**ACADEMIC REGULATIONS**

**COURSE STRUCTURE**

**AND**

**detailed syllabus**

for

**M.Tech Two Year Degree Course**

**(A-19)**

in

**CAD/CAM**

(Applicable for the batches admitted from2019-2020)



**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, MalkajigiriMedchal District -501 301.

**January, 2019**

**VISION**

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

**MISSION**

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 EDUCATIONAL OBJECTIVES (PEOs) OF M.Tech. CAD/CAM PROGRAMME:**

**PEO-I:** To empower the students by providing necessary knowledge base, critical thinking and problem solving capabilities in the field of Computer Aided Design & Computer Aided Manufacturing (CAD/CAM) and allied fields so that they can excel in their profession, in industry, higher studies and Research & Development**.**

**PEO-II:** To develop core competencies in the field of CAD/CAM, so as to conduct experiments, comprehend, analyze, design and use appropriate techniques and tools to provide optimal solutions for the industry related problems

**PEO-III:** To inculcate the responsibility to the society at large by sensitizing regulatory and Intellectual Property related issues along with communication skills and to promote entrepreneurship with sufficient knowledge of project/ finance management techniques for ensuring their career success**.**

**PEO-IV:** To motivate the students not only to be excellent in academics, professional ethics, team work, leadership skills but also to be life long learners in upcoming technologies for successful professional career

**PROGRAMME OUTCOMES (POs) OF M Tech CAD/CAM PROGRAMME:**

|  |  |
| --- | --- |
| **POST GRADUATE ATTRIBUTES(GA)** | **PROGRAMME OUTCOMES(PO)** |
| **1:Scholarship of Knowledge**  Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge | **1.** Post graduates will demonstrate their ability to acquire the state of the art knowledge and to expand frontiers in the field of CAD/CAM Engineering. |
| **2.Critical Thinking**  Analyse complex engineering problems critically, apply independent judgement for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context. | **2.** Post graduates will demonstrate their abilities to analyze and evaluate complex engineering problems to make intellectual in CAD.CAM Engineering. |
| **3.Problem Solving**  Think laterally and originally, conceptualise and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise. | **3.** Post graduates will demonstrate theability of problem solving skills to find optimal solutions in the area of CAD /CAM Technologies including the considerations of public health, safety, cultural society and environmental problems. |
| **4.Research skill**  Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/ in group(s) to the development of scientific/technological knowledge in one or more domains of engineering. | **4.** Post graduates will demonstrate the ability to carry out literature survey, design, conduct of experiments and to analyze the results using appropriate research methodologies. They should also contribute scientific knowledge in in CAD/ CAM areas either individually or in groups. |
| **5.Usage of Modern tools**  Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations. | **5.** Post graduates will demonstrate the ability to develop and use of appropriate techniques and tools for prediction and modeling of various engineering systems. |
| **6.Collaborative and multidisciplinary work**  Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others | **6.** Post graduates demonstrate ability to collaborate and engage in multidisciplinary tasks in scientific research. |
| **7.Project Management and finance**  Demonstrate knowledge and understanding of engineering and management principles and apply the same to one’s own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors. | **7.** Post graduates demonstrate ability to manage projects efficiently including considerations of economical and financial factors. |
| **8.Communication**  Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions. | **8.** Post graduates demonstrate ability in both oral and written communications. |
| **9.Lifelong learning**  Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously | **9.** Post graduates demonstrate ability to learn latest developments independently and continuously developments in the field of CAD/CAM Technology. |
| **10.Ethical Practises and Social responsibility**  Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainability development of society. | **10.** Post graduates shall acquire professional ethics and intellectual integrity in the consideration of impact of research outcomes for sustainable development of the society. |
| **11.Independent and reflective Learning**  Observe and examine critically the outcomes of ones action and make corrective measures subsequently, and learn from mistakes without depending on external feedback | **11.** Post graduates shall learn from their mistakes and make corrective measures results on their own. |

**Academic Regulations for M. Tech / MBA courses**

**SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(An Autonomous Institution)**

**Under**

**Jawaharlal Nehru Technological University Hyderabad**

**ACADEMIC REGULATIONS FOR M. Tech/MBA (Full-Time) PROGRAMS -2019 - 20 ( A -19)**

**(Effective for the students admitted into first year from the academic year 2019- 20 and onwards )**

**The following changes are made in the M.Tech / MBA program from the Academic Year 2019-20**

**Courses**

|  |  |  |
| --- | --- | --- |
| **Sl.**  **No.** | **Dept.** | **Existing M.Tech / MBA Course** |
| **1** | CSE | Computer Science |
| 2 | CSE | Computer Science and Engineering |
| 3 | EEE | Electrical Power Engineering |
| 4 | ECE | Digital Systems and Computer Electronics |
| 5 | ME | CAD/CAM |
| 6 | ME | Thermal Engineering |
| 7 | IT | Computer Networks and Information Security |
| 8 | MBA | Master of Business Administration |

**Existing pattern of internal evaluation and modifications proposed**

Internal Test

a. Part – A - Short answer questions – 5 (10 questions instead of 3)

b. Part – B -

(CIE) : 25 marks = (15 + 2 + 3 + 3 + 2)

It is observed that the students are not taking interest in writing the assignments and they are not concentrating in the subject. Hence, it is decided to conduct assignment test as Part-C in the examination question paper, so that the students will concentrate in the assignments.

The following procedure is proposed by the College Academic Committee in its meeting held on 25-7-2018.

Mid Examinations

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Pattern** | **Existing Marks** | **Proposed Marks** |
| Mid Test | **a)** Part – A – Short answer questions | 3 questions compulsory -  **5 marks** | 10 Questions compulsory  - **5 marks** |
| b) Part – B – Long answer questions | 3 questions out of 4 to be answered (at least one question from each unit) - **10 marks** | 2 questions out of 3 to be answered (at least one question from each unit) - **10 marks** |
| Assignment | a. Written assignment | Average of two assignments**- 5 marks** | Three questions from each unit – total of 9 questions in the assignment. This has to be submitted before the first mid test and before second mid. The average two assignments.  – **2 marks** |
| b. Assignment test along with mid test (Part-C). | **Not existing** | Question Paper will have 3 questions – One from each unit taken from assignment questions. Student has to answer 2 questions out of 3 **- 3 marks** |
| Class room participation | Attendance and attention in the class | **4 marks** | **3 marks** |
| Class notes | Verification of the class notes | **2 marks** | **2 marks** |
| Total | | **25 marks** | 1. **arks** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No** | **Particulars** | **Existing** | **Revised – As per model curriculum of AICTE** |
| 1 | Total Credits | 96 | 68 |
| 2 | Common subject for all branches | Research Methodology | Research Methodology and IPR |
| 3 | Labs | 2 ( 1 in each semester i.e I & II semesters ) | 4 ( 2 each in 1st and 2nd semesters) |
| 4 | Seminars | Literature review and Seminar – 1  (in semester – I ) | Technical Seminar |
| Comprehensive Viva voce – 1  (in semester – I ) | **\_** |
| Literature review and Seminar – II  (in semester – II ) | Mini Project with Seminars |
| Project Seminar (in semester – II ) |
| Comprehensive Viva Voce – II (in semester – II ) | Comprehensive Viva Voce in Semester - II |
| Project work and Review – I | Project Phase – I with  Seminars |
| Project work and Review – II | Project Phase – II with  Seminars |

**ACADEMIC REGULATIONS FOR M. Tech/MBA (Full-Time) PROGRAMS -2019 - 20 ( A -19)**

**(Effective for the students admitted into first year from the academic year 2019- 20 and onwards )**

**1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E & T)** Jawaharlal Nehru Technological University Hyderabad (JNTUH) offers **Two** Years (**Four** Semesters) full-time Master of Technology (M. Tech.) Degree programmes, under Choice Based Credit System (CBCS) at its affiliated colleges in different branches of Engineering and Technology with different specializations.

**2.0 ELIGIBILITY FOR ADMISSIONS**

**2.1** Admission to the PGPs shall be made subject to eligibility, qualification and specializations prescribed by the University from time to time, for each specialization under each M.Tech programme.

**2.2** Admission to the post graduate programme shall be made on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by Telangana State Government (PGECET) for M.Tech. programmes / an entrance test conducted by JNTUH/ on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

**2.3** The medium of instructions for all PG Programmes will be **ENGLISH** only.

**3.0 M.Tech. Programme (PGP in E & T) Structure**

**3.1** The M.Tech Programmes in E & T of JNTUH are of Semester pattern, with **Four** Semesters consisting of **Two** academic years, each academic year having **Two** Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.

**3.2** The student shall not take more than four academic years to fulfill all the academic requirements for the award of M.Tech. degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M.Tech. programme.

**3.3 UGC/AICTE** specified definitions/descriptions are adopted appropriately for various terms and abbreviations used in these PG academic regulations, as listed below:

**3.3.1 Semester Scheme**

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations. The terms

'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or ‘Design/Drawing Subject', or 'Seminar', or 'Comprehensive Viva', or ' Group Project', or “Industry oriented mini project ” or “Project” or ‘Technical Paper Writing’ as the case may be.

**3.3.2 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/ tutorials (T) (L) courses

 One credit for two hours/ week/semester for laboratory/ practical (P) courses Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations, and identified mandatory courses, if any, will not carry credits but they will be evaluated internally if they get grades accordingly as per the table below. If a candidate dosent pass the mandatory courses , he will not be awarded with degree.

|  |  |
| --- | --- |
| **% of marks secured in a mandatory course** | **Grade** |
| Greater than or equal to 90% | Outstanding |
| 80 and less than 90% | Excellent |
| 70 and less than 80% | Very good |
| 60 and less than 70% | Good |
| 50 and less than 60% | Above Average |
| Less than 50% | Fail |
| Absent | Ab |

**3.3.3** The student shall register for all 68 credits and secure all the 68 credits. In case a student who passed in all subjects, but the SGPA in any semester is less than 6.0 he/she can be permitted to write the end semester examinations in the subjects of his/her choice in the corresponding semester in the following academic year for improving the grade in the subjects concerned so that the SGPA of 6.0 can be attained. Thus, a student will not be permitted to write the end semester examinations once again for the purpose of improving the grade in the subject and hence the SGPA, in the event the student has already secured SGPA of 6.0 and above.

**3.3.4 Subject Course Classification**

All subjects/courses offered for the Post-Graduate Programme in E & T (M.Tech Degree Programme) are broadly classified as follows. The University has followed in general the guidelines issued by AICTE/UGC.

|  |  |  |  |
| --- | --- | --- | --- |
| S.No. | Broad Course Classification | Course Group/  Category | Course Description |
| 1 | Core Courses  (CoC) | PC-  Professional  Core | Includes subjects related to the parent  discipline/department/ branch of  Engineering |
| Project Work | M.Tech Project or PG Project or Major  Project |
| Seminar,  Technical  Paper Writing | Seminar/Colloquium based on core contents  related to parent discipline/department/branch of Engineering |
| Comprehensive  Viva-Voce | Viva-voce covering all the PG subjects  studied during the course work and related aspects |
| 2 | Elective Courses  (EιE) | PE -  Professional  Electives | Includes elective subjects related to the  parent discipline/department/branch of  Engineering |
| OE - Open  Electives | Elective subjects which include inter- disciplinary subjects or subjects in an area  outside the parent discipline/department/  branch of Engineering |
| **Total number of Credits – 69** | | | |

**4. COURSES OF STUDY**

**Departments offering M.Tech. Programmes with specializations are noted below:**

|  |  |  |
| --- | --- | --- |
| **Sl.**  **No.** | **Department** | **M.Tech Course** |
| 1 | CSE | Computer Science |
| 2 | CSE | Computer Science and Engineering |
| 3 | EEE | Electrical Power Engineering |
| 4 | ECE | Digital Systems and Computer Electronics |
| 5 | ME | CAD/CAM |
| 6 | ME | Thermal Engineering |
| 7 | IT | Computer Networks and Information Security |

**5.0 ATTENDANCE REQUIREMENTS**

The programs are offered on a unit basis with each subject being considered a unit.

**5.1** Attendance in all classes (Lectures/Tutorials /Laboratories/Seminar/ Mandatory courses) is compulsory. The minimum required attendance in each theory including the attendance of mid-term examination / Laboratory etc. is 75%.

***Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. A student shall not be permitted to appear for the Semester End Examinations (SEE), if his attendance is less than 75%.***

**5.2** A student's seminar report and seminar presentation will be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in seminar presentation classes during that semester.

**5.3 Condoning of shortage of attendance** (between 65% and 75%) up to a maximum of 10% (considering the days of attendance in sports, games, NCC, NSS activities and Medical grounds) in each subject of a semester shall be granted by the College Academic Committee.

**JNTUH 5.4** Shortage of Attendance below 65% in any subject shall in **no case be condoned.**

**SNIST 5.4** Shortage of Attendance below 65% in the semester, shall IN **NO CASE** be condoned and he/she cannot register for end examinations.

**JNTUH 5.5** A Student, whose shortage of attendance **is not condoned** in any subject(s) in any semester, is considered detained in that subject(s) and is not eligible to write Semester End Examination(s) of such subject(s) in that semester, and he has to seek re-registration for those subject(s) in subsequent semesters, and attend the same as and when offered.

**SNIST** 5.5 A candidate who is detained due to shortage of attendance may seek re-registration in to the same semester as and when that is offered. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-registration for the same semester. However, he will be permitted to appear for consecutive examinations.

**5.6** A student fulfills the attendance requirement in the present semester, shall not be eligible for readmission into the same class.

**5.7** A prescribed fee per subject shall be payable for condoning shortage of attendance.

**5.8** A student shall put in a minimum required attendance in at least three theory subjects in I Year I semester for promotion to I Year II Semester.

**6.0 Academic Requirements**

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 5. The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks per subject / course (theory / practical), on the basis of Internal Evaluation and Semester End Examination.

**6.1** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if he/she secures not less than 40% of marks (30 out of 75 marks) in the End Semester Examination, and a minimum of 50% of marks in the sum total of CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades and this implies securing ‘B’ Grade or above in a subject.

