ACADEMIC REGULATIONS (R18)

COURSE STRUCTURE AND DETAILED SYLLABUS

For

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

(Effective from 2018-19)

MASTER OF TECHNOLOGY
IN
CAD & CAM

KANDULA SRINIVASA REDDY MEMORIAL COLLEGE OF ENGINEERING

(UGC-Autonomous)

Kadapa 516003, A.P

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 14001:2004 & 9001: 2015 Certified Institution)

E-mail: principal@ksrmce.ac.in **Website:** www.ksrmce.ac.in

KSRM COLLEGE OF ENGINEERING (AUTONOMOUS)

VISION & MISSION

VISION:

KSRMCE seeks to be recognized as one of the best engineering colleges in India in providing high standards of academics with most productive, creative learning environment by including research, innovation thoughts and producing graduates with human values & leadership qualities to serve nation.

MISSION:

M1: To provide high quality education in Engineering & Technology in order to bring out knowledgeable engineers.

M2: To creative environment a collaborative environment with stakeholders to take up need-based research and industry specific programs.

M3: To organize co-curricular and extracurricular activities for character and personality development to produce highly competent and motivated engineers and professionals to serve and lead the society.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION & MISSION

VISION:

To evolve as a department of high repute in Mechanical Engineering and allied fields through effective teaching, learning process and research activities, operating with a sense of professional and social responsibility.

MISSION:

M1: To produce Mechanical Engineers with sound knowledge through quality teaching-learning process and well-designed curriculum.

M2: To induce critical thinking attitude and inculcate the use of modern tools through inter-disciplinary research and develop entrepreneurial skills through industry-institute interaction.

M3: To provide opportunities/platforms for students to nurture leadership abilities and ethical values.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: To apply engineering principles to develop products, processes or knowledge to solve mechanical and associated engineering problems for successful career in mechanical engineering and allied fields.

PEO2: To pursue higher education, research and development and engage in the process of life-long learning.

PEO3: To demonstrate leadership qualities, professional ethics, and communication skills and adapt current technologies to meet the societal requirements.

PROGRAMME OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO 1: To apply their knowledge in the domain of engineering mechanics, thermal andfluid sciences to solve engineering problems utilizing advanced technology.

PSO 2: To successfully apply the principles of design, analysis and implementationof mechanical systems/processes which have been learned as a part of the curriculum?

PSO 3: To Develop and implement new ideas on product design and development with thehelp of modern CAD/CAM tools, while ensuring best manufacturing practices.

KSRM College of Engineering, Kadapa-516003, AP
Regulations for PG Programs in Engineering (R18PG)
(Effective from 2018-19)

Index

1.0 Nomenclature

1.1 *Academic Term*: Extent of time during which academic instructions are initiated and completed

1.2 *Academic Year*: Academic Term of, approximately, one year duration that usually starts in June/July and ends in April/May next

1.3 *Semester*: Either of two Academic Terms that make up an Academic Year

1.4 *Major*: A specific field of study

1.5 *Minor*: An area outside of, or complementary to, a Major

1.6 *Subject*: An area of knowledge that is studied as part of a Course

1.7 *Core*: A subject that is mandatory for a Major course of study

1.8 *Elective*: A subject that is selected for study to suit one's individual needs

1.9 *Audit Subject*: A subject that is studied to meet certain requirements but has no credits assigned to it

1.10 *Humanities subjects*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy

1.11 *Social Sciences subjects*: Subjects that describe the mental and behavioural activities of individuals, groups, organizations, institutions, and nations covering the disciplines of anthropology, economics, linguistics, political science, and psychology

1.12 *Exam*: A test to measure one's progress, knowledge, or ability in a subject

1.13 *Credit*: A numerical weight given to a subject

1.14 *Grade*: A numerical or alphabetic designation measuring the level ofachievement in an exam

1.15 *Attendance*: Physical presence of oneself in a classroom/laboratory forpurpose of a scheduled academic instruction

1.16 *Course*: A series of subjects that constitute a Major field of study

1.17 *Branch*: Same as Course

1.18 *Program*: Same as Course

1.19 *Specialization*: Same as branch

1.20 *Degree*: An academic title conferred to honour distinguished achievement.

2.0 Short Title and Application

2.1 These rules and regulations may be called as R18 PG and come into force from Academic Year 2018-19 and exist until superseded by new regulations

2.2 These rules and regulations are applicable to all post graduate courses in engineering and technology leading to Master's Degree in Technology (M. Tech)

2.3 The Specializations offered, at present, are:

2.3.1 Geotechnical Engineering

2.3.2 Power Systems

2.3.3 CAD & CAM

2.3.4 Digital Electronics and Communication Systems

2.3.5 Computer Science and Engineering

2.4 The Institute may offer new Specializations in future to which these rules and regulations will be applicable

3.0 Suspension and Amendment of Rules

3.1 Academic Council has the authority to suspend a rule temporarily

3.2 Academic Council has the authority to amend a rule

3.3 For affirmative action on any suspension or amendment of a rule, an affirmative vote of three-fifths of the members present and voting shall be required in Academic Council.

4.0 Requirements for Admission

4.1 At present, admissions into first semester of various Specializations are governed by Government and the Affiliating University. The eligibility criteria and procedure for admission are prescribed by Government and Affiliating University

4.2 A student is not allowed change of Specialization after admission

4.3 A student must fulfill medical standards required for admission

4.4 The selected students are admitted into first semester after payment of the prescribed fees.

5.0 Structure of the M. Tech course

5.1 *Duration*: The duration of M. Tech degree course is four semesters

5.2 *Working Days*: Calendar for any semester shall be announced at least four weeks before its commencement. Minimum number of working days is90 per semester

5.3 *Curriculum*: Each Specialization shallhave core, elective and audit subjects. The curriculum for each Specialization shall be approved by its corresponding Board of Studies and then by the Academic Council

5.4 *Credits*: All subjects that are assessed for marks have credits assigned to them. The credits assigned to subjects shall be given in curriculum. The total number of credits for entire course is 68forallSpecializations. The distribution of total credits semester-wise is given in Table 1

Table 1 Semester-wise Total Credits

Semester	Total Credits
First Semester	18
Second Semester	18
Third Semester	16
Fourth Semester	16
Total for entire course	**68**

5.5 The curriculum and syllabus is given in Annexure-1 and Annexure-2 respectively

5.6 Responsibility and Advising: It is the responsibility of the student to understand and know the regulations and requirements to earn the degree. Each student admitted in to the degree programs is assigned to a Faculty Advisor who assists the student in designing an effective program of study. Students should consult their Faculty Advisors for selection of electives and for general advice on academic program

6.0 Registration and Enrolment

6.1 Prior to opening of each semester, every student shall register for all the credit-bearing and audit subjects listed in curriculum of the semester. Excepting first semester, the registration for asemestershallbe done during a specified week after end examinations of previous semester. In first semester, the registration shall be done within six working days from date of opening. Recommendation of Faculty Advisor is needed for registration

6.2 Late registration will be permitted with a fine, decided from time to time, up to six working days from the last date specified for registration

6.3 A student will be eligible for registration for a semester if she or hei) is promoted to that semester, ii) has cleared all fees to the Institute, library and hostel of previous semester, and iii) is not disqualified for registration by a disciplinary action of the Institute

6.4 A student will be enrolled and allowed to attend the classes on successful registration and payment of necessary fees to Institution, library, and hostel

6.5 Registration and enrolment will be controlled by the Office of the Controller of Examinations

7.0 Assessment Procedure – Internal Tests and End Examinations

7.1 Performance of students in all subjects is assessed continuously through internal assessment tests and an End examination

7.2 Allocation of internal assessment and End examination marks

7.2.1 For theory subjects, the allocation is 40 marks for internal assessment and 60 marks for End examination totaling 100 marks

7.2.2 For laboratory/project work subjects, the allocation is 50 marks for internal assessment and 50 marks for End examination totaling 100 marks

7.2.3 For mini-project/mini-project with seminar total 100 marks are allocated for internal assessment. There shall be no end examination for this mini-project

7.2.4 For all audit subjects the allocation is 40 marks for internal assessment and no allocation for End examination

7.3 Internal Assessment Examinations

7.3.1 Internal assessment means performance evaluation of students by faculty members who teach the subjects

7.3.2 For theory subjects, including audit subjects, the internal assessment shall be done by midterm tests. For each subject, two midterm tests will be conducted for 40 marks each and the internal assessment mark is the better of two marks. If any student abstains for any midterm test, she or he will be awarded zero marks for that midterm test. There shall be no choice of questions in midterm tests

7.3.3 For laboratory/practical subjects, the internal assessment will be based on regular laboratory work over full semester. The assessment will be done by the faculty concerned. The students shall be informed sufficiently early of the procedure to be followed for internal assessment

7.3.4 For subjects like seminar, project-work, industrial training, and comprehensive viva-voce, the internal assessment will be done by a concerned Department Committee consisting of two senior faculty members and faculty guide of concerned student. The assessment procedure will be informed sufficiently early to the students

7.4 End examinations

7.4.1 End examinations shall be conducted after completion of coursework in each semester

7.4.2 The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting will be selected by the Principal

7.4.3 Evaluation of answer scripts shall be done by faculty members from outside of the Institute selected by the Principal

7.4.4 For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be recommended by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal

7.4.5 For project work viva-voce, End examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal

7.4.6 If a student abstains from End examination of any subject, for any reason, she or he shall be awarded zero marks in that subject

7.4.7 There is no end examination for audit subjects.

8.0 Method of Assigning Letter Grades and Grade Points

8.1 For all credit-bearing subjects, performance of a student in a subject is indicated by a letter grade that corresponds to absolute marks earned in that subject. Each letter grade is assigned a numeric Grade Point that is used to compute Grade Point Average on a scale of 0 to 10

8.2 Performance of a student in both internal assessment and End examination will be considered for awarding grades for credit bearing subjects. Total marks earned in a subject is the sum of marks obtained in internal and End examinations in that subject

8.3 Pass grade A+ to D+ is assigned to a subject based on total marks earned in that subject provided that a student earns at least i) 35% of marks in End examination marks and ii) 50% of marks in internal and End examination marks put together; otherwise fail grade F will be assigned to that subject

8.4 Grade I will be assigned to a subject if a disciplinary action is pending and is not resolved before publication of results. Office of Controller of Examinations shall resolve the pending disciplinary action within six working days from the date of publication of results and change the grade to any of A+ to D+ or F

8.5 Grade X will be assigned to a subject if a student abstains for End examination of that subject

8.6 The absolute marks and corresponding letter grade and grade points are given in Table2

Table 2 Letter Grades and Grade Points

Absolute Marks	Letter Grade	Grade Points	Remark
95-100	A+	10.0	Pass
90-94	A	9.5	Pass
85-89	A-	9.0	Pass
80-84	B+	8.5	Pass
75-79	B	8.0	Pass
70-74	B-	7.5	Pass
65-69	C+	7.0	Pass
60-64	C	6.5	Pass
55-59	C-	6.0	Pass
50-54	D+	5.5	Pass
0-49	F	0.0	Fail
-	I	0.0	Result Withheld
-	X	0.0	Absent for End Exam

