *Write ALP for 8051 architecture*
2. *Implement interfaces for Embedded System using various protocols and hardware modules.*
3. *Identify the design constraints and challanges of an embedded system with case studies.*

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**UNIT – I: Introduction to Embedded Systems**

Embedded Systems, Comparing Embedded and General Computing, Complex System Design and Processors, Classification of Embedded Systems, Embedded System Design Process, Formalization of System Design, Embedded SOC and VLSI Circuit Technology, Application examples of Embedded Systems.

**UNIT – II: 8051 Architecture, Memory Organization and Programming**

8051 Architecture, features, Addressing modes, Instruction set, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data, Input/Output, Interrupts; The Assembly Language programming Process, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, use of C programming for 8051.

**UNIT – III: 8051 Real World Interfacing**

Part A - Real World Interfacing, Performance metrics, Memory map, Processor and Memory selection,

Part B - IO Subsystem, Sensors and Actuators, LED and LCD Interfacing, Keyboard Interfacing, Stepper Motor Interfacing, DC motor Interfacing Using PWM

**UNIT – IV: Embedded Communication Interface**

Serial and Parallel Communication, Timer and Counting Devices, Watchdog Timer, Real Time Clock, I2C, SPI protocol, ISA , PCI, Internet Enabled Systems, Wireless and Mobile Systems Protocols

**UNIT – V: Introduction to Real - Time Operating Systems**

Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. (Chapter 6 and 7 from Text Book 3, SImon).

**UNIT – VI: Basic Design Using a Real-Time Operating System** : Principles, Semaphores and Queues, HardReal-Tjme Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source);

**Embedded Software Development Tools**: Host and Target machines, Linker! Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging

**Techniques:** Testing on Host Machine, Using Laboratory Tools, An Example System. (Chapter 8,9,10 & 11 from Text Book 3, Simon).

**TEXT BOOKS:**

1. Embedded Systems- Architectuer, Programming and Design 2E, Raj Kamal, TMH
2. Introduction to Embedded Systems, K.Shibu, Tata McGraw-Hill
3. The 8051 Microcontroller And Embedded Systems Using Assembly And C – Mazidi, Pearson Education India, 2nd edition, 2008.
4. An Embedded Software Primer, David E. Simon, Pearson Education

**REFERENCES:**

1. An Embedded Software Primer, David E. Simon, Pearson Education.
2. Computers and Components: principles of embedded *computing* system design, Wayne Wolf, Elseveir.
3. 8051 Application Notes by Atmel.

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

**Mechanical Engineering**

**INTERNET OF THINGS (IOT)**

**(Open Elective-II)**

**Code: 6DC55 L T P/D C 2 1 - 2**

***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. *Describe the management of an IoT system using necessary protocols*
3. *Design, Develop and Illustrate IoT applications using Raspberry PI platform and Python Scripting*
4. *Implement web based services on IoT devices*

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**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 I semester**

**Mechanical Engineering**

**Code: 6H576 QUANTITATIVE APTITUDE**

**L T P/D C**

**- - 2 1**

**Course Objectives:**

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| * Students learn and solve problems related to number systems |
| * Students find averages of numbers and groups |
| * Students solve problems related to ratio and proportion |
| * Students find simple interest, solve time work and distance problems |
| * Students solve mensuration problems |
| * Students interpret the various kinds of data and find the relation between them. |

**Course Outcomes:**

|  |
| --- |
| * Students learn and solve problems related to number systems |
| * Students find averages of numbers and groups |
| * Students solve problems related to ratio and proportion |
| * Students find simple interest, solve time work and distance problems |
| * Students solve mensuration problems |
| * Students interpret the various kinds of data and find the relation between them. |

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **3** | H |  |  |  |  |  |  |  |  |  |  | L |
| **4** | H |  |  |  |  |  |  |  |  |  |  | L |
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| **6** | H |  |  |  |  |  |  |  |  |  |  | L |

**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 – Mixtures.

**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 – Time and Work – Time and Distance.

**Unit V**

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

**Unit VI**

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

**Text Books:** 1.Quantitative Aptitude by R.S.Agarwal

2. Quantitative Aptitude by Abhijit Guha

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

**Mechanical Engineering**

**Code: 6B579 GROUP PROJECT**

**L T P/D C**

**- - 2 1**

**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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| CO1 | H | H | H | H | H |  |  |  | M | M |  |  |
| CO2 | H | H | H | H | H |  |  |  | M | M |  |  |
| CO3 | H | H | H | H | H |  |  |  | M | M |  |  |
| CO4 | H | H | H | H | H |  |  |  | M | M |  |  |
| CO5 | 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 **internal evaluation** shall consist of:

Day to day work 10 marks

Report 05 marks

Demonstration / presentation 10 marks

End examination 50 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 I semester**

**Mechanical Engineering**

**Code: 6B580 APPLIED THERMODYNAMICS LAB**

**L T P/D C**

**--- -- 3 2**

**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.

**Course Outcomes:**

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

* Performance test on air compressor will make the student to analyze the performance of the camp
* Disassembly and assembly of I.C engine will make the student understand the internal components and their functionality
* Heat balance test will make the student the student understand have the energy supplied to the engine in distributed in a cycle
* Study of boiler will make the student understand the working of different types of boilers
* Vapour compression Refrigeration system will make the student understand the components and working of a refrigeration cycle
* Value timing diagram will make the student understand the operation of inlet and exhaust valves in a cycle

***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 |  | L |  |  |  |  |  |  |  |
| CO2 |  |  | H |  | L |  |  |  |  |  |  |  |
| CO3 |  | M | H | L |  |  |  |  |  |  |  |  |
| CO4 |  | M | H | L |  |  |  |  |  |  |  |  |
| CO5 | L | M | H | L |  |  |  |  |  |  |  |  |
| CO6 | L | 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 two stroke petrol engine
6. Performance test on four stroke petrol engine
7. Heat balance test on diesel engine
8. Morse test on four cylinder four stroke petrol/diesel engine
9. Study of boilers
10. Vapour compression refrigerator
11. Air conditioning
12. Variable compression ratio diesel engine test rig with eddy current dynamometer
13. Computer based single cylinder diesel engine eddy current dynamometer

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

**Mechanical Engineering**

**Code: 6B581 MACHINE TOOLS LAB**

**L T P/D C**

**-- -- 3 2**

**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:

1. Use precision measuring instruments such as vernier calipers, micrometers, gauges and measure dimensions of various work pieces using the instruments
2. Make simple products using lathe and covering various machining operations as per drawing
3. Produce jobs as per drawing using shaper, Planer, Slotter machines
4. Understand the principle and working of Drilling machine and conduct various machining operations as per drawing
5. Work on Grinding and Milling machine and conduct various machining operations as per drawing
6. Conduct alignment test on lathe and drilling machines

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

**List of Experiments**

1. Introduction to General purpose machine tools - Lathe, Drilling machine, Milling machine, Shaper and Grinding machines
2. Study 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

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

**Mechanical Engineering**

**Code: 6B595 TECHNICAL REVIEW & SEMINAR-I**

**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** | | | | | | | | | | | |
| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
| **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**

**DESIGN OF MACHINE MEMBERS-II**

**Code: 6B619**

**L T P/D C**

**2 2 -- 2**

**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, internal combustion engine parts, spur and helical gears, and cylindrical pressure vessels.
* acquire skills to utilize bearing catalogs and machine design data handbook, and,
* Learn the application of statistical mathematics for machine design subject.

***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** |  |  |  |  |  |  |  |  |
| **2** |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| **3** |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| **4** |  | **H** |  | **M** |  |  |  |  |  |  |  |  |
| **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**

**HEAT TRANSFER**

**Code: 6B620**

**L T P/D C**

**3 1 -- 3**

**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 to:

* 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
* Students shall able to deal with problems like conduction through walls and composite walls; critical radius of insulation; heat transfer in fins
* Students must be in a position to Calculate of heat transfer coefficient; overall heat transfer coefficient;log-mean temperature differences
* Students must be in a position 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
* To make the students capable of employing the heat transfer principles in real life situation
* To bring in confidence to apply the principles in industrial appliances and machinery like Power Plants, Heat Exchangers, coolers 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 |  |  |  |  |  |  | M | H |  |
| CO2 | H |  | H |  |  |  |  |  |  | L | H |  |
| CO3 | H |  | H |  |  |  |  |  |  |  | H |  |
| CO4 | H |  | H |  |  |  |  |  |  |  | H |  |
| CO5 | H |  | H |  | M |  |  |  |  |  | H |  |
| CO6 | H |  | H |  | M |  |  |  |  |  | H |  |

**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.

**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.

**UNIT – 1V**

**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. Heat Transfer – P.K.Nag/ TMH

3. Heat and Mass Transfer – R.K. Rajput – S.Chand & Company Ltd.

4. Heat and Mass Transfer-Kondandaraman

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

**Mechanical Engineering**

**CAD/CAM**

**Code: 6B621**

**L T P/D C**

**2 2 --- 2**

**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 etc. 3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.

4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control.

5. To learn the overall configuration and elements of computer integrated manufacturing systems.

**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 the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix.

3. Outline and classify the various modeling techniques in CAD

4. Asses the difference between conventional and NC techniques and develop programs for simple products

5. Describe the use of GT and CAPP for the product development.

6. Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

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

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|  | POa | 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**

Computers in Industrial Manufacturing, Product cycle, scope of CAD/CAM, Applications of CAD/CAM, brief treatment of interactive input/output devices, Graphic terminals, display devices, hard copy devices, storage devices, selection criteria of CAD workstations

**UNIT – II**

**Computer Graphics:** Raster scan graphics coordinate system, Line drawing algorithms windowing, line clipping algorithm, transformation of geometry, 2D & 3D transformations, mathematics of projections, hidden surface removal, database structures for graphic modeling.

**UNIT – III**

**Geometric modeling:** Requirements of Geometric modeling, Wireframe modelling- entities, curve representation methods, surface modeling-entities, surface representation methods, solid modelling-B-rep, CSG representation, modeling facilities desired.

**Automated drafting facilities:** Basic geometric commands, layers, display control commands, editing commands, dimensioning

**UNIT – IV**

**Numerical control:** NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

**UNIT – V**

**Group Technology:** Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

**Computer Aided Quality Control (CAQC):** Terminology in quality control, the computer in QC, contact and Non-contact inspection methods, computer aided testing, integration of CAQC with CAD/CAM.

**UNIT – VI**

**Computer integrated manufacturing systems:** CAD/CAM integration, Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits

**TEXT BOOK:**

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

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

**REFERENCES:**

1. Automation , Production systems & Computer integrated Manufacturing/ Groover/P.E

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

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

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

**Mechanical Engineering**

**DYNAMICS OF MACHINERY**

**Code: 6B622**

**L T P/D C**

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

**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 II semester**

**Mechanical Engineering**

**DESIGN AND ANALYSIS OF EXPERIMENTS**

**(Professional Elective-I)**

Code: 6B623

**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 |  | M |  |  |  |  |  |  |  |  |  |
| **2** | H |  | M |  |  |  |  |  |  |  |  |  |
| **3** | H |  | M |  |  |  |  |  |  |  |  |  |
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| **6** | H |  | M |  |  |  |  |  |  |  |  |  |

**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. III Year II semester**

**Mechanical Engineering**

HYDRAULICS AND PNEUMATIC SYSTEMS

**CODE: 6B624 (Professional Elective-I)**

**L T P C**

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

**COURSE OBJECTIVE:**

To teach student the principles and construction of hydraulic and pneumatic systems that presently used in different mechanical engineering applications.

