ACADEMIC REGULATIONS (R20)

COURSE STRUCTURE AND DETAILED SYLLABUS

(CHOICE BASED CREDIT SYSTEM (CBCS))

MASTER OF TECHNOLOGY
IN
CAD / CAM

For

M. Tech. - Regular Two Year Post Graduate Degree Programme

(Applicable for the batches admitted from 2020 - 2021)

CMR INSTITUTE OF TECHNOLOGY

(UGC - Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUH, Accredited by NAAC with A Grade and NBA

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FOREWORD

CMR Institute of Technology, established in the year 2005, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, twice Accredited by NBA, Achieved UGC Autonomous Status and has been bestowed with NAAC 'A' Grade in July 2018 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it, in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

CMR Institute of Technology takes pride for having won the confidence of such distinguished academic bodies meant for monitoring the quality in technology education. Besides, the institution is delighted to sustain the same spirit of discharging the responsibilities that it has been conveying since a decade to attain the current academic excellence, if not improving upon the standards and ethics. Consequently, statutory bodies such as the Academic Council and the Boards of Studies have been constituted under the supervision of the Governing Body of the College and with the recommendations of the JNTU Hyderabad, to frame the regulations, course structure and syllabi for autonomous status.

The autonomous regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution along with certain valuable suggestions from professionals of various ancillary fields such as the academics, the industry and the research, all with a noble vision to impart quality technical education and contribute in catering full-fledged engineering and management graduates to the society.

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Principal to seek any clarifications, if needed, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and for brightening the career prospects of engineering and management graduates.

CMR INSTITUTE OF TECHNOLOGY

Vision: To create world class technocrats for societal needs.

Mission: Impart global quality technical education for a better future by providing appropriate learning environment through continuous improvement and customization.

Quality Policy: Strive for global excellence in academics & research to the satisfaction of students and stakeholders.

Department of Mechanical Engineering (ME)

Vision: To be a centre of excellence committed to provide quality education and research for nurturing technically competent and socially responsible mechanical engineering professionals

Mission: Provide state-of-art technical knowledge, research and consultancy in collaboration with industries and R&D organizations to meet the global and societal challenges in the field of mechanical engineering.

M.Tech. - Regular Two Year Post Graduate Degree Programme

(For batches admitted from the academic year 2020 - 21)

PREAMBLE

For pursuing M.Tech. - Regular Two Year Post Graduate Degree Programme offered by **CMR Institute of Technology (CMRIT)** under Autonomous status will herein be referred to as CMRIT (Autonomous).

All the specified rules are herein approved by the Academic Council. These rules will be in force and are applicable to students admitted from the academic year 2020-21 onwards. Any reference to "**Institute**" or "**College**" in these rules and regulations stand for CMRIT (Autonomous).

All the rules and regulations specified shall hereafter be read as a whole for the purpose of interpretation, as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, CMRIT (Autonomous) shall be The Chairman, Academic Council.

1. POST GRADUATE PROGRAMS OFFERED

CMR Institute of Technology, an autonomous college affiliated to JNTUH, offers M.Tech. - Regular 2 years (4 semesters) Post Graduate Degree Programme, under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations with effect from the academic year 2020 - 21 onwards. The following specializations are offered at present for the M. Tech. programme of study.

Sl. No.	Programme	Offering Department
1	Structural Engineering	Civil Engineering
2	CAD/CAM	Mechanical Engineering
3	VLSI System Design	Electronics & Communication Engineering
4	Computer Science and Engineering	Computer Science and Engineering

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

2.1. Admission into first year of M.Tech. - Regular Two Year Post Graduate Degree Programme

2.1.1 Eligibility: A candidate seeking admission into the first year of M.Tech. shall be made subject to eligibility and qualification as prescribed by the university from time to time. Admissions shall be made on the basis of merit/rank obtained by the candidate qualified at TSPGECET/GATE or any entrance test conducted by the university or on the basis of any other order of merit as approved by the university, subject to reservations as laid down from time to time by government of Telangana.

2.1.2 Admission Procedure: Admissions are made into the first year M.Tech. as per the stipulations of the TSPGECET/GATE.

(a) Category A: 70% seats are filled through TSPGECET/GATE counseling.
(b) Category B: 30% seats are filled by the management.

2.2. College Transfers: There shall be no college transfers after the completion of admission process.

2.3. Medium of Instruction: The medium of instruction and examinations for the entire M.Tech. - Programme will be in **English** only.

3. M.Tech. PROGRAMME (PGP in E&T) STRUCTURE

3.1 Admitted under M.Tech. (PGP in E&T) - Regular Two Year Post Graduate Degree Programme:

3.1.1 A student after securing admission shall pursue the post graduate programme in M.Tech. Programme for a minimum period of two academic years (4 semesters), and a maximum period of four academic years (8 semesters) starting from the date of commencement of first year first semester, failing which he/she shall forfeit his/her seat in M.Tech. Programme.

3.1.2 I Year is structured to provide typically 18 Credits in each of the I and II Semesters, and II Year 16 credits in each of the III & IV semesters, totaling to 68 Credits for the entire M.Tech. Programme.

3.1.3 Each student shall secure 68 credits (with CGPA ≥ 5) required for the completion of the post graduate programme and award of the M.Tech. Degree.

3.2 **UGC/AICTE** specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester Scheme:

M.Tech. (Regular) Programme is of 2 academic years (4 semesters) with the each academic year being divided into two semesters. Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester and shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)', Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and curriculum/course structure as suggested by AICTE / JNTUH. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Design / Drawing Subject', or 'Mini Project with Seminar', or 'Dissertation', as the case may be.

3.2.2 Credit Courses:

a) All subjects/courses are to be registered by a student in a semester to earn credits. Credits shall be assigned to each subject/course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) structure, based on the following general pattern.

Theory		Practical	
1 Hr. Lecture (L) per week	1 credit	1 Hr. Practical (P) per week	0.5 credit
1 Hr. Tutorial (T) per week	1 credit	2 Hrs Practical (Lab) per week	1.0 credit

All Mandatory Courses, Study Tour, Guest Lecture, etc., will not carry any Credits.

3.2.3 Subject/ Course Classification:

The College has followed the guidelines issued by AICTE/UGC. All Subjects/Courses offered for the PGP in E&T are broadly classified as Program Core, Program Elective, Open Elective, Audit Course, Minor Course and Mini Project with Seminar, Industrial Training and Dissertation.

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course-Structure Grouping for the M.Tech. Degree Programmes is as listed below:

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Courses Description*
	Core Courses (CoC)	PC- Program Core	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engineering.
		Dissertation	M.Tech. Project or PG Project or PG Major Project
		Mini Project with Seminar	Seminar based on core contents related to parent discipline/department/branch of Engineering
		Minor Courses	1 or 2 Credit courses
		Audit Courses	Mandatory courses (non credit)
	Elective Courses (EℓC)	PE– Program Electives	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engineering.
		OE-Open Electives	Elective subjects which include inter-disciplinary subjects in an area outside the parent discipline/ department/ branch of Engineering

* **Students are encouraged to go to Industrial Training/Internship for at least 4 - 6 weeks during semester break.**

4. COURSE REGISTRATION

4.1 A **'Faculty Advisor or Counselor'** shall be assigned to each student, who advises the student about the M.Tech. Programme, its course structure and curriculum, choice / option for subjects / courses, based on his/her competence, progress, pre-requisites and interest of the students.

4.2 A Student may be permitted to Register for Subjects / Courses of 'his/her CHOICE' with a typical total of 18 Credits per Semester in I Year (Minimum being 15 Credits and Maximum being 21 Credits, permitted deviation being ±15%), and 16 Credits (inclusive of Project) per III Semester in II Year (Minimum being 14 Credits and Maximum being 21 Credits), 16 credits (inclusive of Project) per IV Semester in II Year (minimum being 16 Credits and maximum 21 Credits), based on his interest, competence, progress, and 'Pre-Requisites' as indicated for various Subjects/ Courses, in the Department Course Structure (for the relevant Specialization) and Syllabus contents for various Subjects/ Courses.

4.3 Choice for 'additional Subjects / Courses' in any Semester (above the typical 18/16 Credit norm, and within the Maximum Permissible Limit of 21/21 Credits, during I/ II Years as applicable) must be clearly indicated in the Registration, which needs the specific approval and signature of the Faculty Advisor/ Counselor on hard-copy.