8.7 *SGPA*: Semester Grade Point Average indicates the performance of a student in all credit-bearing subjects of a semester. SGPA is calculated as the weighted average of Grade Points of all subjects of the semester with corresponding credits of subjects as weights. Audit subjects are not considered for SGPA calculation

8.8 *CGPA*: Cumulative Grade Point Average indicates the performance of a student in all terms up to and including the current semester under consideration. CGPA is calculated as the weighted average of SGPAs with total credits in each semester as the weights

8.9 *Grade Card*: All students shall be issued Grade Cards after the publication of results of a semester. Grade Card is a statement of performance of a student in a semester. It contains information about each registered subject: type of subject, allocated credits, and letter grade earned.SGPA and CGPA will also be indicated

9.0 Requirements for Completing Subjects

9.1 A student shall complete all credit-bearing and audit subjects successfully to be eligible for award of degree

9.2 *Credit-bearing subjects*: A student is considered to have completed a credit-bearing subject successfully and earned credits if she or he obtains a pass grade from A+ to D+ in that subject. If a student receives fail grade F or X in any subject, she or he must register for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade

9.3 *Audit subjects*: A student is considered to have successfully completed an audit subject if she or he earns at least 40% of marks in internal assessment marks.
Supplementary exam for audit subjects: If a student fails in audit subject, she or he shall register for supplementary examination in that subject as and when the opportunity arises and pass that subject. The supplementary exam will be conducted for 40 marks covering the entire syllabus and student is deemed to have passed in the subject if she or he earns 16 marks (40% marks) in the supplementary exam, disregard of her or his performance in internal tests.

10.0 Requirements for taking End Examinations

10.1 A student is eligible to take regular End Examinations of current semester ifshe or he full fills the attendance requirement

10.2 A student shall be promoted from current semester to succeeding semesteron satisfying the attendance requirement

10.3 A student shall complete all credit-bearing and audit subjects successfully before taking End examination for project viva-voce

10.4 Attendance Requirement

10.4.1 Attendance of students shall be recorded for credit-bearing and audit subjects as per the workload indicated in curriculum

10.4.2 Total class-periods conducted shall be reckoned from beginning to end of a semester as published in academic calendar

10.4.3 Aggregate Percentage of Attendance is calculated using total number of class-periods attended as numerator and total number of class- periods conducted for the concerned subject as the denominator

10.4.4 A minimum aggregate attendance of 75% is required for promotion to succeeding semester

10.4.5 A student can appeal to the Principal for condoning deficiency in aggregate attendance if she or he gets 65% or more aggregate attendance presenting a valid reason for deficiency. Such a student will be granted promotion if the Principal pardons the deficiency. Principal has the right to reject the appeal if it is not satisfied with the performance of the student or the reason cited for deficiency of the attendance

10.4.6 A student earning less than 75% aggregate attendance will be denied promotion. A student who is not promoted on basis of attendance shall be removed from the rolls and shall register for the same semester when opportunity arises. The current semester record of the student is cancelled automatically

10.5 A student can forego promotion and opt to repeat the current term on written request. Recommendation of the concerned Faculty Advisor is required for cancellation of promotion. This option shall be exercised before the commencement of the End examinations of the current term.

11.0 Revaluation of End Examination Scripts

11.1 Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee

11.2 A Procedure for Revaluation: The script will be revaluated by an examiner appointed by the Principal. The maximum of revaluation and regular end examination marks will be awarded for that subject

11.3 A student can apply for revaluation in a subject only once

12.0 Supplementary End Examinations

12.1 Students are eligible to take Supplementary examinations in subjects with fail grade F or X only

12.2 Supplementary examinations for even semester subjects will be conducted with regular examinations of odd semester subjects and vice versa

12.3 A student will be allowed to improve grade in any theory subject provided she or he has completed coursework of all semesters but before award of provisional/final degree.

13.0 Requirements for Award of M. Tech degree

13.1 Time Limit for completion of requirements for award of degree is four calendar years from the date of admission. A student who could not complete all the requirements in this time limit shall forego admission and will be removed from the rolls of the Institute

13.2 A student shall be eligible for award of degree provided she or he has:

13.2.1 Registered and successfully completed all required credit-bearing and audit subjects with a total of 68 credits

13.2.2 Secured a CGPA of 5.5 or more

13.2.3 Cleared all dues to the Institute, library and hostel

13.2.4 No disciplinary action is pending against her or him

13.2.5 Satisfied any other stipulation of the affiliating University

13.3 Award of Class: Each student will be given class in degree based on CGPA as given in Table 3

Table 3 Class of Degree

Class of Degree	Range of CGPA
Second Class	>= 5.5 but <6.5
First Class	>= 6.5 but <7.5
First Class with Distinction	>= 7.5

13.4 Consolidated Grade Card and Degree will issued under the seal of affiliating University

14.0 Transitory Regulations

14.1 A student who initially joins the Institute in a previous Regulation and has to re-join in any semester of the present Regulations, due to any reason, shall be bound by the rules of the current Regulations. Board of Studies of the concerned Major will specify, extra or otherwise, academic coursework to be undertaken by such students who re-join the current Regulations.

COURSE STRUCTURE

Curriculum and Syllabus

L-Theory Lecture T- Tutorial P- Lab Work (Numbers under teaching Scheme indicate contact clock hours)

IM- Internal Marks EM-External Marks CR-credits

I SEMESTER

S.No.	Core / Elective / Audit	Course Code	Course Name	L	T	P	IM	EM	CR
1	Core	1853101	Geometric Modeling	3	0	0	40	60	3
2	Core	1853102	Computer Integrated Manufacturing	3	0	0	40	60	3
3	Elective1	1853103	1.Computer Aided Process Planning	3	0	0	40	60	3
		1853104	2.Concurrent Engineering						
		1853105	3.Quality Engineering & Manufacturing						
4	Elective2	1853106	1.Advanced optimization techniques	3	0	0	40	60	3
		1853107	2.Design For Manufacturing						
		1853108	3.Mechatronics						
5	Core	1800109	Research Methodology & IPR	2	0	0	40	60	2
7	Core	1853110	Lab-I (Computer graphics Lab)	0	0	4	50	50	2
8	Core	1853111	Lab-II (CAD Lab)	0	0	4	50	50	2
6	Audit Course	One of the Audit courses	1. English for Research paper writing. 2. Disaster Management 3. Sanskrit for Technical Knowledge 4. Value Education 5. Constitution of India 6. Pedagogy Studies 7. Stress Management by Yoga 8. Personality Development through Life Enlightenment skills.						
			Total	**14**	**0**	**8**	**300**	**400**	**18**

II SEMESTER

S.No.	Core / Elective / Audit	Course Code	Course Name	L	T	P	IM	EM	CR
1	Core	1853201	Finite Element Methods	3	0	0	40	60	3
2	Core	1853202	Robotics	3	0	0	40	60	3
3	Elective3	1853203	1.Advances in Manufacturing Technology	3	0	0	40	60	3
		1853204	2.Artifical Intelligence & Expert Systems						
		1853205	3.Advances Stress Analysis						
4	Elective4	1853206	1.Flexible Manufacturing Systems	3	0	0	40	60	3
		1853207	2.Computer Graphics						
		1853208	3.CNC Technology and Programming						
5	Core	1853209	Mini-project with seminar	0	0	4	100		2
7	Core	1853210	Lab-III (CAE Lab)	0	0	4	50	50	2
8	Core	1853211	Lab-IV (CAM Lab)	0	0	4	50	50	2
6	Audit	One of the eight audit courses	1. English for Research paper writing 2. Disaster Management 3. Sanskrit for Technical Knowledge 4. Value Education 5. Constitution of India 6. Pedagogy Studies 7. Stress Management by Yoga 8. Personality Development through Life Enlightenment skills						
			Total	**12**	**0**	**12**	**360**	**340**	**18**

III SEMESTER

S.No.	Core / Elective / Audit	Course Code	Course Name	L	T	P	IM	EM	CR
1	Elective 5	1853301	1.Rapid Prototyping	3	0	0	40	60	3
		1853302	2.Automation in Manufacturing						
		1853303	Advanced Tool Design						
2	Open Elective	1870304	1.Business Analytics	3	0	0	40	60	3
		1870305	2.Industrial Safety						
		1870306	3.Operations Research						
		1870307	4.Cost Management of Engineering Projects						
		1870308	5.Composite Materials						
		1870309	6.Waste to energy						
3	Core	1853310	Dissertation Phase-I	0	0	20	100		10
			Total	**6**	**0**	**20**	**180**	**120**	**16**

IV SEMESTER

S. No	Core / Elective	Course Code	Course Name	L	T	P	IM	EM	CR
1	Major Project	1853401	Dissertation Phase-II	0	0	32	50	50	16
			Total	**0**	**0**	**32**	**50**	**50**	**16**

M.TECH.-
I- SEMESTER SYLLABUS

Course Title	GEOMETRIC MODELING				M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853101	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objective:

- The students will learn principles and practices used in the creation of 3D models; mathematical principles of geometric modeling; theory and application of modeling techniques, study representation schemes for curves, surfaces, solids, and other spatial data and the impact of representation on graphics algorithms. Topics include spline curves and surfaces, quadric surfaces, and how to design, program and analyze algorithms and systems for interactive 3D shape modeling.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Student can able to understand to equations
CO 2	Student can able to understand applications of geometric modeling techniques
CO 3	Student can able to understand modeling complex curves and surfaces.
CO4	Implement the transformation and projection over the geometric model
CO5	Develop and manipulate the solid models using different modeling approaches

UNIT – I

Introduction: Definition, Explicit and implicit equations, parametric equations.

UNIT – II

Cubic Splines: Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves.

UNIT – III

Bezier Curves: Bernstein basis, equations of Bezier curves, properties, derivatives. B-Spline Curves: B-Spline basis, equations, knot vectors, properties, and derivatives.

UNIT – IV

Surfaces: Bicubic surfaces, Coons surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, Sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, Gaussian curvature.

UNIT – V

Solids: Tricubic solid, Algebraic and geometric form. Solid modeling concepts: Wire frames, Boundary representation, Half space modeling, spatial cell, cell decomposition, classification problem.