**COURSE OUTCOMES:**

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

1. Explain the meaning of fluid power. List the various applications of fluid power.

Differentiate between fluid power and transport systems.

2.List the advantages and disadvantages of various fluid power cylinders. Explain the industrial applications of fluid power.

3.List the basic components of the fluid power control valves.

4.understand the principles of hydraulic circuits along with their applications

5.Describe the basic components of the pneumatic systems.

6. Integrate the application of hydraulic and pnematic systems.

***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** |
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| **3** | **H** | **M** | **M** |  |  |  |  |  |  |  |  |  |
| **4** | **H** | **M** | **M** |  |  |  |  |  |  |  |  |  |
| **5** | **H** | **M** | **M** |  |  |  |  |  |  |  |  |  |
| **6** | **H** | **M** | **M** |  |  |  |  |  |  |  |  |  |

**UNIT I**

Fluid power fundamentals: Introduction - operation principle of fluid power – definitions, units, standards and symbols – advantages and disadvantages – applications in various fields.

**UNIT II**

Hydraulic cylinders: Classification and characteristics - connection types and performance parameters - differential and float concepts - typical cylinder structure - ancillary hydraulic element

**UNIT-III**

Control valves: Directional control valve - structure and operation of pilot-operated check valves and the directional control valves - standard symbols for representing the elements - concepts of position and way - actuation mechanisms. Pressure control valves – operation - remote pressure adjustment of the pilot-operated pressure relief valve - pressure reducing valve, sequence valve, counterbalance valve and pressure switch. Flow control valves - throttle characteristics of various orifices - flow regulating valve. Cartridge valves, proportional valves and servo valves.

**UNIT-IV**

Hydraulic circuits: Rapid motion circuits, speed control circuits, synchronous circuits, sequential circuits, counter balance circuits and unloading circuits. Typical hydraulic system examples - movable platform system of modular machine tools - the hydraulic system of truck cranes

**UNIT-V**

Pneumatic circuits: Compressed air production and distribution, pneumatic control components, examples of application including electro-pneumatic and hydro pneumatic controls.

**UNIT-VI**

Design of circuits: Hydraulic circuit design for typical hydraulic systems such as hydraulic press, movable platform of modular machine tools, truck cranes – design calculations. Pneumatic circuit design and associated design calculations.

**TEXT BOOKS:**

1. Pippengar, John J. and Koff, Richard M, “Fluid Power Controls”, McGraw Hill, 1959.

2. Pippengar, John J. and Hicks, Tyler G, “Industrial Hydraulics”, McGraw Hill, 1979.

3. Kirshner, Joseph M, “Fluid amplifiers”, McGraw Hill, 1966.

4. Kirshner, Joseph M. and Silas Katz, “Design Theory of Fluidic Components”, Academic press, 1975.

5. Dr. Heinza Zoebl. Techn, “Fundamentals of Hydraulic Circuitry”, Iliffe, 1970.

6. Leskiewics H.J. and Zarhmba M, “Pneumatic and Hydraulic components and instrumentations in automatic controls”, International Federation of Automatic Control.

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

**Mechanical Engineering**

**THERMAL TURBO MACHINERY**

**(Professional Elective-I)**

**Code 6B625**

**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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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **4** | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| **5** | **H** | **M** | **M** | **L** |  |  | **L** |  |  |  |  |  |
| **6** | **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. III Year II semester**

**Mechanical Engineering**

**AUTOMOBILE ENGINEERING**

**(Professional Elective-I)**

**Code: 6B626**

**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** | | | | | | | | | | | |
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| **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. III Year II semester**

**Mechanical Engineering**

**ADDITIVE MANUFACTURING TECHNOLOGIES**

**(Professional Elective-I)**

**Code: 6B627**

**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:**

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, music, toys, health care (e.g. hearing aids), direct part production and mass customization

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

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

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

**UNIT-II**

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

**UNIT-III**

**Powder Based Rapid Prototyping Systems**: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

**UNIT-IV**

**Rapid Tooling:** Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling : Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP

**UNIT-V**

**Rapid Prototyping Data Formats:** STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software’s: Features of various RP software’s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

**UNIT-VI**

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

**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.D.T. Pham and S.S. Dimov, Rapid Manufacturing, Springer, 2001.

3.TerryWohlers, Wholers Report 2000, Wohlers Associates, 2000. 4.PaulF.Jacobs, Rapid Prototyping and Manufacturing ASME Press, 1996.

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

**Mechanical Engineering**

**INTRODUCTION TO NANOTECHNOLOGY**

**(Professional Elective-I)**

**Code 6B628**

**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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| 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 to Nanotechnology**,** Crystal Structure: Introduction, arrangement of atoms, two dimensional crystal structures

**Unit-II:** Three dimensional crystal structures, some examples of three dimensional crystals, planes in crystals and crystallographic directions,

**Unit-III:** Reciprocal lattice Bragg’s law, reciprocal lattice vectors, diffraction conditions, Laue and Powder methods; Quasicrystals, Type of bonds – ionic, covalent and metallic bonds

**Unit-IV:** Why quantum mechanics? Matter waves, Length scales, De-Broglie hypothesis,Wave particle duality, Heisenberg’s uncertainty principle, Schrodinger wave equation, Particle in one dimensional box

**Unit-V:** Finite Potential Wells and barriers: Periodic lattice, Energy gaps, Qualitative Description of the theory of conduction in Solids, Particle in 2-D box, Quantum Fluctuation and Discrete Quantum states, Concepts of Quantum Confinement

**Unit-VI:** Thermodynamics, phase diagrams and phase transformations

**Textbooks:**

1. Introduction to Nanotechnology by Charles P.Poole Jr & Frank J. Owens, Wiley India Pvt. Ltd.
2. Nano pahysics and nanotechnology by E.L.Wolf willely VCH
3. A Textbook of Quantum Mechanics by P.M. Mathews and K. Venkatesan, Tata McGraw Hill Publishing Company Ltd.
4. Modern Quantum Mechanics by J.J. Sakurari, Addison Wesley Longman Inc.
5. Solid state Physics by Kittel
6. Nanotechnology:Principles and Practices by S.K. Kulkarni, Capital Publishing Company
7. Quantum mechanics by Pawling and Wilson
8. The Feynman lectures on Physics; Vol I to III
9. “Nanoscience and Nanotechnology: Fundamentals to Frontiers” by M.S. Ramachandra Rao and Shubra Singh, Wiley Publishers, 2013.

**Reference Books:**

1. Nanotechnology and Nano Electronics – Materials, devices and measurement techniques by WR Fahrner, Springer
2. Nanotechnology – science, innovation and opportunity by Lynn E Foster, Prentice Hall - Pearson education.
3. Encyclopedia of Nanotechnology by H.S. Nalwa

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

**Mechanical Engineering**

**Computational Biology**

(Open Elective-III)

Code: 6GC50

**L T P/D C**

**2 1 - 2**

**Course objective**

To impart knowledge on the computational problems in the emerging areas of Bioinformatics, Computational Biology, Proteomics and Genomics. The students will be prepared to work in the interdisciplinary area understanding the recent advances in high-performance computing and networking, with the exploding information resources of the human genome and related data.

**Course Outcomes:**

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| **CO:1** | Demonstrate knowledge and understanding of application of computational biology in genomics |
| **CO:2** | Develop the ability to perform database searching and infer homolgy using BLAST and FASTA |
| **CO:3** | Demonstrate knowledge and understand the importance of phylogenetic analysis algorithms and tools |
| **CO:4** | Demonstrate knowledge and understanding of application of computational biology in proteomics. |
| **CO:5** | Gain an understanding of protein structure methods and applications in proteomics. |
| **CO:6** | Gain an understanding of big data and its applications in OMICS |

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **5** | **H** | **M** | **M** | **M** |  |  |  |  |  |  |  |  |
| **6** | **H** | **M** | **M** | **M** |  |  |  |  |  |  |  |  |

**UNIT I INTRODUCTION TO COMPUTATIONAL BIOLOGY**

Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Functional Annotation

**UNIT II SEQUENCE ALIGNMENT ALGORITHMS**

Sequence Alignment, Dynamic Programming for computing edit distance and string similarity, Local and Global Alignment, Needleman Wunsch Algorithm, Smith Waterman Algorithm, BLAST family of programs, FASTA algorithm, alignment tools for database searching : (Blast, FASTA, ), Progressive and Iterative Methods for Multiple sequence alignment

**UNIT III PHYLOGENETICS**

Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and, Parsimonous trees, Additive trees, Bootstrapping.

**UNIT IV PROTEIN STRUCTURE, MODELLING AND SIMULATIONS**

Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations.

**UNIT V SYSTEMS BIOLOGY AND MACHINE LEARNING**

Introduction to Systems Biology and its applications, Microarrays and Clustering techniques for microarray data analysis, informatics in Genomics and Proteomics, DNA computing. Machine learning techniques: Artificial Neural Networks and Hidden Markov Models:Applications in Protein Secondary Structure Prediction and Gene Finding,

**Unit VI OMICS AND BIG DATA**

Data acquisition, cleaning, distribution, and best practices, Visualization and design principles of big data infrastructures, Biological databases for big data management, Grid and cloud computing for omics sciences, Processing of Proteomics Data Using Hadoop.

**TEXT BOOKS**

1.David W Mount. Bioinformatics- Sequence and genome analysis. CSHL Press.2014

2.Jonathan Pevsner. Bioinformatics and Functional Genomics. A Jhon Wiely & Sons, Inc., Publication ,2005

**REFERENCES BOOKS**

1. Brandon and Tooze, – Proteomics ,2010

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

**Mechanical Engineering**

**Data Analytics**

**(Open Elective-III)**

Code: 6FC33  **L T P/D C**

**2 1 - 2**

**Course Objectives:**

1. Obtain, clean/process and transform data.
2. Analyze and interpret data using an ethically responsible approach.
3. Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.
4. Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.
5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges.
6. Perform well in a group.
7. Interpret data findings effectively to any audience, orally, visually and in written formats.

**Course Outcomes:**

1. Ability to Analyze and interpret data

1. Ability to formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges.
2. Ability to demonstrate proficiency with statistical **analysis of data.**
3. Ability to apply data science concepts and methods to **solve** problems in real-world contexts and will **communicate** these solutions effectively

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**Unit-1**

**Introduction:**

What is data warehousing?, What is data mining?, Classification of Data Mining systems, Data pre-processing: Why data pre-processing is needed, Data Cleaning, Data Integration and Transformation, Data Reduction. Data Warehouse: Data Warehouse and OLAP Technology, Multidimensional Data Model, Data Warehouse Architecture.

**Unit-2**

**Data Mining Tasks:**

Association Analysis: Frequent Itemsets generation using Apriori Algorithm, Evaluation of Association Patterns, Classification: General approach to solving a classification problem, Decision Tree Induction, Model Overfitting, Clustering: Overview, k-means algorithm.