4.4 Dropping of Subjects/ Courses in any Semester of I Year may be permitted, ONLY AFTER obtaining prior approval and signature from the Faculty Advisor (subject to retaining a minimum of 15 Credits), 'within 15 Days of Time' from the beginning of the current Semester.

4.5 **Core Electives**: Students have to choose five core electives as per the course structure.

4.6 **Open Electives**: Students have to choose open elective other than parent department as per the course structure.

4.7 **Project work registration:** The Project shall start immediately after the completion of I year II semester. Every Student must compulsorily register for his/her M.Tech. Project Work. The student registered for the Project work shall work for two semesters.

5. ATTENDANCE REQUIREMENTS

The programmes are offered based on a unit system with each subject being considered a unit. Attendance is calculated separately for each subject.

5.1 Attendance in all classes (Lectures / Laboratories) is compulsory. The minimum required attendance in each theory subject (***also mandatory (audit) courses***) excluding the attendance of mid-term examination is 75%. 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 presentation on Mini Project shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Seminar presentation classes on Mini Project 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 (Theory / Lab / Mini Project with Seminar) of a semester shall be granted by the College Academic Committee on genuine reasons.

5.4 A prescribed fee per subject shall be payable for condoning shortage of attendance after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain relevant documents along with the request from the student.

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

5.6 A Student, whose shortage of attendance is not condoned in any Subject(s) (Theory / Lab / Mini Project with Seminar) in any Semester, is considered as 'Detained in that Subject(s), and is not eligible to write Semester End Examination(s) of such Subject(s), (in case of Mini Project with Seminar, his/her Mini Project with Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he/she has to seek re-registration for those Subject(s) in subsequent Semesters, and attend the same as and when offered.

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

5.8 **a)** A student shall put in a minimum required attendance in at least **three theory subjects (excluding *mandatory (audit)* course)** in first Year I semester for promotion to first Year II Semester.

b) A student shall put in a minimum required attendance in at least **three theory subjects (excluding *mandatory (audit)* course)** in first Year II semester for promotion to second Year I Semester.

6. ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 5.

6.1 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 40% Marks (28 out of 70 Marks) in the End Semester Examination, and a minimum of 50% of Marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing B Grade or above in that Subject.

6.2 A Student shall be deemed to have satisfied the academic requirements and earned the Credits allotted to - Mini Project with Seminar, if student secures not less than 50% of the total Marks to be awarded. The Student would be treated as failed, if the student -

(i) does not present the Mini Project with Seminar as required, or
(ii) Secures less than 50% of Marks (< 50 Marks) in Mini Project with Seminar.

6.3 A Student shall - register for all Subjects covering 68 Credits as specified and listed in the Course Structure for the chosen PGP Specialization, put up all the Attendance and Academic requirements for securing 68 Credits obtaining a minimum of B Grade or above in each Subject and 'earn 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 successfully complete the PGP.

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

(2) CGPA is calculated only when the student 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 68 Credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card / Marks Memo of II Year II Semester.

6.5 If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engineering.) other than those listed Subjects totaling to 68 Credits as specified in the Course Structure, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 68 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 5 and 6.1 – 6.4 above.

6.6 Students who fail to earn 68 Credits as per the specified Course Structure, and as indicated above, within 4 Academic Years from the date of Commencement of their I Year, shall forfeit their seats in M.Tech. Programme and their admissions shall stand cancelled.

6.7 When a student is detained due to shortage of attendance in any subject(s)/seminar in any semester, no Grade Allotment will be done for such Subject(s)/Seminar, and SGPA/ CGPA calculations of that Semester will not include the performance evaluations of such subject(s)/seminar in which he got detained. However, he becomes eligible for re-registration of such subject(s)/seminar (in which he got detained) in the subsequent Semester(s), as and when next offered, with the Academic Regulations of the Batch into which he gets readmitted, by paying the stipulated fees per subject. In all these re-registration cases, the student shall have to secure a fresh set of Internal Marks (CIE) and End Semester Examination Marks (SEE) for performance evaluation in such subject(s), and subsequent SGPA/ CGPA calculations.

6.8 A student eligible to appear in the Semester End Examination (SEE) in any subject, but absent at it or failed (failing to secure B Grade or above), may reappear for that subject at the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/ Course will be carried over, and added to the marks to be obtained in the supplementary examination (SEE), for evaluating his performance in that Subject.

7. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

7.1 The performance of a Student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 Marks for Theory or Practical's or Mini Project with Seminar or Drawing/Design etc; however, the M.Tech. Project Work (Major Project) will be evaluated by the external examiner for 100 Marks.

7.2 **a)** For Theory Subjects (inclusive of Minor Courses), during the Semester, there shall be 2 mid-term examinations for 25 marks (with duration of 120 minutes). Further, there will be an allocation of 5 marks for Assignment.

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

c) First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second mid-term examinations. The Assignments shall be as specified by the concerned subject teacher.

d) The first mid-term examination Marks and first Assignment Marks shall make one set of CIE Marks, and the second mid-term examination Marks and second Assignment Marks shall make second set of CIE Marks. The final CIE marks (for total of 30) are the better of these two mid-term examinations in each subject.

7.3 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 Internal Marks, and 70 Marks are assigned for Lab/Practical's Semester End Examination (SEE). Out of the 30 Marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 20 Marks; and the performance in an internal Lab/Practical Test shall be evaluated for 10 marks, there shall be two internal Lab/Practical Test in a semester and the better of these two shall be taken as final marks. The SEE for Lab / Practical's shall be conducted at the end of the Semester by the concerned Lab teacher and external examiner appointed by the Head of the Institution.

7.4 For mandatory (audit) courses, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course. No marks or letter grades shall be allotted for mandatory (audit) courses. Only Pass/Fail shall be indicated in Grade Card.

7.5 There shall be a Mini Project with Seminar presentation in I Year II Semester for 100 marks, for which the student shall collect the information on a specialized topic, prepare a Mini Project Report and submit to the department. The Continuous Internal Evaluation (CIE) of 30 Marks evaluated by the guide / supervisor and Semester End Examination (SEE) of 70 marks evaluated by the committee. The evaluation committee consisting of Head of the Department, Mini Project Guide and senior faculty as appointed by Head of the Department.

7.6 Guidelines for Project Work Evaluation:

a) The Project shall start immediately after the completion of I year II semester. Every Student must register for his M.Tech. Project Work, within the 4 weeks after the completion of I year II Semester. The student registered for the Project work shall work for two semesters. After Registration and in consultation with the guide, the Student has to present the title, objective and plan of action of his project work to the Project Review Committee (PRC) for approval within 6 weeks after the completion of I year II Semester. Only after obtaining the approval of the PRC, the student can initiate the Project work.

b) A Project Review Committee (PRC) shall be constituted by Head of the Department and shall consist of the Head of the Department (Chairperson) Project Guide and one senior faculty member of the Department.

c) If a student wishes to change his Guide 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/Guide 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 Guide or topic as the case may be.

7.7 Monitoring of Project work progress by PRC

a) The PRC will monitor the progress of the Project Work of the student. Project work Review-I will be held at the end of the III Semester (II Year I Semester) and Project work Review- II will be held at the end of the IV Semester (II year II Semester) before the submission of Project Report/ Dissertation.

b) **The Project Work Review-I:** There shall be a Dissertation-I/Industrial Project-I during the III Semester (II Year I Semester). The Dissertation-I/Industrial Project-I shall be evaluated by the project external viva-voce examination committee for 70 Marks (which will be considered as SEE). The student has to get a minimum of 40% marks (28 marks out of 70 marks) for successful completion. Project guide and PRC-I shall evaluate for 30 marks (which will be considered as CIE). The guide evaluates for 15 marks and PRC-I evaluates for rest of 15 marks. The student has to secure a minimum of 50 marks (CIE + SEE) out of 100 marks to be declared successful. If the student fails to obtain the minimum marks, the student has to reappear for the Dissertation-I/Industrial Project-I during the supplementary examinations. The student shall be permitted to register Dissertation-II/Industrial Project-II only after successful completion of Dissertation-I/Industrial Project-I.

c) **The Project Work Review-II:** There shall be a Dissertation-II/Industrial Project-II during the IV Semester (II Year II Semester). The Dissertation-II/Industrial Project-II shall be evaluated by the project external viva-voce examination committee for 70 Marks (which will be considered as SEE). The student has to get a minimum of 40% marks (28 marks out of 70 marks) for successful completion. Project guide and PRC-II shall evaluate for 30 marks (which will be considered as CIE). The guide evaluates for 15 marks and PRC-II evaluates for rest of 15 marks. The student has to secure a minimum of 50 marks (CIE + SEE) out of 100 marks to be declared successful. If the student fails to obtain the minimum marks, the student has to reappear for the Dissertation-II/Industrial Project-II during the supplementary examinations.

