Prof. Ram Meghe Institute Of Technology And Research
Badnera –Amravati

An Autonomous Institute Affiliated to Sant Gadge Baba Amravati University, Amravati, Maharashtra (India)

PROGRAMME SCHEME & SYLLABI

2024-25

M.Tech.

(CAD/CAM)

Prof. Ram Meghe Institute Of Technology And Research, Badnera - Amravati.

Published By

Principal

Prof. Ram Meghe Institute Of Technology And Research, Badnera - Amravati.

Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati (An Autonomous Institute)
Two Year Post Graduate Degree Program in Master of Technology
Choice Based Credit System (Semester Pattern)
Branch : Mechanical Engineering (CAD/CAM)

SEMESTER: I																			
Sr. No.	**Subject Code**	**Subject**	**Teaching Scheme**					**Examination Scheme**											
			Hours/ Week			**Total Hours/ Week**	**Credits**	**THEORY**							**PRACTICAL**				
			Lecture	**Tutorial**	**P/D**			**Duration of paper (Hrs)**	**Max. Marks ESE/ ESSE**	**Internal Marks**		**Total**	**Min. Passing Marks in ESE/ ESSE**	**Overall Min Passing Marks**	**Max. Marks**		**Total**	**Min. Passing Marks**
										Max. Marks MSE/ MSIE	**Max. Marks TA**				**Int.**	**Ext.**		
Theory																			
01	1SMTCC1	Computer Aided Design	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
02	1SMTCC2	Computer Aided Manufacturing	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
03	1SMTCC3	Mechatronics	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
04	1SMTCC4	Professional Elective-I	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
05	1SMTCC5	Professional Elective-II	3	--	--	3	3	3	60	30	10	100	24	50	--	--	--	--
06	1SMTCC6	Research Methodology & IPR	2	--	--	2	2	3	60	30	10	100	24	50	--	--	--	--
Practicals																		
07	1SMTCC7	Computer Aided Design - Lab			2	2	1	..	..		..	..	..		25	25	50	25
08	1SMTCC8	Computer Aided Manufacturing - Lab			2	2	1	..	..		..	..	..		25	25	50	25
09	1SMTCC9	Mechatronics - Lab			2	2	1	..	..		..	..	..		25	25	50	25
		Total	**17**		**6**	**23**	**20**	**..**	**..**		..	**600**	..	..	..		150	
															Total	**750**		

Professional Elective 1	1SMTCC4PE1A: Computer Aided Production Management 1SMTCC4PE1B: Management Information System
Professional Elective 2	1SMTCC5PE2A: Concurrent Engineering 1SMTCC5PE2B: Optimization Techniques

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SEMESTER: II

Sr. No.	Subject Code	Subject	Teaching Scheme					Examination Scheme										
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL			
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.		
Theory																		
01	2SMTCC1	Finite Element Analysis	3	--	--	3	3	3	60	30	10	100	24	50				
02	2SMTCC2	Robotics & Robot Application	3	--	--	3	3	3	60	30	10	100	24	50				
03	2SMTCC3	Rapid Prototyping and Tooling	3	--	--	3	3	3	60	30	10	100	24	50				
04	2SMTCC4	Professional Elective-III	3	--	--	3	3	3	60	30	10	100	24	50				
05	2SMTCC5	Professional Elective-IV	3	--	--	3	3	3	60	30	10	100	24	50				
Practical																		
07	2SMTCC6	Finite Element Analysis - Lab			2	2	1								25	25	50	25
08	2SMTCC7	Robotics & Robot Application - Lab			2	2	1								25	25	50	25
09	2SMTCC8	Rapid Prototyping and Tooling - Lab			2	2	1								25	25	50	25
10	2SMTCC9	Mini-Project & Seminar -1			4	4	2	--	--	--	--	--	--	--	50	50	100	50
		Total	**15**		**10**	**25**	**20**					**500**					250	
															Total		**750**	

Mini-Project & Seminar -1 : Project should be relevant to current technology and must include innovative element, Seminar1: It will be based on Mini-Project

Professional Elective III	2SMTCC4PE3A: Flexible Manufacturing System, 2SMTCC4PE3B: Industrial Automation
Professional Elective IV	2SMTCC5PE4A: Industrial Product Design, 2SMTCC5PE4B: Simulation Theory and Application