**6.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/ course, if he/she secures not less than 50% of the total marks. The student is deemed to have failed, if he/she (i) does not attend the comprehensive viva- voce as per the schedule given, or (ii) does not present the seminar as required, or (iii) does not present the Technical Paper Writing as required. In such a case, he may reappear for comprehensive viva-voce in supplementary examinations and for seminar/ technical paper writing, in the subsequent semesters, as and when scheduled by paying required fee as per the norms of the Institution.

**6.3** A student shall register for all subjects for total of 68 credits as specified and listed in the course structure for the chosen specialization, put in required the attendance and fulfill the academic requirements for securing 68 credits obtaining a minimum of ‘B’ Grade or above in each subject, and all 68 credits securing Semester Grade Point Average **(SGPA) 6.0** (in each semester) and final Cumulative Grade Point Average **(CGPA)** (i.e., CGPA at the end of PGP**)  6.0**, to complete the PGP successfully.

**Note: (1) The SGPA will be computed and printed on the marks memo only if the candidate passes in all the subjects offered and gets minimum B grade in all the subjects.**

**(2) CGPA is calculated only when the candidate passes in all the subjects offered in all the semesters**

**6.4** Marks and Letter Grades obtained in all those subjects covering the above specified 66 credits alone shall be considered for the calculation of final CGPA, which will be indicated in the Grade Card /Marks Memo of second year second semester.

**6.5** If a student registers for extra subject(s) (in the parent department or other departments/ branches of Engineering) other than those listed subjects totaling to 66 credits as specified in the course structure, the performance in extra subject(s) (although evaluated and graded using the same procedure as that of the required 66 credits) will not be taken into account while calculating the SGPA and CGPA. For such extra subject(s) registered, percentage of marks and Letter Grade alone will be indicated in the Grade Card/Marks Memo, as a performance measure, subject to completion of the attendance and academic requirements as stated in items 5 and 6.1 - 6.3.

**6.6** When a student is detained due to shortage of attendance in any subject(s) in any semester, no Grade allotment will be made for such subject(s). However, the student is eligible for re-registration of such subject(s) in the subsequent semester(s), as and when next offered, with the academic regulations of the batch into which the student is re-registered, by paying the prescribed fees per subject as per the norms of Institution. In all these re-registration cases, the student shall have to secure a fresh set of internal marks and Semester End Examination marks for performance evaluation in such subject(s), and SGPA/CGPA calculations.

**6.7** A student eligible to appear for the Semester End Examination in any subject, but absent from it or failed (failing to secure ‘B’ Grade or above), may reappear for that subject at the supplementary examination as and when conducted. In such cases, his Internal Marks assessed earlier for that subject will be carried over, and added to the marks secured in the supplementary examination, for the purpose of evaluating his performance in that subject.

**6. 8** A student can opt for one extra subject from II year I semester in M. Tech. I year I semester and also in I year II semester so that the student can complete all the courses of II year I semester and student can concentrate on Project work in the entire II semester either in the institution or in the industry to complete quality work.

6.9 A Student who fails to earn 68 credits as per the specified course structure, and as indicated above, within **four** academic years from the date of commencement of his first year first semester, shall forfeit his seat in M. Tech. programme and his admission **shall stand cancelled.**

**7.0 EVALUATION**

The performance of a student in each semester shall be evaluated subject- wise (irrespective of credits assigned) for a maximum of 100 marks. The M.Tech. project work (major project) will also be evaluated for 100 marks.

7.1 There shall be two midterm examinations in every theory course. 18 marks are earmarked for each midterm examination. The marks shall be awarded considering the average of two midterm examination marks in each course. If any candidate is absent from any subject for mid-term examination and he/she 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 examinations. The result will be treated equal to a mid test and average of better two mid tests will be considered. Each mid test will have compulsory questions without choice and long answer questions as detailed in the following paragraphs.

* Separate registration for third mid for each subject can be done by the student by paying an amount as decided by the Finance Committee time to time, for each subject.
* **The midterm examination** question paper shall be of three parts, i.e. Part ‘A’, Part ‘B’ and Part ‘C’.

The following procedure is to be followed for internal evaluation as given in the below table

|  |  |
| --- | --- |
| Item | Proposed Marks |
| 1. Part – A of Mid Test | 10 questions – **5 marks** |
| 1. Part – B of Mid Test will have 3 questions (1 from each unit ) and student has to answer 2 questions | 2 Questions out of 3 questions – **10 marks** |
| 1. Part – C Mid test | Questions Paper will have 3 questions – One from each unit taken from assignment questions. Student has to answer 1 question out of 3 questions – **3 marks** |
| 1. Assignment | Three questions from each unit- total of 9 questions to be submitted before first mid test – **2 marks**  Similarly assignment – II will be given to be submitted before II Mid test and average of two assignments will be considered |
| 1. Attendance | **3 marks** |
| 1. Class notes | **2 marks** |

The duration of examination Mid test I and Mid test II will be for two hours and for Mid test – III for a duration of 2 ½ hours

* Each Midterm 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. Mid test III will be from entire syllabus and conducted on the same day of main examination for a period of 2 ½ hours.
* Two assignments shall be given for a total weightage of 2 marks. Assignment-I for 2 Marks is to be submitted before the first mid examinations and 2 marks for assignment-II which is to be submitted before the second mid test and average of 2 assignments will be taken for 2 marks. Students will be given back the assignment before mid term examinations. Two marks are allotted for class notes which are to be signed by concerned teacher every fortnight.

Three 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 85% | 2 |
| 3. | More than 85 % | 3 |

* 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.
  + 1. The external examination question paper shall be of two parts, Part ‘A’ and Part ‘B’.

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

There shall be external examination in every theory course and it consists of two parts (part-A & part-B). The total time duration for the 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 to be set for 3 marks each and other five questions are to be set for 2 marks each.

Part-B of the question paper shall have subjective type questions for 50 marks and shall have 7 questions out of which 5 are to be answered. At least one question must appear from each Unit. And not more then 2 questions from each unit All the questions carry equal marks.

**Pattern of Evaluation for Lab Subjects (100 marks)**

It is decided to offer two labs in the I semester and two labs in the II semester of I year. For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 75 marks for end examination. Out of the 25 marks for internal, 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 and viva - 05 marks
5. Project demo - 05 marks

**Total - 25 marks**

The end examination 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 - 20 marks
3. Results including graphs, discussions and conclusion - 20 marks
4. Viva voce and record - 20 marks

**Total - 75 marks**

**In case computer based examinations (internal) :**

1. Flowchart and algorithms - 05 marks
2. Program writing and execution - 10 marks
3. Result and conclusions - 05 marks
4. Viva voce and record - 05 marks

**Total - 25 marks**

7.2 Laboratory marks and the sessional marks awarded by the Department are not final. They are subject to scrutiny and scaling by the college wherever necessary. In such cases, the sessional and laboratory marks awarded by the department will be referred to a Committee. The Committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. 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 as and when the same is asked for.

7.3 A candidate shall be deemed to have secured the minimum academic requirement in a subject/practical, if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

7.4 In case the candidate does not secure the minimum academic requirement in any subject/practical (as specified in 7.3) he/she has to reappear for the End Examination in that subject/practical. The candidate can re-register, when the college is subsequently offering the subject/practical. In case the college is no longer offering the subject/practical, alternate subject/practical will be suggested by the Department Academic Council consisting of Head of Department and three other senior faculty members of the Department. However, approval has to be taken from the college Academic Committee this regard. In the event of taking another chance, the internal marks and end examination marks obtained in the previous attempt are nullified. The candidate getting re-registered shall pay tuition / other fees which will be calculated based upon the credits and the fee.

**7.5** **Technical Paper writing and seminar :**

Technical paper writing and seminar is divided into four parts one in each semester as stated below :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Semester | Subject | Credits | Internal marks | External marks |
| I year I sem | Technical seminar and CVV | 1 | 50 | 50 |
| I year II sem | Mini project with seminar | 2 | 25 | 75 |
| II year I sem | Project Phase – I and Seminar | 10 | 25 | 75 |
| II year II Sem | Project Phase – II and Seminar | 6 | 50 | 50 |

There shall be technical seminar and comprehensive viva ( CVV) during I year I semester and Mini Project and seminar during I year II Semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee, which shall consist of the Head of the Department, a senior Faculty Member and the Supervisor and will jointly evaluate the report and presentation. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. The comprehensive Viva voce in the subjects of I year I semester will be conducted by the External examiner and it will be valid for 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

In the First semester the report must be in the form of the review paper with a format used by IEEE / ASME etc. In the Second semester Mini project with seminar in the form of Independent Review Paper must be of high quality fit for publication in a reputed conference / journal.

**The evaluation format for seminar is as follows:**

|  |  |
| --- | --- |
| Selection of topic, literature survey  Review by the guide | 5 marks |
| Final report and viva | 5 marks |
| Level of content | 8 marks |
| Presentation | 10 marks |
| Discussion & Involvement | 8 marks |
| Class notes | 7 marks |
| Attendance | 7 marks |
| Total | 50 Marks |

**7.6 Comprehensive Viva-Voce:**

There shall be a Comprehensive Viva-Voce Examination. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and one Senior Faculty member of the Department and external examiner. The Comprehensive Viva-Voce is aimed to assess the student’s understanding in various subjects, he/she studied during the M.Tech I year I semester. The Comprehensive Viva-Voce is valued for 50 marks. There are no internal marks for comprehensive viva voce. A candidate has to secure a minimum of 50 % of marks to be declared successful.

**7.7 Project Seminars**

In II year I semester and II semester there will be Project Phase – I and seminar, Project phase – II and seminar shall be conducted for 25 marks internal and 75 marks external. The evaluation for the project reviews shall be done in 2 stages (not less than 4 weeks between two consecutive stages) including end semester evaluation. A candidate shall secure a minimum 50% of marks to be declared successful

**Project work Phase I and II**

The student shall submit a project status report at the end of II year I semester along with a review paper on the subject of the thesis and same shall be evaluated at the end of the semester by the Project Review Committee ( PRC).

**8.0 EVALUATION OF PROJECT/DISSERTATION WORK**

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

8.3 After satisfying 7.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in four stages at least with a gap of 4 weeks between two consecutive stages.

8.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses (no backlogs) with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

8.7 After approval from the PRC, the soft copy of the thesis should be submitted to the College for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 24%, then only thesis will be accepted for submission.

8.8. After approval from the PRC, a soft copy of the thesis should be submitted for ANTI- PLAGIARISM check and the plagiarism report should be submitted to the University and be included in the final thesis. The Thesis will be accepted for submission, if the similarity index is less than 30%. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re-submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to TWO. The candidate has to register for the Project work and work for two semesters. After three attempts, the admission is liable to be cancelled. The college authorities are advised to make plagiarism check of every soft copy of theses before submissions.

8.9 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College.

8.10 The thesis shall be evaluated by one examiner selected by the college. For this, the Head of the department shall submit a panel of 5 examiners i.e. eminent persons with Ph.D or should have guided at least 5 M.Tech projects or should have been working in an R&D organization at the level of not less than Scientist-C, with the help of the guide concerned. The Principal will select one of the examiners and thesis will be sent for evaluation. If the report is favourable, the head of the department must organize for viva-voce examination.

8.11. If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected. Then the candidate has to work on the thesis once again and shall be submitted to the PRC for its evaluation and further action on the matter.

8.12 For Project Evaluation (Viva Voce) in II Year II Sem. there are external marks of 150 for 6 credits. HoD shall submit a panel of 5 examiners, eminent in that field. Principal will appoint one of them as examiner.

8.13 The thesis shall be adjudicated by examiner selected by the College. If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

8.14 If the report of the examiner is favourable, Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis. Candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.15 If he fails to fulfill as specified in 8.12, he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill, he will not be eligible for the award of the degree.

8.16 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva- Voce examination.

9.0 Re-Admission/Re-Registration

9.1 Re-Admission for Discontinued Student

A student, who has discontinued the M.Tech. degree programme due to any reason whatsoever, may be considered for 'readmission' into the same degree programme (with the same specialization) with the academic regulations of the batch into which he gets readmitted, with prior permission from the authorities concerned.

9.2 If a student is detained due to shortage of attendance in any semester, he/she may be permitted to re-register for the same semester(s).

9.3 A candidate shall be given one chance to re-register for a maximum of two subjects, if the internal marks secured by a candidate are less than 50% and failed in those subjects. A candidate must re-register for failed subjects within four weeks of commencement of the class work and secure the required minimum attendance. In the event of the student taking this chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stand cancelled.

10.0 Examinations and Assessment - The Grading System

10.1 Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Technical Paper Writing or Project, etc., based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 7 above, and a corresponding Letter Grade shall be given.

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

|  |  |  |
| --- | --- | --- |
| % of Marks Secured in a subject/Course  (Class Intervals) | Letter Grade (UGC  Guidelines) | Grade Points |
| 90% and above (  90% , ≤ 100% ) | O (Outstanding) | 10 |
| Below 90% but not less than 80% ( 80% , <90% ) | A+ (Excellent) | 9 |
| Below 80% but not less than 70% ( 70% , <80% ) | A (Very Good) | 8 |
| Below 70% but not less than 60% ( 60% , <70% ) | B+ (Good) | 7 |
| Below 60% but not less than 50% (  50% , <60% ) | B (above Average) | 6 |
| Below 50% ( < 50% ) | F (FAIL) | 0 |
| **Absent** | **Ab** | **0** |

9.3 A student obtaining F Grade in any Subject is deemed to have ‘failed’ and is required to reappear as ‘Supplementary Candidate’ for the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those subjects will remain as obtained earlier.

9.4 If a student has not appeared for the examinations, ‘Ab’ Grade will be allocated to him for any subject and shall be considered ‘failed’ and will be required to reappear as ‘Supplementary Candidate’ for the Semester End Examination (SEE), as and when conducted.

9.5 A Letter Grade does not imply any specific marks percentage; it is only the range of percentage of marks.

9.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of ‘Grade Improvement’ or ‘SGPA/ CGPA Improvement’.