d) To satisfy item (c), the student has to submit a soft copy of the final consolidated report of Dissertation - I & II / Industrial Project – I & II to the Head of the Department for 'ANTIPLAGIARISM' check. The Head of the Department should carry out plagiarism check and submit the report to the Principal. The Dissertation will be accepted for submission, only 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 Dissertation only after one month. Only after submission of a hard copy of final project report in 4 copies along with plagiarism report, the Dissertation-II / Industrial Project-II shall be evaluated by the project external viva-voce examination committee. The maximum number of re-submissions of Dissertation after plagiarism check is limited to TWO.

e) The candidate has to register for the project and work for two semesters (not less than 44 weeks including registration and approval of Project-I and Project-II). After three attempts (including regular attempt), the admission is liable to be cancelled. The college authorities are advised to make plagiarism check of every soft copy of theses before submissions.

f) The Student shall be allowed to submit his Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Practical's.), Mini Project with Seminar, etc. (securing B Grade or above), and after obtaining all approvals from PRC.

g) Three copies of the Dissertation Thesis certified by the supervisor shall be submitted to the College/School/Institute, after submission of a research paper related to the Dissertation work in a reputed journal / conference. A copy of the submitted research paper shall be attached to thesis.

h) The Dissertation of the student will be evaluated by the committee along with external examiner (appointed by the Head of the Institution) based on his/her presentation followed by viva-voce examination.

i) If the report of the committee is unsatisfactory, the student shall revise and resubmit the project after ONE semester, or as per the time specified by the committee. If the resubmitted report is also unsatisfactory, then the Dissertation shall be rejected summarily. No further correspondence in this matter will be entertained, if there is no specific recommendation for resubmission by the committee.

j) If the student's oral presentation is not satisfactory, the committee may defer it and the student has to re-appear for the oral presentation before the same committee for the award of degree.

k) The Committee should submit Project External examination marks to the Head of the Institution on the day of the examination.

8. Re-Admission / Re-Registration:

8.1. **Re-Admission for Discontinued Students:** Students, who have discontinued the M.Tech. Degree Programme due to any reasons whatsoever, may be considered for 'Readmission' into the same Degree Programme (with same specialization) with the Academic Regulations of the Batch into which he gets Re-admitted, with prior permission from the concerned authorities, subject to Item 3.1.

8.2. **Re-Registration for Detained Students:** When any Student is detained in a Subject (Theory / Practical / Seminar etc.) due to shortage of attendance in any Semester, he may be permitted to re-register for the same Subject in the 'same category' (Core or Elective Group) or equivalent Subject if the same Subject is not available, as suggested by the Board of Studies of that Department, as when offered in the sub-sequent Semester(s), with the Academic Regulations of the Batch into which he seeks re-registration , with prior permission from the concerned authorities, subject to Item 3.1.

9. GRADING PROCEDURE

9.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Practical, or Mini Project with Seminar, Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

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

% of Marks Secured (Class Intervals)	Letter Grade	Grade Points
90% and above	O (Outstanding)	10
Below 90% but not less than 80%	A^+ (Excellent)	9
Below 80% but not less than 70%	A (Very Good)	8
Below 70% but not less than 60%	B^+ (Good)	7
Below 60% but not less than 50%	B (Above Average)	6
Below 50% (< 50%)	F (Fail)	0
Absent	**Ab**	**0**

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

9.4 If a student not appear for the examinations, 'Absent' Grade will be allocated to him for any subject and shall be considered 'failed' and will be required to reappear as 'Supplementary

Student' for the Semester End Examination (SEE), as and when conducted.

9.5 A Letter Grade does not imply any specific % 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 (excluding Audit non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

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

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 (ΣCP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\mathbf{SGPA\ (S_i) = \sum (C_i\ X\ G_i) / \sum C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

9.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** Semesters, and the total number of credits registered in **all** 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:

$$\mathbf{CGPA = \sum (C_i\ X\ S_i) / \sum C_i}$$

where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

Illustration of calculation of SGPA					Illustration of calculation of CGPA			
Course /Subject	Credits	Letter Grade	Grade Points	Credit Points	Semester	Credits	SGPA	Credits x SGPA
Course 1	3	A	8	24	Sem I	18	7.00	126
Course 2	3	O	10	30	Sem II	18	6.00	108
Course 3	4	B^+	7	28	Sem III	16	6.50	104
Course 4	3	B	6	18	Sem IV	16	8.00	128
Course 5	2	A^+	9	18				
Course 6	1.5	B	6	09				
Course 7	1.5	O	10	15				
Total	18			142	Total	68		426
SGPA = 142/18 = 7.89					**CGPA** =466/68 = 6.85			

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

9.12 For calculations listed in item 9.7 to 9.11, performance in failed subjects/courses (securing '**F'** grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations.

10. DECLARATION OF RESULTS

10.1 Computation of SGPA and CGPA are done using the procedure in item Nos. 9.6 to 9.9.

10.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used:

Percentage of Marks = (final CGPA – 0.5) x 10

11 AWARD OF DEGREE

11.1 After a student has satisfied the requirement prescribed for the completion of the Program and is eligible for the award of M.Tech. Degree he shall be placed in one of the following four classes based on CGPA:

Class Awarded	CGPA	Remarks
First Class with Distinction	≥ 7.75	From the aggregate marks secured from 68 credits for regular students
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.

11.2 First Class with Distinction will be awarded to those students who clear all the subjects in single attempt during his/her regular course of study by fulfilling the following conditions:

11.2.1 Should have passed all the subjects/courses in '**first appearance'** within the first 2 academic years (or 4 sequential semesters) for M.Tech.

11.2.2 Should have secured a CGPA ≥7.75, at the end of each of the 4 sequential semesters.

11.2.3 Should not have been detained or prevented from writing the Semester End Examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**First Class with Distinction'**.

11.3 Award of Medals: Students fulfilling the conditions listed under item 11.2 alone will be eligible for award of **'College ranks'** and **'Medals'**.

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

12 WITH HOLDING OF RESULTS

If the student has not paid the fee to college at any stage, or has dues pending against his/her name due to any reason what so ever, or if any case of indiscipline is pending against him/her, the result of the student may be withheld, and he/she will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

13 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for odd semester subject(s) / course (s) shall be conducted along with even semester regular examinations and vice versa.

14. TRANSITORY REGULATIONS

A Student - who has discontinued for any reason, or who has been detained for want of attendance as specified, or who has failed after having undergone PGP, may be considered

eligible for readmission to the same PGP with same set of Subjects/ Courses (or equivalent Subjects/ Courses as the case may be), and same Professional Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the time-frame of 4 years from the Date of Commencement of his I Year I Semester).

15. STUDENT TRANSFERS

There shall be no transfers from other colleges/streams.

16 RULES OF DISCIPLINE

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

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

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

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

17. MALPRACTICE

17.1 **Malpractice Prevention Committee:** The committee shall examine the student's malpractice and indiscipline cases occurred, while conducting the examinations and recommend appropriate punishment to the Academic Council after taking explanation from the student and concerned invigilator as per the malpractice rules mentioned below. The committee consists of

a) Controller of Examinations - Chairman
b) Addl. Controller of Examinations.- Convener
c) Subject Expert - Member
d) Head of the Department of which the student belongs to - Member
e) The Invigilator concerned - Member

17.2 **Malpractice Rules:** Disciplinary action for improper conduct in examinations

S. No.	Nature of Malpractices / Improper Conduct	Punishment
1(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.

1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that

	creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not

		belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

18. SCOPE

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

ii) The above mentioned rules and regulations are applicable in general to M.Tech., unless and otherwise specific.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

19. REVISION AND AMENDMENTS TO REGULATIONS

The Academic Council may revise or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the Academic Council Authorities.