Text Books:

1. CAD/CAM by Ibrahim Zeid, Tata McGraw Hill.
2. Elements of Computer Graphics by Roger & Adams Tata McGraw Hill.
3. Computer Graphics, Steven Harrington, TMH
4. Principles of computer Graphics, ShaliniGovil, PHI, 2005, Springer.
5. Computer Graphics and Automation, M.C. Trivedi, Jaico Pub./ PearsonEducation

Reference Books:

1. Geometric Modeling by Micheal E. Mortenson, McGraw Hill Publishers
2. Computer Aided Design and Manufacturing, K.Lalit Narayan, K.MallikarjunaRao, MMM Sarcar, PHI Publisher
3. Mathematical Elements for computer graphics, David. Rodgers, TMH
4. Computer Graphics C version, Donald Hearn and M.PaulineBaker,Pearson/PHI
5. Computer Graphics Principles & Practice, C.Foley, Vndom, Fener, Hughes,2/e, Pearson Publications.
6. Computer Graphics second edition, Zhigandxiang, Roy Plastock, Schaum‟soutlines, TMH.

Course Title	COMPUTER INTEGRATED MANUFACTURING					M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853102	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course objectives:

- To understand the role of computer in manufacturing
- To introduce hardware and software components for soft automation.
- To conduct on automatic data capture systems
- To provide an in depth understanding of control of manufacturing, automated material handling, storage and retrieval systems
- To introduce group technology and concurrent engineering and develop skill in the developing automated process plans using variant and generative approaches.
- To take up case studies on FMS and CIM systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	At the End of the course student can able to learn fundamental concepts of automation and NC control machines.
CO 2	Student can able to computer control in NC.
CO 3	Student can learn GT & FMS Concepts.
CO4	Students can able to know CAPP & MRP Topics.
CO5	Knowledge on Adaptive control machining systems is obtained for student.

UNIT – I

Introduction: Fundamental concepts in Manufacturing and Automation, Automation Strategies, Economic analysis in production, Fundamentals of CAD / CAM, Product cycle and CAD/CAM Numerical control machines: Introduction, basic components of an NC system, the NC procedure, NC coordinate system, NC motion control system, application of numerical control and Economics of Numerical control.

UNIT – II

NC part programming: Introduction, the Punch tape in NC, Tape code format, Manual part programming. NC programming with manual data input. Computer controls in NC: NC controller‟s technology, Computer Numerical Control (CNC) and Direct Numerical control (DNC).

UNIT – III

Group Technology: Part families, Parts classification and coding, Production flow analysis, Composite part concept, Machine cell design and Benefits of GT. Flexible Manufacturing Systems: Components of FMS, FMS Work stations, Material Handling Systems, Computer Control system, FMS layout configurations and Benefits of FMS.

UNIT – IV

Computer aided planning systems: Approaches to Computer aided Process Planning (CAPP), Generative and Retrieval CAPP systems, Benefits of CAPP, Material Requirement Planning (MRP), Mechanism of MRP, Benefits and Capacity Planning.

UNIT – V

Computer integrated manufacturing: Adaptive control machining systems, Adaptive control optimization system, Adaptive control constraint system, Applications to machining processes, Computer process monitoring, Hierarchical structure of computers in manufacturing, and computer process control.

Text Books:

1. Automation, Production systems and Computer Integrated Manufacturing Systems, MikelP.Groover, PHI Publishers
2. Computer Integrated Manufacturing by Ayres R.U
3. Computer Integrated Manufacturing by Springer-Verlag Berlin and Heidelberg GmbH & Co. KG
4. Computer Integrated Manufacturing by ALAN WEATHERALL

Reference Books:

1. CAD/CAM ,MikellP.Grooverand Emory W.Zimmers.Jr. PHI Publishers
2. Computer Aided Design and Manufacturing, K.Lalit Narayan, K.MallikarjunaRao, MMM Sarcar, PHI Publishers.
3. CAD/CAM/CIM, Radhakrishnan and Subramanian, New Age Publishers
4. Computer aided and integrated manufacturing systems by Cornelius T Leondes.

Course Title	COMPUTER AIDED PROCESS PLANNING Elective-I				M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853103	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of this subject is

- To understand the concept of process planning and various methods of process planning using computer
- To understand the geometric model of the component in CAD technology of computer graphics in order to describe part features for process planning.
- To understand the Steps involved in variant type computer aided process planning and generative type computer aided process planning.
- Understanding the concept of Group technology to implement variant type computer aided process planning.
- To understand the principle of NC, CNC, Machining Centre and various methods of part programming.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To understand the importance of CAPP and group Technology.
CO 2	To know the basic concepts of NC and CNC machine tool programming and computer aided part programming.
CO 3	Acquire knowledge about advanced manufacturing systems like CAPP, Group Technology FMS and CIM.
CO4	Select the proper cutting tool material and components of jigs and fixtures.

UNIT- I

Introduction to process planning, Information required for process planning system, Steps in process planning, Route sheet, Manual approach, Computer aided process planning: Retrieval CAPP system, Generative CAPP system, Hybrid approach, CAPP applications, Facts about CAPP technology, Criteria for selecting a CAPP system, Benefits of CAPP and Limitations of CAPP.

UNIT-II

Introduction to group technology, Benefits of group technology, Part family, Methods of grouping the parts into part family: The visual inspection method, Part classification and coding system, MICLASS classification and coding system, Opitz classification system, Production flow analysis , Composite part, Limitations of group technology, Application of group technology in CAPP, Retrieval CAPP system: Principle, Structure of Retrieval CAPP system, Advantages ,Disadvantages, Applications and MIPLAN system.

UNIT – III

Generative CAPP system:Principle of Generative CAPP system, Essential elements in a generative CAPP system, Implementation of generative CAPP systems, Advantages, Disadvantages and Applications Selection of manufacturing sequence: Identifying machinable volumes or pockets requiredin machining process, Setup planning, Attaching pockets to setups, Determining holding method, Alternative sequences, Quantitative

methods for optimal selection and Computer method for sequencing operations for assembly lines

UNIT –IV

Factors affecting selection of manufacturing process, Manufacturing possesses for metals, Machining process, Cutting parameters, Different approaches for solving speed/feed selection problem, Elements of cost in manufacturing operation, Optimization model to predict the optimum speed, Breakeven analysis in selection of process. Flexible Manufacturing System: Components of FMS, FMS equipment & control, Programmable logic controller, Processes interface programming the PLC, Local area network , Automated guided vehicle systems, Automated storage and retrieval system, Operational problem in FMS. Computer Integrated Manufacturing (CIM): Elements of CIM, CIM hierarchy, implementation of processes

UNIT –V

Determination of manufacturing tolerances:Design tolerances, Manufacturing tolerances, Need of tolerances in design and manufacturing, Tolerance allocation ,Tolerance analysis models for assemblies: Worst case, Statistical, Tolerance allocation methods: Allocation by proportional scaling, Allocation by constant precision factor, Tolerance allocation using optimization techniques, Automatic tolerance analysis, Advantages of integrated approach over sequential approach

Text Books:

1. Automation, Production systems and Computer Integrated Manufacturing Systems, Mikel P.Groover, PHI Publishers
2. Modelling and Design Objects and Processes,Takkai Yagiu
3. Computer Aided Engineering, David Bedworth New Product Design and Analysis - Ronald Engene Kinetoricz
4. CAD/CAM/CIM, Radhakrishnan and Subramanian, New Age Publishers.

Reference Books:

1. Applied Information Science ,Engineering and technology-Gabriella Bognar and Tibor Toth
2. Computer Aided Process and planning H P Wang & JKLI
3. Computer Aided Design and Manufacturing,W.Zimmers

4.Anderson M.M. & Hein L. Berlin, "Integrated Product Development", Springer Verlog, 1987.

Course Title	CONCURRENT ENGINEERING Elective-I				M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853104	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of this subject is

- To study the principles of concurrent engineering and its implementation
- To familiarize with the basics of concurrent engineering
- To study the tools and methodologies available in CE
- To study various approaches to CE
- To study the other related aspects of CE

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Student can learn topics of Concurrent engineering and its Goals.
CO 2	At the end of course student can learn concurrent Engineering Tools and Techniques.
CO 3	Students learn Roles and Responsibilities.
CO4	At the end student can have knowledge on JIT Systems.

UNIT- I

Introduction to Concurrent Engineering, Definitions, Historical Background, Goals of CE, Need for CE, Development process with CE Role of CAD/CAM in CE and Product life cycle

UNIT- II

Concurrent Engineering Tools & Techniques, Quality function Deployment, Value function analysis, Failure Mode & Effect Analysis, Design for Manufacture & Assembly, Design for X , Taguchi‟s Robust Design approach ,Pugh process , customer Focused Design , rapid prototyping and simulation.

UNIT- III

Implementing CE in an organization, concurrent engineering teams, their roles and responsibilities, Organizational functions to support CE team environment, Setting Team goals, measuring performance of team &managing a CE Team, Limitations of team.

UNIT- IV

Design for manufacture & Assembly, Design for economics, Design for X, Product Data Management, Agile manufacturing and rapid prototyping& simulation.

UNIT- V

Introduction JIT, Design, development & management for JIT , Implementation of JIT, supply product Life cycle management, Project time management , Techniques of time management and Collaborative product commerce simple case studies in CE

Text Books:

1. Thomas A. "Concurrent Engineering", Salomone, Maarcel Dekker Inc.New York, 1995.
2. Moustapha .I "Concurrent Engineering in product Design Development" New Age International (p) Ltd., 2003
3. Sammy G. Sinha, "Successful implementation of concurrent product & process", Wiley
4. Concurrent engineering-Josip Stjepandić, Wim J. C. Verhagen, Nel Wognum

Reference Books:

1. Concurrent engineering-John Hartly
2. Prasad, "Concurrent Engineering fundamentals - Integrated Product Development", Prentice Hall, 1996.
3. Design for Manufacturability & Concurrent Engineering- David M. Anderson
4. Design for Manufacturability-David M. Anderson

Course Title	QUALITY ENGINEERING &MANUFACTURING Elective-I				M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853105	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives

To explain basic quality concepts of Quality engineering and manufacturing, its tools and techniques used in engineering. To familiarize:

- Various theories about quality engineering and manufacturing
- Planning and manufacturing for quality, its tools and techniques
- Supporting tools and techniques for TQM
- Design of Experiments for quality
- Failure patterns and preventive maintenance

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Student can have knowledge on Quality value and Engineering.
CO 2	At the of topic student know about Tolerance Design.
CO 3	Student have knowledge on orthogonal Arrays.
CO4	Gains knowledge on Various Interpolation of experimental results.

UNIT-I

Quality value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design production processes. Loss function and quality level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type, S-type and L-type)

UNIT-II

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components. Parameter and tolerance

design: Introduction to parameter design, signal to noise ratios, parameter design strategy, Introduction to tolerance design, tolerance design using the loss function, identification of tolerance design factors.

UNIT-III

Design of Experiments: Introduction, Task aids and Responsibilities for DOE process steps, DOE process steps description. Analysis of variance (ANOVA): no-WAY ANOVA, One-way ANOVA, two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors. UNIT-IV Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, conducting and analyzing an experiment. Interpolation of experimental results: Interpretation methods, percent contribution, estimating the mean.