9.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him 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**

9.8 The student passes the Subject/ Course only when he gets GP 6 (B Grade or above).

9.9 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



where ‘i’ is the Subject indicator index (taking 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), C୧ is the no. of Credits allotted to the ith Subject, and G୧ represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

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



(ie., upto 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’ for from the 1st Semester onwards upto and inclusive of the Semester S ( obviously M > N ), ‘j’ is the Subject indicator index (taking into account all Subjects from 1 to S Semesters), C୨ is the no. of Credits allotted to the jth Subject, and G୨ represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

**Illustration of calculation of SGPA**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course/Subject** | **Credits** | **Letter**  **Grade** | **Grade**  **points** | **Credit**  **Points** |
| Course 1 | 4 | A | 8 | 4\*8 = 32 |
| Course 2 | 4 | O | 10 | 4\*10 = 40 |
| Course 3 | 4 | B | 6 | 4\*6 = 24 |
| Course 4 | 3 | B | 6 | 3\*6 = 18 |
| Course 5 | 3 | A+ | 9 | 3\*9 = 27 |
| Course 6 | 3 | B | 6 | 3\*6 = 18 |
|  | 21 |  |  | 159 |

SGPA = 159/21 = 7.57

**Illustration of calculation of CGPA**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Credits** | **SGPA** | **Credits \* SGPA** |
| Semester I | 24 | 7 | 24\*7 = 168 |
| Semester II | 24 | 6 | 24\*6 = 144 |
| Semester III | 24 | 6.5 | 24\*6.5 = 156 |
| Semester IV | 24 | 6 | 24\*6 = 144 |
|  | 96 |  | 612 |

CGPA = 612/96 = 6.37

## 10.0 Award of Degree and Class

* 1. 10.1 If a student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **88** Credits (with CGPA

6.0), shall be declared to have ‘QUALIFIED’ for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with the specialization that he was admitted into.

## 10.2 Award of Class

After a student has earned the requirements prescribed for the completion of the programme and is eligible for the award of M.Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

|  |  |
| --- | --- |
| **Class Awarded** | **CGPA** |
| First Class with Distinction | ≥ 7.75 |
| First Class | 6.75≤ CGPA < 7.75 |
| Second Class | 6.00≤ CGPA < 6.75 |

A student with final CGPA (at the end of the PGP) < 6.00 shall not be eligible for the Award of Degree.

**11.0 Withholding of Results**

If the student has not paid the dues, if any, to the University or if any case of indiscipline is pending against him, the result and degree of the student will be withheld and he will not be allowed into the next semester.

**12.0. Transitory Regulations**

12.1 A student who has been detained in any semester of I Year of R13/R15 Regulations due to lack of attendance, shall be permitted to join the same semester of I Year of R17 Regulations and he is required to complete the study of M.Tech programme within the stipulated period of four academic years from the date of first admission in I Year I semester. The R17 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester.

12.2 Candidate detained due to shortage of attendance in one or more subjects is eligible for re- registration of maximum of two earlier or equivalent subjects at a time as and when offered.

12.3 The candidate who fails in any subject under R13/R15 regulations will be given two chances to pass the same subject in the same regulations; otherwise, he has to identify an equivalent subject and fulfill the academic requirements of that subject as per R17 Academic Regulations.

12.4 For student readmitted to R17 Regulations, the maximum credits that a student acquires for the award of the degree, shall be the sum of the total number of credits secured in R13/R15 regulations of his/her study including R17 Regulations.

12.5 If a student readmitted to R17 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R17 regulations will be substituted by another subject to be suggested by the university.

**13.0 General**

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

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

13.3 Wherever the words “he”, “him”, “his”, occur in the regulations, they s h a l l include “she”, “her”.

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

13.5 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the University is final.

13.6 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

**MALPRACTICES RULES**

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

|  |  |  |
| --- | --- | --- |
| **S.No** | **Nature of Malpractices/Improper**  **conduct** | **Punishment** |
|  | If the candidate: |  |
| 1.(a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject to the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination). | Expulsion from the examination hall and cancellation of the performance in that subject only. |
| (b) | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. Incase 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  to the examination (theory or practical)  in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.  The Hall Ticket of the candidate is to be cancelled and sent to the University. |
| 3. | Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and  project work) already appeared and shall not  be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. |
| 4. | Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that subject. |
| 6. | Refuses to obey the orders of the 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. | Incase of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. |
| 7. | Leaves the exam hall taking away answer script or intentionally tears of the script or any par there of inside or outside the examination hall. | Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8. | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. |
| 9. | If student of the college, who is not a  candidate for the particular examination  or any person not connected with the  college indulges in any malpractice or  improper conduct mentioned in clause6  to 8. | Student of the colleges expulsion from the  examination hall and cancellation of the  performance in that subject and all other  subjects the candidate has already appeared  including practical examinations and project  work and shall not be permitted for the  remaining examinations of the subjects of  that semester/year. The candidate is also  debarred and forfeits the seat. Person(s)  who do not belong to the College will be  handed over to police and, a police case will  be registered against them. |
| 10. | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. |
| 11. | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. |
| 12. | If any malpractice is detected which is not covered in the above clauses1to11shall be reported to the University for further action to award suitable punishment. |  |

**Malpractices identified by squad or special invigilators**

* + 1. Punishments to the candidates as per the above guidelines.
    2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
       1. A show cause notice shall be issued to the college.
       2. Impose a suitable fine on the college.
       3. Shifting the examination centre from the college to another college for a specific period of not less than one year

**Department of Mechanical Engineering**

**M.Tech. (CAD/CAM)**

**Course Structure and Syllabus(CBCS)**

**Academic Regulations: 2019-2020**

**M.Tech.(CAD/CAM) I Year – I Semester:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | **Code** | **Course Title** | **L** | **T** | **P** | **Credits** | **CIE**  **marks** | **SEE**  **marks** |
| PC-1 | **7W101** | Advanced CAD | 3 | - | - | 3 | 25 | 75 |
| PC-2 | **7W102** | Advanced Finite Element Analysis | 3 | - | - | 3 | 25 | 75 |
| PC-3 | **7W103** | Advanced Mechanics of Solids | 3 | - | - | 3 | 25 | 75 |
| PC-4 | **7W104** | Design for Manufacturing & Assembly | 3 | - | - | 3 | 25 | 75 |
| PE-1 | **7W106** | Mechatronics | 3 | - | - | 3 | 25 | 75 |
| **7W107** | Nano Science and Nanotechnology |
| AC-1 | **7HC18** | English for Research Paper Writing | 2 | - | - | 0 | 25 | 75 |
| Research Methodology | **7W105** | Research Methodologies and IPR | 3 | - | - | 3 | 25 | 75 |
| Lab-1 | **7W171** | Advanced CAD &CAE Lab | **-** | - | 4 | 2 | 25 | 75 |
| Technical Seminar | **7W172** | Technical Seminar I | - | - | 2 | 1 | 100 | - |
| **Total** | | | **20** | **-** | **6** | **21** | **300** | **600** |

**L : Lectures; T :Tutorial; P :Practical; C: Credits**

**CIE:** Continuous Internal Evaluation; **SEE:** Semester End Evaluation;

**PC:**Programme Core; **PE:**Programme Elective; **AC**: Audit Course;

**M.Tech.(CAD/CAM) I Year – II Semester:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | **Code** | **Course Title** | **L** | **T** | **P** | **Credits** | **CIE**  **marks** | **SEE**  **marks** |
| PC-5 | **7W208** | Advanced CAM | 3 | - | - | 3 | 25 | 75 |
| PC-6 | **7W209** | FMS & Robotics | 3 | - | - | 3 | 25 | 75 |
| PC-7 | **7W210** | Optimum Design of Mechanical Elements | 3 | 1 | - | 4 | 25 | 75 |
| AC-2 | **7HC19** | Ethics. Moral, Gender Sensitization and Yoga  (EMGY) | 2 | - | - | 0 | 25 | 75 |
| PE-2 | **7W211** | Performance Modeling of Automated Manufacturing Systems | 3 | - | - | 3 | 25 | 75 |
| **7W212** | Micro Electro Mechanical Systems(MEMS) |
| **7W213** | Mechanical Vibrations & Condition Monitoring |
| PE-3 | **7W214** | 3D Printing Technology& Additive Manufacturing | 3 | - | - | 3 | 25 | 75 |
| **7W215** | Production and Characterization of Nano Materials |
| Seminar | **7W273** | Technical Seminar II | - | - | 2 | 1 | 100 | -- |
| Lab-2 | **7W274** | CAM & Robotics Lab | **-** | - | 4 | 2 | 25 | 75 |
| Comprehensive Via | **7W275** | Comprehensive Viva | **--** | -- | 2 | 1 | 25 | 75 |
| Miniproject |  | Mini Project with Seminar | **Evaluation is in II Year I Sem** | | | | | |
| Total | | | **17** | **1** | **8** | **20** | **300** | **600** |

**L :**Lectures**; T :**Tutorial; **P :**Practical**; C:**Credits

**CIE:** Continuous Internal Evaluation ,**SEE:** Semester End Evaluation

**PC:** Programme Core; **PE:**Programme Elective; **AC**: Audit Course

**M.Tech.(CAD/CAM)II Year - I Semester:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | **Code** | **Course Title** | **L** | **T** | **P** | **Credits** | **Marks** | |
| **CIE** | **SEE** |
| PC-8 | **7W316** | Mechanics and Manufacturing Methods of Composites | 3 | - | - | 3 | 25 | 75 |
| OE | **7ZC29** | Business Analytics | 3 | -- | -- | 3 | 25 | 75 |
| **7WC17** | Industrial Safety |
| **7WC18** | Operation Research |
| **7WC19** | Composites |
| **7ZC28** | Cost management of Engineering Projects |
| **7MC17** | Waste to Energy |
| Mini Project | **7W376** | Mini Project with Seminars ( Project Conducted in summer ) | -- | -- | 6 | 3 | 25 | 75 |
| Project | **7W377** | Project Phase I with Seminar | - | - | 10 | 5 | 25 | 75 |
| **Total** | | | **6** | **--** | **16** | **14** | **100** | **300** |

**L: Lectures; T: Tutorial; P: Practical; C: Credits**

**CIE:** Continuous Internal Evaluation; **SEE:** Semester End Evaluation

**AC**: Audit Course; **OE**: Open Elective.

**M.Tech.(CAD/CAM) II Year - II Semester:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | **Code** | **Subject** | **L** | **T** | **P** | **Credits** | **Marks** | |
| **CIE** | **SEE** |
| Poject | **7W478** | Project Phase II with Seminar | - | - | 12 | 6 | 25 | 75 |
| Dissertation | **7W479** | Dissertation and Defense Viva | - | - | -- | 7 | 50 | 150 |
| **Total** | | | - | - | **12** | **13** | **75** | **225** |

**L : Lectures; T: Tutorial; P : Practical; C : Credits CIE**: Continuous Internal Evaluation; **SEE**: Semester End Evaluation

**M.Tech. (CAD/CAM) I Year – I Sem.**

**ADVANCED CAD**

**(Programme Core)**

**L T P C**

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

|  |
| --- |
|  |
| **CODE: 7W101 CIE Marks:25,SEE Marks:75**  **Course Objective:**  To provide a comprehensive knowledge of various topics related to CAD. The topics include CAD Tools, Product life cycle through CAD collaborative design principles  .  **Outcomes:**  After completion of this course, student able to  **Unit-1:**dentify various CAD peripherals and learn concepts of various space curves  **Unit-II:.**demonstrate how to draw various surfaces with the CAD Tools  **Unit-III.**Demonstrate the different CAD data exchange standards design  **Unit-IV.**develope different geometric models with wire frame , surface and solid modeling methods  **Unit-V.** identify the importance the role of collaborative Engineering in product cycle  **Unit-VI.** Demonstrates the various stages of PLM with appropriate examples.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | | CO-1 |  |  |  |  |  |  |  |  | X |  |  | | CO-2 |  |  |  |  | X |  |  |  |  |  |  | | CO-3 |  |  |  |  | X |  |  |  |  |  |  | | CO-4 |  |  |  |  | X |  |  |  |  |  |  | | CO-5 |  |  |  |  | X |  |  |  |  |  |  | | CO-6 |  |  |  |  |  | X |  |  |  |  |  | |
|  |

**Unit – I**

**CAD Tools:** Definition of CAD Tools, Graphics standards, Graphics software: requirements ofgraphics software, DDA and Bresenhams, algorithm for generating various figures, Functional areas of CAD, and efficient use of CAD software.**Basics of Geometric Modeling:** Requirement of geometric modeling, Geometric models, Geometricconstruction methods, modeling facilities desired.

**UNIT-II**

**Geometricmodeling:** Classification of wireframe entities, Curve representation methods, Parametricrepresentation of analytic curves: line, circle, arc, conics. Parametric representation of syntheticcurves: Hermite cubic curve, Bezier curve, B-Spline curves, NURBS, Curve manipulations.

**UNIT-III**

**Geometric Modeling of Surfaces:** Classification of surface entities, Surface representation methods, Parametricrepresentation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulatedcylinder, Parametric representation of synthetic curves: Hermite cubic surface, Bezier surface, B-Spline surface, Blending surface, Surface manipulations.

**UNIT- IV:**

**Solid Modeling:** Geometry and topology, Boundary representation, The Euler-Poincare formula, Euler operators, Constructive solid geometry: CSG primitives, Boolean operators, CSG expressions, Interior, Exterior, closure, Sweeping: linear and non-linear, Solid manipulations. **Geometric transformations**2D and 3D techniques, Perspective projection, orthotropic projection, isometricprojection, Hidden surface removal, shading, rendering.

**UNIT-V**

**CAD/CAM Data Exchange**: Evaluation of data­-exchange format, IGES data representations and file structure and format, testing and verification, STEP Architecture, implementation, ACIS & DXF. **Design Applications:** Mechanical tolerances, Mass property calculations, and Mechanical Assembly, Assembly modeling, Mechanical Assembly representation schemes generation of assembly sequence and assembly analysis.

**Unit – VI**

**Collaborative Engineering:** Collaborative Design Approaches in Design and Development, Integratedproduct development, Collaborative Design, Collaborative Design Principles, Collaborative designTools, A web based virtual reality for collaborative product review and customization.