**Unit-3**

**Introduction to Big Data**

What is big data, why big data, convergence of key trends , unstructured data ,industry examples of big data ,web analytics, big data and marketing, fraud and big data ,risk and big data ,credit risk management, big data in medicine, introduction to Hadoop open source technologies , cloud and big data

**Unit-4**

**Frameworks of Big Data:**

The Map Reduce Framework; Uses of Map Reduce; Architecture, Storing Big Data with HBase, Role of HBase in Big Data Processing, NoSQL Databases.

**Unit-5**

**Introduction to Data Science**

Need for data scientists, Foundation of Data Science, What is Business Intelligence, What is Data Analysis, Machine Learning, Analytics VS Data Science, Types of Analytics, Life cycle probability, Analytics Project Lifecycle.

**Unit-6**

**Data Visualization:**

Introduction-Terminology-Basic charts and plots-Multivariate Data Visualization-Data Visualization Techniques-Explorative Data Analysis (EDA)-

Introduction to EDA, Needs of EDA, Goals of EDA, Types of EDA, Implementation of EDA, Boxplots, cor() in R ,EDA functions, Elements of Data Visualization, Info-graphics vs Data Visualization, Data Visualization and Graphical Functions in R, Plotting of Graphs.

**Textbooks:**

* Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011. **[FOR UNIT-1]**
* Introduction to Data Mining - First Edition, by Pang-Ning Tan, Michael Steinbach and Vipin Kumar, ISBN-13: 978-0321321367 **[FOR UNIT-2]**
* BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications. **[FOR UNITS – 3 & 4]**
* Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, Arno Meysman, Mohamed Ali, Manning Publications, 2016, ISBN 1633430030, 9781633430037 **[FOR UNITS - 5 & 6]**

**References:**

* Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
* Tom Mitchell. Machine Learning. Mc Graw Hill 1997.
* Jure Leskovek, Anand Rajaraman and Jefrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
* BIG DATA, Black Book TM , DreamTech Press, 2015 Edition
* Seeing What Others Don’t. The Remarkable Ways We Gain Insights. Gary Klein. First Edition. Public Affairs Press.

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

**Mechanical Engineering**

**ELECTRONIC CIRCUIT DESIGN AND ANALYSIS**

**(Open Elective-III)**

Code: 6CC44  **L T P/D C**

**2 1 - 2**

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

1. *Analyse and Design of BJT Single stage, multistage amplifiers at low and high frequencies.*
2. *Analyse and Design JFET and MOSFET amplifiers*
3. *Design different types of Feedback Amplifier, Oscillators and their analysis.*
4. *Analyse and Design power amplifiers.Understand distortions*
5. *Analyse and Design tuned and RF amplifiers such as single tuned, double tuned, stagger tuned and wide band amplifier.*
6. *Understand the stability of oscillators and tuned amplifiers.*

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

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| CO3 | H | M | M |  |  |  |  |  |  |  |  | 2 | 3 |
| CO4 | H | M | M |  |  |  |  |  |  |  |  | 2 | 3 |
| CO5 | H | M | M |  |  |  |  |  |  |  |  | 2 | 3 |
| CO6 | H | M | M |  |  |  |  |  |  |  |  | 2 | 3 |

**unit i**

**MULTISTAGE AMPLIFIERS**

Review of Transistor Amplifiers. Review of BJT hybrid π model. Methods of inter stage coupling, N-stage cascaded amplifier, equivalent circuits, Miller’s theorem, high input resistance transistor circuits, cascade transistor configuration, CE – CC amplifier, two stage RC coupled J-FET amplifier (common sources configuration). **Frequency response of BJT Amplifier, Analysis at Low and High frequencies.**

***Applications: Design of a 3-stage RC coupled amplifier (gain= 30 dB) which operates from 350Hz to 2 KHz.***

**unit iI**

**FET AMPLIFIERS**

Biasing of JFET - Self bias and fixed bias. Biasing of MOSFETS -. Depletion and Enhancement mode. Analysis of common source, common drain and common gate amplifier configurations – Thermal runaway in MOSFET – MOS Differential amplifier – Analysis. **Frequency Response of Common Source Amplifier.**

**unit iII**

**FEED BACK AMPLIFIERS**

Fundamentals-classification- Characteristics of feedback Amplifier effect of feedback in voltage series, voltage shunt, current series and current shunt amplifiers.

***Applications: Design of a stable 50 KHz sinusoidal oscillator.***

**unit iV**

**OSCILLATORS**

Condition for Oscillations. Classification of Oscillators.RC Oscillators-LC Oscillators, tuned collector and tuned drain oscillator and stability of oscillators. Design of audio and radio frequency oscillators.

**unit V**

**POWER AMPLIFIERS**

Class A, B, AB, C& D power amplifiers –push pull configuration, complementary symmetry circuits , Distortion in Amplifiers. Harmonic distortion and Crossover Distortion in Power Amplifiers– Conversion efficiency and relative performance,

**unit VI**

**TUNED AND RF AMPLIFIERS**

Introduction to Tuned Amplifiers,Q**-**Factor.single tuned capacitive coupled amplifier, tapped single tuned capacitance coupled amplifier, single tuned transformer coupled amplifier, stagger tunning, wideband tuned amplifiers.

***Applications: Design of a IF tuner for AM receiver.***

**Text Books:**

1. Integrated electronics-J.Milliman and C.C.Halkias, MC Graw –Hill-1972

2. Electronic Devices and Circuits: T.F.Bogart, j.s.Bearsley, Pearson Edition, 6th edition, 2000

3. Electronic devices and Circuit Theory-Robert L. Boylsted, Louis Nashelsky, 9ht ed., 2008, PE

**Reference:**

* + - 1. Electronic Circuit Analysis-K.Lal Kishore, 2004, BSP
      2. Electronic Circuits and Applications, Muhammad H Rashid, Cengage Learning
      3. Microelectronic Circuits – Sedra and Smith-5th ed., 2009, OxfordUniversity Press
      4. Electronic Devices and Circuits –S.Salivahanan, N.Suresh Kumar,A Vallavaraj, 2ed., 2009,TMH.

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

**Mechanical Engineering**

**ADVANCED ENTREPRENEURSHIP**

**(Common to all Branches)**

**(Open Elective-III)**

**Code: 6ZC23**

**L T P/D C**

**2 1 0 2**

**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:***

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**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 II semester**

**Mechanical Engineering**

**INDIAN HISTORY, CULTURE AND GEOGRAPHY**

**(Common to all branches)**

**(Open Elective-III)**

**Code: 6ZC27**

**L T P/D C**

**2 1 0 2**

**Course Objectives**: To equip the students with necessary knowledge relating to ancient, medieval and modern Indian and its culture and also facts relating to existence of earth.

**Course Outcomes**:

1. To appreciate and understand our Indian History, Culture and Indian heritage.
2. To understand secularism of our country.
3. To appreciate and understand the social reformers who brought revolutionary changes in

Indian society.

1. To understand earth evolution and world climatic change.
2. To understand India Oceanography,
3. Able to enhance and understand Indian monsoons, Indian agriculture.

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**Unit I: Ancient Indian History**

Fundamental Unity of Indian Harappan and Vedic Civilization – Evolution of Caste System – ainism 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: 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 III: 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.

**Unit IV:** **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 V: 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 VI: 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.

**References:**

* 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.
* 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**

**GENERAL MANAGEMENT & ENTREPRENEURSHIP**

**(Open Elective-III)**

**L T P/D C**

**Code 6ZC21 2 1 -- 2**

**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**

**FINANCIAL INSTITUTIONS, MARKETS AND SERVICES**

**(Open Elective-III)**

**Code:6ZC15**

**L T P/D C**

**2 1 -- 2**

**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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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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**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.

**References:**

* 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
* 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**

**SAP – II : SAP ABAP Workbench Concepts**

**(OPEN ELECTIVE - III)**

**Code: 6EC27**

**L T P/D C**

**2 1 -- 2**

**Teaching Scheme** **Examination Scheme**

Lecture-4 Hours/Week in Semester Assessment: 30Marks

Practical-2 Hours/Week End Semester Assessment: 70Marks

**Course Objectives**

1. Write object oriented programs with ABAP

2. Understand the techniques in enhancements and modifications

3. Create simple Web Dynpro for ABAP applications

**Course Outcomes**

1. To carry out enhancements and modifications to SAP standard, in future proof manner

2. To develop simple Web Dynpro for ABAP applications

3. To be able to understand Functional Specifications and write Technical Specifications

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

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**UNIT – I : ABAP Objects-Part 1**

1. Object-Oriented Programming (OOPS Programming)

2. Fundamentals Object-Oriented syntax

3. Inheritance and casting

4. Interfaces and casting

5. Events

**UNIT – 2: ABAP Objects-Part2**

1. Global Classes and Interfaces

2. Exception handling

3. ABAP Object-Oriented examples-ALV and BAdls

4. Abstract classes, factory methods, singletons

UNIT – 3: **Shared Objects and shared Memory Areas**

1. Shared Objects

2. Shared Memory Access

UNIT – 4: **Dynamic Programming**

1. Generic data types

2. Field symbols and data references

3. Runtime Type Identifications (RTTI)

4. Runtime Type Creation (RTTC)

UNIT – 5: **Enhancements and Modifications**

1. Adjustment of SAP Standard Software

2. Enhancing Dictionary elements

3. Customers Exits

4. Business Add Ins (BAdls)

5. Modifications of the SAP standard applications

6. Implicit and Explicit Enhancements

UNIT – 6: **Fundamentals of Webdynpro for ABAP**

1. Web Dynpro Components, Windows and Views

2. Web Dynpro Controllers

3. Web Dynpro Context

4. Web Dynpro User Interface

5. Controller and Context programming

**Textbooks:**

* 1. SAP ABAP Workbench Concepts, Part 1, SAP India
  2. SAP ABAP Workbench Concepts, Part 2, SAP India

References:

www.Training.sap.com/in/en **Syllabus for B. Tech. III Year II semester**

**Mechanical Engineering**

**MEASUREMENTS AND INSTRUMENTATION**

(Open Elective-III)

Code: 6AC44

**L T P/D C**

**2 1 - 2**

**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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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
| **1** |  |  |  |  | **H** |  | **M** |  |  |  |  |  |
| **2** |  |  |  |  | **H** |  | **M** |  |  |  |  |  |
| **3** |  |  |  |  | **H** |  | **M** |  |  |  |  |  |
| **4** |  |  |  |  | **H** |  | **M** |  |  |  |  |  |
| **5** |  |  |  |  | **H** |  | **M** |  |  |  |  |  |
| **6** |  |  |  |  | **H** |  | **M** |  |  |  |  |  |

**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**

**LOGICAL REASONING**

**Code: 6H677**

**L T P/D C**

**- - 2 1**

**Course Objectives:**

**Course outcomes:**

After completing the subject, students will be able to

|  |
| --- |
| **Unit I**  Students figure out the number and alphabet series |
| **Unit II**  Students grasp the concept of analogy and solve related problems |
| **Unit III**  Students classify and figure out odd one |
| **Unit IV**  Students realize the various techniques for coding and decoding |
| **Unit V**  Students solve the relations puzzles. |
| **Unit VI**  Students solve the problem related to number, ranking and arithmetic reasoning  ***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** | | **2** | **H** |  |  |  |  |  |  |  |  |  |  | **M** | | **3** | **H** |  |  |  |  |  |  |  |  |  |  | **M** | | **4** | **H** |  |  |  |  |  |  |  |  |  |  | **M** | | **5** | **H** |  |  |  |  |  |  |  |  |  |  | **M** | | **6** | **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**

**COMPREHENSIVE VIVA-VOCE-II**

**Code: 6B682**

**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** | |

Students are assessed in the courses they have undergone till the completion of that academic year

They are asked to comprehend the concepts in the core subjects and the elective subjects, to make them ready to face technical interviews which improve their employability skills

There are no sessional marks. The end examination shall be conducted by a committee consisting of an External examiner, Head of the department and two senior faculty members. It carries marks 50.