UNIT-V

ISO-9000 Quality system, BDRE, 6-sigma, bench marking, quality circles-brain storming fishbone diagram-problem analysis.

Text Books:

1. Taguchi techniques for quality engineering, Philip J.Ross , McGraw Hill Intl, 2nd Edition,1995. 2. Quality Engineering Handbook by (Author), R.W. Berger (Author)
2. Quality Engineering by Su Chao-Ton
3. **Quality Management And Qualification Needs 1 by Johannes K**

Reference Books:

1. Quality Engineering in Production systems, G.Taguchi, A.Elasayed et al/Mc.GrawHillIntl. Edition, 1989.
2. Taguchi methods explained: Practical steps to Robust Design,PapanP.Bagchi,Prentice Hall Ind. Pvt. Ltd., New Delhi
3. a textbook of production technology: manufacturing processes author: p c sharma
4. Quality Management In Plastics Processing by Robin Kent

Course Title	ADVANCED OPTIMIZATION TECHNIQUES Elective-II					M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853106	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of this subject is

- To understand and apply operation research techniques to design and production problems
- To understand concept of linear programming techniques and obtaining optimal solution using various linear programming techniques
- To understand Assignment Problem in order to solve process planning problem To understand various nonlinear programming techniques to solve nonlinear programming problems with constrains and without constraints
- To learn search techniques to solve nonlinear programming problems with constrains and without constraints.
- To understand genetic algorithm in order to solve nonlinear programming and travelling salesman problem.
- To learn genetic programming in order to generate programs Applying above techniques to solve design and manufacturing problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Illustration of different approaches for optimization.
CO 2	Understand about the application optimization in Engineering
CO 3	Learning of different optimization techniques.
CO4	Knowledge of different practical applications of optimization

UNIT I

Linear programming: Two-phase simplex method, Big-M method, Duality, Applications of linear programming to design and manufacturing. Assignment problem: Hungarian algorithm,

Degeneracy, Applications, Unbalanced problems, Traveling salesman problem.

UNIT II

Nonlinear programming: Nonlinear programming formulation, Cases of nonlinear programming problem, Extreme points, Single variable and multi variable optimization without constraints, Nonlinear programming with constraints: Graphical solution, Lagrange multiplier method and Kuhn-Tucker conditions

UNIT III

Integer linear programming: Definition, Integer linear programming techniques, Branch and Bound algorithm for obtaining optimal solution and Gomory cutting plane algorithm

UNIT IV

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, Working principle, Reproduction, Crossover, mutation,

Termination criteria, , Application of genetic algorithm for solving unconstrained nonlinear programming problem and Traveling salesman problem, Draw backs of GA Genetic Programming (GP): Principles of genetic programming, Terminal sets, Functional sets, Differences between GA & GP, Random population generation, Solving differential equations using GP.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, Minimization of weight of a cantilever beam, Optimization of springs and gears, General optimization model of a machining process, Optimization of arc welding parameters, and General procedure in optimizing machining operations sequence.

Text Books:

1. Optimization Techniques And Applications With Examples by Yang, Wiley
2. Optimal design – JasbirArora, McGraw Hill (International) Publishers
3. Operations research,K.Rajagopal,PHI
4. Engineering Optimization – S.S.Rao, New Age Publishers

Reference Books:

1. Linear and Optimization -Prasad, Gerard Sierksma
2. Operation research -Gang yu
3. Numerical Optimization -Jorg Nocedal
4. Industrial Engineering-Fethi Calsir& Emire Cavican

Course Title	DESIGN FOR MANUFACTURING Elective II					M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853107	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: To enable the students to understand the Design for manufacture and assembly to familiarize

- DFM approach and Processes
- Selective assembly& Thermal stress in weld joints
- Metal casting joining
- Form design of castings and Extrusion & sheet metal work

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Knowledge on rules for manufacturability Basic principles.
CO 2	Over view of various machining Process.
CO 3	Knowledge on metal Castings.
CO 4	Design of weldments.
CO 5	Various plastic design procedures.

UNIT I

Introduction: Design philosophy, steps in design process, general design rules for manufacturability, and basic principles of designing for economical production and creativity in design.

Materials: Selection of materials for design, developments in material technology,criteria for material selection, material selection interrelationship with process selection and process selection charts.

UNIT II

Machining processes: Overview of various machining processes, general design rules for machining, dimensional tolerance and surface roughness, Design for machining, ease redesigning of components for machining ease with suitable examples and General design recommendations for machined parts

UNIT III

Metal casting: Appraisal of various casting processes, selection of casting process, general design considerations for casting, casting tolerance, use of solidification, simulation in casting design and product design rules for sand casting.

UNIT IV

Metal joining: Appraisal of various welding processes, factors in design of weldments, general design guidelines, pre and post treatment of welds, effects of thermal stresses in weld joints and design of brazed joints.

Forging: Design factors for forging, closed die forging design, parting lines of dies, drop forging die design and general design recommendations.

UNIT – V

Extrusion & Sheet metal work: Design guide lines extruded sections, design principles for punching, blanking, bending, deep drawing, Keeler Goodman forging line diagram and component design for blanking.

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding, design guidelines for machining andjoining of plastics.

Text Books:

1. Design for manufacture, John cobert, Adisson Wesley. 1995 Design for Manufacture by Boothroyd,
2. Design for Manufacturing: A Structured Approach-by Corrado Poli BS MS Ph.D Ohio State
3. 4.Design for Manufacturability & Yield for Nano-Scale CmosChiang 2009 Edition by Chiang Charles , Springer

Reference Books:

1. ASM Hand book Vol.20
2. Design for Manufacturability (Hardcover, Balasinski, Artur)
3. Design for Manufacturing-c.poli
4. Product Technology:Manufacturing Processes,Technology and Automation by R.K Jain pustakkosh.com

Course Title	MECHATRONICS Elective-II				M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853108	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: To study about various, sensors, transducers, microprocessors and

- To study the Actuators and drive systems, used in mechanical engineering
- To study how motion controls can be used to do simple applications in mechanical engineering
- To study about Architecture of intelligent machines and sensors its applications

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	At the of the course student can learn about various Actuators and drive systems
CO 2	Knowledge fuzzy logic
CO 3	Student learn Various Analog and Digital Sensors

UNIT I

Introduction: Definition of Mechatronic products, design considerations and Tradeoffs, Overview of Mechtronic products. Intelligent machine Vs Automatic machine economic and social justification, **Actuators and drive systems:** Mechanical, Electrical, hydraulic drive systems, Characteristics of mechanical, Electrical, Hydraulic and pneumatic actuators and their limitations.

UNIT II

Motion Control: Control parameters and system objectives, Mechanical Configurations, Motion Control algorithms: Significance of feed forward control loops, shortfalls,fundamentals concepts of adaptive and fuzzy – control. Fuzzy logic compensatory control of transformation and deformation non- linearity's.

UNIT III

Architecture of intelligent machines: Introduction to Microprocessor and programmable logic controls and identification of systems. System design classification, Motion control aspects in design, **Manufacturing data bases:** Data base management system, CAD/CAM data bases, graphic data base, introduction to object oriented concepts, objects oriented model language interface.

UNIT IV

Sensor interfacing: Analog and digital sensors for motion measurement, Digital transducers, human-Machine and machine- Machine inter facing devices and strategy.

UNIT V

Machine vision: Feature and pattern recognition methods, concepts of perception and cognition in decision-making.

Text Books:

1. "Designing intelligent machines", open university, London.MichelB.Histand and davidG.
2. Alciatore.
3. Introduction to Mechatronics and Measurement systems, Tata McGraw Hill.
4. C.W.desilva, "Control sensors and actuators, Prentice Hall.
5. Mechatronics: Electronic Control Systems in Mechanical Engineering Book by W. Bolton

Reference Books:

1. Introduction to mechatronics and measurement systems Book by David Alciatore
2. Mechatronics : Fundamentals and Applications -Charles
3. An Introduction to Mechatronics -Robert H Bishop
4. Mechotronics System Design -Devdas Shetty

Course Title	RESEARCH METHODOLOGY AND IPR					M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853109	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		2	0	0	2	40	60	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: To study about various, sensors, transducers, microprocessors and

- To study the Actuators and drive systems, used in mechanical engineering
- To study how motion controls can be used to do simple applications in mechanical engineering
- To study about Architecture of intelligent machines and sensors its applications

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand research problem formulation.
CO 2	Analyze research related in formation
CO 3	Follow research ethics
CO 4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO 5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering Understand that IPR protection provides an incentive to inventors for further in particular.
CO6	Understand that IPR protection provides an incentive to inventors for further Research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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.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.

Text Books:

1. .Stuart Melville and Wayne Goddard, "Research methodology: an introduction for
2. science & engineering students""
3. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
4. The Craft of Research, Third Edition Gregory G. Colomb, Joseph M. Williams, Wayne C. Booth
5. Qualitative Research by Sharan B. MerriamElizabeth J. Tisdell

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches - J. David Creswell, John W. Creswell

2. Research Methods in Education Book by Keith Morrison, Lawrence Manion, and Louis Cohen

3. 3..Handbook of Qualitative Research Norman K. Denzin, Yvonna S. Lincoln
4. .RanjitKumar, 2nd Edition, "Research Methodology: A Step by Step Guide

Course Title	COMPUTER GRAPHICS LAB					M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853110	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives:

- Understand the need of developing graphics application
- Learn algorithmic development of graphics primitives like: line, circle, polygon etc.
- Learn the representation and transformation of graphical images and pictures.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Draw Geometric primitives using OpenGL
CO 2	Execute scan line polygon filling using OpenGL
CO 3	Implement basic transformations on objects using OpenGL
CO 4	Implement clipping algorithm on lines using OpenGL

List of Experiments

1) C Program me for Generation of Line
2) C Program me for Generation of Circle using DDA Algorithm
3) C Program me for Generation of Entities using Ellipse
4) C Program me for Generation of Bezier Curve

Any Four Experiments in CAD Software Covering 2D Modeling ,Boolean Operations ,Add, Subtract, Pan Zoom & Rotate ,Trim and other Draw & Editing commands

C-Language, Any Cad Software

4) C Program me for Generation of Bezier Curve Any Four Experiments in CAD Software Covering 2D Modeling ,Boolean Operations ,Add, Subtract, Pan Zoom & Rotate ,Trim and other Draw & Editing commands

Course Title	CAD LAB				M. Tech. CAD/CAM I Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853111	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: 2 Hrs						End Exam Duration : 3Hrs		

Course Objectives: To study about various, sensors, transducers, microprocessors and This Lab introduces students to software and equipments associated with CAD/CAM This Lab helps students to build their basic concepts about CAD/CAM This Lab helps students to learn the following using different CNC Machine's

- Basic working principal.
- Axis movements.
- G& M code Development.
- Programming and Test run of Programmed part.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Design and draft the product drawings.
CO 2	Analyze, synthesize and control the design parameters to manufacture highly reliable products
CO 3	Identify potential changes in design as they are altered and influenced by advancements in manufacturing processes.
CO 4	Understand the constructional features of a CNC machine
CO 5	Write a manual part programming to manufacture a product on CNC Machines.