Exit Option after completion of First Year: Student has to complete 10 credit online courses (NPTEL/MOOCS/SWAYAM) suitable for CAD/CAM to qualify for the **Post-Graduate Diploma in CAD/CAM**

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SEMESTER: III																	
Sr. No.	**Subject Code**	**Subject**	**Teaching Scheme**					**Examination Scheme**									
			HOURS/WEEK			**Total HOURS/WEEK**	**CREDITS**	**THEORY**						**PRACTICAL**			
			LECTURE	**TUTORIAL**	**P/D**			**Duration of paper (Hrs)**	**Max. Marks Theory Paper**	**Internal Marks**		**Total**	**Min. Passing Marks**	**Max. Marks**		**Total**	**Min. Passing Marks**
										Unit Test	**Term Work**			**Int.**	**Ext.**		
Practicals																	
01	3SMTCC1	Compulsary Internship Two months (After complition of 1st year)	--	--	--	--	6	--	--	--	--	--	--	--	200	200	100
02	3SMTCC2	Seminar & Dissertation Phase -I	--	--	8	8	4	--	--	--	--	--	--	100	--	100	50
		Total			**8**	**8**	**10**								**Total**	**300**	

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Two Year Post Graduate Degree Program in Master of Technology
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Branch : Mechanical Engineering (CAD/CAM)

SEMESTER: IV

Sr. No.	Subject Code	Subject	Teaching Scheme					Examination Scheme										
			Hours/ Week			Total Hours/ Week	Credits	THEORY							PRACTICAL			
			Lecture	Tutorial	P/D			Duration of paper (Hrs)	Max. Marks ESE/ ESSE	Internal Marks		Total	Min. Passing Marks in ESE/ ESSE	Overall Min Passing Marks	Max. Marks		Total	Min. Passing Marks
										Max. Marks MSE/ MSIE	Max. Marks TA				Int.	Ext.		
Practicals																		
01	4SMTCC	Seminar & Dissertation Phase -II	--	--	20	20	10	--	--	--	--	--	--	--	100	200	300	150
		Total			20	20	10									..	**300**	..
																Total	**300**	

Summary of Marks & Credits					
Year	Semester	Sem Marks	Yearly Marks	Sem Credits	Yrly Credits
First Year	I	750	1500	20	40
	II	750		20	
Second Year	III	300	600	10	20
	IV	300		10	
Total		**2100**		**60**	

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC1	**Computer Aided Design**	03	00	00	03

Pre-requisites:

1. Knowledge of mechanical engineering drawing and design

Course Learning Objectives:

CLO1. To understand the concept of computer aided design.
CLO2. To study hardware and software requirement of CAD systems.
CLO3. To study various graphics modeling techniques.
CLO4. To study various CAD modeling packages.

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the application of computers in design.
2. Understand the various graphics modeling and transformation techniques.
3. Understand the Computer aided drafting and documentation systems.
4. Understand the Graphics standards used in CAD.
5. Understand use of different CAD packages
6. Apply the CAD modeling knowledge for modeling of mechanicals parts and assemblies.

	Computer Aided Design	**L**
UNIT I	Introduction to computer technology, Introduction to CAD systems, Computer Aided Design workstation and peripherals, Graphics input/output devices. Design process and CAD models, Applications and benefits of CAD.	6
UNIT II	Computer graphics, Coordinate systems, 2D geometry transformations, mapping of geometry models.	6
UNIT III	3D geometry transformations. Graphics manipulation and editing.	7
UNIT IV	CAD software: Graphics system and functions of a graphics package. Wireframe, solid and surface modeling. Approaches to solid modeling.	6
UNIT V	Computer aided drafting and documentation, Principles and concepts of automated drafting, drafting packages, Data exchange standards. Graphics standards like GKS, PHIGS, OpenGL, etc.	6
UNIT VI	Introduction of CAD packages like AutoCAD, Autodesk, FreeCAD, SOLIDWORKS, CATIA, Creo, etc.	7
	Total	38

TEXT BOOKS :

1. CAD/CAM Computer-Aided Design and Manufacturing; by M. Groover, E. Zimmers (Pearson)
2. CAD/CAM Principles and Applications; by P N Rao (Tata McGraw Hill)
3. Computer Aided Design & Manufacturing; by Dr. Sadhu Singh (Khanna Publishers)

REFERENCE BOOKS :

1. CAD/CAM Theory and Practice; by Ibrahim Zeid, R Sivasubramanian (Tata McGraw Hill)
2. Computer Graphics; by Donald Hearn, M. Pauline Baker (Pearson Education)

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC2	**Computer Aided Manufacturing**	03	00	00	03

Pre-requisites:

1) Knowledge of mechanical engineering drawing and design

Course Learning Objectives:

1) To understand the concept of NC and CNC Machines.
2) To understand the working of DDA
3) To evaluate the part programming of NC/CNC Machines.