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

**Mechanical Engineering**

**Code: 6B683** **HEAT TRANSFER LAB**

**L T P/D C**

**--- --- 3 2**

**Course Objectives**

**Course Outcomes**

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

1. Compute the thermal conductivity of a given material expert mentally and understand the physical significance of the thermal conductivity of the given material insulating powder.

2. Natural convection:will make the student know the concept of convection.

3. should be able to calculate the emissivity of a given surface and to calculate Stefan-Boltzmann’s constant experimentally.

4. Composite wall will make the student know the concept of conduction

5. Able to calculate LMTD for parallel flow and counter flow heat exchangers and overall heat transfer coefficient.

6. Stefan Boltzmann constant will make the student know the concept of radiation

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

Note: A minimum of 10 experiments are to be conducted

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.

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

**Mechanical Engineering**

**Code: 6B684 CAD/CAM LAB**

**L T P/D C**

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

**Course Outcomes**

After studying this laboratory course, the students students will be able to:

1. to solve design and manufacturing problems using basic CAD/CAM.

2. acquire skills of developing geometric modeling of various components

3. Analyse the stresses and deflectionsof beams , trussesand plates under staticloads

4. Draw Computer aided 2D dRAWING

5. Learn skills of writing CNC Part programming

6. Ability to import and export geometric models between modeling software and Analysis software.

**Softwares:** PROE,CREO and ANSYS

**Equipment:** CNC Lathe , CNC Mill and Six AXis Robot

***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 | H |  |  |  |  |  |  |  |  |
| 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.** Generation of various 2D Models (Minimum of five Excercises)

2. BD Modeling of Simple Components (Minimum of five Excercises)

3. 3D Modeling and Assebly of Flange Coupling

4. Determination of deflection and stresses in 2D trusses

5. Determination of deflection and stresses of beams

6.Thermal Analysis of Steady State Composite Slab

7. Themal- Structural Analysis of Composite Slab

8.Simulation of Tool path for CNC Lathe operations

9. Simulation of Tool path for CNC Lathe operations

10.Machining of Simple Components on CNC Lathe.

11. Machining of Simple Components on CNC Lathe.

12.Demo of Six Axis Robot

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

**Mechanical Engineering**

**KOM &DOM LAB**

**Code:6B685**

**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 KOM and DOM Lab course, students will be able to get:

1. Ability to understand the principles used in kinematic analysis of CAM.

3. Ability to do the analysis of primary and secondary forces in balancing machines.

3. Ability to identify the time period and amplitude of basic oscillating pendulums.

4. Ability to understand the gyro principles applied in stabilizing various machines

5. Ability to realize the theory related to longitudinal, transverse and torsinal vibrations.

6. Ability to design lubrication system in journal bearing

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

**List of Experiments**

1. To determine the state of balance of machines for primary and secondary forces

2. To determine the frequency of torsional vibration of a given rod

3. To determine the effect of varying mass on the centre of sleeve in Porter and Proell governor

4. To find the motion of the follower of the given profile of the cam

5. To balance masses statically and dynamically for single rotating mass systems

6. To determine the critical speed of a given shaft for different n-conditions

7. To determine the time period and natural frequency for a simple pendulum

8. To determine time period and its natural frequency for a compound pendulum

9. To determine the gyroscopic effect for different types of motions

10. To determine time period, amplitude and frequency of undamped, free longitudinal vibration for Single Degree spring mass systems.

11. To determine the pressure distribution of lubricating oil at various loads and speed of a Journal bearing.

12. To determine the time period, amplitude and frequency of damped free longitudinal vibrations of single degree spring mass systems

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

**Effective English Communication & Soft Skills**

**(Common for all braches)**

**Code: 6HC754**

**L T P/D C**

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

**Course Out comes**

* **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**

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

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

**UNIT I**:

**Interview Skills**

* Types of Interviews
* Frequently Asked Questions
* Dos and Don’ts
* Mock Interviews

**UNIT II**:

**Advanced Writing Skills**

* Résumés / Curriculum Vitaé
* Cover Letter
* Statement of Purpose
* Letters of Recommendation

**UNIT III**:

**Professional Ethics**

* Dignity
* Integrity
* Sincerity
* Honesty

**UNIT IV**:

**Cultural Communication**

* Definition
* Cultural Differences
* Cross-cultural associations

**UNIT V**:

**Corporate Culture**

* Characteristics
* Superiors and Subordinates’ Relations
* Work Ethic
* Contributing

**UNIT VI**:

**Social Responsibilities**

* Identifying Needs
* Finding / Suggesting Remedies
* Civic Sense: Behavior in Public; Driving Ethics
* Avoiding Negative Influences

**Text:**

**Compiled Text Book**

**Suggested Reading**

***Talk Your Way to the Top Communication Secrets to Change Your Life-*** Kevin Hogan- Magna Pub Book Division

***Soft Skills Know Yourself And Know The World-*** K Alex- S Chand

***Strategic Corporate Communication-*** Paul A Argenti- MGH

**\*\*\*\*\***

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

**Mechanical Engineering**

**TECHNICAL REVIEW & SEMINAR-II**

**Code 6B696**

**L T P/D C**

--- --- 2 1

**Course Objectives**

Learn basics of technical paper writing and enhance verbal and writing skills useful for employabilty.

**Course Outcomes:**

1.Apply  effective  strategies  in  literature  searches  using   libraries’  resources.

2. Locate reliable Internet sites related to Mechanical Engineering

3. Document properly according to a specific style

4. Know how to present the content within specified time.

5. Learns  research related activities

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

**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.
3. The same sheet shall be affixed in the respective classrooms and seminar register.
4. 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.
5. Progress of the seminars needs to be reviewed by the concerned HOD once in 15 days.
6. The evaluation for Technical Seminars has to be informed to students and displayed in the classrooms.
7. 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. IV Year I semester**

**Mechanical Engineering**

**Code: 6B729 METROLOGY and INSTRUMENTATION**

**L T P/D C**

**3 1 -- 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:***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P0a | POb | POc | POd | POe | POf | POg | POh | POi | POj | POk | POl |
| 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. IV Year I semester**

**Mechanical Engineering**

**Code: 6B730 FINITE ELEMENT METHOD**

**L T P/D C**

**3 1 -- 3**

**Course Objectives:**

1. To provide the fundamental concepts of the theory of the principles finite element method
2. To enable the students to formulate the beam and 2D design problems into FEA.
3. To introduce basic aspects of finite element technology in symmetric and axi symmetric solid design problems.
4. To introduce the basic aspects of finite element technology in higher order elements with natural coordinate system
5. To introduce the basic aspects of finite element technology in scalar field problems
6. To introduce the application of generalized finite element software’s in different design problems

**Course Outcomes:**

After completing the subject, students will be able to:

1.Identify mathematical model for solution of common engineering problems related to 1D problem

2.Formulate mechanical problems such as trusses and beams into finite elements

3.Derive Finite element matrix equation for 2D and ax symmetric problems by different methods by applying basic laws in mechanics

4.Able to apply isoparametric formulation to engineering problems

5.Understand the application of FEM in Heat Tranfer Problems.

6.Use professional-level finite element software to solve engineering problems related to structural dynamics and heat transfer problems. He should also in a position to handle open end design related projects in multi disciplinary subjects.

* ***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** |
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| **3** | H |  |  | H |  |  |  |  |  |  |  |  |
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| **6** | H |  |  | H |  |  |  |  |  |  |  |  |

**UNIT-I:**

**FUNDAMENTALS OF FEM:**

Introduction, Historical back ground, strain displacements, strain stress, equilibrium, potential energy principal, Ray leigh – Ritz method, Galerkin’s method.

**FINITE ELEMENT MODELING OF ONE DIMENSIONAL PROBLEMS (BAR ELEMENT):**

Elements, nodes, number scheme, coordinate systems, shape functions, element stiffness matrix and force vectors using potential energy approach, Assembly of the local stiffness matrices and load vectors, quadratic shape functions, temperature effect on bar element.

**UNIT-II:**

**FINITE ELEMENT MODELING OF TRUSSES:**

Plane trusses, local and global coordinate systems, direction cosines, stiffness matrix, Stress calculation, temperature effects.

**FINITE ELEMENT MODELING OF BEAMS:**

Potential energy approach to derive stiffness and load matrices, shear force and bending moment calculations.

**UNIT-III:  
FINITE ELEMENT MODELING OF TWO-DIMENTIONAL PROBLEMS USING TRAINGULAR ELEMENTS:**

Introduction, Isoparametric representation of triangular element, potential energy approach to derive element stiffness and force matrices.

**AXISYMMETRIC FORMULATION:** using triangular element, boundary conditions in long cylinder subjected to internal pressures.

**UNIT-IV:**

**TWO DIMENSIONAL ISOPARAMETRIC ELEMENTS:**

Introduction to isoparametric formulation, shape functions of four node quadrilateral and eight node quadrilateral elements.Concept of numerical Integration

**INTRODUCTION TO 3D ELEMENTS:**

Tetrahedral and Hexahedral elements for three dimensional problems.

**UNIT-V:**

**FINITE ELEMENT MODELING OF HEAT TRANSFER:**

Galerkin approach, Steady state on-dimensional heat conduction problems, steady state heat transfer in thin fins, Two dimensional steady state heat conduction with triangular element.

**UNIT-VI:**

**FINITE ELEMENT MODELING OF DYNAMIC PROBLEMS:**

Introduction, solid elements with distributed mass, Langrargian method, element mass matrices, evaluation of eigen values and eigen vectors for axial vibrating members and beams.

**INTRODUCTION TO FEM SOFTWARES:** Feature of commercially available soft wares, convergence criteria, FEM concept of mesh generation, geometry isotropy, pre-processing and post-processing, Type of errors in FEM.

**TEXT BOOKS:**

1. Tirupathi R-Chandrupatla: “Introduction to finite elements in engineering”, PHI publishers
2. Singiresu S.Rao -The finite element methods in Engineering , BH, Elsevier publishers

**REFERENCES:**

1. George R.Buchan, Finite elements analysis, Schhaum’s outlines-tata MC graw –hill edition,

2. David V.Hutton “Fundamentals of finite elements analysis”.

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

**Mechanical Engineering**

**ROTOR DYNAMICS**

**(Professional Elective-II)**

**Code:6B731**

**L T P/D C**

3 - - 3

**Course Objective:**

to give a basic understanding of the rotor dynamics phenomena with the help of simple rotor models and subsequently the modern analysis methods for real life rotor systems.