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COURSE STRUCTURE

M.Tech. (CAD/CAM) – R20 COURSE STRUCTURE

(Applicable from the batch admitted during 2020-21 and onwards)

I – Semester									
S. No	Course Code	Subject	Hours Per Week			Credits	Scheme of Evaluation		
							Maximum Marks		
			L	T	P		Int.	Ext.	Tot.
1	20CAPC101	Computer Aided Design	3	0	0	3	30	70	100
2	20CAPC102	Computer Aided Manufacturing	3	0	0	3	30	70	100
3	**Professional Elective-1:**		3	0	0	3	30	70	100
	20CAPE101	Mechanical Behavior of Materials							
	20CAPE102	Experimental Stress Analysis							
	20CAPE103	Fuzzy Logic & Neural Networks							
4	**Professional Elective-2 :**		3	0	0	3	30	70	100
	20CAPE104	Simulation & Analysis of Manufacturing Systems							
	20CAPE105	Computer Aided Process Planning							
	20CAPE106	Industrial Robotics							
5	20CAPC103	Computer Aided Design Lab	0	0	4	2	30	70	100
6	20CAPC104	Simulation of Manufacturing Systems Lab	0	0	4	2	30	70	100
7	20MC101	Research Methodology and IPR	2	0	0	2	30	70	100
8	**Audit Course -1**		2	0	0	0	100	-	100
	20AC101	English for Research Paper Writing							
	20AC102	Value Education							
	20AC103	Constitution of India							
TOTAL			**16**	**0**	**8**	**18**	**310**	**490**	**800**

II – Semester									
S. No.	Course Code	Subject	Hours Per Week			Credits	Scheme of Evaluation		
							Maximum Marks		
			L	T	P		Int.	Ext.	Tot.
1	20CAPC201	Advanced Finite Element Analysis	3	0	0	3	30	70	100
2	20CAPC202	Automation in Manufacturing	3	0	0	3	30	70	100
3	**Professional Elective -3**		3	0	0	3	30	70	100
	20CAPE201	Intelligent Manufacturing Systems							
	20CAPE202	Advanced Manufacturing Processes							
	20CAPE203	Optimization Techniques & Applications							
4	**Professional Elective -4**		3	0	0	3	30	70	100
	20CAPE204	Advanced Mechatronics							
	20CAPE205	Micro Electro Mechanical Systems							
	20CAPE206	Additive Manufacturing Technologies							
5	20CAPC203	Automation in Manufacturing Lab	0	0	4	2	30	70	100
6	20CAPC204	Computer Aided Engineering Lab	0	0	4	2	30	70	100
7	20CAPR201	Mini Project with Seminar	0	0	4	2	30	70	100
8	**Audit Course -2**		2	0	0	0	100	-	100
	20AC201	Pedagogy Studies							
	20AC202	Stress Management by yoga							
	20AC203	Personality Development through Life Enlightenment Skills							
TOTAL			**14**	**0**	**12**	**18**	**310**	**490**	**800**

III – Semester									
S. No	Course Code	Subject	Hours Per Week			Credits	Scheme of Evaluation		
							Maximum Marks		
			L	T	P		Int.	Ext.	Tot.
1	**Professional Elective -5**		3	0	0	3	30	70	100
	20CAPE301	Flexible Manufacturing Systems							
	20CAPE302	Computational Fluid Dynamics							
	20CAPE303	Product Design and Process Development							
2	**Open Elective**		3	0	0	3	30	70	100
	20MEOE301	Composite Materials							
	20CEOE302	Construction Management							
	20ECOE303	VLSI Design							
	20CSOE304	Data Mining and Analytics							
3	20CAPR301	Project – I / Dissertation Phase -I	0	0	20	10	30	70	100
TOTAL			**6**	**0**	**20**	**16**	**90**	**210**	**300**

IV – Semester									
S. No.	Course Code	Subject	Hours Per Week			Credits	Scheme of Evaluation		
							Maximum Marks		
			L	T	P		Int.	Ext.	Tot.
1	20CAPR401	Project – II / Dissertation Phase -II	0	0	32	16	30	70	100
TOTAL			**0**	**0**	**32**	**16**	**30**	**70**	**100**

Total Credit for the Programme PG Credits: = 18+ 18+16+16 = 68

I-M.TECH.-I-SEMESTER SYLLABUS

COMPUTER AIDED DESIGN

I -M.Tech.-I-Sem **L T P C**
Subject Code: 20CAPC101 **3 0 0 3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain the functionality of CAD tools
2. construct geometric models using parametric representation
3. build various surface models using parametric representation
4. develop solid models using modeling techniques
5. apply data exchange formats for geometric models

UNIT - I

CAD Tools: Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software. Geometric Modeling: Requirement of geometric modeling, Geometric models, Geometric construction methods, Modeling facilities desired.

UNIT - II

Geometric modeling: Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic Curves: Hermite cubic curves, Bezier, B-Spline curve, NURBS, Curve manipulations.

UNIT- III

Surface Modeling : Classification of surface entities, Surface representation methods, Parametric Representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder, 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.

UNIT- V

Transformations: 2-D and 3-D homogeneous transformations: translation, scaling, rotation, reflection, concatenation,. **Evaluation Criteria**: Evaluation criteria of CAD software, Data exchange formats: GKS, IGES, PHIGS, CGM, and STEP Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), Least material condition (LMC), Regardless of feature size (RFS).

TEXT BOOKS:

1. CAD/CAM Concepts and Applications/ Alavala/ PHI.
2. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw Hill International.

REFERENCES:

1. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
2. CAD/CAM /Groover M.P./ Pearson education
3. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age

COMPUTER AIDED MANUFACTURING

	L	T	P	C
I-M.Tech.-I-Sem.				
Subject Code: 20CAPC102	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. plan tool path for machining using APT and NC programming
2. make use of controls for various machining processes
3. explain post processors for CNC
4. illustrate micro controllers and PLCs in CNC machines
5. develop expert systems using AI

UNIT–I

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. Automatic Tool path Generation.

UNIT–II

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

UNIT–III

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: Communication channels and major variables in the DAPP — based Post Processor, the creation of a DAPP — Based Post Processor.

UNIT–IV

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

UNIT–V

Computer Aided Inspection and quality control : Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, CAI, Machine Vision ,Optical Inspection Methods.
Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

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 / Yoram Koren / Mc Graw Hill. 1983.
2.Computer Aided Design Manufacturing – K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, PHI, 2008

MECHANICAL BEHAVIOUR OF MATERIALS
(Professional Elective-I)

I-M.Tech.-I-Sem.	L	T	P	C
Subject Code: 20CAPE101	3	0	0	3

Course outcomes: Upon completion of the course, the students will be able to

1. illustrate the stress formation around the cracks
2. apply the concepts of elasticity and plasticity
3. formulate fatigue cracks formation
4. interpret the life of structures under fatigue loading
5. evaluate creep deformation of structures

UNIT-I

Fracture: Introduction, Types of Fracture in Metals, Griffith Theory of Brittle Fracture, Fracture of Single Crystals, Ductile Fracture, Concept of the Fracture Curve. Fracture Mechanics: Strain Energy Release rate, Fracture Toughness and Design, Crack Opening Displacement, J-Integral, R Curve,

UNIT-II

Theory of Elasticity and Plasticity: Elasticity Theory: The State of Stress and strain, elastic stress-strain relation, anisotropy, elastic behaviour of metals, ceramics and polymers. Plasticity: Hydrostatic and Deviatoric stress, Octahedral stress, yield criteria and yield surface, texture and distortion of yield surface, true stress and true strain, flow rules, strain hardening, Ramberg Osgood equation, stress - strain relation in plasticity, plastic deformation of metals and polymers

UNIT-III

Fatigue-I: Introduction, Stress Cycles, S-N Curve, Effect of Mean Stress on Fatigue, Cyclic Stress strain curve, Low Cycle Fatigue, Strain Life Equation, Structural Features of Fatigue, Fatigue Crack Propagation, Effect of Metallurgical Variables on Fatigue.

UNIT-IV

Fatigue-II: Effect of stress concentration on Fatigue, Size Effect, Surface effects on Fatigue, Fatigue under Combined stresses, Design for Fatigue, Machine Design approach-Infinite life design, Local strain approach, Corrosion Fatigue, Effect of Temperature on fatigue.

UNIT-V

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

TEXT BOOKS:

1. Mechanical Metallurgy by G. E. Dieter, McGraw Hill, (1988)
2. Thin Film Materials L.B. Freund and S. Suresh, Cambridge University Press (2003).

REFERENCE BOOKS:

1. Fracture Mechanics Fundamentals and Applications by T.L. Anderson, 2nd Ed. CRC press, (1995)
2. Fracture of Brittle Solids by B. Lawn, Cambridge Solid State Science Series 2nd ed 1993.