Course Outcomes:

After the completion of course students will be able to…

CO1: Understand the basics construction and working of NC Machines.

CO2: Understand the basics principle of working and construction and working of CNC Machines.

CO3: Understand the working of DDA and software interpolator also knows the types of motion control.

CO4: Able to do the manual part programming and APT programming of NC/CNC machines.

CO5: Understand the concept and architecture in Direct Numerical Control systems.

CO6: Understand the concept and use of adaptive control in Machining with CNC.

	Computer Aided Manufacturing	**L**
UNIT I	Numerical control (NC): Fundamentals of NC, merits and demerits of NC, classification of NC systems, basic components of N C systems. NC tape and coding, control units, features of machine tools and system devices	6
UNIT II	Computer Numerical Control CNC: Problems in conventional NC, CNC controller technology, computer numerical control, designing CNC systems. NC/CNC machine tools: Types and features	6
UNIT III	DDA integrator, DDA hardware interpolator, software interpolators, reference word interpolator, point to point, straight line and contouring Controls in CNCs	7
UNIT IV	NC/CNC part programming: Introduction, computer-aided part programming (APT), CNC part programming	6
UNIT V	Direct numerical control (DNC), Types of DNC Systems. combined DNC/CNC systems. Difference Between CNC & DNC\ systems	6
UNIT VI	Adaptive control: ACC and ACO systems, optimization of AC. Benefits off AC in Machining. Problems in implementing Generative AC.	7
	Total	38

REFERENCE BOOKS :

1) Yoram Koren- Computer control of manufacturing, McGraw Hill.
2) Mikell P. Groover- Automation, Production Systems and CAD/CAM-Prentice-Hall of India pvt. Ltd.
3) Kundar T.K., Rao P.N., Tewari N.K.-Numerical control and computer aided manufacturing; Tata McGraw Hill.
4) D. Kochan- CAM Development in computer integrated manufacturing- Springer Verlag, Berlin

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC3	**Mechatronics**	03	00	00	03

Pre-requisites:

1. Knowledge of mechanical measurement systems

Course Learning Objectives:

CLO1. To study various types of switches, sensors, motors and their working.
CLO 2. To study various parts of mechatronic system.
CLO 3. To study various types of valves and their working.
CLO4. To understand and create pneumatic and hydraulic circuits for various industrial applications.

Course Outcomes:

At the end of course, Learner will be able to
1. Understand the importance and principles of various sensors,
2. Understand the working & applications of pneumatic, hydraulic & electric actuators for mechatronic systems.
3. Understand the computer processes, electronic circuits, and controllers for mechatronics systems.
4. Understand the working principles of various control valves in mechatronics systems.
5. Design pneumatic circuits for various industrial applications.
6. Design hydraulic circuits for various industrial applications

	Mechatronics	**L**
UNIT I	**Introduction**: Definition, Scope , Block diagram & Example. **Sensors-** selection, contact & non contact optical types, performance, Proximity Sensors & Switches, LVDT, Digital optical encoder, Temperature Sensors, Piezoelectric Transducers	6
UNIT II	**Actuators**: Principal, types of hydraulic, pneumatic, electrical actuators. Contact speed, multispeed, step and continuous variable, actuators with stepping motors.	6
UNIT III	**Computer process controls:** Computer process interface, interface hardware, direct digital control, supervisory computer control. Design of mechatronics elements: Measuring system, control software and user interface, gauging, tool monitoring system, spindle drives, feed drives, servo principles, configuration CNC systems, interfacing, monitoring, diagnostics.	7
UNIT IV	**Control Valves :** Study of different control components and pneumatic & Hydraulic system- Construction, working and function of Directional control valve, Flow control valves, Pressure relief valve, Standard symbols for control valves	6
UNIT V	**Pneumatic system:** Different control components of pneumatic systems and there conversion valves, auxiliary devices, synchronizing, clamping, declamping, application to robotics	6
UNIT VI	**Hydraulic systems:** Different control components of hydraulic systems, valves and auxiliary devices, design and analysis of hydraulic circuits sequencing, synchronizing, pneumo-hydraulic, CNC lubrication, machine tool applications	7
	Total	38