**Course Outcomes:**

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

1.Understand principles of rotor bearing systems.

2.Learn linear models of rotor systems with damping

3.Model multidegree freedom rotor system

4.deduce models related to shafts with rotors.

5Analyze dynamic behavior of rotor bearing system and Predict the response of a rotor bearing system through analytical and computational models

6.Identify the malfunctions in rotating machinery using vibration measurements

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

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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **2** | H | M | M | M |  |  |  |  |  |  |  |  |
| **3** | H | L | M | M |  |  |  |  |  |  |  |  |
| **4** | H | M | H | L |  |  |  |  |  |  |  |  |
| **5** | H | L | H | M |  |  |  |  |  |  |  |  |
| **6** | H | H | H | H |  |  |  |  |  |  |  |  |

**UNIT-I**

Introduction: Introduction to rotor dynamics, Review of Vibration of single and multi degree of freedom systems. Rotating and reciprocating unbalances in mechanical systems.

**UNIT-II**

Linear Rotor dynamics: Equation of motion for Rotating systems, Undamped Jeffcott Rotor, Free whirling, Unbalance response, Shaft Bow, Jeffcott Rotor with viscous damping – Free whirling, Unbalance response, Shaft Bow, Jeffcott Rotor with structural damping – Free whirling, Unbalance response, frequency dependent loss factors.

**UNIT-III**

Discrete multi-degree of freedom rotors: Introduction, Transfer matrix approach for rotor systems, The finite element method for rotors, Beam elements, spring elements, Mass elements, Assembly and constraints Computation of critical speeds, Computation of unbalance response, Campbell and root locus diagrams.

**UNIT-IV**

Transmission Shafts: Euler-Bernoulli and Timoshenko beam models. Dynamic stiffness, Free Torsional and axial vibrations and critical speeds

**UNIT-V**

Rotor Bearing Interaction : Rigid body and flexural modes, Isotropic rotors on Anisotropic supports, nonisotropic rotors on isotropic supports, Linearization of bearing Characteristics, Rolling element bearings, Fluid film bearings, Magnetic bearings, Bearing alignment in multi rotor bearings

**UNIT-VI**

Malfunctioning of Rotors: Measurement of vibration data in rotor systems, Data processing, Signature analysis, Identification of malfunctioning using measured data.

**TEXT BOOKS:**

1. Giancarlo Genta, Dynamics of Rotating Systems, Springer, 2009

2. Rao, J.S., Rotor Dynamics, 3 Ed. New Age International, 2003

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

**Mechanical Engineering**

**Code: 6B732 REFRIGERATION and AIR CONDITIONING**

**(Professional Elective-II)**

**L T P/D C**

3  **- - 3**

**Course Objectives**

This course deals with the design and implementation of refrigeration and air conditioning systems and building services. The objectives of the course is to enable the student;

1. To understand the principles of refrigeration and air conditioning.
2. To calculate the cooling load for different applications.
3. To select the right equipment for a particular application.
4. To design and implement refrigeration and air conditioning systems using standards.

**Course Outcomes:**

After completing the subject, students will be able to:

* Understand air refrigeration and types of air refrigeration systems
* Principle and working of VCR system and understand T-S and P-h diagrams of VCR cycles
* Principle and working of types of compressors , condensers, expansion devices and evaporators, and Types of refrigerants , and uses
* Understand the working of VARS and difference between VARS and VCR; understand the working of LI-Br Absorption system, Steam jet Refrigeration System. Understand the working Thermo-electric refrigeration system, Vertex tube.
* Types of A.C Systems and related load calculation problems
* Understand the elements of A.C systems, Understand the different heat pump circuits

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

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

**UNIT – I**

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

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air crafts.

**UNIT – II**

Vapour compression refrigeration – working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems.

**UNIT III**

**System Components:** Compressors – General classification – comparison – Advantages and Disadvantages.

Condensers – classification – Working Principles

Evaporators – classification – Working Principles

Expansion devices – Types – Working Principles

**Refrigerants** – Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion – Global Warming.

**UNIT IV**

**Vapor Absorption System** – Calculation of max COP – description and working of NH3 – water system and Li Br –water ( Two shell and Four shell) System. Principle of operation Three Fluid absorption system, salient features. Steam Jet Refrigeration System – Working Principle and Basic Components.

Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

**UNIT – V**

**Introduction to Air Conditioning:** Psychometric Properties and Processes – Characterization of Sensible and latent heat loads –– Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

Requirements of human comfort and concept of effective temperature- Comfort chart –Comfort Air conditioning – Requirements of Industrial air conditioning , Air conditioning Load Calculations.

**UNIT – VI**

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

**TEXT BOOKS:**

1. Refrigeration and Air Conditioning / CP Arora / TMH.

2. A Course in Refrigeration and Air conditioning / SC Arora and Domkundwar / Dhanpatrai

**REFERENCES:**

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.

2. Principles of Refrigeration - Dossat / Pearson Education.

3. Refrigeration and Air Conditioning-P.L.Bellaney

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

**Mechanical Engineering**

**Advanced Manufacturing Processes**

**(Professional Elective-II)**

Code:**6B733**

**L T P C**

**3** 1- **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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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
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| **2** | M | H | H |  | L |  |  |  |  |  |  |  |
| **3** | M | H | H |  | L |  |  |  |  |  |  |  |
| **4** | M | H | H |  | L |  |  |  |  |  |  |  |
| **5** | M | H | H |  | L |  |  |  |  |  |  |  |
| **6** | 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 I semester**

**Mechanical Engineering**

**CHARACTERIZATION OF NANOMATERIALS**

**(Professional Elective-II)**

**L T P/D C**

**3 - - 3**

**CODE: 6B734**

**Course Objective:**

After synthesis of nanomaterial’s, the analysis of various structural characterization and different properties is essential.

**Course Outcomes:**

In this subject we included compositional and structural characterization for better understanding of structural parameters and crystal structures. Along with these techniques, we also included different spectroscopy techniques and different properties such as electrical, magnetically, and dielectrically measurement techniques. So that to analyse the various properties of different materials. Therefore these characterization techniques will help the students to understand the structure property correlations and to apply in various techniques.

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

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| 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:** Compositional and structural Characterization techniques**:** X-ray Photoelectron Spectroscopy (XPS), X-Ray topography, Energy Dispersive X-ray analysis (EDAX), Principles and applications of X-ray diffraction:

**Unit-II:** Small angle X-ray diffraction and Wide angle X-Ray diffraction; electron diffraction, Electron probe microanalysis (EPMA), Ion beam techniques: SIMS and RBS, 3-D atom probe

**Unit-III:** Surface characterization Techniques: Scanning electron microscopy (SEM), Transmission electron microscopy, Basic principles and the applications of scanning probe techniques (SPM), Atomic force microscopy, scanning tunneling microscopy

**Unit-IV:** Spectroscopic techniques:UV-Visible spectroscopy, Infrared (IR) and Fourier Transform infrared (FTIR) spectroscopy, Raman spectroscopy techniques: micro Raman and laser Raman; Photo luminescence spectroscopy

**Unit-V:** Electrical characterization techniques: Hall measurement, Dynamic and static Current voltage (I-V) characteristics, capacitance, voltage measurements, I-V analysis by AFM and STM (STS), electron beam induced current measurement (EBIC)

**Unit-VI:** Magnetic and dielectric characterization: SQUID, VSM, MFM, Neutron diffraction, Dielectric measurements, impedance and ferroelectric measurements

**Text books:**

1. Nano: The Essentials -Understanding Nano Scinece and Nanotechnology by T.Pradeep, Tata Mc.Graw Hill
2. Introduction to Nano Technology by Charles. P. Poole Jr and Frank J. Owens, Wiley India Pvt Ltd.
3. A practical approach to X-Ray diffraction analysis by C.Suryanarayana
4. Electron Microscopy and analysis by P.J. Goodhew and F.J. Humpreys
5. Scanning electron microscopy and x-ray microanalysis by J.I. Goldstein
6. Characterization of nanostructured materials by Z.L. Wang
7. Modern Raman Spectroscopy: A practical approach by E. Smith and G.Dent
8. Principles of Instrumental analysis by D.A. Skoog, F.J. Hollen and T.A. Niemann
9. “Nanoscience and Nanotechnology: Fundamentals to Frontiers” by M.S. Ramachandra Rao and Shubra Singh, Wiley Publishers, 2013.

**Reference Books:**

1. Nanotechnology : Principles and Practices – Sulabha K. Kulkarni – Capital Publishing Company
2. Specimen preparation for Transmission Electron microscopy by John and Bravmno et al, published by MRS
3. Photoelectron spectroscopy by JHD Eland, Butterworth and Co. publishers, 2nd education.

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

**Mechanical Engineering**

**QUALITY AND RELIABILTY ENGINEERING**

(**Professional Elective-II)**

**CODE:6B735**

**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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| **COs** | Programme Outcomes | | | | | | | | | | | |
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| **2** | **H** |  | **M** |  |  |  |  |  |  |  | **L** |  |
| **3** | **H** |  | **M** |  |  |  |  |  |  |  | **L** |  |
| **4** | **H** |  | **M** |  |  |  |  |  |  |  | **L** |  |
| **5** | **H** |  | **M** |  |  |  |  |  |  |  | **L** |  |
| **6** | **H** |  | **M** |  |  |  |  |  |  |  | **L** |  |

**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**

**DESIGN OF MECHANISM**

(**Professional Elective-III)**

**L T P/D C**

**3 - - 3**

**Code:6B736 `**

**Course Objective:**

to provide basic approaches to synthesize planar mechanisms and simulate the kinematic parameters generated by planar mechanisms.

**Course Outcomes:**

1. The student will learn the basics of theoretical kinematics i.e., the geometry of motion and incorporating them in the design of mechanisms.
2. The student will learn the synthesis and analysis problems in mechanism design; and in specific, the type and number synthesis.
3. The focus here is on application of the synthesis techniques to mechanism design.
4. The student will focus on designing the mechanism for motion and / or function generation.
5. The techniques of dimensional synthesis are learnt here.
6. This unit lays the fundamentals for design of mechanisms for path generation purposes

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

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| 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-1**

**Planar Mechanisms and Geometry of Motion:** Definitions and basic concepts, Classification of links, Classification of pairs, Mechanism and machine, Inversions, Grashoff’s law, Transmission of torque and force in mechanisms, Mobility, Degree of freedom permitted by joints other than turning and sliding, Equivalent mechanisms, Unique mechanisms.

**UNIT-2**

**Number Synthesis:** Effect of even or odd number of links on degree of freedom, Minimum number of binary links in a mechanism, Minimum possible number of turning pairs, Enumeration of kinematic chain, Degree of freedom of special mechanisms.

**UNIT-3**

**Synthesis of Linkages:** Type, Number and dimensional synthesis, Function generation, Path generation and body guidance, Precision positions,Structural error, Chebychev spacing, Two position synthesis of slider crank mechanisms, Crank-rocker mechanisms with optimum transmission angle.

**UNIT-4**

**Motion Generation:** Poles and relative poles, Relative poles of 4-bar mechanism, Relative poles of slider crank mechanism.