**Product Life CycleManagement through CAD:** Introduction – the path to PLM, PLM life cycle model, the threads of PLM (CAD, EDM, PDM, CIM), weaving threads in to PLM, Characteristics of PLM, PLM elements, developing PLM strategy

***Note: Students will be given Engineering Component and student has to design the components and produce its drawing and present it as assignment.***

**TEXT BOOK**:

1. CAD/CAM Theory and Practice / Ibrahim Zeid / Mc Graw Hill international.
2. CAD/CAM Concepts and applications /Chennakesava R. Alavala/PHI Learning Private Limited (2013)

**REFERENCE BOOKS**:

1. Mastering CAD/CAM / IbrhimZeid / Mc Graw lull international.

2. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age

3. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition

4. Principles of Computer Aided Design and Manufacturing/ FaridAmirouche/ Pearson

**M.Tech. (CAD/CAM) I Year – I Sem.**

**ADVANCEDFINITE ELEMENT ANALYSIS**

**(Programme Core)**

**L T P C**

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

**CODE: 7W102 CIE Marks:25; SEE Marks:75**

**Course Objective:** to familiarize the procedures and techniques of Finite element formulations for various mechanical Egg problems and apply them on CAD/CAM related projects/problems

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| **Course Out Comes :** |
| **Unit-1:** Student able to demonstrate the solution techniques for Finite Element Formulations of Mechanical Engineering Problems |
| **Unit-2:** Student able to solve stress analysis problems of frames ,beams and trusses with FEM Techniques |
| **Unit-3**: Student acquires knowledge of stress analysis of plates under bending with FEM formulation |
| **Unit-4:** Student gains knowledge and in position to apply FEM to solve Dynamics related problems. |
| **Unit-5**:Student will learn the method to convert heat transfer problems in to simple solvable equations through FEM |
| **Unit-6:** Student will get various ideas and approaches to handle Fluid Flow problems through FEM that leads to gain skills to develop CFD related applications. |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-2** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-3** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-4** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-5** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-6** |  | **X** |  |  | **X** |  |  |  |  |  |  |

**Unit – I: Solutions of Finite Element Equations:**

Introduction, Solution of Equilibrium Problems (boundary values problems), Guass elimination and Choleski methods, Solutions of Eigen value problems, Jacobi and power methods, Solution of propagation problems (initial value problems), Runga-Kutta method and finite difference method

**Unit – II**: **Analysis of Space truss and frame Elements:**

Introduction to truss and beam elements, Element formulation of space truss element and frame element, characteristics of stiffness matrices.

**Unit – III:**A**nalysis of structural plates:**

Introduction, Triangular membrane element, rectangular plate element, FEA of plates in bending, Analysis of triangular and rectangular plates bending.

**Unit – IV:Analysis of free and forced undamped vibrations:**

FE formulations of equation of motion, Natural frequencies and mode shapes of uniform stepped bars, beams and planer trusses, othogonilisation of modes, Dynamic response (forced vibration analysis) of stepped axial bar and beam.

**Unit – V: Analysis of unsteady state Heat Transfer Problems:**

Introduction to differential equations to unsteady state heat transfer problems, FE formulation, Time dependant temperature distribution in 1D fins and plane walls. Heat transfer problems with radiation.

**Unit – VI: Analysis of Inviscid and incompressible flows:**

Introduction to partial differential equations to steady state fluid flow, Potential function formulation, Stream function formulation, Finite element solutions, Numericals on 1D flow.Introduction to ANSYS software

**TEXT BOOKS**:

1. “The Finite Element Methods in Engineering”, S.S. Rao, Heinemann, 4th Edition-2004.

2. Finite and Boundary Element methods in Engineering: O.P.Gupta, Oxford&IBH Publishing Co.Pvt.Ltd.

3. “Introduction to Finite Elements in Engineering”, TirupathiR.Chandrupatla and Ashok D. Belagundu, Pearson Education (Singapore) Pte Ltd, 2006.

**REFERENCE BOOKS:**

1. “Concepts and Applications of Finite Element Analysis”, Robert Cook, Wiley India, Pvt., Ltd., 4th Edition-2007

2. “An Introduction to Finite Element Methods”, J.N. Reddy, Tata Mc Graw Hill, 2008. ­

3. “First Course in the Finite Element Method”, [Platteville Daryl Logan &](http://www.flipkart.com/author/platteville-daryl-logan-university-of-wisconsin/)[Daryl Logan](http://www.flipkart.com/author/daryl-logan/), Nelson Engineering, 2007.

4. “Finite Element Procedures”, K.J. Bathe, PHI Learning, 2009.

**M.Tech. (CAD/CAM) I Year – I Sem.**

**ADVANCED MECHANICS OF SOLIDS**

**(Programme Core)**

**L T P C**

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

**CODE: 7W103 CIE Marks:25; SEE Marks:75**

**Course Objectives:**

to provide subject knowledge of advanced topics of Mechanics of solids such as theries of shear centre,curvedbeam,torsion,columns and fracture mechanics.This will help them to analyse stresses in various mechanical structures.

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| **Course Out Comes :** |
| After completing the course, the students will : |
| Unit I: learn Basics of Energy Methods and applications in structural mechanics |
| Unit II: demonstrate Concept of shear centre, symmetric and un-symmetric bending |
| Unit III: analyze Bending stresses in curved beams |
| Unit IV: derive Torsion of circular and non-circular cross section beams, membrane analogy, torsion of thin-walled and multiply connected cross-section members |
| Unit V: apply theoretical on study on Elastic stability of columns using energy methods |
| Unit VI: learn the role fracture mechanics in failure of mechanical parts |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-2** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-3** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-4** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-5** |  | **X** |  |  | **X** |  |  |  |  |  |  |
| **CO-6** |  | **X** |  |  | **X** |  |  |  |  |  |  |

**Unit – I**: **Energy Methods**:

Hooke’s law and the Principle of Superposition, Work done by forces and the elastic strain energy stored, Reciprocal relation, generalized forces and displacements, Castigliano’s first theorem, fictitious load method, Theorem of Virtual work, Castigliano’s second theorem. Case studies of statically determinate and indeterminate structures, closed ring subjected to concentrated and uniform loads, stresses in chain links.

**Unit – II**: **Shear Centre**:

Bending axis and shear center; shear center for axi-symmetric and unsymmetrical sections. Unsymmetrical bending: Bending stresses in beams subjected to unsymmetrical bending; deflection of straight beams due to unsymmetrical bending.

**Unit – III**: **Curved bean theory& Contact Stresses**

**Beams:** Circumferential stress in curved beams, limitations, correction factors; Winkler Bach formula, ­Radial stresses in curved beams, Winkler Bach correction factors.

**Contact stresses**: Geometry of the Contact Surface, Method of Computing Contact Stresses, and Stress for Two Bodies in Line Contact: Loads Normal to Contact Area

**Unit** – **IV**: **Torsion**:

Torsion of a cylindrical bar of circular cross Section; Saint-Venant's semi-inverse method; Linear elastic solution; Prandtl elastic membrane (soap film) analogy; torsion of narrow rectangular cross sections; hollow thin wall torsion members, multiply connected cross sections.

**Unit – V**: **Elastic Stability of Columns**:

Concept of buckling, columns under one or more axial, concentrated load(s) and with / without eccentricity: Euler’s buckling load, Secant and Johnson’s formulae; treatment of column buckling stability problem as an Eigen-value problem, related case studies. Energy methods for buckling problems: theorem of stationary potential energy, energy and stability considerations, application to buckling problems, The Rayleigh-Ritz method

**Unit – VI**: **Introduction toFracture Mechanics**:

Why structures fail, the fracture mechanics approach to design, effect of material properties on fracture, Linear Elastic Fracture Mechanics (LEFM): stress concentration effect of flaws, the Griffith energy balance, the energy release rate, stress analysis of cracks, plane stress versus plane strain, fracture modes. Elastic—Plastic Fracture Mechanics (EPFM): crack tip opening displacement, Green's theorem, the J-contour integral. Design considerations: K as a failure criterion, J-integral as a fracture criterion

**TEXT BOOK**:

1. “Advanced Mechanics of Solids”, Third Edition, L.S.Srinath, TATA McGraw-Hill
2. “Advanced Mechanics of Materials”, Sixth Edition, Arthur P. Boresi, Richard J. Schmidt., Wiley International

**REFERENCE BOOKS**:

1. “Strength of Materials”, Sadhu Singh“Fracture Mechanics: Fundamentals and Applications”, Second Edition, T.L.Anderson, CRC Press

**M.Tech. (CAD/CAM) I Year – ISem.**

**DESIGNFOR MANUFACTURING & ASSEMBLY**

**(Programme Core)**

**L T P C**

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

**CODE: 7W104 ICE Marks:25; SEE Marks:75**

**Course Objective:**

To explore the applications of design processes / methods in manufacturing &Assembly and art of creating cost effective product development.

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| **Course Out Comes :** |
| After completing the course, the students will : |
| **Unit I:** learn Basic principles of designing for economical production material for design development with charts |
| **Unit II:** Overview of various machining process, Redesigning of components for machining with suitable examples and various casting process |
| **Unit III:** Design principles for Punching, Blanking, Bending, Deep drawing etc. Design factors for forging |
| **Unit IV:** Develop the assemblies process, automatic assembly transfer system,assembly advantages |
| **Unit V:** Develop of the systematic DFA methodology, assembly, efficiency, classification system for material handling |
| **Unit VI:** Evaluate of part symmetry handling time |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** | **X** |  |  |  |  |  |  |  |  |  |  |
| **CO-2** | **X** |  |  |  | **X** |  |  |  |  |  |  |
| **CO-3** | **X** |  |  |  | **X** |  |  |  |  |  |  |
| **CO-4** | **X** |  |  |  | **X** |  |  |  |  |  |  |
| **CO-5** | **X** |  |  |  | **X** |  |  |  |  |  |  |
| **CO-6** | **X** |  |  |  | **X** |  |  |  |  |  |  |

**Unit – I: Introduction:**

Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of design Ling for economical production -creativity in design. Materials: Selection of Materials (or design Developments in Material technology -criteria for material selection - Material selection interrelationship with process selection process selection charts.

**Unit – II**: **Machining Process:**

Overview of various machining processes - general design rules for machining ­Dimensional tolerance and surface roughness - Design for machining - Ease **-** Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

**Metal Casting:** Appraisal of various casting processes, selection of casting process, - general design considerations for casting - casting tolerances -use of solidification simulation in casting design - product design rules for sand casting.

**Unit – III: Metal Joining:**

Appraisal of various welding processes, Factors in design of weldments - general design guidelines - pre and post treatment of welds - effects of thermal stresses in weld joints - design of brazed joints.

**Forging:** Design factors for forging - Closed die forging design - parting lines of die5 drop forging die design - general design recommendations.

**Unit – IV: Extrusion & Sheet Metal Work:** Design guidelines for extruded sections –

Design principles for Punching, Blanking, Bending, and Deep Drawing - Keeler

Goodman Forming Line Diagram - Component Design for Blanking. .

**Unit – V: Assembly advantages:**

Development of the assemble process, choice of-assemble method assemble advantages social effects of automation.

**Automatic Assembly Transfer Systems:** Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free - transfer machine.

**Unit – VI: Design of' Manual Assembly:**

Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening;' effect of pal1 symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

**TEXT BOOKS**:

1. Geoffrey Boothroyd,”Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.

2. Engineering Design - Material & Processing Approach - George E. Deiter, McGraw Hill IntI. 2nd Ed. 2000.

**REFERENCE BOOKS**:

1. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekken, N.Y. 1990.

2. A Delbainbre "Computer Aided Assembly London, 1992.

**M.Tech. (CAD/CAM) I Year – I Sem.**

**MECHATRONICS**

**(Programme Elective-I)**

**L T P C**

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

**CODE:7W106 CIE Marks:25; SEE Marks:75**

**Course Objectives:**

1. To explain the role of multidisciplane subject

2. To provide knowledge in specification, design, implimentation, trouble shoot and maintenance of mechatronics systems

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| **Course Out Comes :** |
| After completing the course the students will learn:  **Unit1:** Mechatronics measurement systems, control systems, case studies, actuation systems. |
| **Unit2:** Modeling dynamic systems- first order and second order systems. Transfer functions |
| **Unit3:** Frequency response, performance specifications and stability. Closed loop controllers- P, PI, PID adaptive control. |
| **Unit4:** Introduction of microprocessor, and PLC and identification system |
| **Unit5:** Sensors in speed, position, stress, strain, acceleration and temperature measurement sensor. Machine vision |
| **Unit6:** Data base management system, CAD/CAM data bases, graphic database, and Oops concepts. |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** | **X** |  |  |  |  |  |  |  |  |  |  |
| **CO-2** |  |  |  |  |  | **X** |  |  | **X** |  |  |
| **CO-3** |  |  |  |  |  | **X** |  |  | **X** |  |  |
| **CO-4** |  |  |  |  |  | **X** |  |  | **X** |  |  |
| **CO-5** |  |  |  |  |  | **X** |  |  | **X** |  |  |
| **CO-6** |  |  |  |  |  | **X** |  |  | **X** |  |  |

**Unit-I**:

**Introduction:** Definition of Mechatronics Measurement systems, Control systems, Microprocessor – based controller, Response of systems, the mechatronics approach, traditional and mechatronics designs, possible mechatronics design solutions, case studies of Mechatronic systems .

**Actuators and Motion Control:** Pneumatic, Hydraulic, Mechanical and Electrical actuation systems and their limitations, Motor/Load inertia matching. Design with linear slides.

**Unit-II**:

**Dynamic responses of systems:** Modeling dynamic systems, first- order systems, second – order systems Performance measures for second – order systems, system identification.

**System transfer functions:** The transfer function, first – order systems, second – order systems, Systems in series, systems with feedback loops, Effect of pole location on transient response.

**Unit-III**:

**Frequency response:** Sinusoidal input, phasors, frequency response, bode plots, performance specifications, and stability**.**

**Closed Loop Controllers:** Continuous and discrete processes, control modes, two-step mode, proportional mode, derivative control, integral control, PID controller, digital controllers, control system performance, controller tuning, velocity control, adaptive control.

**Unit-IV**:

**Architecture of intelligent Machines:** Introduction to Microprocessor and programmable logic controllers and identification of system, System design Classification. Motion control aspects in Design.

**UNIT-V**:

**Sensors:** Introduction, position and speed measurement, stress and strain measurement, temperature measurement vibration and acceleration measurement, pressure and flow measurement, semiconductor sensors and Micro electromechanical devices.