Any Four Experiments Covering 3D Modeling Cad Software, Revolve, Box, Loft, sweep ,Etc..

Any Two Experiments Covering 3D Modeling, Extrude ,Delete segment, pattern ,etc..

Any Two Experiments Covering Assembly Commands For various components.. Any Software related to CAD-Autocad, Inventory, Creo-4.0, Catia, Etc…

Course Title	FINITE ELEMENT METHODS				M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853201	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objectives of this course is to teach the fundamentals of Finite Element Methods with emphasis on the underlying theory, assumptions and modeling issues, revision of matrix algebra, introduction to formulating system equations for structural problems, concept of shape functions, properties and usage of linear, quadratic and cubic shape functions. The students will learn the fundamentals of Finite Element Methods including discrete system analysis,

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	students are able to know introductory basic principles and approaches for solving FEM problems in different fields.
CO 2	students are able to formulate FEM model for simple problems
CO 3	students are able to write interpolation functions to higher order isoparametric elements.
CO 4	students are able to derive element matrices for applying the principles to find stresses in beamsand trusses and temperature distribution in composite walls

UNIT I

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT II

One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, Assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection Problems. Examples: one dimensional fin.

UNIT III

Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, and temperature effects.

Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for **displacments, reactions, stresses**

UNIT IV

Two dimensional problems: CST, four noded and eight noded rectangular elements, **Axisymmetric Problems:** Axisymmetric formulations, Element matrices boundaryconditions. **Heat Transfer problems:** Conduction and convection, examples: two-dimensional fin.

UNIT V

Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration. Finite elements in Structural Dynamics: Dynamic equations, Eigenvalue problems, and their solution methods, simple problems.

Convergence: Requirements for convergence, h-refinement and p-refinement, Pascal‟s triangle

Text Books:

1. Finite Element Analysis in Engineering, S.Md. Jalaludeen, Anuradha Publishers
2. Introduction to Finite Elements in Engineering, Chandraputla,a and Belegundu, PHI.
3. Applied finite elements by G. Ramamurthy,Osmania university, I K International Publishing House Pvt. Ltd
4. The Finite Element Method Basic Concepts And Applications With Matlab Maple And Comsol 3Rd Edition by Darrell W Pepper and Juan C Heinrich, Taylor and Francis

Reference Books:

1. An Introduction to Finite Element Method, JN Reddy, TMH
2. Finite Element Method, its basics and fundamentals, O.C.Zienkiewicz, Elsevier
3. Fundamentals of Finite element analysis ,David V Hutton ,TMH
4. Finite Element Analysis, G. Laksminarasaiah, B.S.Publ.
5. Textbook of Finite Element Analysis by P. Seshu PHI Publishers
6. Finite Element Methods in Engineering, SS Rao, Pergamon,

Course Title	ROBOTICS					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853202	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: To make the student to understand, The basics and the latest technology of sensors used in robotics. The different sensing variables and Robot vision system Robot programming.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Student should come to know the various components in the anatomy of robot. By knowing this the student may apply in the design of new robotic structure.
CO 2	Students are able to understand the applications of various types of end effectors, and sensor devices. Student should also learn about the homogeneous transformations and its applications.
CO 3	CO3.students are able to understand robot programming languages which may adopt in different applications of robot.

UNIT I

Fundamentals of Robots: Introduction, definition of robot, classification of robots, History of robotics, robot components, degree of freedom, robot joints, robot coordinates, reference frames, programming modes, robot characteristics, robot work space, robot languages, advantages, disadvantages and applications of robots.

Matrix transformations: Introduction, robots as a mechanisms, matrix representation-representation of a point in a space, representation of a vector in space, representation of a frame at the origin of a reference frame, representation of a frame in a reference frame, representation of a rigid body.

UNIT II

Robot kinematics: Forward and inverse kinematics of robots-forward and inverse kinematicequations for position, forward and inverse kinematic equations for orientation, forward and inverse kinematic equations for position and orientation ,Denavit - Hartenberg(DH)representation of forward kinematic equations of robots.

UNIT III

Differential motions and Velocities:

Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame, Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT IV

Dynamic analysis and forces: Introduction, Lagrangian mechanics, Effective moments of inertia, dynamic equations for multi-degree of freedom robots-kinetic energy,potential energy, the Lagrangian,robot‟s equations of motion, static force analysis of robots.

Trajectory planning: Introduction, path Vs trajectory, basics of trajectory planning, joint space trajectory planning-third order polynomial trajectory planning, fifth order polynomial trajectory planning, Cartesian-space trajectories.

UNIT V

Robot Actuators: Introduction,characteristics of Actuating systems-weight, power to weight ratio, operating pressure, stiffness Vs compliance,comparison of actuating systems, hydraulic devices, pneumatic devices.

Robot sensors: Introduction, sensor characteristics,Position sensors-potentiometers, encoders, LVDT, Resolvers, time of travel displacement sensor, Velocity sensors-Encoders, Tachometers, differentiation of position signal.

Text Books:

1) Automation , Production systems and CIM, M.P.Groover, Pearson Edu.
2) Industrial Robotics, M.P. Groover, TMH.
3) Robotics, fundamental Concepts and analysis, AshitaveGhosal, Oxford Press, 2006
4) Ulrich Rembold, Robot Technology and Applications
5) Robotics and Control, Mittal RK &Nagrath IJ, TMH.

Reference Books:

1. Robotics, Fu KS, McGraw Hill.
2. An Introduction to Robot Technology, P. Coiffet and M.Chaironze, Kogam Page Ltd. 1983 London.
3. Robotics Engineering, Richard D.Klafter, Prentice Hall
4. . A text book of Robotics by Saeed B. Niku, Pearson Publisher

Course Title	ADVANCESIN MANUFACTURING TECHNOLOGY Elective-III				M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853203	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course objective:

- To develop the ability to understand the advanced manufacturing techniques evolved in manufacturing scenario.
- To study the Advanced techniques in Welding processes
- To study the Surface processing operations
- To study the Different types of unconventional Machining Methods
- To study about Rapid prototyping and Nano Technology

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	At the end of course student can able to know Welding Automation and Testing procedures for welds
CO 2	Knowledge on organic coatings and surface processing operations
CO 3	Gains knowledge on unconventional machining methods
CO 4	Working principles of various RP techniques

UNIT I

Welding Processes: Fusion and Solid state welding process, Automation in Welding, Design aspects of welds, Nondestructive testing of welds, Residual stresses and distortion in weldments.

UNIT II

Surface Processing Operations: Plating and Related Processes, Conversion Coatings, Physical Vapor Deposition, Chemical Vapor Deposition, Organic Coatings, Porcelain Enameling and other Ceramic coatings, Thermal and Mechanical Coating Processes.

UNIT III

Un-conventional Machining Methods-I: Abrasive jet machining:Elements of the process, applications and limitations, recent developments. Ultrasonic machining: Elements of the process, machining parameters, applications and limitations. Un-conventional Machining Methods-II: Metal removal rate in ECM, Tool design, Surface finish and accuracy economics aspects of ECM Wire EDM Process: General Principle and applications of Wire EDM.

UNIT IV

Un-conventional Machining Methods-III: Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages and limitations, comparison of thermal and non thermalprocesses. Plasma Arc Machining: Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations Laser Beam Machining: Principle, effect of machining parameters on surface finish, applications, and limitations.

UNIT V

Rapid Prototyping: Working principle, methods-Steriolithography, Laser sintering, Fused deposition method, applications and limitations. Nano Technology: Nano milling processes, wet milling, dry milling, nano materials, fabrication of nano tubes, advantages of nano tubes, mechanical properties.

Text Books:

1. Manufacturing Technology, Vol I P.N. Rao, Tata Mc Graw Hill, 4th Edition,2013
2. Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition,2002
3. Manufacturing Management , Priciples and Concepts, P. Gibson, G.Greenhaigh & R. Kerr
4. Manufacturing Technology by Helmi A.Youssef

Reference Books:

1. Production Technology, K.L Narayana, I.K. International Pub, 3rd Edition,2013
2. Manufacturing Process Vol. I, H.S.Shah Pearson, 2013,
3. Principles of Metal Castings, Rosenthal, Tata McGraw Hill ,2nd Edition,2001
4. Advance in Production Technology by Christian Brecher

Course Title	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS Elective-III					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853204	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course objective:

- To develop informed opinions about the present and past opinion leaders in the artificial intelligence debate.
- To develop a simple, informal expert system by performing an effort of knowledge engineering of a real, human expert.
- To develop a series of Web pages that will serve as a current "state of the art" review of the various AI application areas, areas which may be suggested by the instructor or brought to the course by participants.
- To experience some actual hands-on demonstration software while accomplishing the review of current applications areas in AI. Examples of such areas might include natural language processing (NLP), genetic algorithms or artificial life environments
- , neural nets or massively parallel computing environments, data mining, fuzzy logic, machine vision or speech, robotics, intelligent tutoring systems, etc.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students Gains knowledge in problems in production systems and Artificial intelligence Characteristic and control Strategies.
CO 2	Know ledge on End analysis Search Techniques Logic Programming.
CO 3	Representations and Mapping, Approaches Etc.
CO 4	Student gains knowledge in statistical and probabilistic Reasoning.
CO 5	Types of learning, Genticalgorthims etc.

UNIT I

Artificial Intelligence : Introduction, definition, underlying assumption, Important of Al, Al & related fields State space representation, defining a problem, production systems and its characteristic, search and control strategies –Introduction, preliminary concepts, examples of Search , problems.

UNIT II

Uniformed or preliminary Concept: Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques- Generate and Test, Hill climbing, Bestfirst search, Problem reduction, Constraint satisfaction, Means- Ends Analysis.

UNIT III

Knowledge Representation Issues: Representations and Mapping, Approaches, Issues in Kr, Types of knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic. Use of Predicate Logic: Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to casual form, Resolution, Natural deduction.