**UNIT-5**

**Graphical Methods of Dimensional Synthesis:** Two position synthesis of crank and rocker mechanisms, Three position synthesis, Four position synthesis (point position reduction), Overlay method.

**Analytical Methods of Dimensional Synthesis:** Freudenstein’s equation for 4-bar mechanism and slider crank mechanism, Examples, Bloch’s method of synthesis.

**UNIT-6**

**Coupler Curves:** Equation of coupler curves, Synthesis for path generation,Graphical synthesis for path generation, Robert-Chebyshev theorem (cognate linkages), Coupler curves from 5-bar mechanisms, Examples.

**Cams:** Introduction, Pressure angle, Parameters affecting pressure angle,Effect of offset follower motion, Radius of curvature and undercutting, Cams with specified contours.

**TEXT BOOKS:**

1. **“Theory of Machines and Mechanisms",** J.J. Uicker, , G.R.Pennock, J.E. Shigley. OXFORD 3rd Ed.

2. **'Mechanism and Machine Theory'**, A.G. Ambekar, PHI, 2007

**REFERENCE BOOKS:**

1. **'Kinematics, Dynamics and Design of Machinery'**, K. J. Waldron,G. L. Kinzel, Wiley India, 2007.

2. **‘Advanced Mechanism Design’**, Erdman Sandoor, Vol-l PHI,2006,

3. **“Kinematics and Dynamics of Machinery**” H.H. Mabie, F.W.Ocvirk, John Wiley and Sons, New York, 3rd Ed.

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

**Mechanical Engineering**

**RENEWABLE ENERGY SYSTEMS**

**(Professional Elective-III)**

**Code:6B737**

**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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| **COs** | **Programme Outcomes** | | | | | | | | | | | |
| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
| **1** | **M** | **H** |  |  |  |  | **L** |  |  |  |  |  |
| **2** | **M** | **H** |  |  |  |  | **L** |  |  |  |  |  |
| **3** | **M** | **H** |  |  |  |  | **L** |  |  |  |  |  |
| **4** | **M** | **H** |  |  |  |  | **L** |  |  |  |  |  |
| **5** | **M** | **H** |  |  |  |  | **L** |  |  |  |  |  |
| **6** | **M** | **H** |  |  |  |  | **L** |  |  |  |  |  |

**Unit-01:**

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**

**DESIGN OF PRESS TOOLS and TOOL DESIGN**

**(Professional Elective-III)**

**L T P C**

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

Code:6B738

**Course Objective:**

aimed at providing a learning platform for engineers wherein they can learn Tool Design supported by theory and laboratory courses offered under this programme. The subjects of study are designed in such a way that an aspirant can be an expert in Jigs & Fixture Design, Press Tool Design, Injection Mould Design and Die Casting die Design. Candidates are also given extensive training in CAD and Analysis Software.

**Course Outcomes:**

At the end of successful completion of this programme, candidates will be capable of a)Designing Jigs & Fixtures and Press Tools

b) Designing Injection Moulding Dies and Die Casting Dies

c) Using software efficiently for Tool Design and analysis.

d) Working collaboratively in a team for Tool Design.

***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** |  |  |  |  |  |  |  |  |
| 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: Presses and Press Working:**

Classification of Mechanical, Hydraulic, and pneumatic presses Press Characteristics, safety devices in presses. Principles of stretch forming machines, principles of feeding and unloading equipment. Design principles of presses.

**Unit-II : Design of Dies**:

Introduction, terminology, shearing dies- types of dies - analysis process shearing clearance - size and tolerances of die opening and punch - force, power, energy in shearing -loading center, shearing with inclined edges - strip layouts, economical stock - Utilization.

**Unit-III : Theory of Shearing and Various Types of dies:**

Theory of shearing ,Dies andPunches Compound dies, progressive dies, stock feeding devices - earn actuated die, horn dies (type, sub-press dies)- precision shearing dies, shaving dies, lamination dies- Bending dies, theory of bending development of blank, spring back, curling, flanging and press brake dies, bending on press brake.

**Unit-IV : Split dies and various types of press tool components**

Split dies, rules of development for split dies, inserts, types of punches, punch holders, punches - strippers - calculation of springs and rubber ejector, shedders, stops - pilots - stock guides - alignment system design for press tools.

**Unit-V :**

Theory of drawing, Draw Dies, Various types of draw-dies. Deep drawing dies andshallow drawing dies. Rectangular draw dies. Trimming dies. Defects in deep drawing blank development, strain factor, calculation of force, Ironing (application of rubber and hydraulic system) –

**Unit-VI :**

Application of CAD/CAM soft-ware in designing of die-casting dies. Plastic moulds and press tools

**TEXT BOOKS:**

1. *Fundamentals of tool Design-* ASTME, Prentice Hall, New Delhi, 1987

2. Heinrich Makelt, *Mechanical Presses,* Edward Arnold, London, 1968

**REFERENCE BOOKS**:

1. Geoffrey Rowe W., An *Introduction to the Principles of Metal Working,* Edward Arnold, 1977.

2. Sheet metal working Read and Eary, *Mechanical Processing in Materials,* 1967.

3. *Die design Hand book* - Wilson, Mc Graw Hills, New York, 1965.

4. Eary and Redds, *Shear Working of Metals,* Prentice Hall, New Delhi, 1969.

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

**Mechanical Engineering**

**NANO BIO-MATERIALS**

**(Professional Elective-III)**

**L T P/D C**

**3 - - 3**

**CODE:6B739**

**Course Objective:**

After synthesis of nanomaterial’s, the analysis of various nano bio materials and different properties is essential.

**Course Outcomes:**

1. In this subject we included compositional and structural characterization for better understanding of structural parameters and crystal structures.
2. Along with these techniques, we also included different spectroscopy techniques and different properties such as electrical, magnetically, and dielectrically measurement techniques.
3. So that to analyse the various properties of different materials.
4. Therefore these characterization techniques will help the students to understand the structure property correlations and to apply in various techniques.

***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:** Biological building blocks: Sizes of building blocks and Nanostructures, Polypeptide nanowire and protein nanoparticles

**Unit-II:**  Nucleic Acids – DNA Double Nano wire, Genetic code and protein synthesis

**Unit-III:** Biological Nanostructures: Bio-mimicry with examples, Bio compatible Bio sensors, Examples of proteins, vesicles, bilayers, and Multilayer films, application of bio- nanotechnology: bio nano machines, molecular modeling.

**Unit-IV:** Applications to NEMS and Nano devices: Nano bio-sensors and biomedical applications involving drug delivery using implantable drug delivery devices with the emphasis on Biochips and nanoencapsulation

**Unit-V:** organic semiconductors, biological neurons and their functions, modeling of neuron cells by VLSI circuits, bio-chemical and quantum mechanical computers: DNA computers, parallel processing, Bit and ‘Q’ bit, Quantum parallelism

**Unit-VI:** Nanoscale processes in the environment, Nano technology for Immune system, clinical imaging, nano robots, Nano Fibres for Tissue Engineering

**Text books:**

1. Bio Nano Technology by Good Sell, Wiley Liss
2. Introduction to Nanotechnology by Charles. P.Poole Jr and Frank J. Owens, Wiley India Pvt Ltd.
3. Nano Technology, A gentle introduction to the next big idea by Mark Ranter and Daniel Ranter, Pearson education
4. Nanotechnology – science, innovation and opportunity by Lynn E Foster, Prentice Hall - Pearson education
5. “Soft Nanoparticles for Biomedical Applications” Royal Society of Chemistry, 2014 edited by Joan Estelrich etc.,

**Reference books:**

1. Encyclopedia of Nanotechnology by H.S.Nalwa

2. Encyclopaedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy (Vol I to

X), Campus books.

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

**Mechanical Engineering**

**MECHATRONICS**

**(Professional Elective-III)**

**CODE :6B740**

**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:***

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|  | 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.

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

**Mechanical Engineering**

**INTELLECTUAL PROPERTY RIGHTS**

**CODE :6GC49**

**L T P/D C**

**1 1 - 1**

**Course Objective:**

**This course is intended to impart awareness on intellectual property rights and various regulatory issues related to IPR**

**Course Outcomes:**

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| **CO:1** | Demonstrate a breadth of knowledge in Intellectual property |
| **CO:2** | Overview of Patents, Searching ,filling and drafting of Patents |
| **CO:3** | Overview of copyright & GI . |
| **CO:4** | Overview of Trade Mark & Trade Secret, |
| **CO:5** | Overview of Integrated Circuit and Industrial Design. |
| **CO:6** | Knowledge about different national and international : Conventions and Treaties Governing the IPRs |

***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: Introduction to IPR:** Discovery, Invention, Creativity, Innovation, History & Significance of IPR, Overview of IPR -Patent, Copyright, Trade Mark, Trade Secret , GI, Industrial Design & Integrated Circuit, Non-patentable criteria

**Unit II: Patents**: Patents- Patentability Criteria, Types of Patents-Process, Product & Utility Models, Software Patenting and protection, Patent infringement- Case studies- Apple Vs Samsung, Enfish LLC Vs Microsoft, Overview of Patent search-Types of Searching, Public & Private Searching Databases, Basics of Patent Filing & Drafting, Indian Patents Law

**Unit III: Copyrights and Geographical Indications:** Types of Copyrights, Procedure for filing, copyright infringement, Copyright Law, Geographical Indications -Tirupati Laddu , Darjeeling Tea, Basmati rice

**Unit IV: Trademark and Trade secrets:** Trade Marks –Commercial importance, protection, registration, Case Studies- Sabena and Subena, Castrol Vs Pentagon, Trade Secrets- Case Studies-Kentucky Fried Chicken (KFC), Coca-Cola

**Unit V: Protection of Industrial Designs & Integrated Circuits:** Industrial Designs – Scope, protection, filing, infringement; Integrated Circuits & Layout design, Semiconductors, Unfair competition, Designs Act.

**Unit VI: International Conventions & Treaties:** Overview of WTO, GATT, TRIPS, WIPO, Berne Convention, Rome convention, Paris Convention, Patent Cooperation Treaty (PCT), Madrid Protocol, Budapest Treaty, Hague agreement

**Text Book:**

1. Deborah E. Bouchoux, Intellectual Property for Paralegals – The law of Trademarks, Copyrights, Patents & Trade secrets, 3rd Edition, Cengage learning, 2012
2. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property, Eastern Book Company, Lucknow, 2009.

**References**

1. M. M. S. Karki , Intellectual Property Rights: Basic Concepts, Atlantic Publishers, 2009
2. Neeraj Pandey & Khushdeep Dharni, Intellectual Property Rights, Phi Learning Pvt. Ltd
3. Ajit Parulekar and Sarita D’ Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006.
4. B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
5. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

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

**Mechanical Engineering**

**Code: 6ZC03 MANAGEMENT SCIENCE**

**L T P C**

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

**Course Objective:** The course is aimed at giving the basics of management, its principles, practices and latest concepts for increasing the performance of engineering graduates in their respective fields.

**Course Outcomes:**

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

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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**

**INTRODUCTION TO MANAGEMENT:** Management- Definitions, Fayol’s principles of Management, Levels of Management, functions of management. Planning: types of planning, planning process; Organizing: Organizational Design and structure, staffing; Directing; Maslow’s Motivational theory, Leadership styles, Controlling: Basic control process.