TEXT BOOKS :

1. Industrial Automation by Turgam, Mir Publication.

2. Pneumatics and Hydraulics by Stewar

3. Mechatronics – A multidisciplinary approach 4/e by W.Bolton- Pearson Publication

REFERENCE BOOKS :

1. Mechatronics by HMT

2. Introduction to Mechatronics and Measurment Systems by Michal B. Histand & David G. Aiciatore.

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC4PE1A	**PE – I : Computer Aided Production Management**	03	00	00	03

Pre-requisites:

1. Knowledge of Computer Applications & Management Principles

Course Learning Objectives:

CL01. To understand the concept of Production & Operations Management.
CL02. To study Computer solutions to Linear Programming & Material Requirement Planning Problem
CL03. To study the Plant Layout concept & Computer based program for Layout Analysis.
CL04. To study the types of Production Systems & Scheduling.
CL05. To study the Advanced Manufacturing Systems.

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the concept & objectives of Production Management
2. Understand the application of Linear Programming & Computer Software Packages.
3. Understand the functions & objectives of MRP, ERP & CRP
4. Understand the types of layout & computer based program for layout analysis
5. Understand the use of computer for Scheduling
6. Understand the advanced manufacturing technologies & systems.

	Subject: Computer Aided Production Management	**L**
UNIT I	Production & Operations Management Function: History of the Production & Operations Management, Criteria of Performance, Jobs/Decisions, Classification of Decision Areas	6
UNIT II	Linear Programming: Formulation of a Linear Programming Problem, Mathematical Procedures & Computer Software Packages, Application of Linear programming, Computer Solution of the Problem, Sensitivity Analysis, Slack Variables & Shadow Prices	6
UNIT III	Material Requirement Planning (MRP):Functions & Objectives of MRP, MRP Calculations, Handling Uncertainties, Evolution of MRP into MRP II & further to Enterprise Resource Planning (ERP), Capacity Requirements Planning (CRP)	7
UNIT	Plant Layout: Layout Concept, Developing Process & Product Layout	6

IV	(Models & Behavior), Optimization of Process & Product Layout, Computer Based Program for Layout Analysis CRAFT (Computerized Relative Allocation of Facilities Technique), CORELAP (Computerized Relationship Layout Planning), ALDEP (Automated Layout Design Programme)	
UNIT V	Scheduling: Sequencing or Prioritization, Use of Computer for Scheduling, Scheduling in Mass, Continuous, Job-Shop & Project Type Production Systems, Line of Balance Technique	6
UNIT VI	Advanced Manufacturing Technologies and Systems: Advanced Manufacturing Philosophies, Growth of Technologies, CAD, CAM, CAPP (Computer Aided Process Planning), CIM, FMS, Lean & Agile Manufacturing	7
	Total	38

TEXT BOOKS:

1. Production & Operation Management; by S N Chary (McGraw Hill)
2. Industrial Engineering & Production Management; by M. Mahajan (Dhanpat Rai & Co.)

REFERENCE BOOKS:

1. Production & Operation Management; Everett E. Adam, Jr., & Ronald J. Ebert (PHI)
2. Industrial Engineering & Production Management; by Martand Telsang (S.Chand)

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC4PE1B	**PROFESSIONAL ELECTIVE - I : Management Information Systems**	03	00	00	03

Pre-requisites:

1. Students should have a knowledge of management of Products andProcesses.

Course Learning Objectives:

CLO1. To study principles of Management of Information system
CLO 2. To study the basic Planning Technique's
CLO 3. To study the tele-processing system.
CLO4. To study the application of decision support system

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the principles of Management of Information system
2. Understand the basic Planning Technique's
3. Understand the tele-processing system.
4. Understand the decision support system.