EXPERIMENTAL STRESS ANALYSIS
(Professional Elective-I)

	L	T	P	C
I -M.Tech.-I-Sem.				
Subject Code: 20CAPE102	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain the principles of measurements
2. make use of extensometers for finding stresses
3. demonstrate the use of electrical resistance strain gauges
4. apply the photo elasticity techniques for stress measurements
5. test material properties using NDT

UNIT-I

Measurements: Principles of measurements, Accuracy, Sensitivity and range of measurements.

UNIT-II

Extensometers: Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

UNIT-III

Electrical Resistance Strain Gauges: Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheat stone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT-IV

Photo elasticity: Two dimensional photo elasticity, Concept of light – photo-elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

UNIT-V

Non – Destructive Testing :Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C-Scan, Thermograph, Fiber – optic Sensors.

TEXT BOOKS

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., “Experimental Stress Analysis”, Tata McGraw-Hill, New Delhi, 1984.

REFERENCES

1. Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, McGraw-Hill Inc., New York. Hetyenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., Ny
2. Pollock A.A., “Acoustic Emission in Acoustics and Vibration Progress”, Ed. Stephens R.W.B., Chapman and Hall.

FUZZY LOGIC & NEURAL NETWORKS
(Professional Elective-I)

	L	T	P	C
I-M.Tech.-I-Sem.				
Subject Code: 20CAPE103	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. apply basic fuzzy logic operations
2. model the relations between fuzzy variables
3. predict the outcome using fuzzy logics
4. summarize the concepts of neural networks
5. construct mathematical models of neural networks

UNIT-I

Knowledge and Processing – Knowledge and Intelligence- logic frames- production systems. Fundamentals of Fuzzy logic-characteristics of fuzzy logic and systems-Fuzzy sets-Fuzzy number-Equality of fuzzy sets- Empty Fuzzy set –Fuzzy point-universal Fuzzy set. Operations on Fuzzy sets - Intersection-union –complement.

UNIT-II

Fuzzy Relations-classical N-Array Relation-Reflexivity-Anti reflexivity-symmetricity –Transitivity-Equivalence-Binary fuzzy relations, operation on Fuzzy relations-Intersection-union-projection-Cartesian product.

UNIT-III

Fuzzy Implications-Translation rules, Triangular norms, Triangular conorm, Fuzzy Rule base system, Fuzzy logic controller, Defuzzification Methods, Fuzzy logic applications-prevention of Road accidents-control room temperature-Robot control system-domestic applications-Industrial applications.

UNIT-IV

Basic concepts of Neural Network-Processing units-connection between units-output rules-Network topologies-paradigms of learning –perception, Back-propagation, classification Models-Association Models, optimization models.

UNIT-V

Rule Based Neural Networks-Network Training –Application of Neural Network in Mathematical Modelling-Knowledge based approaches-applications in Mechanical Engineering –Fuzzy –Neural, example, Neuro –Fuzzy examples-Intelligence in Automation.

TEXTBOOKS:

1. Intelligent Control Fuzzy Logic Applications/ Clarence W.de Silva/ CRS Press,1995.
2. Fuzzy logic &Neural Networks/ Chennakesava R. Alavala/ New Age International,2008

SIMULATION & ANALYSIS OF MANUFACTURING SYSTEMS
(Professional Elective-II)

I -M.Tech.-I-Sem	L	T	P	C
Subject Code: 20CAPE104	3	0	0	3

Course Outcomes: Upon successful completion of this course, student will be able to

1. model quality control systems
2. apply probabilistic models in manufacturing processes
3. construct queuing models in manufacturing systems
4. explain Queuing Network models
5. classify petrinets for manufacturing models

UNIT - I

Manufacturing Systems & Control: Automated Manufacturing Systems – Modelling – Role of performance modelling – 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 – II

Manufacturing Processes: Examples of stochastic 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 – III

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 centre.

UNIT – IV

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 – V

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

TEXTBOOKS:

1. Performance Modelling of Automated Manufacturing Systems/ Viswanadham, N and Narahari, Y/ Prentice Hall of India, New Delhi, 1994
2. Probability and Statistics with Reliability, Queuing and Computer Science Applications/ Trivedi, K.S./Prentice Hall, New Jersey, 1982.

COMPUTER AIDED PROCESS PLANNING
(Professional Elective-II)

I-M.Tech.-I-Sem **L T P C**
Subject Code: 20CAPE105 **3 0 0 3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain fundamentals of process planning
2. relate geometric models for process planning
3. create automatic process planning sheets
4. illustrate various computer aided process planning systems
5. extend totally integrated process planning systems

UNIT- I

Introduction: The Place of Process Planning in the Manufacturing Cycle-Process planning and production Planning-Process planning and Concurrent Engineering, CAPP, Group Technology.

UNIT- II

Part Design Representation: Design Drafting-Dimensioning-Conventional Tolerance- Geometric Tolerance-CAD-input/output devices-Topology - Geometric Transformation-Perspective Transformation-Data Structure-Geometric modelling for process planning--GT Coding-The OPITZ system-The MICLASS System.

UNIT- III

Process Engineering and Process Planning: Experience based planning-Decision table and Decision Trees-Process capability analysis-Process Planning-Variant process planning-Generative Approach-Forward and backward planning, Input format, AI.

UNIT- IV

Computer Aided Process Planning Systems: Logical Design of process planning- Implementation Considerations-Manufacturing system components, Production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT-V

An Integrated Process Planning Systems: Totally integrated process planning systems-An Overview-Modulus Structure-Data Structure-Operation-Report Generation, Expert process planning

TEXT BOOKS:

1. Gideon Halevi and Roland D. Weill, "Principle of process planning- A Logical Approach", Chapman & Hall, 1995
2. Chang T. C. & Richard A. Wysk, "An Introduction to automated process planning systems", Prentice Hall 1985.

REFERENCE BOOKS:

1. Chang, T.C., "An Expert Process Planning System", Prentice Hall,1985
2. Nanua Singh, "Systems Approach to Computer Integrated Design and Manufacturing", John Wiley &Sons,1996
3. Rao P.N., "Computer Aided Manufacturing", Tata McGraw Hill Publishing Co., 2000.

INDUSTRIAL ROBOTICS
(Professional Elective-II)

	L	T	P	C
I-M.Tech.-I-Sem.				
Subject Code: 20CAPE106	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. illustrate principles and functioning of the robot
2. perform kinematic analysis for end-effector positioning
3. perform dynamic analysis for end-effector positioning
4. develop programs for path generation
5. construct robot ell layouts for industrial applications

UNIT-I

Introduction: Automation and Robotics, Robot anatomy configuration, motions joint motion and notation, work volume, robot drive system, control system and dynamic performance, precision of movement. Control System and Components: basic concept and modals controllers control system analysis, robot actuators and feedback components (sensors): Internal & External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics, Power Transmission Systems.

UNIT-II

Motion Analysis and Control: Manipulator kinematics, position representation Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward & Inverse transformations, problems on planar & spatial manipulators, Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated & Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending.

UNIT-III

Robot Dynamics: Lagrange – Euler & Newton - Euler formulations, problems on two link planar manipulators, configuration of robot controller. End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT-IV

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations. Robot Languages: Textual robot languages, Generation, Robot language structures, Elements and functions.

UNIT-V

Robot Cell Design and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller. Robot Applications: Material transfer, Machine loading/unloading. Processing operations, Assembly and Inspection,

TEXT BOOKS:

1. Introduction to Robotics Mechanics & Control by John J. Craig, Pearson
2. Industrial robotics by Mikell P. Groover, McGraw Hill.

REFERENCE BOOKS:

1. Industrial robotics by Mikell P. Groover, McGraw Hill
2. Robotics by K.S.Fu, McGraw Hill.

COMPUTER AIDED DESIGN LAB

	L	T	P	C
I-M.Tech.-I-Sem.				
Subject Code: 20CAPC103	**0**	**0**	**4**	**2**

Course Outcomes: Upon completion of the course, the students will be able to

1. build simple 3D geometric models
2. construct 3D models of shaft couplings
3. develop 3D models of machine components
4. build 3D models of engine components
5. model industrial accessories

Creation of 3D assembly model of following machine elements using 3D Modelling software

1. Flange coupling
2. Knuckle joint
3. Screw jack
4. Universal coupling
5. Plummer Block
6. Machine Vice
7. Stuffing Box
8. Cross head
9. Safety Valves
10. Piston

Reference Books:

1. Computer Aided Design Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd

SIMULATION OF MANUFACTURING SYSTEMS LAB

I-M.Tech.-I-Sem.	**L**	**T**	**P**	**C**
Subject Code: 20CAPC104	**0**	**0**	**4**	**2**

Course Outcomes: Upon completion of the course, the students will be able to

1. make use of simulation software for turning operations
2. utilize CNC software for circular and square slots in mill
3. plan CNC software for profile cutting
4. build robot programs for pick and place operations
5. write robot programs for welding/assembly operations

Experiments

1. CNC program for Turning – 4 exercises using of Simulation Software
2. CNC program for Milling – 4 exercises using of Simulation Software

   [Circular slot, Square slot, Profile cutting, Drilling, Circular pocket, square pocket]
3. Robot programming for Pick and place, welding operations / assembly – 2 exercises

Reference Books:

1. Simulation Of Manufacturing Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd

RESEARCH METHODOLOGY AND IPR

	L	T	P	C
I-M.Tech.-I-Sem.				
Subject Code: 20MC101	**2**	**0**	**0**	**2**

Course Outcomes: Upon completion of the course, the students will be able to

1. formulate research problem
2. analyze research related information
3. follow research ethics
4. perceive nature of IPR and its development.
5. Outline the patent rights

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, 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. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

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.