**Machine Vision:** Feature and Pattern Recognition methods, concepts of perception and cognition in decision making.

**UNIT VI**:

**Manufacturing Data Bases:** Data Base management system, CAD/CAM Data bases, Graphic Data Base, Introduction to object oriented concepts, objects oriented model language interface, procedures and methods increation, edition and manipulation of Data.

**TEXT BOOK**:

1. W. Bolton, “Mechatronics – Electronics Control Systems in Mechanical and Electrical Engineering”, Pearson Education 3rd Edition.

**REFERENCE BOOK:**

2. Michel B. Histand and David G. A1ciatore, “Introduction to Mechatronics and Measurement      systems”, “Tata MC Graw”.

**M.Tech-CAD-CAM (ME) - I Year – I Sem.**

**NANO SCIENCE AND NANOTECHNOLOGY**

**(Programme Elective-I)**

**L T P C**

**3 - 0 3**

**CODE:7W107 CIE Marks:25; SEE Marks:75**

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| **Course Objectives** |
| The course aims at providing an overview of basic physics of solids and advanced topics in solid state materials of technological value, a working knowledge of the foundations, techniques, and key results of quantum mechanics and the basic principles of thermodynamics and to lay emphasis on the fundamentals |

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| **Course Outcomes** | |
| 1. | To show how diverse properties (electronic, thermal, optical) of solid materials can be related to interactions at the atomistic level. |
| 2. | To deduce and verify macroscopic properties of solids using standard theoretical models and understand their significance in wider context of solid materials |
| 3. | To show how solid state physics forms vital part of developing materials of technological value |
| 4. | To achieve an understanding of the theory of quantum mechanics, and an ability to apply the quantum theory to important physical systems |
| 5. | The objective of this course is to make the students acquire depth of knowledge in the concepts of statistical mechanics and thermodynamics. |
| 6 | To understand the phase diagrams of binary alloys systems |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** |  | **X** |  |  |  |  |  |  | **X** |  |  |
| **CO-2** |  | **X** |  |  |  |  |  |  | **X** |  |  |
| **CO-3** |  | **X** |  |  |  |  |  |  | **X** |  |  |
| **CO-4** |  |  |  |  | **X** |  |  |  | **X** |  |  |
| **CO-5** |  |  |  |  | **X** |  |  |  | **X** |  |  |
| **CO-6** |  |  |  |  | **X** |  |  |  | **X** |  |  |

**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. Nanopahysics and nanotechnology by E.L.Wolfwillely 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

**M.Tech. (CAD/CAM) I Year –I Sem**

**ENGLISH FOR RESEARCH PAPER WRITING**

**(Audit Couse –I)**

L T P C

2 - - 0

**CODE: 7HC18 CIE Marks:25, SEE Marks:75**

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| **Course Objectives** |
| Understand how to improve writing skills and level of readability and ensure the good quality of paper at very first-time submission Syllabus |

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| **Course Outcomes** | |
| 1. | Planning for preperation of research paper by avoiding ambiguity and removing reduandancy |
| 2. | Identifying who did what and preparing abstract which consists of body of the paper and expected outcomes |
| 3. | Identifying key papers and writing literature review |
| 4 | Able to understand and identify the key skills required for writing the title and body of the research paper |
| 5 | Able to understand and identify the key skills required for writing the results and discussions, and conclusion |
| 6 | Able to write good quality research paper |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** |  |  |  |  |  |  |  | **X** |  |  |  |
| **CO-2** |  |  |  |  |  |  |  | **X** |  |  |  |
| **CO-3** |  |  |  |  |  |  |  | **X** |  |  |  |
| **CO-4** | **X** |  |  |  |  |  |  | **X** |  |  |  |
| **CO-5** |  |  |  |  |  |  |  | **X** |  |  |  |
| **CO-6** | **X** |  |  |  |  |  |  | **X** |  | **X** |  |

**UNIT-I:**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

**UNIT- II:**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**UNIT-III**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**UNIT-IV:**

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

**UNIT-V:**

Skills are needed when writing the Methods, skills needed whenwriting the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

**UNIT-VI**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**REFERENCES:**

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google

Books)

1. HighmanDay R (2006) How to Write and Publish a Scientific Paper, Cambridge

University Press

1. N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.

Highman’sbook .

1. Adrian Wallwork , English for Writing Research Papers, Springer New York

Dordrecht Heidelberg London, 2011

**M.Tech. (CAD/CAM) I Year – I Sem.**

**RESEARCH METHODOLOGIES &IPR**

**L T P C**

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

**CODE:7W105 CIE Marks:25, SEE Marks:75**

**Course objectives**:

This course is intended to familiarize the students with effective procedures and methodologies to conduct research and to gain an understanding of intellectual property.

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| **Course Outcomes:** At the end of this course, students will be able to | |
| 1. | Understand research problem formulation. |
| 2. | Analyze research related informationFollow research ethics |
| 3. | Understand that today’s world is controlled by Computer, Information Technology, but Tomorrow world will be ruled by ideas, concept, and creativity. |
| 4 | Understanding that when IPR would take such important place in growth of individualsand nation, it is needless to emphasis the need of information about Intellectual PropertyRight to be promoted among students in general & engineering in particular |
| 5 | Understand that IPR protection provides an incentive to inventors for further research  work and investment in R & D, which leads to creation of new and better products, and  in turn brings about, economic growth and social benefits. |
| 6 | Able to understand the recents trends and applications in IPR |

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| **Mapping** | **Po-1** | **P0-2** | **Po-3** | **P0-4** | **Po-5** | P0-6 | **Po-7** | **P0-8** | **Po-9** | **Po-10** | **Po-11** |
| **CO-1** | **X** |  |  | **X** |  |  |  |  |  |  |  |
| **CO-2** |  |  |  | **X** |  |  |  |  |  |  |  |
| **CO-3** |  |  |  | **X** |  |  |  | **X** |  |  |  |
| **CO-4** |  |  |  | **X** |  |  |  |  |  | **X** |  |
| **CO-5** |  |  |  | **X** |  |  |  |  |  | **X** |  |
| **CO-6** | **X** |  |  | **X** |  |  |  |  |  |  |  |

Unit I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit II:

Effective literature studies approaches, analysis Plagiarism, and Research ethics

Unit III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit IV:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit V:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit VI:

New Developments in IPR: Administration of Patent System. IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Reference Books:**

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
5. Mayall, “Industrial Design”, McGraw Hill, 1992.
6. Niebel, “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

**M.Tech.(CAD/CAM) I Year – I Sem.**

**ADVANCED CAD & CAE LAB**

**L T P C**

**- - 4 2**

**CODE: 7W171 CIE Marks:25, SEE Marks:75**

***Course Objective:***

to Exposure to CAD tools such as Pro-E & CATIA ,ANSYS and PROMODEL for use in mechanical engineering applications

**Softwares**: Pro-E orCatia, ANSYS and PROMODEL

1. Solid modeling features in modeling: blend revolve, sweep rib, tweak Blend cut etc.

**2.**3D-Modeling of truss bearing bracket

**3.**3D Modeling & Assembly of Oldham coupling

**4.**3D modeling various parts of knuckle joint & Assembly of Knuckle joint

**5.**3D modeling of plumber bearing

6. Static analysis of 3D truss structure

7. Structural static analysisof beams with distributed load and point loads

8. StructuralModal Analysis of cantilever beam

9. Thermal Analysis of composite slab.

10. Buckling Analysis of a column

11. Manufacturing cell process simulation

12. Process Simulation of Paint line

**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 end examination. Out of the 25 marks for internal, 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 and viva - 05 marks
5. Project demo - 05 marks

**Total - 25 marks**

The end examination 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 - 20 marks
3. Results including graphs, discussions and conclusion-20 marks
4. Viva voce and record - 20 marks

**Total - 75 marks**

**M.Tech. (CAD/CAM) I Year – I Sem.**

**TECHNICAL SEMINA-I**

**L T P C**

**- - 4 2**

**CODE: 7W172 CIE Marks: 100**

**Course Objective:**To give sufficient technical life long skills to learn impact various engineering solutions in global products and process industries.

|  |  |
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| **Course Outcomes:** At the end of this course, students will be able to | |
| 1. | Identify a research topic |
| 2. | Collect literature |
| 3. | Present seminar |
| 4 | Discuss the queries |

There shall be two seminar presentations during I year I semester and I year II Semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee, which shall consist of the Head of the Department, a senior Faculty Member and the Supervisor and will jointly evaluate the report and presentation. For each Seminar there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% to be declared successful.

In the First semester the report must be in the form of the review paper with a format used

by IEEE / ASME etc. In the Second semester Technical Seminar in the form of

Independent Review Paper must be of high quality fit for publication in a reputed

Conference / journal.

**The evaluation format for seminar is as follows:**

|  |  |
| --- | --- |
| Selection of topic, literature survey  Review by the guide | 10 marks |
| Final report and viva | 10 marks |
| Level of content | 15 marks |
| Presentation | 20 marks |
| Discussion & Involvement | 15 marks |
| Class notes | 15 marks |
| Attendance | 15 marks |
| **Total** | **100 Marks** |

**Contents:**

* Identification of specific topic
* Analysis
* Organization of modules
* Naming Conventions
* Writing style
* Figures
* Feedback
* Miscellaneous

# REFERENCES:

# 1. Teach Technical Writing in Two Hours per Week by Norman Ramsey

2. For Technical Seminar the student must learn few tips from sample seminars and correcting himself, which is continues learning process

**NOTE:** A student can use any references for this process, but must be shared in classroom.

**M.Tech. (CAD/CAM) I Year – II Sem.**

**ADVANCED CAM**

**(Programme Core)**

**L T P C**

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

**CODE:7W208 CIE Marks: 25, SEE Marks:75**

**Course Objectives:**

To be familiar with the principles &implementation o of automation and brief history, kinematics, programming of robots and applications.

**Course outcomes:**

Up on the completion of this course, students able to

**UNIT-I:** Describe various basic structures of NC/CNC machines

**UNIT-II:** Identify different types of control systems used in various CNC Machines

**UNIT-III:** Identify the different types of Post-Processors and their applications

**UNIT-IV:** Explain the concepts involved in FMS and automated quality control

**UNIT-V:** Analyze the selection of type robot manipulator for a given application

**UNIT-VI:** Deduce the expressions related to kinematics and dynamics of different robots.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 |  |  |  |  |  |  |  |  | X |  |  |
| CO-3 |  |  |  |  |  |  |  |  | X |  |  |
| CO-4 |  |  |  |  |  |  |  |  | X |  |  |
| CO-5 |  |  |  |  |  |  |  |  | X |  |  |
| CO-6 |  |  |  |  |  |  |  |  | X |  |  |

**UNIT - I**

**Tooling for CNC Machines:** Interchangeable tooling system, preset and qualified tools, coolant fedTooling system, modular fixturing, quick change tooling system, automatic head changers. DNCSystems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages ofDNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control ofMachining processes like turning, grinding.

**UNIT - II**

**Post Processors for CNC:** Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post-Processor, the functions of a Post Processor, DAPP-based- Post Processor: Communicationchannels and major variables in the DAPP- based Post Processor, the creation of a DAPP-BasedPost Processor.

**UNIT - III**

**Micro Controllers:** Introduction, Hardware components, I/O pins, ports, external memory:,counters,Timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications and Programming of Micro Controllers. Programming Logic Controllers (PLC’s): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC’s in CNCMachines.

**UNIT - IV**

**Computer-Aided Programming:** General information, APT programming, Examples APT Programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAM software, Automatic Tool PathGeneration.

**UNIT - V**

**Computer Aided Process Planning:**Basic Steps in Developing a Process Plan, Principal Process PlanningApproaches, Computer Applications in a Manufacturing Plant, Key Aspectsof CAM in a Manufacturing System and Manufacturing Control, Feature Technology, Feature-BasedMethodologies, Basic Concepts of Feature recognition, Classification of Feature Recognition Systems,Feature detection, Feature Generation.

**UNIT – VI**

**Computer Aided Inspection and qualityControl:** Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, OpticalInspection Methods. Artificial Intelligence, Knowledge-Based Systems, Expert Systems Technology, Applications of GeneticAlgorithm, Agent-Based Technology, Virtual Business, e-Commerce Technologies, Global ManufacturingNetworks, Digital enterprise technologies.

TEXT BOOKS:

1. CAD/CAM Concepts and Applications/ Alavala/ PHI.

2. CAD/CAM Principles and Applications, P.N.Rao, TMH

REFERENCES:

1. Computer Control of Manufacturing Systems / YoramKoren / Mc Graw Hill. 1983.

2. Computer Aided Design Manufacturing – K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M.

Sarcar, PHI, 2008.

3. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age

4. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson

5. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

6. Nanua Singh, Systems approach to computer integrated design and manufacturing, Wiley, 1996

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

**M.Tech. (CAD/CAM) I Year – II Sem.**

**FMS& ROBOTICS**

**(Programme Core)**

**L T P C**

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

**CODE: 7W209 CIE Marks: 25, SEE Marks:75**

**Course Objectives:**

To be familiar with the principles &implementation o of automation and brief history, kinematics, programming of robots and applications.

**Course outcomes:**

Up on the completion of this course, students able to

1. Describe various basic structures of NC/CNC machines

2. Identify different types of control systems used in various CNC Machines

3. Identify the different types of Post-Processors and their applications

4. Explain the concepts involved in FMS and automated quality control

5. Analyze the selection of type robot manipulator for a given application

6. Deduce the expressions related to kinematics and dynamics of different robots.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 | X |  |  |  |  |  |  |  |  |  |  |
| CO-3 | X |  |  |  | X |  |  |  |  |  |  |
| CO-4 | X |  |  |  |  |  |  |  |  |  |  |
| CO-5 | X |  |  |  |  |  |  |  |  |  |  |
| CO-6 | X |  |  |  |  |  |  |  |  |  |  |

**Unit-I:**

Introduction - Components of FMS - Application workstations - Computer control and functions - Planning,

Scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control -

Supervisory computer.