**UNIT II**

**INTRODUCTION TO OPERATIONS MANAGEMENT:** Plant Location, plant layout, types of production, Work Study, Method study and Work Measurement, Basic Procedures Project Management: Network Analysis - Programme Evaluation and Review Techniques, Critical Path Method, Crashing of Simple Networks.

**UNIT III**

**MATERIALS MANAGEMENT**: Objectives of Materials, Need for Inventory Control, Economic Order Quantity, ABC Analysis, Inventory Control Systems, Just In Time, Introduction to LSCM, Quality Control Techniques– Inspection, ISO standards, Six Sigma.

**UNIT IV**

**(i) Human Resources Management**: Objectives of HRM, Challenges of HRM, HR Planning process HR functions and policies – Recruitment, Selection, Training and Development, Performance Appraisal, Balanced Score Card**.**

**(ii) Marketing Management**: Concept of Marketing, Functions, Marketing Mix, Product Life Cycle, Marketing Strategies, Channels of Distribution, Differences between products and services.

**UNIT V**

**INTRODUCTION TO ORGANIZATIONAL BEHAVIOR:** Definition, Nature and Scope, Perception – Perceptual selectivity and organization, Personality and Attitudes, Determinants of personality Formation of Attitudes-**,** Perceptual Distortions Attribution analysis Attribution theories, Johari Window and Transactional Analysis.

**UNIT VI**

**STRATEGIC MANAGEMENT:** Concepts in Strategic Management, Vision, Mission, Objectives, SWOT Analysis, Concept of Strategic Planning, Competitive Advantage, Concept of Core Competence; An overview, Process and its Implementation, Target Setting, Types of strategies, strategy formulation; Implementation.

**Essential Reading:**

* A R Aryasri: Management Science, Tata Mc Graw Hill

**Suggested Readings:**

* Dr. Y. Satyanarayana: Management control systems in competitive environment,
* Koontz and Weihrich: Essentials of Management, 6/e, TMH, 2005
* Kotler Philip and Keller Kevin Lane: Market Management 12/e, PHI, 2005
* 5 Strategic Management, Text and Cases, VSP Rao, V Hari Krishna
* Thomas N Duening and John M. Ivancevich Management – Principles and Guidelines

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

**Mechanical Engineering**

**Code: 6B786**  **PROJECT Phase-I**

**L T P/D C**

* **1 3 3**

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

A pre-project seminar in fourth year first semester will be evaluated for 50 marks as follows. This is aimed at the students to identify a project on which they are likely to continue for their project in final year second semester.

Preliminary Report on progress of the work 10 marks

Mid Semester presentation 10 marks

Final report 10 marks

Final Presentation and Defense before a departmental

Committee consisting of head, a senior faculty and supervisor 20 marks

There shall be no external evaluation in pre-project seminar.

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

**Mechanical Engineering**

**Code 6B787 INDUSTRY - ORIENTED MINI PROJECT**

**L T P/D C**

**- - - 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:***

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

After completing the subject, students will be able to:

Students use the concepts learned in the courses, so far, in conceptualizing, designing and executing the projects.

Enables to apply modern IT tools and technologies

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

There shall be an industry-oriented mini-Project in their specialization that may be carried out in collaboration with an industry / R and B organization / Academic Institution, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated during IV year I Semester. The industry oriented mini project shall be evaluated for a total of 100 marks with 25 marks for internal assessment and 75 marks for end examination. The mini project must be submitted in report form and should be presented before a committee, consisting of an external examiner, head of the department, a senior faculty member of the department and supervisor of the mini project.

**The pattern of internal evaluation** is as follows:

Work in progress as evaluated by internal guide : 5 marks

Work in progress as evaluated by External guide : 5 marks

Report : 5 marks

Seminar presentation and defense of project : 10 marks

If the mini project is conducted within the college, the work in progress is evaluated by the supervisor for 25 marks.

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

**Mechanical Engineering**

**Code: 6B788**  **METROLOGY LAB**

**L T P/D C**

**- - 3/2 2**

**Course Objective:**

To the undergraduate students through a series of experiments. The CO are given below:   
Identify and classify different measuring tools related to experiments  
Identify, define, and explain accuracy, precision, and some additional terminology  
Conduct, Analyse, interpret, and present measurement data from measurements experiments  
Identify sources of variability, error, and uncertainties  
Demonstrate excellent laboratory skills and techniques including the proper use of relevant instruments and related technology  
Enhance the ability to apply knowledge of mathematics, statics, physics and engineering sciences

**Course Outcomes:**

1. The student shall be measuring the various parameters like length, height, angle, displacement, flatness etc., by using various instruments like vernier calipers, micrometer, dial indicator, etc.
2. The student shall be able to measure the threads, gear tooth profiles and surface roughness using appropriate instruments and analyze the data.
3. The student shall be able to recognize various types of governors and gyroscopes, and improve their performance as per requirement.
4. The student shall be able to determine the balancing forces, inertial forces of rotating and reciprocating components in real life problems.
5. The student shall be able to check alignment of various components in various mechanisms using advanced scientific tools.

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

**Note:** Minimum 5 experiments to be conducted from each section

**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.

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

**Mechanical Engineering**

**INSTRUMENTATION LAB**

**Code: 6B789**

**L T P/D C**

**- - 3/2 2**

**Course Objective:**

The course focuses on all principles, working, advantages, disadvantages and applications of various measuring instruments.

**Course Outcomes:**

1. Understand the basic principles and performance characteristics of measurement.
2. Apply the working principles and identify the measurands for displacement.
3. Understand the temperature and importance of maintaining in various applications.
4. Visualize the areas affected with pressure in equipment and calibrate the pressure measuring devices.
5. Comprehend the level of liquid in any container and the various applications of measurement of flow.
6. Evaluate the measurement of speed in engineering applications and importance of speed measurement in instrumentation

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

**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.

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

**Mechanical Engineering**

**PRODUCTION DRAWING PRACTICES**

**Code:6B790**

**L T P/D C**

**--- 1 4 2**

**Course Objective:**

PDP (Production Drawing Practice) provides a convenient means to create designs for almost every engineering discipline. Computer Aided Design software can be used for the component drawings and explaining clearly the tolerances, surface roughness‘s etc

**Course Outcomes:**

1. Draw the conventional representation of different materials used in engineering practice like wood, glass, metal etc., and the limits and tolerances.
2. Understandand indication of form and position tolerances on drawings, types of runout, total runout and their indication.
3. Improve visualization ability of surface roughness and its indications with respect to the material surface.
4. Applythe drawing techniques to draw various part drawings and assembly, indicate tolerances, roughness 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 |  |  |  |  |  |  |  |  |  |  |

**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**

**Code: 6B797 TECHNICAL PAPER WRITING and SEMINAR-I**

**L T P/D C**

--- --- 2 1

The evaluation is purely internal and will be conducted as follows:

**Course Objectives:**

UG students with exposure to a variety of on-going technical advances, projects and activities in order to enrich their academic experience. An opportunity for UG students to develop skills in presentation and discussion of technical topics in a public forum.

**Course Outcomes:**

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

1.Identify and compare technical and practical issues related to the area of course specialization.

2.Outline annotated bibliography of research demonstrating scholarly skills.

3.Prepare a well organized report employing elements of technical writing and critical thinking.

4.Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting

***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 |  |  |  |  |  |  |  |

**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 |
| Punctuality/Attendance | 10 marks |
| Quality of content | 20 marks |
| Presentation with PPT | 20 marks |
| Discussion & Involvement | 20 marks |
| Final report and viva | 15 marks |
| Total | 100 Marks |

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

**Mechanical Engineering**

**FRACTURE MECHANICS**

**(Professional Elective-IV)**

**Code:5B841**

**L T P C**

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

**Course Objectives:**

1.Students learn linear and nonlinear fracture mechanics principles and their applications to structural design.

2. students describe Fracture phenomena in metals and nonmetals will be discussed and testing methods will be highlighted.

**Course Outcomes:**

On completion of the course the student should be able to:

1.Predict material failure for any combination of applied stresses.

2. Estimate failure conditions of a structure with Grifth analysis

3. Determine failure prediction factor for simple components of simple geometry

4.Predict the likelihood of failure of a structure containing a defect

5.learn methodology of failure condition of material under fatigue condition

6.demonstrate creep deformations in metals

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

**UNIT-I**

Introduction: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behaviour. Fracture in brittle and ductile materials – characteristics of fracture surfaces; intergranular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, The ductile/brittle fracture transition temperature for notched and unnotched components. Fracture at elevated temperature.

**UNIT-II**

Griffiths analysis: Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves.

**UNIT-III**

Linear Elastic Fracture Mechanics, (LEFM). Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor. The effect of Constraint, definition of plane stress and plane strain and the effect of component thickness. The plasticity at the crack tip and the principles behind the approximate derivation of plastic zone shape and size. Limits on the applicability of LEFM.

**UNIT-IV**

Elastic-Plastic Fracture Mechanics; (EPFM). The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

The effect of Microstructure on fracture mechanism and path, cleavage and ductile failure, factors improving toughness,

**UNIT-V**

Fatigue: definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodmans rule and Miners rule. Micromechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction

**UNIT-VI**

Creep deformation: the evolution of creep damage, primary, secondary and tertiary creep. Micromechanisms of creep in materials and the role of diffusion. Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters. Creep-fatigue interactions. Examples.

**TEXT BOOKS:**

1. T.L. Anderson, Fracture Mechanics Fundamentals and Applications, 2nd Ed. CRC press, (1995)

2. B. Lawn, Fracture of Brittle Solids, Cambridge Solid State Science Series 2nd ed1993.

3. J.F. Knott, Fundamentals of Fracture Mechanics, Butterworths (1973)

4. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials.

5. H.L.Ewald and R.J.H. Wanhill Fracture Mechanics, Edward Arnold, (1984).

6. S. Suresh, Fatigue of Materials, Cambridge University Press, (1998)

7. L.B. Freund and S. Suresh, Thin Film Materials Cambridge University Press,(2003).

8. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, (1988)

9. D.C. Stouffer and L.T. Dame, Inelastic Deformation of Metals, Wiley (1996)

10. F.R.N. Nabarro, H.L. deVilliers, The Physics of Creep, Taylor and Francis, (1995)

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

**Mechanical Engineering**

**Code: 6B842 POWER PLANT ENGINEERING**

**(Professional Elective-IV)**

**L T P/D 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 nonconventionalmethods, factors affecting the site selection for a power plant and concept of base load plantand 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 | H |  | H |  | H |  |  |  |  |  | M |  |
| CO2 | H |  | H |  | H |  |  |  |  | M |  |  |
| CO3 | H |  | H |  | H |  |  |  |  |  |  |  |
| CO4 | H |  | H |  | H |  |  |  |  |  |  |  |
| CO5 | H |  | H |  | H |  |  |  |  |  |  |  |
| CO6 |  |  |  |  |  |  |  |  |  |  |  | L |

**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 II semester**

**Mechanical Engineering**

**AUTOMATION and ROBOTICS**

**(Professional Elective-IV)**

**Code: 6BC43**

**L T P/D C**

**3 - - 3**

**Course Objective:**

Course covers fundamentals of robot working, programming and integration in a manufacturing process. It starts with examples of robotics idea over history and continue with a numerous of examples in nowadays robot applications on different areas of human activities. Topics to be covered include robot mechanical, power, measuring and control system, robot kinematics, dynamic, control and programming. Special chapter of mobile robots will cover mobile robot kinematics, path planning and control. Overview of nowadays research in robotics and view of the robotics impact in human future.