UNIT IV

Statistical and Probabilistic Reasoning: Symbolic reasoning under uncertainly, Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster- Shafer Theory, Fuzzy Logic Expert Systems: Introduction, Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

UNIT V

Introduction to Knowledge Acquisition Types of learning, General learning model, and performance measures. Typical Expert Systems: MYCIN, Variants of MYCIN, PROSPECTOR DENDRAL, PRUFFetc. Introduction to Machine Learning: Perceptions, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

Text Books:

1) " Artificial Intelligence" , Elaine Rich & Kevin Knight,M/H 1983
2) "Artificial Intelligence in Business", WendryB.Ranch, Science & Industry –Vol– IIapplication, Ph 1985.
3) Artificial Intelligence: A Modern Approach 3rd Edition by by Stuart J. Russell and Peter Norvig
4) Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp 1st Editionby Peter Norving

Reference Books:

1) " A Guide to Expert System" Waterman, D.A., Addison,– Wesley inc. 1986.
2) "Building expert system" Hayes, Roth, Waterman, D.A (ed), AW 1983.
3) "Designing Expert System", S.M. and Kulliknowske
4) Artificial Intelligence And Emerging Technologies In International Relations Hardcover – Import, 14 June 2021 by Bhaso Ndzendze (Author), Tshilidzi Marwala

Course Title	ADVANCED STRESS ANALYSIS Elective-III					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853205	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course objective:

Analysis of stresses in a component subjected to loading is an inevitable part of design process. This requires understanding and knowledge of various theories. The course aims to expose students to such theories while emphasizing on their applications under stated conditions. This includes, theories of elasticity, theory of plasticity and experimental stress analysis.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will understand the tonsorial approach of continuum mechanics and comprehend modern research material.
CO 2	Student will learn basic field equations such as equilibrium equations, compatibility and constitutive relationship.
CO 3	Students will be able to apply basic field equations to torsion, bending and two dimensional elasticity problems, and energy methods.
CO 4	Students will be able to solve problems in unsymmetrical bending and shear center, contact stresses and pressurized cylinders and rotating discs.

UNIT I

Theory of Elasticity Analysis of stress, Analysis of stain, Elasticity problems in two dimension and three dimensions, Mohr‟s circle for three dimensional stresses. Stress tensor, Air‟s stress function in rectangular and polar coordinates.

UNIT II

Energy Methods Energy method for analysis of stress, strain and deflection The three theorem‟s -theorem of virtual work, theorem of least work, Castiglioni‟s theorem, Rayleigh Ritz method, Galekin‟s method, Elastic behavior of anisotropic materials like fiber reinforced composites.

UNIT III

Theory of Torsion Torsion of prismatic bars of solid section and thin walled section. Analogies for torsion, membrane analogy, fluid flow analogy and electrical analogy. Torsion of conical shaft, bar of variable diameter, thin walled members of open cross section in which some sections are prevented from warping, Torsion of noncirculershaft. .Unsymmetrical Bending and Shear Centre Concept of shear center in symmetrical and unsymmetrical bending, stress and deflections in beams subjected to unsymmetrical bending, shear center for thin wall beam cross section, open section with one axis of symmetry, general open section, and closed section.

UNIT IV

Pressurized Cylinders and Rotating Disks Governing equations, stress in thick walled cylinder under internal and external pressure, shrink fit compound cylinders, stresses in rotating flat solid disk, flat disk with central hole, disk with variable thickness, disk of uniform strength, Plastic action in thick walled cylinders and rotating disc.

UNIT V

Contact stresses Geometry of contact surfaces, method of computing contact stresses and deflection of bodies in point contact, stress for two bodies in line contact with load normal to contact area and load normal and tangent to contact area. Introduction to Analysis of low speed impact.

Text Books:

1. Dally, J. W. and W.F. Riley, Experimental Stress Analysis, McGraw Hill International, Third Edition,1991
2. Theory of Elasticity – Timoshenko and Goodier, McGrawHill
3. Advanced Strength of Materials, Vol. 1,2 – Timoshenko,CBS
4. Advanced Strength of Materials – DenHarteg.

Reference Books:

1. Sadd, Martin H., Elasticity: Theory, applications and Numeric, Academic Press 05
2. Boresi, A.P. and K. P. Chong, Elasticity in Engineering Mechanics, Second Edition, John Wiley & Sons,
3. Budynas, R. G. Advance strength and Applied Stress Analysis, Second Edition, WCB/ McGraw Hill1999
4. Advanced Strength and Applied Stress Analysis (Mcgraw-Hill Series MechanicalEngineering)by Richard G. Budynas

Course Title	FLEXIBLE MANUFACTURING SYSTEMS Elective-IV					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853206	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objectives:
To understand the design, planning and operational concepts of FMS and learn about the different tools and techniques for analyzing the same

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand FMS and job-shop and mass production manufacturing systems.
CO 2	Knowledge of concept and design of flexible manufacturing cells.
CO 3	Explore processing stations and material handling systems used in FMS environment.
CO 4	Analyze the production management problems in planning, loading, scheduling, tool management and breakdown in a typical FMS.
CO 5	Design and analyze FMS using analytical techniques.

UNIT I

Understanding of FMS: Classifications of Manufacturing Systems, Definition, Objective and Need, Components, Merits, Demerits and Applications of FMS. Design of FMS: Performance Evaluation, Analytical models of FMS.

UNIT II

Flexible Manufacturing Cell: Introduction to group technology, Benefits of group technology, Part family, Methods of grouping the parts into part family: The visual inspection method, Part classification and coding system, MICLASS classification and coding system, Opitz classification system, Production flow analysis, Composite part, Limitations of group technology, Application of group technology.

UNIT III

FMS Processing Stations: Machining Centers, Turning centers, CMM, Washing/ Deburringstation. Different types FMS Layouts.

UNIT IV

Material Handling Systems: An introduction, Conveyor, AGV, ASRS, Robots, etc. and their salient features.

UNIT V

Management Technology: Tool Management, Configuration planning and routing, Production Planning and Control, Scheduling and control, Computer Networks and Control.

Text Books:

1. Groover,M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009
2. Tempelmeier.H and Kuhn.H. "Flexible Manufacturing system: Decision support for design and operation", John Wiley and Sons 2003.
3. Maleki A. "Flexible Manufacturing Systems: the technology and management". Prentice Hall International –2009
4. Analysis of production systems and Operations and production Management, Rajagopal Kurnool, CBS publishers
5. Modern Production, Operations Management, Baffa & RakeshSarin.

Reference Books:

1. Operations Management, S.N. Chary.
2. Inventory Control Theory and Practice, Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach , John E. Biegel.
4. Production & Operations Management, KanishkaBedi, Oxford Univ Press.

Course Title	COMPUTER GRAPHICS Elective-IV					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853207	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objective:

- The students will learn principles and practices used in the creation of 3D models; mathematical principles of geometric modeling; theory and application of modeling techniques, Study representation schemes for curves, surfaces, solids, and other spatial data and the impact of representation on graphics algorithms. Topics include spline curves and surfaces, quadric surfaces, and how to design, program and analyze algorithms and systems for interactive 3D shape modeling.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Student can able to understand to various display devices and algorithms.
CO 2	Student can able to understand applications of geometric modeling techniques.
CO 3	Student can able to understand various clipping algorithms.
CO 4	Gains Knowledge Various transformations and shading algorithms.

UNIT I

Introduction to computer graphics: Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, hard copy devices. Raster scan graphics: Line drawing algorithms – DDA &Bresenham‟s algorithms, circle generation, general function rasterization, displaying lines, characters and polygons. Filling algorithms: polygon filling, edge fill algorithm, seed fill algorithm.

UNIT II

Line clipping: Simple visibility algorithm, Cohen-Sutherland subdivision line clipping algorithm, midpoint sub division algorithm. Polygon clipping: polygon clipping, reentrant polygon clipping – Sutherland – Hodgeman algorithm, character clipping, 3D- clipping.

UNIT III

Transformations: Cartesian and homogeneous coordinate systems two dimensional and three dimensional transformations – scaling, rotation, Shearing, Zooming, viewing transformation, reflection, rotation about an axis, concatenation.

UNIT IV

Rendering: Hidden line removal algorithms, surface removal algorithms, painters, Warnock, Z-buffer algorithm.

UNIT V

Shading algorithms: Constant intensity algorithm, Phong‟s shading algorithm, gourand shading algorithm, Comparison of shading algorithms.

Text Books:

1. Mathematical Elements for computer graphics, David. Rodgers, TMH
2. Computer Graphics C version, Donald Hearn and M.PaulineBaker,Pearson/PHI
3. Computer Graphics Principles & Practice, C.Foley, Vndom, Fener, Hughes,2/e, Pearson Publications.
4. Computer Graphics and Automation, M.C. Trivedi, Jaico Pub./ PearsonEducation

Reference Books:

1. CAD/CAM Theory, Ibrahim Zeid,
2. Computer Graphics second edition, Zhigandxiang, Roy Plastock, Schaum‟soutlines, TMH.
3. Computer Graphics, Steven Harrington, TMH
4. Principles of computer Graphics, ShaliniGovil, PHI, 2005, Springer.

Course Title	CNC TECHNOLOGY AND PROGRAMMING Elective-IV					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853208	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objective:

To provide knowledge on principle, constructional features, programming, tooling and work holding devices in CNC machine tools Upon completion of this subject, student will be able to:

- Understand of CNC machine tools and machining centres
- Describe constructional features of CNC machine tools
- Explain drives and tooling systems used in CNC machine tools
- Understand feedback and adaptive control of CNC machines
- Write simple programs for CNC turning and machining centres
- To understand economics and maintenance of CNC machine Tools

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Student gains knowledge various CNC and DNC Machining Centers.
CO 2	Student's gains knowledge on Various Feed Back Devices.
CO 3	Students know APT Language and various Motion Commands.
CO 4	Student have knowledge on various maintenance.

UNIT I

Introduction to CNC Machine tools: Evolution of Computerized control in manufacturing, Components, Working principle of CNC, DNC and Machining centers. Constructional features of CNC machine tools: Introduction, Spindle drives, Transmission belting, axes feed drives, Slide ways, Ball screws.

UNIT II

Accessories: Work tables, Spindles, Spindle heads, Beds and Columns, Tooling – Automatic Tool changer (ATC). Feedback devices: Introduction, Digital incremental displacement measuring systems, Incremental rotary encoders, Moire fringes, Digital absolute measuring system.

UNIT III

Electro-magnetic analogue position transducers: Principle, advantages, characterstics,Synchros, Synchro-Resolvers, Inductos, Laser interferometer. Control Systems and interface: Open and closed loop systems, Micro processor based CNC systems, block diagram of typical CNC system, description of hard ware and soft interpolation systems, Standard and optional features of CNC control systems.

UNIT IV

APT programming: APT language structure, APT geometry, Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to point motion commands, continuous path motion commands, post processor commands, control commands, Macro subroutines, Part programming preparation for typical examples.

UNIT V

Economics and Maintenance of CNC machine tools: Introduction, factors influencing Selection of CNC machines, Cost of operation of CNC machines, Maintenance features of CNC machines, Preventive maintenance, Documentation, Spare parts, Training in Maintenance.