**Unit-II:**

**CAD/CAM Considerations for FMS**:

FMS Planning, Software for simulation and database of FMS. Specification and selection, trends, application of simulation software, Planning FMS database. Just –In –Time Manufacturing System, Kanban system and Preventive maintenance.

**Unit-III:**

**Software Simulation and Database of FMS**: Automated material handling - System issues - Types of software - specification and selection - Application of simulation - Manufacturing datasystems - data flow - CAD/CAM considerations - Planning FMS database.

**Unit-IV: Industrial Robotics:**

Classification and structure of Robotic systems, Performance of Robots, structure of continuous path robot systems, drives and control systems, control approaches for robots. Applications of Robotics in Industry.

**Unit-V**: Robotic Kinematics and Dynamics: D-H Convention, Homegeneoustranformation, Link parameters and Joint parameters, Robot arm kinematics, the direct kinematics problem and inverse kinematic solutions, planning of manipulator trajectories, Forward Dynamics formulation, Examples on planar robotic manipulators.

**Unit-VI**: Robot Sensors and Programming:

robot sensors, range sensors, proximity sensors, touch sensors, force and torque sensors, programming, manual teaching, lead through teaching, programming languages, storing and operating task programs, robot selection and application.

**TEXT BOOKS:**

1. Mikell P. Grover, Automation, Production Systems and Computer Integrated Manufacturing, Second Edition, Pearson Education Asia, First Indian Reprint 2001.

2. N.K. Jha, “Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.

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

**REFERENCE BOOKS:**

1. C. Ray Asfahl, Robots and Manufacturing automation, John Wiley and Sons New York-1992.

2. TaiichiOhno, Toyota, “Production System beyond Large-Scale production ",

Productivity Press (India) Pvt.Ltd. 1992.

1. R.D.Klafter, T.A., Chnielewski and Michael Negin, ‘Robotic Engineering-An integrated approach-Prentice Hall, New Delhi, 1994

**M.Tech. (CAD/CAM) I Year – II Sem.**

**OPTIMUM DESIGN OF MECHANICAL ELEMENTS**

**(Programme Core)**

**L T P C**

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

**CODE: 7W210 CIE Marks:25, SEE Marks:75.**

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| **Course Objectives:**  The students will get a fundamental knowledge to optimization techniques  To provide optimization methods in engineering design a view of optimization weight, cost, stresses etc...  **Course Outcomes:** |
| After completing the course, the students will learn: |
| **Unit I:** Basics of optimization, considerations relevant to mechanical / structural systems |
| **Unit II:** Concepts and methods for single-variable unconstrained and constrained optimisation |
| **Unit III:** Concepts and methods for multi-variable unconstrained and constrained optimization |
| **Unit IV:** Techniques for nonlinear optimization |
| **Unit V:**Advanced optimization techniques |
| **Unit VI:**Optimisation of complex mechanical elements |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 |  |  |  |  | X |  |  |  |  |  |  |
| CO-3 |  |  |  |  | X |  |  |  |  |  |  |
| CO-4 |  |  |  |  |  |  |  |  |  | X |  |
| CO-5 |  |  |  |  |  |  |  |  |  | X |  |
| CO-6 |  |  |  |  |  |  |  |  |  | X |  |

**Unit – I: Introduction:**

Introduction, Engineering Applications of Optimization , Statement of an Optimization Problem , Design Vector , Design Constraints , Constraint Surface ,Objective Function , Objective Function Surfaces , Classification of Optimization Problems, Formulation of Single-Variable Optimization , Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints and Multivariable Optimization with Inequality Constraints.

**Unit – II: Single VariableUnconstrainedOptimisation:**

Search Methods: Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval Halving Method, Fibonacci Method, Golden Section Method, Interpolation method: Quadratic Interpolation Method, Newton Method.

**Unit – III: Multi-Variable Unconstrained optimisation**:

Problem formulation; optimality conditions, Direct Search Method: Powell's method.

Indirect Search methods: Steepest descent method, Conjugate gradient method, Newton’s method, Davidon-Fletcher-Powell (DFP) method, Broyden-Fletcher-Goldfarb-Shanno (BFGS) method.

**Unit – IV: Multivariable Constrained optimisation**:

Problem formulation, Necessary conditions for optimality (equality, inequality and mix of both types of constraints), sufficient conditions. Direct Method: Lagrangian method, Zoutendijk’s method. Indirect Method: Basic Approach of the Penalty Function Method, Interior and exterior penalty function methods.

**Unit – V: Advanced Optimisation Technique: Geometric Programming**

Posynomial, Unconstrained Minimization Problem, Solution of an Unconstrained Geometric Programming Program, Primal–Dual Relationship and Sufficiency Conditions in the Unconstrained Case, Constrained Minimization , Solution of a Constrained Geometric Programming Problem, Primal and Dual Programs in the Case of Less-Than Inequalities, Geometric Programming with Mixed Inequality Constraints .

**Unit–VI: Applications of Optimisation in Design and Manufacturing:** Design of a 2-bar truss structure of for minimum weight; Minimum weight tubular column design to support a given load without overstressing and buckling, Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of helical coiled springs an, general optimization model of a machining process and optimization of arc welding parameters.

**TEXTBOOK:**

1. S.S.Rao, “Engineering Optimisation: Theory and Practice”, Wiley Eastern Edition
2. Ray C. Johnson, “Optimum Design of Mechanical Elements”, John Wiley & Sons

**REFERENCE BOOKS:**

1. Jasbir S. Arora, “Introduction to Optimum Design”, McGraw Hill International Edition
2. Kalyanamoy Deb, “Optimisation for Engineering Design Algorithms and Examples”, Prentice Hall of India
3. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

**M.Tech. (CAD/CAM) I Year – II Sem.**

**PERFORMANCE MODELING OF AUTOMATEDMANUFACTURING SYSTEMS**

**(Programme Elective-II)**

**L T P C**

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

**CODE: 7W211 CIE Marks:25, SEE Marks:75**

**Course Objectives:**

Toprovideappropriateknowledgeandskills to understand the Simulation technicques /processes for Manufacturing Systems

**Course Outcomes:**

At the end of this course, student able to

1. Demonstrate modeling techniques of manufacturingystems

2. Apply simulation process for manufacture facilities

3. Explain the applications of queuing simulation

4. Understand the concepts of queuing networks

5. Model simple manufacturing activities withpetrinets

6. Demonstrate few simulation applications in manufacturing withpromode software

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  | X |  |  |
| CO-2 |  |  |  |  |  |  |  |  | X |  |  |
| CO-3 |  |  |  |  |  |  |  |  | X |  |  |
| CO-4 |  |  |  |  | X |  |  |  | X |  |  |
| CO-5 |  |  |  |  | X |  |  |  | X |  |  |
| CO-6 |  |  |  |  | X |  |  |  | X |  |  |

**UNIT-I:**Automated Manufacturing Systems

Introduction, Manufacturing Systems, Performance Measures, Computer-Controlled Machines, Material Handling Systems, Plant Layout, Computer Control Systems, Flexible Manufacturing Systems.

UNIT-II: Modeling of Manufacturing Systems & Control: Automated Manufacturing Systems – Modeling – Role of performance modeling – simulation models-Analytical models. Product cycle – Manufacturing automation – Economics of scale and scope – input/output model – plant configurations. Performance measures – Manufacturing lead time – Work in process – Machine utilization – Throughput – Capacity – Flexibility – Performability – Quality Control Systems – Control system architecture – Factory communications – Local area network interconnections – Manufacturing automation protocol – Database management system.

UNIT-III: Manufacturing simulation Processes:

Examples of stochastics processes – Poisson process - Discrete time Markov chain models – Definition and notation – Sojourn times in states – Examples of DTMCs in manufacturing – Chapman – Kolmogorov equation – Steady-state analysis. Continuous Time Markov Chain Models – Definitions and notation – Sojourn times in states – examples of CTMCs in manufacturing – Equations for CTMC evolution – Markov model of a transfer line.Birth and Death Processes in Manufacturing – Steady state analysis of BD Processes – Typical BD processes in manufacturing.

UNIT-IV

**QUEUING SIMULATION APPLICATIONS:**

Queuing Model: Notation for queues – Examples of queues in manufacturing systems – Performance measures – Little’s result – Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns – Analysis of a flexible machine center

UNIT-V: **Queuing Networks:**

Examples of QN models in manufacturing – Little’s law in queuing networks – Tandem queue – An open queuing network with feedback – An open central server model for FMS – Closed transfer line – Closed server model – Garden Newell networks.

UNIT-VI: Petrinets: Classical Petri Nets – Definitions – Transition firing and reach ability – Representational power – properties – Manufacturing models. Stochastic Petri Nets – Exponential timed Petri Nets – Generalized Stochastic Petri Nets – modeling of KANBAN systems – Manufacturing models

Text books

1. Performance Modelling of Automated Manufacturing Systems/ Viswanadham, N AndNarahari, Y/ Prentice Hall Of India, New Delhi, 1994.

References:

2. Probability And Statistics With Reliability, Queuing And Computer Science Applications/ Trivedi, K.S./ Prentice Hall, New Jersey, 1982.

3. Fundamentals Of Mathematical Statistics/ Gupta S.C. & Kapoor V.K./ 3rd Edition, Delhi, 1988

**M.Tech. (CAD/CAM) I Year – II Sem.**

**Micro Electro Mechanical Systems(MEMS)**

**(Programme Elective-II)**

**L T P C**

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

**CODE*:*7W212 CIE Marks:25, SEE Marks:75**

**Course Objective:**

To introduce students to the concepts and applications MEMS.

**Course Outcomes:**

At the end of this course, students able to

1. Acquire knowledge on MEMS principles and applications.

2. Demonstrate basics of micro system

3. Learn mechanics principles for microsystem design

4. Realize the applications of Thermal fluid

5. Applygenaral approach to design amicro systems

6. Understand various types of Manufacturing of MEMS

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 |  |  |  |  | X |  |  |  |  |  |  |
| CO-2 |  |  |  |  | X |  |  |  |  |  |  |
| CO-3 |  |  |  |  | X |  |  |  |  |  |  |
| CO-4 | X |  |  |  |  |  |  |  |  |  |  |
| CO-5 |  | X |  |  |  |  |  |  |  |  |  |
| CO-6 |  |  |  |  | X |  |  |  |  |  |  |

**UNIT - I:**

**Overview and Working Principles of MEMS and Microsystems**

MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems &Miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Microactuators Micro accelerometers, Micro fluidies.

**UNIT - II:**

**Engineering Science for Microsystems Design and Fabrication:**

Atomic structure of Matter, Ions and Ionization, Molecular Theory of Mater and Intermolecular Force,Doping of Semiconductors, The diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

**UNIT - III:**

**Engineering Mechanics for Microsystems Design:**

Static Bending of thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics, Thin-FilmMechanics, Overview of Finite Element Stress Analysis

**UNIT - IV:**

**Thermo Fluid Engineering:**

Overview of Basics of Fluid Mechanics in Macro and Meso scales, Basic equations in Continuum Fluiddynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible FluidFlow in Micro conduits, Fluid Flow in Sub micrometer and Nano scale, Overview of Heat conduction inSolids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale.

**UNIT-V:**

**Microsystems Design:**

DesignConsiderations, Process Design Mechanical Design, Mechanical Design using FEM, Design of a SiliconDie for a Micro pressure Sensor.

**UNIT - VI:**

**Materials for MEMS & Microsystems and Their Fabrication:**

Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds,SiliconPiezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography,Ion implantation, Diffusion and oxidation, chemical and physical vapor deposition, Etching, Bulk micromanufacturing, Surface Micromachining, The LIGA Process

**REFERENCES:**

1. MEMs & Microsystems: Design & Manufacture/ Tai-Ran Hsu/Tata Mc-Graw

Hill. ed. /2002

2. An Introduction to Microelectromechanical Systems Engineering/ Maluf, M. /Artech

House, Boston, 2000

3. Micro robots and Micromechanical Systems/ Trimmer, W.S.N/ Sensors & Actuators,

vol19, no.1989.

4. Applied Partial Differential Equations/ Trim, D.W/ PWS-Kent Publishing/ Boston 1990.

5. Fundamentals of Microfabrication. Madou, M/ CRC Press, Boca Raton, 1997.

6. The Finite Element Method in Thermomechanics/ Hsu, T.R / Alien & Unwin, London

**M.Tech. (CAD/CAM) I Year – II Sem.**

**MECHANICAL VIBRATIONS & CONDITION MONITORING**

**(Programme Elective-II)**

**L T P C**

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

**CODE: 7W213 CIE Marks:25, SEE Marks:75**

**Course Objective:**

to provide knowledge to understand the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions and be able to make free and forced (harmonic, periodic) vibration analysis of single and multi degree of freedom linear systems and Student will learn principles of condition monitoring for diagnostic of machines.

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| **Course Out Comes :** |
| 1. Student should be ableto develop ability to analyze mechanicalvibrations and select elements for various vibration applications - with attention to amplitude and frequencies. |
| 1. To analyze resonance conditions and Safety factors for machine members of multi degree freedom under steady state and periodic fatigue loads. |
| 1. to derive vibration equations for continuous systems |
| 1. To acquire procedure to analyze and designof vibration measurement devices. |
| 1. to learn technique to evaluate random and non linear vibrations and |
| Various types of monitoring techniques and their applications. |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 |  | X |  |  | X |  |  |  |  |  |  |
| CO-2 |  | X |  |  | X |  |  |  |  |  |  |
| CO-3 |  | X |  |  | X |  |  |  |  |  |  |
| CO-4 |  | X |  |  | X |  |  |  |  |  |  |
| CO-5 |  | X |  |  | X |  |  |  |  |  |  |
| CO-6 |  | X |  |  | X |  |  |  |  |  |  |

**Unit I:VibrationsofSingle Degree of Freedom Systems:**

Simple harmonic motion, Free and forced vibrations of damped and undamped systems; Simple harmonic excitation; steady state response forced vibrations; free transverse and torsion vibrations;

**Unit II: Vibration of Systems with Two Degrees of Freedom:**

Free vibration of spring coupled systems, Two degree freedom of mass coupled system, bending vibrations of two degree of freedom system, Forced vibrations of un damped two degree of freedom system, Forced damped vibrations, Vibration isolation, Close coupled system, Far coupled system, mode shapes and modal analysis

**Unit III**: **Vibration of Systems with Multi-degree of Freedom:**

**Continuous Systems:** Vibrating string, longitudinal vibration of rods, Torsional vibration of rods, and Euler equation for beams.