ENGLISH FOR RESEARCH PAPER WRITING
(AUDIT COURSE -1)

M.Tech. I Year I-Sem.	L	T	P	C
Course Code: 20AC101	2	0	0	0

Course Outcome: Upon completion of the course, the students will be able to

1. determine that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. determine the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

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, 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 when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Reference:

1. Goldbort R Writing for Science, Yale University Press (available on Google Books)
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

VALUE EDUCATION
(AUDIT COURSE -1)

M.Tech. I Year I-Sem. **L T P C**
Course Code: 20AC102 **2 0 0 0**

UNIT - I
Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments

UNIT - II
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline

UNIT - III
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor.

UNIT - IV
Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT - V
Character and Competence –Holy books vs Blind faith., Self-management and Good health. Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

REFERENCE:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

CONSTITUTION OF INDIA
(AUDIT COURSE -1)

M.Tech. I Year I-Sem. **L T P C**
Course Code: 20AC103 **2 0 0 0**

UNIT- I

History of Making of the Indian Constitution:

History Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution**:** Preamble, Salient Features

UNIT- II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT- III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT-IV

Local-Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayat Raj: Introduction, PRI: Zilla Pachayat. Elected officials and their roles, CEO Zilla Pachayat: Position and role.Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT- V

Election Commission: Election Commission: Role and Functioning., Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

REFERENCE:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

I-M.TECH.-II-SEMESTER SYLLABUS

ADVANCED FINITE ELEMENT ANALYSIS

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPC201	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain the fundamentals of FEM
2. solve the linear equations of truss elements, beam elements using FEM
3. evaluate the load and displacements for 2-D problems
4. apply the FE method for heat transfer problems
5. model the dynamic equations for modal analysis

UNIT-I

Introduction to FEM: Basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

UNIT-II

1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems. Analysis of Trusses : Plane Trusses and Space Truss elements and problems- Analysis of BECAD/CAM : Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III

2-D problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite Element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular Elements. 3-D Problems: Tetrahedron element – Jacobian matrix – Stiffness matrix.

UNIT-IV

Scalar Field Problems: 1-D Heat conduction-Slabs – fins - 2-D heat conduction problems – Introduction to Torsional problems.

UNIT-V

Dynamic considerations: Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

TEXT BOOKS:

1. Finite Element Methods: Basic Concepts and applications, Alavala, PHI.
2. Finite Element Method – Zincowitz / Mc Graw Hill

REFERENCE BOOKS

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice Hall

AUTOMATION IN MANUFACTURING

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPC202	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain levels of automation
2. apply the principles of material handling in automation
3. model manual assembly lines
4. analyze transfer lines in manufacturing
5. summarize automated assembly systems

UNIT- I

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT- II

Introduction to Material Handling: Overview of Material Handling Equipment, Considerations in Material Handling System Design, the 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT – III

Manual Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT- IV

Transfer lines : Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT- V

Automated Assembly Systems: Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

TEXT BOOKS:

1. Automation, Production systems and computer integrated manufacturing by Mikel P. Groover, Pearson Education.

REFERENCE BOOKS:

1. CAD CAM: Principles, Practice and Manufacturing Management by Chris Mc Mohan, Jimmie Browne, Pearson edu. (LPE)
2. Automation by Buckinghsm W, Haper& Row Publishers, New York, 1961

INTELLIGENT MANUFACTURING SYSTEMS
(Professional Elective-III)

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPE201	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. distinguish various CIM systems
2. explain various knowledge based systems
3. apply the concepts of AI in manufacturing
4. build expert systems for automated process planning
5. recommend cellular manufacturing using GT

UNIT I:

Computer Integrated Manufacturing Systems: Structure and functional areas of CIM system, - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems - MAP/TOP, OSI Model, Data Redundancy, Top- down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

UNIT II:

Components of Knowledge Based Systems: - Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT III:

Machine Learning: Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT IV:

Automated Process Planning: Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning. Knowledge Based System for Equipment Selection (KBSES) - Manufacturing system design. Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KRSES.

UNIT V:

Group Technology: Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation - Similarity Coefficient Method, Sorting- based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology - Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBSCIT) — Data Base, Knowledge Base, Clustering Algorithm.

TEXTBOOKS :

1. Intelligent Manufacturing Systems/ Andrew Kusiak/Prentice Hall
2. Artificial Neural Networks/ Yagna Narayana/PHI/2006

REFERENCE BOOKS

1. Automation, Production Systems and CIM / Groover M.P./PHI/2007
2. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.

ADVANCED MANUFACTURING PROCESSES
(Professional Elective-III)

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPE202	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. summarize surface treatment processes
2. explain different methods of processing for ceramics and composites
3. select the processes for fabrication of micro devices
4. illustrate e-manufacturing techniques
5. develop models using rapid prototyping techniques

UNIT- I

Surface Treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT- II

Processing of Ceramics: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT- III

Fabrication of Microelectronic Devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics.

UNIT - IV

E-Manufacturing: Nano manufacturing techniques and micromachining, High Speed Machining and hot machining

UNIT -V

Rapid Prototyping: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method, Applications and Limitations, Rapid tooling, Techniques of rapid manufacturing

TEXTBOOKS

1. Manufacturing Engineering and Technology I Kalpakijian / Adisson Wesley.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI.

REFERENCE BOOKS:

1. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,
2. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH

OPTIMIZATION TECHNIQUES & APPLICATIONS
(Professional Elective-III)

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPE203	**3**	**0**	**0**	**3**

Course Outcomes: At the end of the course the students are able to

1. formulate objective functions
2. solve unconstrained minimization problems
3. apply penalty functions for optimization of mathematical functions
4. make use of optimization techniques in engineering applications
5. model optimization techniques for vibration problems

UNIT- I:
General Characteristics of Mechanical Elements: adequate and optimum design, principles of optimization, formulation of objective function, design constraints, classification of optimization problems. Single and multivariable optimization techniques

UNIT- II
Technique of Unconstrained Minimization: Golden section, Random, Pattern and Gradient search methods, interpolation methods, equality and inequality constraints.

UNIT-III
Direct Methods and Indirect Methods using Penalty Function, Lagrange multipliers, Geometric programming, stochastic programming, Genetic algorithms

UNIT-IV
Engineering applications, structural-design application axial and transverse loaded members for minimum cost, maximum weight. Design of shafts and torsion members, design optimization of springs.

UNIT-V
Dynamics applications for two degree freedom system. vibration absorbers. Application in mechanisms.

TEXTBOOKS
1. Engineering Optimization -Theory and Practice/ Singerusu S. Rao/ New Age.
2. Optimum Design of Mechanical elements/ Johnson Ray C/ Wiley, John & Sons

ADVANCED MECHATRONICS
(Professional Elective-IV)

I-M.Tech.-II-Sem.	L	T	P	C
Subject Code: 20CAPE204	3	0	0	3

Course Outcomes: Upon completion of the course, the students will be able to

1. explain elements of mechatronic systems
2. choose electronic devices in MEMS
3. make use of various actuation systems
4. built the mechatronics system controls
5. apply SCADA principles for data acquisition

UNIT-I

Mechatronics system: elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid State Electronic Devices: PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT-III

Hydraulic and pneumatic actuating systems: Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV

Digital electronics and Systems: Digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and Interfacing and Data Acquisition, DAQS, SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

TEXTBOOKS:

1. Mechatronics Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.

MICRO ELECTRO MECHANICAL SYSTEMS
(Professional Elective-IV)

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPE205	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to:

1. identify elements of MEMS
2. apply the concepts of engineering science for MEMS fabrication
3. analyze MEMS using FEA
4. make use of thermo fluid engineering for micro systems design
5. choose appropriate materials for MEMS devices

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 Micro actuators Micro accelerometers, Micro fluidise.