Text Books:

1. Computer Numerical Control Machines – Dr.RadhaKrishnanan, New Central Book Agency
2. Computer Numerical Control Machines – Hans B.Keif and T. Frederick Waters Macmillan/McGrawHill
3. Cnc Programming Techniques: An Insider's Guide to Effective Methods Applications Hardcover – Import, 9 December 2005 by Peter Smid
4. CNC PROGRAMMING – Principles and Applications | MICHAEL MATTSON | Cengage

Reference Books:

1. CNC Machines – B.S. Aditahn and Pabla
2. CNC Machining technology – Springer – Verlag
3. Computer Numerical Machine tools - G.E. Thyer, NEWNES
4. CNC Machining Technology Volume 1 Design Development and CIM Strategies By GrahamT. Smith

Course Title	MINI PROJECT					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853209	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	100		100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will get an opportunity to work in actual industrial environment if they opt for internship.
CO 2	In case of mini project, they will solve a live problem using software / analytical / computational tools.
CO 3	Students will learn to write technical reports, Students will develop skills to present and defend their work in front of technically qualified audience.

Syllabus Contents:

Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

Course Title	CAE LAB				M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks	
1853210	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: Engineering design begins with market surveys whereby a product need is identified. Based on this identification, a conceptual design is created. Before the product can be manufactured, the conceptual design has to be refined and a detailed design produced. Detailing a conceptual design involves determining material specifications, dimensions, tolerances, performance measures, etc. There are determined by engineering analysis.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Learn Finite Element Analysis Fundamentals.
CO 2	Formulate Design Problems into FEA.
CO 3	Perform Engineering Simulations Using Finite Element Analysis Software's.
CO 4	Understand Ethical issues Related to the utilization of FEA in the Industry.

LIST OF EXPERIMENTS

1).Analysis of Simple Supported Beam

2).Analysis of bar Elements

3).Analysis of Rectangular Plate

4).Analysis of Truss Element Problem

5).Modal Analysis of Cantilever Beam

6).Modal Analysis of Solid

7).Thermal Analysis on Compound block only conduction

8).Thermal Analysis of Rectangular Plate

Any FEA Software- Creo-4.0 simulate, Autodesk Nastran in CAD, Ansys, Hyper Mesh Abaqus, etc

Course Title	CAM LAB					M. Tech. CAD/CAM II Sem		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
1853211	Professional Core (PCC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		0	0	4	2	50	50	100
Mid Exam Duration: 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of CAD/CAM Lab is to design, assemble and manufacture engineering components using computer aided tools. After the completion of the course, students should be able to Design and assemble of the parts using geometric modelling.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	CNC Techniques and coding.
CO 2	Effective learning of G-coding and M-Coding.
CO 3	Hands on operation on CNC Lathe and Milling Machines.
CO 4	Effective Selection of CNC Tools.

Any Four Experiments covering Step Turning,
Taper Turning Multiple Turning, Threading, Etc.
Any Four Experiments Covering Slotting, Drilling Circular Pocketing , Profile Milling Etc

Any CAM Software:- CNC Train, Cut miller ,Edge Cam, Solid Cam Etc…

M.TECH.-
III- SEMESTER SYLLABUS

Course Title	RAPID PROTOTYPING ELECTIVE -V				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1853301	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To study the basics of RPT
- To study the various process in RP
- To study the principles of Rapid tooling and reverse engineering
- To study the Rapid tooling-Direct ,Indirect soft & Hard tooling

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	At end of semester students gains knowledge on various types rp techniques
CO 2	Student gains various operation principles and applications
CO 3	Various Part building errors in rp Process
CO 4	Gains knowledge in Rapid tooling
CO 5	Gains Knowledge in various stl conversions

UNIT I

Introduction: Need for the compression in product development, History of RP system, Survey of applications, Growth of RP industry and classification of RP system.

UNIT_II

Stereo Lithography System: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Applications.

UNIT III

Fusion Decomposition Modeling: Principle, process parameter, Path generation, Applications. Solid ground curing: Principle of operation, Machine details, Applications.

UNIT IV

Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details, Applications Concepts Modelers: Principle, Thermal jet printer, Sanders model market, 3-D printer, GenisysXs printer HP system, Object Quadra system.

UNIT V

Rapid Tooling: Direct soft tooling- selective laser sintering of sand casting molds, Direct ACES injection molding, SL composite tooling, Indirect soft tooling-Arc spray metal tooling, silicone rubber molds, spin casting with vulcanized rubber molds, Castable resin molds, Castable ceramic molds, Plaster molds ,casting, Direct Hard tooling-Rapid tool, laminated metal tooling, Direct metal laser sintering tooling, Pro metal rapid tooling, Indirect Hard tooling- 3D keltool, EDM Eletrodes ,Eco tool, copy millingSoftware for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc.Internet based software, Collaboration tools. Rapid Manufacturing ProcessOptimization: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

Text Books:

1. Rapid Prototyping , principles & Applications, by Rafiq noorani
2. Rapid Manufacturing **",** Flham D.T & Dinjoy S.S, Verlog London 2001
3. Rapid automated**"**, Lament wood, Indus Press New York.
4. Rapid Prototyping- Principles & Applications"-Third Edition ,world scientific publishing co pte Ltd

Reference Books:

1. Engineering Design and Rapid Prototyping by Ali k.kamrani & Emad Abouel Nasr
2. " Stereo lithography and other RP & M Technologies**"**, Paul F.Jacobs, SME, NY 1996
3. Rapidly Prototyping Interfaces With Indesign , Carla viviana coleman
4. Rapid Prototyping Technology , Selection & Application , Kenneth G. Cooper

Course Title	AUTOMATION IN MANUFACTURING ELECTIVE -V				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1853302	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course objective:
To emphasize the knowledge on the quality improvement, automation, and advanced manufacturing techniques to create the highest-caliber products quickly, efficiently, inexpensively, and in synchronization with the marketing, sales, and customer service of the company.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	At the end of semester student knows Various Automation Principles and strategies.
CO 2	Gains knowledge in various materials Handling equipment's.
CO 3	Various Automation and Production lines.
CO 4	Students knows various Quality control Parameters.

UNIT I

Over View Of Manufacturing And Automation: Production systems, Automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT II

Material Handling And Identification Technologies: Material handling, equipment, Analysis. Storage systems, performance and location strategies, automated storage systems, AS/RS, types, Automatic identification methods, Barcode technology, RFID.

UNIT III

Manufacturing Systems And Automated Production Lines: Manufacturing systems: components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.

UNIT IV

Automated Assembly Systems: Fundamentals, Analysis of Assembly systems, Cellular manufacturing, part families, cooling, and production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT V

Quality Control and Support Systems: Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact Vsnon contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Text Books:

1. Automation, production systems and computer integrated manufacturing/ Mikell.PGroover/PHI/3rd edition/2012
2. Automation, Production Systems and CIM/ Mike J P. Grower/PHI
3. Automation Production Systems And Computer-Integrated Manufacturing 2019 Edition by Mikell Groover,
4. Automation, Production Systems, and Computer-integrated Manufacturing| By Pearson by Mikkel P Groover

Reference Books:

1. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahamanyarn and Raju/New Age International Publishers/2003
2. Svstem Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
3. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009
4. Manufacturing Automation by Altintas Yusuf

Course Title	ADVANCE TOOL DESIGN ELECTIVE -V				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1853303	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objective:

- To reduce the expenditure of manufacturing and improve quality

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Describe tool design methods and punch and die manufacturing techniques
CO 2	Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature
CO 3	Describe the principles of clamping, drill jigs and computer aided jig design
CO 4	Design fixtures for milling, boring, lathe, grinding, welding; identify fixtures and cutting tools for NC machine tools
CO5	Explain the principles of dies and moulds design

UNIT I

TOOL DESIGN METHODS :Introduction, Design procedure, Statement of the problem, Needs Analysis – Tentative design solutions, Finished design, Drafting and design techniquesin tooling drawings, Punch and die Manufacturing Techniques.

UNIT II

TOOLING MATERIALS :Introduction, Properties of tool materials, Metal cutting tools, Single-point cutting tools, Milling cutters, Drills and Drilling, Reamer classification, Taps, Tap classification, The selection of carbide cutting tools, Determining the insert thicknes s forcarbide tools, Various heat treatments.

UNIT III

GAGES AND GAGE DESIGN: Introduction, Fixed Gages, Gage Tolerances, The selection of material for Gages, Indicating Gages, and Automatic gages.

UNIT IV

DESIGN OF DRILL JIGS, FIXTURES AND DIES:

DRILL JIGS Principles of location, Locating methods and devices, Principles of clamping, Drill jigs, Chip formation in drilling, General considerations in the design of drill jigs, Drill bushings, Methods of construction, Drill jigs and modern manufacturing, Computer aided Jig design.

FIXTURES Introduction, Fixtures and economics, Types of Fixtures, Vise Fixtures, Milling Fixtures, Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Grinding Fixtures, Types of Die construction, Computer aided Fixture Design.

DIES Die-design fundamentals, Blanking and Piercing die construction, Pilots, Strippers andpressure pads, Presswork materials, Strip layout, Short -run tooling for Piercing, Bending dies, Forming dies, Drawing operations.

UNIT V

TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHI: Introduction, The need for numerical control, A basic explanation of numeric control, Numerical control systems in use today, Fixture design for numerically controlled machine tools, Cutting tools for numerical control, Tool holding methods for numerical control, Automatic tool changers and tool positioners, Tool presetting, Introduction, Genera l explanation of the Brown and Sharpe machine, tooling for Automatic screw machines.

Text Books:

1. Donaldson, Cyrll, George H. LeCain, Goold, V.C., "Tool Design", Tata McGraw HillPublishing Company Ltd., 36th Reprint 2006.
2. Joshi, PrakashHiralal, "Tooling data", Wheeler Publishing, 2000
3. Sharma, P.C., "Machine Tool and Tool Design ", S Chand Company. 2004.
4. Mehta N.K., "Machine Tool Design", Tata McGraw Hill, 1989

Reference Books:

1. Paquin, J. R. and Crowley, R. E., Die design fundamentals, Ind. Press Inc., New York, 1987
2. Tool designauthor: Cyril donaldson / h. lecain george / v. c. goold
3. Textbook of Machine Tools and Tool Design Sharma P. C.
4. Tool Design (SIE) by Cyril Donaldson **(Author),** George H. Lecain **(Author),** VC Goold **(Author)**

Course Title	BUSINESS ANALYTICS (Open Elective)				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1870304	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course objective:

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

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students will demonstrate knowledge of data analytics
CO 2	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
CO 3	Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making
CO 4	Students will demonstrate the ability to translate data into clear, action ableinsights

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Text Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, personsEducation.
3. Business NLP For Dummies by Lynne Cooper
4. Technical Analysis of the Currency Market: Classic Techniques for Profiting from Market Swings and Trader Sentiment by Boris Schlossberg

Reference Books:

1. Human Capital Systems, Analytics, and Data Mining by Robert C. Hughes.
2. Analytic Function Theory of Several Variables by Junjiro Noguchi
3. Statistics for Management | Eighth Edition | By Pearson Paperback by I. Levin Richard
4. Business Analytics: Data Analysis and Decision Making by S. Christian Albright (Author), Wayne L. Winston (Author)

Course Title	INDUSTRIAL SAFETY (Open Elective)				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1870305	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods
- To analyse industrial hazards and its risk assessment.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze the effect of release of toxic substances
CO 2	Understand the industrial laws, regulations and source models
CO 3	Apply the methods of prevention of fire and explosions.
CO 4	Understand the relief and its sizing methods.
CO5	Understand the methods of hazard identification and preventive measures.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv.Internal combustion engine, v. Boiler,

Electrical motors, Types of faults in machine tools and their general causes.