**Approximate methods**: Dunkerley lower bound method, Rayieigh’s upper bound method, Holzer method, Stodola’s methods

**Unit IV: Experimental methods in vibration analysis:**

Vibration instruments: exciters, transducers, analysers, measurement devices: vibrometers, velocity meters and accelerometers; Signal analysis techniques: time domain analysis, frequency domain analysis, amplitude and power spectra, coherence, auto and cross correlations, amplitude and frequency modulations; Tests for free and forced vibrations

**Unit V: Condition Monitoring of Systems:**

Introduction to Vibration and Condition Monitoring; Failure types, investigation and occurrences; Machinery Signatures and analysis; Wear and lubricant / contaminant monitoring and analysis; Introduction to Active Control of Structures

**Unit VI:**

**Random Vibrations** : Random phenomena, Time averaging and expected value, Frequency response function, Probability distribution, Correlation, Power spectrum and power spectral density, Fourier transforms, FTs and response.

**Introduction to Vehicle dynamics**: vehicle subjected to random vibrations (for example an uneven road), Introduction to nonlinear and random vibrations, Vibrations in turbines.

**TEXTBOOK:**

1. “Introductory Course on Theory and Practice of Mechanical Vibrations”, J.S.Rao, K.Gupta, Revised second edition, New Age International Publishers
2. “Theory of Vibration with Applications”, William T. Thomson, Marie Dillon Dahleh, Pearson Low Price Edition
3. “Condition Monitoring and Condition Based Maintenance”, Dr. Prabhu, Teacher Training Institute, Bhopal

**REFERENCE BOOKS:**

1. “Mechanical Vibration and Shock Measurements”, J.T.Broch, Bruel and Kjae Publication
2. “Mechanical Fault Diagnosis and Condition Monitoring”, R.A.Collacott, Chapman and Hall Publishers
3. "Applications of Random Vibrations", N. C. Nigam, S. Narayanan, Narosa Publishers

**M.Tech. (CAD/CAM) I Year – II Sem.**

**3D PRINTING TECHNOLOGY AND ADDITIVE MANUFACTURING**

**(Programme Elective-III)**

**L T P C**

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

**CODE: 7W214 CIE Marks:25; SEE Marks:75**

**Course Objective:**

To provide subject knowledge of advanced topics of Manufacturing Methods suchasAdditive manufacturing emphasizing the 3D printing Technology.

**Course Outcomes:**

|  |
| --- |
| 1.learn Basics of Additive manufacture |
| 2.demonstrate Concept of Additive Manufacture Process chain |
| 3. able to demonstrate Liquid based Manufacture system. |
| 4. able to demonstrate Solid based Manufacture system. |
| 5. able to demonstrate powder based Manufacture system.  6.Able to discuss applications of AM |
|  |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 |  |  |  |  | X |  |  |  |  |  |  |
| CO-2 |  |  |  |  | X |  |  |  |  |  |  |
| CO-3 |  |  |  |  | X |  |  |  |  |  |  |
| CO-4 | X |  |  |  |  |  |  |  |  |  |  |
| CO-5 |  | X |  |  |  |  |  |  |  |  |  |
| CO-6 |  |  |  |  | X |  |  |  |  |  |  |

**Unit-1.Introduction**

Development of AM, Fundametals of AM, Classification of AM systems, Advantageous of AM, Standards on AM, Commonly used Terms.

Basics of 3D Printing: What is 3D Printing, Types of 3D Printing Technologies, In-depth of FDM/FFF printer, Slicing Software, 3D Printer Operation

**Unit-2.Additive Manufacturing Process chain**

Fundamentals of Automated fabrication Process, Process chain,3D Modeling, Data conversion and transmission, Checking and preparing, Building, Post processing

**Unit-3.Liquid based additive Manufacturing Systems**

3D Systems Sterolithography Apparatus, Stratasys Poly jet,Multi jet printing system,Rapid Freeze Prototyping, OptmecsAersol Jet Systems, Two photon Polymerisation,3D Cerams Ceramic Parts, Other notable Liquid based AM Systems

**Unit-4. Solid Based Additive Manufacturing Systems**

Stratasys Fused Deposition Modeling,Mcor Technologies Selective Deposition Lamination, Sciaky's Electron Beam AM, Fabrisonic's Ultrasonic Additing Manufacturing, Other notable Solid Based AM sytem

**Unit-5. Powdered Based Additive Manufacturing**

3D systems SLS, SLM solutions foe Selective Laser Melting,3D SYSTEM CJP Technology, BeAMs LMD systems,Electron Beam Melting, DMG MORI,s Hybrid AM,HP,s Multi Jet Fusion, Other notable Powered Based AM Systems.

**Unit-6. AM Data Formats AND Application of AM**

STL Format, STL File Problems, Tessellated Model, STL fILE REPAIR, Other translators, Stanadard representation of AM, Standards on AM.

Applications in Aero space, Automotive, Jewellery, coin, Tableware, marine and offshore etc.

Text Books:

1. Chee Kai Chua, Kah Fai Leong " 3D Printing and Additive Manufacturing Principles and Applications Fifth Addition,Kindle Text book store.

2.M.Adithan "Rapid Protoyping" Atalntic Publishers.

**M.Tech-CAD-CAM (ME)- I Year – II Sem.**

**Production and characterization of nanomaterials**

**(Program Elective-III)**

**L T P/D C**

**3 - 0 3**

**CODE:7W215 CIE Marks : 25, SEE Marks :75**

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| --- |
| **OBJECTIVES** |
| In this Subject students will learn about different physical methods, chemical methods, thermolysis rule and biological methods. For the synthesis of nanomaterials, students gain in depth of knowledge which will be helpful to them in the career to go forward successfully in the field of nanoscience and nanotechnology. |

**Course Outcomes:**

|  |
| --- |
| 1.Student acquires knowledge on advanced synthesis of nanomaterials via physical methods. |
| 1. Student acquires knowledge on topdown and bottom up new synthesis methods for making nanomaterials. |
| 3. Students learns advanced methods of synthesis via CVD, biological methods |
| 4. Student acquires knowledge on advanced compositional and structural analysis of nanomaterials |
| 5. Student acquires knowledge on advanced surface characterization techniquesapplied to nanomaterials |
| 6. Student acquires knowledge on advanced electrical characterization techniques applied to nanomaterials |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 |  |  |  |  | X |  |  |  |  |  |  |
| CO-2 |  |  |  |  | X |  |  |  |  |  |  |
| CO-3 |  |  |  |  | X |  |  |  |  |  |  |
| CO-4 |  |  |  |  | X |  |  |  |  |  |  |
| CO-5 |  |  |  |  | X |  |  |  |  |  |  |
| CO-6 |  |  |  |  | X |  |  |  |  |  |  |

**Unit-I:** Introduction to synthesis of nanostructure materials, Bottom-up approach and Top-down approach with examples. Physical methods**:** Inert gas condensation, Arc discharge, RF-plasma, plasma arc technique, electric explosion of wires, laser ablation, laser pyrolysis,

**Unit-II:** Ball milling, molecular beam epitaxy, electrodeposition, rapid solidification (RSP), consolidation, Chemical methods**:** Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, Nanocrystals of semiconductors and other materials by arrested precipitation, emulsion synthesis, sonochemical routes

**Unit-III:**Thermolysis route - spray pyrolysis and solvated metal atom dispersion, sol-gel method, solvothermal and hydrothermal routes, solution combustion synthesis, CVD method and other variants, Biological methods – use of bacteria, fungi**,**actinomycetes for nano-particle sythesis-magnetotaticbacteria for natural synthesis of magnetic nano-particles, role of plants in nano particle synthesis.

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

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

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

**Textbooks:**

1. Inorganic Materials Synthesis and Fabrication by J.N. Lalena, D.A. Cleary, E.E. Carpenter, N.F. Dean, John Wiley & Sons Inc.
2. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens. Wiley India Pvt Ltd.
3. The Chemistry of nanomaterials: Synthesis, Properties and Applications, Vol-I by C.N.R. Rao, A. Muller and A.K. Cheetham
4. “Nanoscience and Nanotechnology: Fundamentals to Frontiers” by M.S. Ramachandra Rao and Shubra Singh, Wiley Publishers, 2013.

**Reference books:**

1. Encyclopedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy, Vol I to X, Campus books.
2. Encyclopedia of Nanotechnology by H.S. Nalwa
3. Nano: The Essentials – Understanding NanoScinece and Nanotechnology – by T.Pradeep; Tata Mc.Graw Hill

**M.Tech.(CAD/CAM) I Year – II Sem.**

**TECHNICAL SEMINA-II**

**L T P C**

**- - 4 2**

**CODE: 7W273 CIE Marks: 100**

**Course Objective:**

To give sufficient technical life long skills to learn impact various engineering solutions in global products and process industries.

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

1. Identify a specific research topic based on the emerging trends

2. Collect literature survey

3. Present series of seminars

4. Discuss the queries and incorporate the suggestions made

5. Prepare the research report as per the format

6. Should give final presentation on the topic selected

There shall be two seminar presentations during I year II semester For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee, which shall consist of the Head of the Department, a senior Faculty Member and the Supervisor and will jointly evaluate the report and presentation. For each Seminar there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% to be declared successful.

In the First semester the report must be in the form of the review paper with a format used by IEEE / ASME etc. In the Second semester Technical Seminar in the form of Independent Review Paper must be of high quality fit for publication in a reputed conference / journal.

**The evaluation format for seminar is as follows:**

|  |  |
| --- | --- |
| Selection of topic, literature survey  Review by the guide | 10 marks |
| Final report and viva | 10 marks |
| Level of content | 15 marks |
| Presentation | 20 marks |
| Discussion & Involvement | 15 marks |
| Class notes | 15 marks |
| Attendance | 15 marks |
| **Total** | **100 Marks** |

**Contents:**

* Identification of specific topic
* Analysis
* Organization of modules
* Naming Conventions
* Writing style
* Figures
* Feedback
* Miscellaneous

# REFERENCES:

# Teach Technical Writing in Two Hours per Week by Norman Ramsey

For Technical Seminar the student must learn few tips from sample seminars and correcting himself, which is continues learning process

**NOTE:** A student can use any references for this process, but must be shared in classroom.

**M.Tech. (CAD/CAM) I Year – II Sem.**

**CAM & Robotics LAB**

L T P C

- - 4 2

**CODE: 7W274 CIE Marks:25, SEE Marks:75**

***Course Objective:***

ToExposure CAM tools such as XL turn &mill, 3DPrinting and Robotics for use in mechanical engineering applications

Equipment: ***CNC Lathe, CNC Mill, 3D Printer, Six Axis Robot.***

***List of Experiments:***

1. Part programme Simulation on lathe operations using XL Turn

2. Partprogramme Simulation on mill and drill operations using XL Mill

3. Exercise on Facing, Turning, Step Turning and Taper turning CNC Lathe

4. Exercise on Pattern repetition through sub program on CNC Lathe

5. Exercise on Thread cutting on CNC Lathe

6. Exercise on Profile cutting and pocket cutting on CNC Mill

7. Exercise on Mirroring on CNC Mill

8. Demo of Part loading on CNC Machines with XL Articulated Robot

9.3D Pinting of screw CAD Model

10.3DPrinting of Spur gear model

11. Writing a Pick and Place Program and Running the Program Line by Line and Running the Program continuously

12. Performing Pick and Place Tasks on Six Axis Robot: Recording Pick and Place positions, Performing Pick and Place Movements.

**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 end examination. Out of the 25 marks for internal, 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 and viva - 05 marks
5. Project demo - 05 marks

Total - 25 marks

The end examination 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 - 20 marks
3. Results including graphs, discussions and conclusion-20 marks
4. Viva voce and record - 20 marks

Total - 75 marks

**M.Tech. (CAD/CAM) I Year -II SEM**

**COMPREHENSIVE VIVA**

**L T P C**

**- - 2 1**

**CODE: 7W275**

**CIE Marks:25, SEE Marks:75**

**Course Objective:**

1. The main objective of this course is to prepare the students to face interview both at the academic and the industrial sector.

2. To Exhibit the strength and grip on the fundamentals of the subjects studied in I year IIsem

There shall be a Comprehensive Viva-Voce Examination in second semester of I year. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students’ understanding in various subjects, he/she studied during the M.Tech I Year II Sem course of study, and The Comprehensive Viva-Voce is valued for 100 marks. There are25 marks to be evaluated by the internal committee and 75 marks for the end semester evaluation by a committee constituted with internal members and external evaluator. A candidate has to secure a minimum of 50% of total marks subject to securing a minimum of 40% mark in external examination to be declared successful.

**M.Tech. (CAD/CAM) I Year –II Sem**

**MINI PROJECT with SEMINAR**

**Course outcomes:**

After studying this course, the students will be able to

1. Identify a research topic
2. Collect literature
3. Do project & write technical review paper
4. Present seminar
5. Discuss the queries and Publish research paper

In I year II semester, a project seminar shall be conducted for 100 marks and for 2 credits. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and frame problem definition based on the literature- methodology- Experiment/simulate-obtain results , submit report to the Department and shall make an oral presentation before the Departmental Committee, which shall consist of the Head of the Department, a senior Faculty Member and the Supervisor and will jointly evaluate the report and presentation.

A Student has to concentrate on the following sections while writing technical paper or presenting seminar.

Contents:

* Identification of specific topic, Analysis
* Organization of modules, Naming Conventions
* Writing style, Figures
* Feedback
* Miscellaneous

**REFERENCES:**

1. Teach Technical Writing in Two Hours per Week by Norman Ramsey

2. For Technical Seminar the student must learn few tips from sample seminars and correcting himself, which is continues learning process

**REFERENCE LINKS:**

1. http://www.cs.dartmouth.edu/~scot/givingTalks/sld001.htm
2. http://www.cse.psu.edu/~yuanxie/advice.htm
3. http://www.eng.unt.edu/ian/guides/postscript/speaker.pdf

NOTE: A student can use any references for this process, but must be shared in classroom.