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, ThinFilm Mechanics, Overview of Finite Element Stress Analysis

UNIT IV:
Thermo Fluid Engineering & Microsystems Design: Overview of Basics of Fluid Mechanics in Macro and Meso scales, Basic equations in Continuum Fluid dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid Flow in Sub micrometer and Nano scale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical Design using FEM, Design of a Silicon Die for a Micro pressure Sensor.

UNIT V:
Materials for MEMS & Microsystems and Their Fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, chemical and physical vapour deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process

TEXTBOOKS:

1. MEMs & Microsystems: Design & Manufacture/ Tai-Ran Hsu/Tata Mc-Graw Hill., ed./2002
2. An Introduction to Micro electro-mechanical Systems Engineering/ Maluf, M./ Artech House, Boston, 2000

ADDITIVE MANUFACTURING TECHNOLOGIES
(Professional Elective-IV)

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPE206	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. distinguish various additive manufacturing technologies
2. choose liquid-based and solid AM systems for manufacturing
3. make use of powder based AM systems
4. classify various AM data formats
5. summarize applications of AMT

UNIT–I

Prototyping fundamentals: Need for Additive Manufacturing, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

UNIT–II

Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Solid ground curing (SGC): Models and specifications, Process, working principle, Poly jet: Process, Principle, working principle, Micro fabrication. Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Case studies.

UNIT–III

Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, **3D Printing** : Models and specifications, Process, working principle, Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Electron Beam Melting (EBM): Models and specifications, Process, working principle, Rapid Tooling: Introduction,Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT–IV

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques. AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, Surgi Guide, 3-matic, Simplant, Mesh Lab

UNIT–V

AM Applications: Application – Material Relationship, Application in Design, Engineering, Analysis and Planning, RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Web Based Rapid Prototyping Systems

TEXT BOOKS:

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

AUTOMATION IN MANUFACTURING LAB

I-M.Tech.-II-Sem.	L	T	P	C
Subject Code: 20CAPC203	0	0	4	2

Course Outcomes: Upon completion of the course, the students will be able to

1. demonstrate various turning operations on CNC turret
2. make use of CNC machine for pocket milling
3. make use of CNC machine for drilling
4. demonstrate pick& place operation using robot
5. plan assembly operation using Robot

List of Experiments

1. Step turning using CNC turret
2. Taper turning using CNC turret
3. Multiple turning using CNC turret
4. Thread cutting using CNC turret
5. Circular pocket using CNC Mill
6. Square pocket using CNC Mill
7. Drilling pocket using CNC Mill
8. Mirroring pocket using CNC Mill
9. Pick & Place operation using Robot
10. Assembly operation using Robot

Reference Books:

1. Automation in Manufacturing Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd

COMPUTER AIDED ENGINEERING LAB

	L	T	P	C
I-M.Tech.-II-Sem.				
Subject Code: 20CAPC204	**0**	**0**	**4**	**2**

Course Outcomes: Upon completion of the course, the students will be able to

1. determine the deflections and stresses in trusses and beams
2. find the stresses in 2D structural members
3. develop harmonic and mode shapes for variety of beams
4. perform heat transfer analysis involving conduction and convection
5. conduct couple field analysis

List of Experiments

1. Truss analysis using FEA software.
2. Beam analysis using FEA software.
3. Frame analysis using FEA software.
4. Buckling analysis of columns using FEA software.
5. Harmonic analysis using FEA software.
6. Fracture analysis using FEA software.
7. Analysis of laminated composites using FEA software.
8. Couple-field analysis using FEA software.
9. Modal Analysis
10. Transient dynamic analysis.

Reference Books:

1. Computer Aided Engineering Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd

MINI PROJECT WITH SEMINAR

M.Tech. I Year II-Sem	L	T	P	C
Course Code: 20CAPR201	0	0	4	2

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the supervisor

PEDAGOGY STUDIES
(AUDIT COURSE - 2)

M.Tech. I Year II-Sem. **L T P C**
Course Code: 20AC201 **2 0 0 0**

UNIT- I: Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT- II: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

UNIT- III: Evidence on the effectiveness of pedagogical practices: Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy, Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV: Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT- V: Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

REFERENCE:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read'

STRESS MANGEMENT BY YOGA
(AUDIT COURSE - 2)

M.Tech. I Year II Sem. **L T P C**
Course Code: 20AC202 **2 0 0 0**

UNIT-I:

Definitions of Eight parts of yoga. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III:

Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:

Asan and Pranayam

UNIT-V:

i) Various yoga poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

1. "Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (AUDIT COURSE - 2)

I-M.Tech.-II-Sem. **L T P C**
Course Code: 20AC203 **2 0 0 0**

UNIT-I:

Neetisatakam-Holistic development of personality: Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality : Verses- 52,53,59 (dont's) Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties: Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge: Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 - Verses 13, 14, 15, 16,17, 18 Personality of Role model.

UNIT-V:

Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

II-M.TECH.-I-SEMESTER SYLLABUS

FLEXIBLE MANUFACTURING SYSTEMS
(Professional Elective-V)

	L	T	P	C
II-M.Tech.-I-Sem.				
Subject Code:20CAPE301	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain the fundamentals of FMS
2. adapt computer controls for FMS
3. choose different softwares for FMS
4. plan data flow in manufacturing systems
5. summarize kanban system

UNIT-I

Introduction to FMS: Planning, scheduling and control of FMS. Knowledge based scheduling.

UNIT–II

Hierarchy of computer control. Supervisory computer.

UNIT–III

Software for simulation and database of FMS: Specification and selection, trends, application of simulation software.

UNIT–IV

Manufacturing data systems: Data flow, CAD/CAM considerations. Planning FMS database, just in time characteristics, Pull method, quality small lot sizes, work station loads, close supplier ties, flexible workforce — line flow strategy.

UNIT–V

Preventive maintenance: Kanban system, implementation issues.

TEXTBOOKS:

1. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.
2. Production System l3eyond Large Scale Production/ Talichi Ohno/ Toyota Productivity Press India Pvt. Lid.
3. Flexible Manufacturing Systems/ H K Shivanand/New Age International/2006

COMPUTATIONAL FLUID DYNAMICS

(Professional Elective-V)

	L	T	P	C
II-M.Tech.-I-Sem.				
Subject Code: 20CAPE302	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. formulate the dynamic equations
2. solve system of equations using numerical methods
3. construct grids around 2D and 3D geometries
4. apply FD techniques in elliptic models
5. explain FVM concepts

UNIT–I

Equations of fluid dynamics: Basic concepts Eulerarian and Lagrangian methods of describing fluid flow motion, acceleration and deformation of fluid particle, vorticity. Laws governing fluid motion, continuity, Navier – stokes & energy equations. Boundary layer equation, Euler equations, potential flow equations, Bernoulli's equation and vorticity transport equation. Initial and boundary conditions. Classification of equation of motions – hyperbolic, parabolic, elliptic.

UNIT–II

Mathematical Preliminaries Numerical integration :Review of linear algebra, solution of simultaneous linear algebraic equations – matrix inversion, solvers – direct methods, elimination methods, ill conditioned systems; Gauss- Sidel method, successive over relaxation method.

UNIT–III

Grid Generation: Transformation of coordinates. General principles of grid generation – structured grids in two and three dimensions, algebraic grid generation, differential equations based grid generation; Elliptic grid generation, algorithm, Grid clustering, Grid refinement, Adaptive grids, Moving grids. Algorithms, CAD interfaces to grid generation. Techniques for complex and large problems: Multi block methods.

UNIT–IV

Finite difference discretization: Elementary finite difference coefficients, basic aspects of finite difference equations, consistency, explicit and implicit methods, errors and stability analysis. Stability of elliptic and hyperbolic equations. Fundamentals of fluid flow modelling-conservative property, upwind scheme, transporting property, higher order upwinding. Finite difference applications in heat transfer – conduction, convection.