UNIT V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. Industrial safety and management, c.rayasfanl,david.w.riesce pearson,2015
2. Industrial safety and management,industrial managemnt,jack e.daugherty,gi publications
3. Safety management. l.m.hernold,mc graw hill publications,july 2017
4. Principle of industrial safety and management,willie hammer,dennnis price, printice hall international series,2018

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, Mcrew HillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & HallLondon.

Course Title	OPERATIONS RESEARCH OPEN (Open Elective)				M. Tech. CAD/CAM III Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1870306	**PJ**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To impart knowledge in concepts and tools of Operations Research
- To understand mathematical models used in Operations Research
- To apply these techniques constructively to make effective business decisions

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
CO 2	Students should able to apply the concept of non-linear programming.
CO 3	Students should able to carry out sensitivity analysis.
CO 4	Student should able to model the real world problem and simulate it.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V

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

Text Books:

1. Operations Research by K.Rajagopal,PHI.
2. Operations Research by Hilier,Liebermann , McGraw Hill Education
3. Introduction to Operations Research, Taha, PHI
4. Operations Research by Frederick S. Hillier McGraw Hill Higher Education

Reference Books:

1. Operations Research: Methods & Problems, Maurice Saseini, Arhur Yaspan & Lawrence Friedman
2. Operations Research, Allen, David Edmund .
3. Operations Research, J.K. Sharma.
4. Operations Research, Wayne L. Winston, Thomson Brooks, Cole

Course Title	COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective)				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1870307	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- Establish systems to help streamline the transactions between corporate support departments and the operating units.
- II. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units.
- III. Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concept of strategic cost management, strategic cost analysis – target costing, life cycle costing and Kaizen costing and the cost drive concept
CO 2	Describe the decision-making; relevant cost, differential cost, incremental cost and opportunity cost, objectives of a costing system.
CO 3	Understand the meaning and different types of project management and project execution, detailed engineering activities.
CO 4	Understand the project contracts, cost behaviour and profit planning types and contents, Bar charts and Network diagram
CO5	Analyse by using quantitative techniques for cost management like PERT/CPM.

UNIT I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

UNIT IV

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Project Management 2.0: Leveraging Tools, Distributed Collaboration, and Metrics for Project Success 1st Edition, Kindle Editionby Harold Kerzner
2. Cost Management Of Capital Projects by Kurt Heinze, Taylor & Francis Inc.
3. Cost Management of Construction Projects Donald Towey
4. The Engineer's Cost HandbookTools for Managing Project Costs*By Richard E. Westney*

Reference Books:

1. Architect's Essentials of Cost Management Michael D. Dell'Isola
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management & CostAccounting
4. AshishK. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

Course Title	COMPOSITE MATERIALS (Open Elective)				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1870308	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- Familiarization with the basic expressions and methods used in the mechanics of composite structures. A complete theoretical and practical knowledge of composite materials.
- The mechanical behaviour of anisotropic materials and how they differ from classical construction materials.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the specifics of mechanical behavior of layered composites compared to isotropic materials.
CO 2	Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
CO 3	Determine stresses and strains in composites.
CO 4	Apply failure criteria and critically evaluate the results.
CO 5	Understand the mechanical behavior of composites due to variation in temperature and moisture.

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.

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L.Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen
5. W. Tasi.

Course Title	WASTE TO ENERGY (Open Elective)				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1870309	PJ	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To enable students to understand of the concept of Waste to Energy.
- To link legal, technical and management principles for production of energy form waste.
- To learn about the best available technologies for waste to energy.
- To analyze of case studies for understanding success and failures.
- To facilitate the students in developing skills in the decision making process.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Apply the knowledge about the operations of Waste to Energy Plants
CO 2	Analyse the various aspects of Waste to Energy Management Systems.
CO 3	Carry out Techno-economic feasibility for Waste to Energy Plants
CO 4	Apply the knowledge in planning and operations of Waste to Energy plants

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Biomass Combustion: Biomass stoves – Improved 70hallahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation – Operation of all the above biomass combustors.

UNIT V

Biogas: Properties of biogas (Calorific value and composition) – Biogas plant technology and status – Bio energy system – Design and constructional features – Biomass resources and their classification – Biomass conversion processes – Thermo chemical conversion – Direct combustion – biomass gasification – pyrolysis and liquefaction – biochemical conversion – anaerobic digestion – Types of biogas Plants – Applications – Alcohol production from biomass – Bio diesel production – Urban waste to energy conversion – Biomass energy programme inIndia.

Text Books:

1. Waste-to-Energy Multi-Criteria Decision Analysis for Sustainability Assessment and Ranking 2020 Edition by Jingzheng Ren , Elsevier
2. . Waste-to-Energy Eduardo Jacob-Lopes, Leila Queiroz Zepka and Maria Isabel Queiroz
3. The Solid Waste Handbook by William D. Robinson
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,1996

Reference Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd.,1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
4. Waste segregation and potential for recycling by Jacob.M.Kihila

Course Title	DISSERTATION PHASE-I				M. Tech. CAD/CAM III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1853310	CORE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	20	10	100	-	100
Internal Assessment								
Course Objectives:								
Course Outcomes : On successful completion of this course, the students will be able to								
CO 1	Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selectedtopic of research.							
CO 2	Students will be able to use different experimental techniques.							
CO 3	Students will be able to use different software/ computational/analytical tools.							
CO 4	Students will be able to design and develop an experimental set up/equipment/test rig.							
CO 5	Students will be able to conduct tests on existing set ups/equipment's and drawlogical conclusions from the results after analyzing them							

M.TECH.-
IV- SEMESTER SYLLABUS

Course Title	DISSERTATION PHASE-II				M. Tech. CAD/CAM IV Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1853401	Major Project	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	32	16	50	50	100
Internal Assessment								
Course Objectives:								
Course Outcomes : On successful completion of this course, the students will be able to								
CO 1	Students will develop attitude of lifelong learning and will develop interpersonalskills to deal with people working in diversified field will.							
CO 2	Students will learn to write technical reports and research papers to publish atnational and international level.							
CO 3	Students will develop strong communication skills to defend their work in front of technically qualified audience.							

AUDIT COURSE-I & II SYLLABUS

Course Title	ENGLISH FOR RESEARCH PAPER WRITING (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1870A01	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

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

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Writing skills and level of Readability.
CO 2	Analyze what to write in each section.

UNIT I

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

UNIT II

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

UNIT III

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

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

UNIT V

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

Text Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Adrian Wallwork, English for Academic Research: Grammar Usage and Style, Springer.

Course Title	DISASTER MANAGEMENT (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1870A02	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand foundations of hazard, disasters and natural/social phenomena.
CO 2	Analyze Repercussions of disasters and hazards.
CO 3	Understand key concepts in disaster risk reduction and humanitarian response.

UNIT I

Introduction to Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III

Disaster Prone Areas In India

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

UNIT IV

Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V

Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People'sParticipation In Risk Assessment. Strategies for Survival.

Disaster Mitigation

Meaning, Concept and Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Text Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Reference Books:

1. Fundamentals of Disaster Management, Shekhawat R.S, Bhatnagar Harshul.
2. Disaster management, Ruthra, Lakshmi Publications.
3. Disaster Management and Preparedness, Nidhi Gauba Dhawan, Ambrina Sardar Khan, CBS Publishers.

Course Title	SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1870A03	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning.
- Learning of Sanskrit to develop the logic in mathematics, science &other subjects enhancing the memory power.
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand Sanskrit grammar and Composition.
CO 2	Understand roots of technical information about Sanskrit literature.
CO 3	Understand Technical concepts of Engineering.

UNIT I

Alphabets in Sanskrit,

Past/Present/Future Tense,

Simple Sentences

UNIT III

Order

Introduction of roots

Technical information about Sanskrit Literature

UNIT III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Text Books:

1. Dr.Vishwas, "Abhyaspustakam" – Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. Suresh Soni , "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi.

Course Title	VALUE EDUCATION (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1870A04	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Knowledge of self-development
CO 2	Learn the importance of Human values
CO 3	Developing the overall personality

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 judgements

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 labour.

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 IV

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

Text Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.
2. John Haffai, Lead on & How to win over worry, World Book Publisher.
3. Swami Vivekananda, Call to the Youth for Nation Building, Advaita Ashrama, Calcutta.
4. Swami Vivekananda, Youth and Modern India, Rama Krishna Mission, Chennai.

Reference Books:

1. M.G. Chitakra, Education and Human values, A.P.H. Publishing corporation, New Delhi.

Course Title	CONSTITUTION OF INDIA (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1870A05	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik
- Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Discuss the growth of the demand for civil right s in India for the bulk of Indians before the arrival of Gandhi in Indian politics
CO 2	Discuss the intellectual origins of the frame work of argument that informed the conceptualization of sociall reforms leading to revolution in India
CO 3	ıss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO 4	ıss the passage of the Hindu Code Bill of 1956

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.

Pachayati raj: Introduction, PRI: Zila Pachayat.
Elected officials and their roles, CEO Zila 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.

Text Books:

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.

Course Title	PEDAGOGY STUDIES (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1870A06	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
CO 2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO 3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

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.

Text Books:

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.

Reference Books:

1. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
2. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Web Links:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Title	STRESS MANAGEMENT BY YOGA (Audit Course)					M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1870A07	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To achieve overall health of body and mind.
- To overcome stress

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	evelop healthy mind in a healthy body thus improving social health also
CO 2	Improve efficiency.

UNIT I

Definitions of Eight parts of yog. (Ashtanga)

UNIT II

- Yam and Niyam. Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III

- Asan and Pranayam

  i)Various yog poses and their benefits for mind & body

  ii)Regularization of breathing techniques and its effects- Types of pranayam

Text Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature" .
3. Advaitashrama (Publication Department), Kolkata.
4. Acharya Yatendra, Yoga & Stress Management, Finger Print Publishing.

Course Title	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (Audit Course)				M. Tech. CAD/CAM I/II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1870A08	Audit Course	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	0	0	40	--	40
Mid Exam Duration: 2 Hours								

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	tudy of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO 2	he person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO 3	tudy of Neetishatakam will help in developing versatile personality of students

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)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT II

- 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 III

- 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. 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:

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.
3. Enlightenment: Personality Development and management, Sagir Ahmed, Independently Published.