**M.Tech. (CAD/CAM) II Year – I Sem.**

**MECHANICS AND MANUFACTURING METHODS OF COMPOSITES**

**L T P C**

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

**CODE:7W316 CIE Marks:25,SEE Marks:75**

**Course Objective:**

To introduce students to the concepts of composite materials along with stress analysis and theories of micro and macromechanics.

**Course Outcomes:**

At the end of this course, students able to

1. Inditify appropriate composite for given application

2. Derive various stress strain relations for composite lamina

3. Do investigate elastic behaviour of composites

4. Deduce failure mechanisms of composites

5. Applyanylitical approach to analyse composite vplates

6. Learn different manufacturing processes for composites

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 |  |  | X |  |  |  |  |  |  |  |  |
| CO-3 |  |  | X |  |  |  |  |  |  |  |  |
| CO-4 |  |  | X |  |  |  |  |  |  |  |  |
| CO-5 |  |  |  |  | X |  |  |  |  |  |  |
| CO-6 | X |  |  |  |  |  |  |  |  |  |  |

**UNIT – I**

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

Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres.Particulate composites, Polymer composites, Thermoplastics, Thermosets, 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.

**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 – III**

**Elastic behaviour of unidirectional composites**: Elastic constants of lamina, relation ship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

**UNIT-IV 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. Micromechanical predictions of elastic constants.

**UNIT – V**

Analysis of laminated composite plates: Introduction, thin plate theory, especially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory. Analysis of composite beams

**UNIT – VI**

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

**TEXT BOOKS:**

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.

2. Engineering Mechanics of Composite Materials by Isaac and M.Daniel, Oxford University Press, 1994.

**REFERENCES:**

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.

2. L. R. Calcote, Analysis of Laminated Composite Structures, VanNostrandRainfold, New York, 1969

**M.Tech. (CAD/CAM) II Year –I Sem**

**BUSINESS ANALYTICS**

**(Open Elective)**

**L T P/D C**

**3 0 0 3**

**CIE Marks:25, SEE Marks:75**

**CODE:7ZC29**

**Course objectives:**

* Understand the role of business analytics within an organization.
* Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
* To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
* To become familiar with processes needed to develop, report, and analyze business data.
* Use decision-making tools/Operations research techniques.
* Mange business process using analytical and management tools.
* Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc

**COURSE OUTCOMES:**

1. Students will demonstrate knowledge of data analytics.

2. Students will demonstrate the ability of think critically in making decisions based on data

and deep analytics.

3. Students will demonstrate the ability to use technical skills in predicative and prescriptive

Modeling to support business decision-making.

4. Students will demonstrate the ability to translate data into clear, actionable insights

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 |  |  |  |  | X |  |  |  |  |  |  |
| CO-3 |  |  |  |  | X |  |  |  |  |  |  |
| CO-4 |  |  |  |  | X |  |  |  |  |  |  |
| CO-5 |  |  |  |  |  |  |  |  |  |  |  |
| CO-6 |  |  |  |  |  |  |  |  |  |  |  |

**SYLLABUS**

**Unit1:** Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

**Unit 2**: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

**Unit 3:** Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

**Unit 4:** Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

**Unit 5:** Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

**Unit 6:** Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

**References:**

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

2. Business Analytics by James Evans, persons Education.

**M.Tech. (CAD/CAM) II Year –I Sem**

**INDUSTRIAL SAFETY**

**(Open elective)**

**L T P/D C**

**3 0 0 3**

**CIE Marks:25, SEE Marks:75**

**CODE: 7WC17**

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| **OBJECTIVES** |
| In this Subject students will learn about different physical methods, chemical methods, thermolysis rule and biological methods. For the synthesis of nanomaterials, students gain in depth of knowledge which will be helpful to them in the career to go forward successfully in the field of nanoscience and nanotechnology. |

**COURSE OUTCOMES:**

|  |
| --- |
| 1. Student acquires knowledge on different safety measured to be taken in industry |
| 2.Student acquires knowledge on different maintenance and systems and service life cycle calculations |
| 3. Students should demonstrate the wear behavior of different mechanical elements and and its preventive measures |
| 4. Student acquires knowledge on different types of faults in machine tools and their general causes. |
| 5. Student acquires knowledge on Periodic and preventive maintenance |
| 6. Student acquires knowledge on procedures and Steps for periodic and preventive maintenance |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  | X |  |  |  |  |  |  |  |  |
| CO-2 | X |  | X |  |  |  |  |  |  |  |  |
| CO-3 | X |  | X |  |  |  |  |  |  |  |  |
| CO-4 | X |  | X |  |  |  |  |  |  |  |  |
| CO-5 | X |  | X |  |  |  |  |  |  |  |  |
| CO-6 | X |  | X |  |  |  |  |  |  |  |  |

**Syllabus:**

**Unit-I:** Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**Unit-II:** Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**Unit-III:** Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**Unit-IV:** Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment’s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

**Unit-V:** Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

**Unit-VI:** Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

**References:**

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.

2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.

4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

**M.Tech. (CAD/CAM) II Year –I Sem**

**OPERATIONS RESEARCH**

**(Open elective)**

**L T P/D C**

**3 0 0 3**

**CIE Marks:25, SEE Marks:75**

**CODE: 7WC18**

**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**

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  | X |  |  |  | X | X |
| CO-2 | X |  |  |  |  | X |  |  |  | X | X |
| CO-3 | X |  |  |  |  | X |  |  |  | X | X |
| CO-4 | X |  |  |  |  | X |  |  |  | X | X |
| CO-5 | X |  |  |  |  | X |  |  |  | X | X |
| CO-6 | X |  |  |  |  | X |  |  |  | X | X |

Syllabus Contents:

Unit 1: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2: Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4: Scheduling and sequencing - single server and multiple server models.

Unit 5: deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 6. Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

**References:**

1. H.A. Taha, Operations Research, an Introduction, PHI, 2008

2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5. Pannerselvam, Operations Research: Prentice Hall of India 2010

6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

**M.Tech. (CAD/CAM) II Year –I Sem**

**COMPOSITES**

**(Open elective)**

**L T P/D C**

**3 0 0 3**

**CIE Marks:25, SEE Marks:75**

**CODE: 7WC19**

**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:**

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| --- |
| 1. Student acquires knowledge on different types of composite materials and its applications |
| 2.Student acquires knowledge on Mechanical Behavior of composites of different composite materials |
| 3. Students should demonstrate the Manufacturing of Metal Matrix Composites and its properties |
| 4. Student acquires knowledge on Manufacturing of Ceramic Matrix Composites and its properties |
| 5. Student acquires knowledge on Manufacturing of Polymer Matrix Composites |
| 6. Student acquires knowledge on Failure Criteria-strength ratio, maximum stress criteria |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  | X |  |  |  |  |  |  |
| CO-2 | X |  |  |  | X |  |  |  |  |  |  |
| CO-3 | X |  |  |  | X |  |  |  |  |  |  |
| CO-4 | X |  |  |  | X |  |  |  |  |  |  |
| CO-5 | X |  |  |  | X |  |  |  |  |  |  |
| CO-6 | X |  |  |  | X |  |  |  |  |  |  |

**Syllabus:**

UNIT–I: INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

UNIT–IV: Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–V: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – VI: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**TEXT BOOKS:**

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

**References:**

1. Hand Book of Composite Materials-ed-Lubin.

2. Composite Materials – K.K.Chawla.

3. Composite Materials Science and Applications – Deborah D.L. Chung.

4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

**M.Tech. (CAD/CAM) II Year –I Sem**

**COST MANAGEMENT OF ENGINEERING PROJECTS**

**(Open elective)**

**L T P C**

**3 0 0 3**

**CODE: 7ZC28 CIE Marks:25, SEE Marks:75**

**Course objective:** To provide the insights of various project management and cost control techniques for successful implementation and completion of the project.

**Course Outcomes:**

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| 1. Student acquires knowledge on different costing system and Cost concepts in decision-making |
| 2. Student acquires knowledge on Break-even Analysis, Cost-Volume-Profit Analysis and various decision-making problems |
| 3. Students should demonstrate the Manufacturing of Metal Matrix Composites and its properties |
| 4. Student acquires knowledge on different project management analysis |
| 5. Student acquires knowledge on Project evaluation systems |
| 6. Student acquires knowledge on different quantitative techniques |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  | X |  |  |
| CO-2 | X |  |  |  |  |  |  |  | X |  |  |
| CO-3 | X |  |  |  |  |  |  |  | X |  |  |
| CO-4 | X |  |  |  |  |  |  |  | X |  |  |
| CO-5 | X |  |  |  |  |  |  |  | X |  |  |
| CO-6 | X |  |  |  |  |  |  |  | X |  |  |

**UNIT I**

**INTRODUCTION AND OVERVIEW OF THE STRATEGIC COST MANAGEMENT PROCESS**: Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

**UNIT II**

**COST BEHAVIOR AND PROFIT PLANNING MARGINAL COSTING**; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis (Theory). Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

**UNIT III**

**BUDGETARY CONTROL:** Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing

**UNIT IV**

**PROJECT MANAGEMENT TECHNIQUES:** Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

**UNIT V**

**PROJECT EVALUATION:**. Meaning of Project, Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of Project Manager. Importance Project site. Project execution Project cost control. Bar charts and Network diagram.

**UNIT VI**

**QUANTITATIVE TECHNIQUES:** For cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

**Books Recommended:**

* Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
* Charles T. Horngren and George Foster, Advanced Management Accounting

**References:**

* Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
* Ashish K. Bhattacharya, Principles & Practices of CostAccounting A. H. Wheeler publisher
* N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

**M.Tech. (CAD/CAM) II Year –I Sem**

**WASTE TO ENERGY**

**(Open elective)**

L T P/D C

3 0 0 3

**CIE Marks:25, SEE Marks:75**

**CODE: 7MC17**

**Course objective:** To provide the insights of utilizing various energy in waste and maintan the environmental sustainability

**Course Outcomes:**

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| 1. Student acquires knowledge on utilization of energy in different types of energy |
| 2. Student acquires knowledge on Biomass Pyrolysis and Manufacture of pyrolytic oils and gases |
| 3. Students should demonstrate the Biomass Gasification process |
| 4. Student acquires knowledge on Biomass Combustion process |
| 5. Student acquires knowledge on Properties of biogas |
| 6. Student acquires knowledge on Urban waste to energy conversion - Biomass energy programme in India. |

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 | X |  |  |  |  |  |  |  |  |  |  |
| CO-3 | X |  |  |  |  |  |  |  |  |  |  |
| CO-4 | X |  |  |  |  |  |  |  |  |  |  |
| CO-5 | X |  |  |  |  |  |  |  |  |  |  |
| CO-6 | X |  |  |  |  |  |  |  |  |  |  |

Syllabus contents:

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion -

Unit-VI: Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

**M.Tech. (CAD/CAM) I Year –II Sem**

**MINI PROJECT with SEMINAR**

L T P C

- - 6 3

**CIE Marks:25, SEE Marks:75**

**CODE: 7W376**

**Course outcomes:**

After studying this course, the students will be able to

1. Identify a research topic

2. Collect literature

3. Do project & write technical review paper

4. Present seminar

5. Discuss the queries and Publish research paper

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| Mapping | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO-1 | X |  |  |  |  |  |  |  |  |  |  |
| CO-2 |  |  |  | X |  |  |  |  |  |  |  |
| CO-3 |  |  |  |  |  |  | X |  |  |  | X |
| CO-4 |  |  |  |  |  |  |  | X |  |  |  |
| CO-5 |  |  |  |  |  |  |  |  |  | X |  |
| CO-6 |  |  |  |  |  |  |  |  |  |  |  |

In II year I semester, a mini-project review shall be done by PRC for 100 marks and 3 credits. The students shall take up an industry-oriented mini-project between I year II semester and II year I semester.

The evaluation of the mini-project shall be done following the submission of a report by the students at the beginning of the II year I semester. The evaluation process shall carry 25 marks for continuous review of project progress and 75 marks for the report and a presentation of a seminar by the students covering the mini-project. The committee shall examine the project scope, the work done, and the knowledge gained by the students during the project time period. A candidate shall secure a minimum of 50% to be declared successful in Mini-Project.

**M.Tech. (CAD/CAM) II Year –I Sem**

**PROJECT PHASE-I WITH SEMINAR**

**L T P C**

**- - 10 5**

**CIE Marks:25, SEE Marks:75**

**CODE: 7W377**

In II year I semester, a project work review shall be done by PRC for 100 marks and for 5credits. The evaluation for the project reviews shall be done in 4 stages (not less than 4 weeks between two consecutive stages) including end semester evaluation.

Each stage project review shall carry marks Weightage and the end semester review shall carry 75marks. The Supervisor and External Examinar will examine the Problem Definition, Objectives, Scope of Work, Literature Survey and design in Project Phase- I. A candidate shall secure a minimum of 50% to be declared successful in Project Phase I. If candidate fails to fulfill minimum marks, he has to reappear during the supplementary examination.

**M.Tech. (CAD/CAM) IIYear –II Sem**

**PROJECT PHASE II WITH SEMINAR**

**L T P C**

**- - 12 6**

**CIE Marks:25, SEE Marks:75**

**CODE: 7W478**

In II year II semester, a project work review shall be done by PRC for 100 marks and for 6credits. The evaluation for the project reviews shall be done in 4 stages (not less than 4 weeks between two consecutive stages) including end semester evaluation.

Each stage project review shall carry marks Weightage and the end semester review shall carry 75marks. The Supervisor and External Examinar will examine the Problem Definition, Objectives, Scope of Work, Literature Survey and design in Project Phase- II. A candidate shall secure a minimum of 50% to be declared successful in Project Phase II. If candidate fails to fulfill minimum marks, he has to reappear during the supplementary examination.

**M.Tech. CAD/CAM) IIYear –II SEM**

**Dissertation and Defense Viva**

**L T P C**

**- - -- 7**

**CIE Marks:50, SEE Marks:150**

**CODE: 7W479**

For Project Evaluation (Viva Voce) in II Year II Sem. there are external marks of 200 for 7credits. HoD shall submit a panel of 3 examiners, eminent in that field. Principal will appoint one of them as examiner.

The thesis shall be adjudicated by examiner selected by the College. If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

If the report of the examiner is favourable, Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis. Candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.