UNIT–V

Finite Volume Method Introduction: Application of FVM in diffusion and convection problems, NS equations – staggered grid, collocated grid, SIMPLE algorithm. Solution of discretised equations using TDMA.Finite volume methods for unsteady problems – explicit schemes, implicit schemes. Finite Element Method: Introduction. Weighted residual and variational formulations. Interpolation in one-dimensional and two-dimensional cases. Application of FEM to ID

TEXTBOOKS:

1. Ferziger J. H., Springer P.M, "Computational Methods for fluid Dynamics", Verlag Berlin
2. Anderson J. D. JR, "Computational fluid Dynamics", Mc Graw Hill Inc, 1995

PRODUCT DESIGN AND PROCESS DEVELOPMENT

(Professional Elective-V)

	L	T	P	C
II-M.Tech.-I-Sem.				
Subject Code: 20CAPE303	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain the functions of product design concepts
2. analyze product for design and development
3. illustrate various manufacturing processes for product design
4. apply the concepts of ergonomics for product development
5. summarize role of computer in product design

UNIT – I

Product design and process design functions: selection of a right product, essential factors of product design, Morphology of design, sources of new ideas for products, evaluation of new product ideas. Product innovation procedure-Flow chart. Qualifications of product design Engineer. Criteria for success/failure of a product. Value of appearance, colours and Laws of appearance.

UNIT – II

Product reliability: Mortality Curve, Reliability systems, Manufacturing reliability and quality control. Patents: Definitions, classes of patents, applying for patents. Trademarks and copyrights. Cost and quality sensitivity of products, Elements of cost of a product, costing methods, cost reduction and cost control activities. Economic analysis, Break even analysis Charts. Value engineering in product design, creativity aspects and techniques. Procedures of value analysis – cost reduction, material and process selection.

UNIT – III

Various manufacturing processes: degree of accuracy and finish obtainable, process capability studies. Methods of improving tolerances. Basic product design rules for Casting, Forging, Machining, Sheet metal and Welding. Physical properties of engineering materials and their importance on products. Selection of plastics, rubber and ceramics for product design.

UNIT – IV

Industrial ergonomics: Man- machine considerations, ease of maintenance. Ergonomic considerations in product design-Anthropometry, Design of controls, man-machine information exchange. Process sheet detail and their importance, Advanced techniques for higher productivity. Just -in -time and Kanban System. Modern approaches to product design; quality function development, Rapid prototyping.

UNIT – V

Role of computer in product design: creation of manufacturing data base, Computer Integrated Manufacturing, communication network, production flow analysis, Group Technology, Computer Aided product design and process Planning. Integrating product design, manufacture and production control.

TEXT BOOKS:

1. Niebel, B.W., and Draper, A.B., Product design and process Engineering, Mc Graw Hill Kogalkusha Ltd., Tokyo, 1974.
2. Chitale, A.K, and Gupta, R.C., Product Design and Manufacturing, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Mahajan, M. Industrial Engineering and Production Management, Dhanpath Rai & Co., 2000.

COMPOSITE MATRIALS
(Open Elective)

	L	T	P	C
II-M.Tech.-I-Sem.				
Subject Code: 20MEOE301	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. explain the characteristics of composite materials
2. choose the fiber reinforcements
3. select appropriate methods for manufacturing MMC
4. select appropriate methods for manufacturing PMC
5. determine mechanical properties of fiber laminates

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

UNIT–IV

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 – V

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.

CONSTRUCTION MANAGEMENT
(Open Elective)

	L	T	P	C
II-M.Tech.-I-Sem.				
Subject Code: 20CEOE302	**3**	**0**	**0**	**3**

Course Outcomes: Upon completion of the course, the students will be able to

1. interpret crystal structure, mechanical behavior of materials and necessity of alloying
2. perform metallographic methods for characterizing the micro structure of metals
3. plot the hardness variations of heat treated and non-heat treated steels
4. select appropriate materials for design
5. apply the skills and modern techniques for latest materials

UNIT -I

Management process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

UNIT-II

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications .Preliminary Planning- Collection of Data-Contract Planning – Scientific Methods of Management: Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.

UNIT-III

Resource planning - planning for manpower, materials, costs, equipment. Labour, -Scheduling .Forms of scheduling - Resource allocation. budget and budgetary control methods

UNIT-IV

Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document - Deposits by the contractor - Arbitration . negotiation - M.Book - Muster roll -stores.

UNIT-V

Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws - Safety in construction: legal and financial aspects of accidents in construction. occupational and safety hazard assessment. Human factors in safety. Legal and financial aspects of accidents in construction. Occupational and safety hazard assessment

REFERENCE:

1. Ghalot, P.S., Dhir, D.M., Construction Planning and Management, Wiley Eastern Limited.
2. Chitkara,K.K., Construction Project Management,Tata McGraw Hill Publishing Co, Ltd., New Delhi.
3. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi.
4. Sengupta, B. &Guha, H, Construction Management And Planning by: Tata McGraw-hill publications.

VLSI DESIGN
(Open Elective)

II-M.Tech.-I-Sem. **L T P C**
Subject Code: 20ECOE303 **3 0 0 3**

Course Outcomes: Upon completion of the course, the students will be able to

1. interpret various MOS transistor fabrication techniques
2. illustrate the operation and electrical characteristics of MOS transistor
3. discuss VLSI Design flow, Stick diagrams, layout, design rules of MOS transistor
4. outline the basic concepts of MOS circuits
5. interpret scaling of MOS transistor and various levels of CMOS testing

UNIT -I

Introduction: Introduction to IC technology, Basic MOS transistors, Enhancement and depletion modes of transistor action. Fabrication process of NMOS, PMOS,CMOS and Bi-CMOS technology and comparison between CMOS and bipolar technologies.

UNIT -II

Basic Electrical properties of MOS circuits: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds. CMOS Inverter analysis and design, Bi-CMOSInverters.MOS Transistor conductance and output conductance, MOS transistor figure of merit, Pass transistors, nMOS inverter , Determination of pull up to pull down ratio for an nMOS inverter driven by another nMOS inverter and for an nMOS inverter driven through one or more pass transistors, Alternate forms of pull up, CMOS inverter, BiCMOS Inverters.

UNIT-III

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μm CMOS Design rules for wires, Contacts and Transistors.Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT-IV

Basic concepts of MOS Circuits: Sheet resistance, Sheet resistance concept applied to MOS transistors and inverters, Area capacitance of layers , standard unit of capacitance, some area capacitance calculations, The delay unit, inverter delays, Driving large capacitance loads, Propagation delays, wiring capacitances, Fan-in and Fan-out characteristics, Choice of layers, CMOS steady state electrical behavior, CMOS dynamic electrical behavior.

UNIT-V

Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling.

CMOS Testing: Need for CMOS testing, design strategies for test Manufacturing test principles, Design for testability (DFT) - Adhoc testing, Scan design, Built in self-test (BIST).

Textbooks:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Dougles A. Pucknell, PHI, 2005.
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

References:

1. CMOS logic circuit Design - John. P. Uyemura, Springer.
2. Modern VLSI Design - Wayne Wolf, Pearson Education.

DATA MINING AND ANALYTICS
(Open Elective)

II-M.Tech.-I-Sem. **L T P C**
Subject Code: 20CSOE304 **3 0 0 3**

Course Outcomes: Upon completion of the course, the students will be able to

1. summarize fundamentals of data mining
2. illustrate various mining association rules
3. make use of classification and clustering techniques
4. outline various data analytics techniques
5. solve statistical problems using R programming

UNIT-I

Introduction to Data Mining: Kinds of Data, Data mining Functionalities – Interesting Patterns Task Primitives, Issues in Data Mining, Data Preprocessing.

UNIT -II

Mining Frequent, Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods:, Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, From Association Analysis to Correlation Analysis.

UNIT -III

Classification: Basic Concepts, Algorithm for Decision Tree Induction, Attribute Selection Measures. Bayes Classification Methods, Bayesian Belief Networks, a Multilayer Feed-Forward Neural Network, k-Nearest-Neighbor Classifiers.
Clustering: Cluster Analysis, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering.

UNIT -IV

Data Definitions and Analysis Techniques: Introduction to statistical learning and R-Programming, Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing.

UNIT -V

Basic Analysis Techniques: Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Maximum likelihood test, regression, Practice and analysis with R.

Textbooks:

1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
3. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013

References:

1. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing
2. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
3. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers,Springer

PROJECT – I / DISSERTATION PHASE – I

II-M.Tech.-I-Sem. **L T P C**
Course Code: 20CAPR301 **0 0 20 10**

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

II-M.TECH.-II-SEMESTER SYLLABUS

PROJECT – II / DISSERTATION PHASE – II

II-M.Tech.-II-Sem. **L T P C**
Course Code: 20CAPR401 **0 0 32 16**

Dissertation – II will be an extension of the topic identified in Dissertation – I.
Continuous assessment should be done for the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.