**Course Outcomes:**

After completing the subject, students will be able to:

* Understand a production system, principles of automobile
* understand the methods of work part transfer mechanical buffer storage control functions
* understand the implementation of automated flow lines
* know the analysis and design of material handling systems, automated guided vehicle system
* understand adaptive control systems and Applications.
* understanding the business process Engineering. Concept of concurrent Engineering, techniques of rapid prototype.

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

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

**UNIT – I**

Introduction: Production system, Automated manufacturing systems, Reasons, Principles and strategies of automation, Basic elements of automated system, pneumatic and hydraulic circuit components, Assembly system and line balancing: Manual Assembly process, and work transport systems, Line pacing, Analysis of manual assembly lines, line balancing methods-problems, ways of improving line balance

lines.

**UNIT – II**

Analysis of Automated flow lines: System configuration, Workpart transfer, General terminology and analysis of transfer lines without and with buffer storage.

Automated Assembly systems: Fundamentals and Design of assembly systems.

**UNIT – III**

Automated material handling: Principles, Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems-technology, Analysis of material transport systems.

Automated storage systems: Basic terminology, AS/RS; Carousel storage, work in process storage,

**UNIT – IV**

Adaptive control systems: Introduction, Adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, Temperature, vibration and acoustic emission. Concept of Concurrent Engineering, MRP,MRP II, Techniques of Rapid Proto typing.

**Unit – V**: **Robotics**:

Classification and structure of Robotic systems, structure of continuous path robot systems, drives and control systems, control approaches for robots.

**Unit – VII**

Robot arm kinematics, the direct kinematics problem and inverse kinematic solutions, planning of manipulator trajectories, robot sensors, range sensors, proximity sensors, touch sensors, force and torque sensors, programming, manual teaching, lead through teaching, programming languages, storing and operating task programmes, robot selection and application.

**TEXT BOOK:**

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover./PE/PHI

2. Mittal and Nagrath, ‘Robotics and Control’, Tata Mc Graw Hill.

**REFERENCES:**

1. Computer control of Manufacturing Systems by Yoram Coreom.

2. CAD / CAM/ CIM by Radhakrishnan.

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

**Mechanical Engineering**

**NANOCOMPOSITES**

**(Professional Elective-IV)**

**L T P/D C**

**3 - 0 3**

**CODE:6B844**

**Course Objective:**

After synthesis of nanomaterial’s, the analysis of various nano bio materials and different properties is essential.

**Course Outcomes:**

1. Learn uses of Composites
2. understand the Nano Composites Applications
3. Demonstrates the carbon nano tubes
4. Learn method to produce Nano Bi composites and coatings
5. Learn Synthesizes methods
6. Apply various characterization techniques on composites

***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 to composites

**Unit-II:** Introduction to nanocomposites

**Unit-III:** Ceramic-Metal Nanocomposites, Ceramic based nanoporous composite, metal matrix nanocomposites, Polymer-based nanocomposites Carbon nanotube based nanocomposites

**Unit-IV:** Natural nanobiocomposites, Biomimetic nanocomposites and biologically inspired nanocomposites; Nano composites for hard coatings; DLC coatings; thin film nanocomposites; Modeling of nanocomposites

**Unit-V:** Synthesis methods for various nanocomposite materials: sputtering, mechanical alloying, sol-gel synthesis, thermal sprays synthesis etc.

**Unit-VI:** Processing of polymer nanocomposites, properties of nanocomposites, Salt infiltration, Powder mixing, Intrusion method, Exfoliation and interaction, Gel-casting impregnation techniques: Hot melt impregnation, solution impregnation.

**Text books:**

1. Nanocomposite Science and Technology by P.M. Ajayan, L.S. Schadler and P.V. Braun, Wiley-VCH GmbH Co.
2. Introduction to Nano Technology by Charles. P.Poole Jr and Frank J. Owens; Wiley India Pvt Ltd.
3. Nanotechnology, A gentle introduction to the next big idea by Mark Ranter, Danie Ranter Pearson education
4. “Polymer Nanocomposites processing, characterization and applications” by Joseph H. Koo, McGrawhill Publishers, 2006.

**Reference books:**

1. Encyclopedia of Nanotechnology by H.S.Nalwa
2. Encyclopaedia of Nano Technology by M.Balakrishna rao and K.Krishna Reddy, Vol I to X Campus books.

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

**Mechanical Engineering**

**SIMULATION AND MODELING OF MANUFACTURING SYSTEMS**

**(Professional Elective-IV)**

**CODE :6B845**

**L T P/D C**

**3 - 0 3**

**Course Objectives:**

to impart skills to Model manufacturing systems using simulation software and interpret experimental simulation results to evaluate system design alternatives.

**Course outcomes:**

Successful completion of this course will enable the students to:

1. Explain various simulation models and steps involved in simulation.

2. Evaluate manufacturing system designs based on key performance measures.

3. Design manufacturing simulation models using a common simulation software.

4. Apply mathematical models in buliding manufacturing simulation models.

5. Learn simulation softwares and implement on new or improved manufacturing systems.

6. Apply simulation modeling to an industrial problem, utilizing experimental design techniques.

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

**UNIT - I:**

System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages and Disadvantages.

**UNIT-II**

Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1 & 2 errors – Framing – Strang law of large numbers.

**UNIT - III:**

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

**UNIT - IV:**

Generation of random variants – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – Weibull – normal Bernoullie – Binomial – uniform – Poisson.

**UNIT-V**

Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.QUEST, WITNESS, PROMODEL and AUTOMOD

**UNIT - VI :**

Output data analysis – Types of Simulation with respect to output data analysis – warm up period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

**TEXT BOOKS:**

1. Simulation Modelling and Analysis, Law, A.M.& Kelton , McGraw Hill, 2nd Edition, New York, 1991.

2. Discrete Event System Simulation, Banks J. & Carson J.S., PH , Englewood Cliffs, NJ, 1984. 3. Simulation of Manufacturing Systems, Carrie A. , Wiley, NY, 1990.

4. A Course in Simulation, Ross, S.M., McMillan, NY, 1990.

5. Simulation Modelling and SIMNET , Taha H.A. , PH, Englewood Cliffs, NJ, 1987

6. Performance modeling and analysis of manufacturing systems,Viswanatham & Narahari,PHI

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

**Mechanical Engineering**

**DESIGN OPTIMIZATION**

**(Professional Elective-V)**

**Code:6B846**

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| **L T P/D C**  **3 -- --- 3**  **Course Objective:**  **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 Out Comes :** |
| After completing the course, the students will learn: |
| 1. Basics of optimization, considerations relevant to mechanical / structural systems |
| 1. Concepts and methods for single-variable unconstrained and constrained optimisation |
| 1. Concepts and methods for multi-variable unconstrained and constrained optimization |
| 1. Techniques for nonlinear optimization 2. Advanced optimization techniques 3. Optimisation of complex mechanical elements |
|  |
| Mapping of Course Outcomes with Program Outcomes:   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | P0a | 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**

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: 6B847**

**L T P/D 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:6B848**

**L T P/D 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 difference method to solve heat transfer problems
* know application of finite difference method and fundamentals of fluid flow modeling
* right fluid flow governing equations, momentum and energy equations apply to fluid flow problems
* gain knowledge about finite volume method to solve fluid flow problems

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

**UNIT-I**

**Elementary details in numerical Techniques:** Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences.

**UNIT – II**

**Applied Numerical Methods**: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

**UNIT - III**

**Finite Difference Applications in Heat conduction and Convention** – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

**UNIT - IV**

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling:

Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

**UNIT - V**

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton’s second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.

**UNIT -VI**

**Finite Volume Method:** Approximation of surface integrals, volume integrals, interpolation and differentiation practices, Upwind interpolation, Linear interpolation and Quadratic interpolation.

**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**

**MECHANICS AND MANUFACTURING METHODS OF COMPOSITE MATERIALS**

**(Professional Elective-V)**

**L T P/D C**

**Code: 6B849 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.

***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**

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**

**FLEXIBLE MANUFACTURING SYSTEMS & MACHINE VISION**

(Professional Elective-V)

**CODE: 6B850 L T P/D 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 computors 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 | H |  |  |  |  | M |  |  |  |  | L |
| CO2 | H | H |  |  |  |  | M |  |  |  | L | L |
| CO3 | H | H |  |  |  |  |  |  |  |  |  | L |
| CO4 | H | H |  |  |  |  |  |  |  |  |  | L |
| CO5 | H | M |  |  |  | M |  |  |  |  |  | L |
| CO6 | M | M |  |  | H | M |  |  |  |  |  |  |

**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**

**Code: 6B868 PROJECT Phase-II**

**L T P/D C**

**- - 20 12**

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

Out of total 200 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 pattern of Internal Evaluation is as follows:**

**Division of marks for internal assessment – 30 marks**

* Progress of Project work and the corresponding interim report   
  as evaluated by internal guides at the end of 5 weeks : 05 Marks
* Seminar at the end of 5 weeks : 05 Marks
* Progress of Project work as evaluated by guides  
  at the end of 10 weeks : 05 Marks
* Project Report : 05 Marks
* Final presentation and defense of the project : 05 Marks

If the project is conducted internally the marks supposed to be given by external guide will be given by internal guide himself.

**Division of Marks for External Evaluation – 150 Marks**

**Pattern of External Evaluation for Project**

* Final Project Report : 10 Marks
* Presentation : 15 Marks
* Demonstration / Defense of Project : 50 Marks

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

**Mechanical Engineering**

Code: 6B869 **COMPREHENSIVE VIVA-VOCE-III**

**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** | |

There shall be a Comprehensive Viva-Voce in IV year II Semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of an external examiner, Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students’ understanding in various subjects he/she studied during the B.Tech. course of study up to IV Year. The Comprehensive Viva-Voce is valued for by the Committee.

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

**Mechanical Engineering**

**Code: 6B898 TECHNICAL PAPER WRITING AND SEMINAR-II**

**L T P/D C**

**- - 2 1**

**Course Objectives:**

UG students with exposure to a variety of on-going technical advances, projects and activities in order to enrich their academic experience. An opportunity for UG students to develop skills in presentation and discussion of technical topics in a public forum.

**Course Outcomes:**

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

1.Identify and compare technical and practical issues related to the area of course specialization.

2.Outline annotated bibliography of research demonstrating scholarly skills.

3.Prepare a well organized report employing elements of technical writing and critical thinking.

4.Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting

***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 |  |  |  |  |  |  |  |

**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 |
| Punctuality/Attendance | 10 marks |
| Quality of content | 20 marks |
| Presentation with PPT | 20 marks |
| Discussion & Involvement | 20 marks |
| Final report and viva | 15 marks |
| Total | 100 Marks |