	Subject: PROFESSIONAL ELECTIVE I Management Information Systems	**L**
UNIT I	Objectives and cost benefits of Management Information Systems (MIS). Decision and MIS. A decision environment model, Decision strategies. Characteristics of information: Measurement and amount of Information, Information search, storage and retrieval, Information feed back systems.	6
UNIT II	Planning techniques: Project proposals, reporting and controlling, Determination for information needs and sources, development of conceptual design, development of detailed design, selection of final design, design report	6
UNIT III	Organization for implementation, training of operational personnel, forms and files for data collection, evaluation control and maintenance of information system.	7
UNIT IV	Computer Based Information System, MIS and CBIS family, MIS in total CBIS environment, an MIS model and dimensions of MIS model	6
UNIT V	an overview of tele-processing system(TPS):Techniques for TPS processing models, MIS and TPS, decision support system : definition : characteristics of DSS difference in DSS and development of DSS and its applications,	6
UNIT VI	Production of sub-systems : Marketing sub-systems, finance sub-systems, personnel sub-system, office automation system : definition, importance, planning and implementation of Automated computer based office communication system.	7
	Total	38

REFERENCE BOOKS :

1) Essentials of MIS by K.C. Laudon, J.P. Laudon; PH
2) Strategic Management and MIS: An Integrated Approach by W. Robson; Pitman Pub.
3) Information systems for Managers by G.W.Reynolds; West Pub.
4) IT for Management by Turban E and McLean E; John Wiley Pub.
5) Foundations of Information systems by Zwass V; Irwin/ McGraw Hill

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC5PE2A	**PROFESSIONAL ELECTIVE – II : CONCURRENT ENGINEERING**	03	00	00	03

Pre-requisites:

1. Students should have a knowledge of Industrial Engineering and Automated fabrication systems.
2. Students should have a knowledge of design of Products andProcesses.

Course Learning Objectives:

CLO1. To study principles of concurrent approach.
CLO 2. To study the basic process issues.
CLO 3. To study various types of concurrent engineering approaches in manufacturing systems.
CLO4. To study the application of concurrent engineering in real life examples

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the principles of concurrent approach,
2. Understand the basic process issues.
3. Understand the concurrent automated fabrication systems.
4. Apply concurrent engineering approach in manufacturing systems.
5. Evaluated the Technical performance.
6. Apply concurrent engineering in real life.

	Subject: PROFESSIONAL ELECTIVE II- **CONCURRENT ENGINEERING**	**L**
UNIT I	Introduction : Principles, traditional versus concurrent approach,schemes and tools of concurrent engineering, Applications of computers in CE.	6
UNIT II	Basic process issues : Process models, types, importance, relationbetween models, specifications, technology, automation and process improvement.	6
UNIT III	Concurrent engineering approach in manufacturing systems: Systemdesign procedure, features, assembly resource alternatives, tasks assignments.	7
UNIT IV	Concurrent automated fabrication systems : Introduction, methodology, preliminary and details work content analysis, humanresource considerations, 'Technical Economic' performance evaluation.	6
UNIT V	Assembly work stations: Strategic issues, technical issues, economicanalysis.	6
UNIT VI	Case studies of concurrent engineering practice	7
	Total	38

REFERENCE BOOKS :

1) David Bedwarth, M.R. Handerson & Philip Wilze- Computer integrated Design and manufacturing.

2) J.L. Nevines and D.E. Whitney-Concurrent Design of Products and Processes.

3) Proceeding of the "Summer school on Application of Concurrent Engineering to Product Development" at P.S.G.College of Technology.

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC5PE2B	**PROFESSIONAL ELECTIVE II Optimization Techniques**	03	00	00	03

Pre-requisites:

1. Students should have a knowledge of optimization s in engineering.

Course Learning Objectives:

CLO1. To study various types of Classical Optimization Techniques
CLO 2. To study the Constrained Optimization Techniques
CLO 3. To study the Genetic Algorithm
CLO4. To study the Theory of Constraints

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the various types of Classical Optimization Techniques
2. Understand the Constrained Optimization Techniques
3. Understand the Genetic Algorithm
4. Understand the Theory of Constraints

	PROFESSIONAL ELECTIVE II Optimization Techniques	**L**
UNIT I	Classical Optimization Techniques: Single-variable and Multi-variable Optimization, Hessian Matrix, Saddle Point, Lagrange Multipliers Method, Kuhn-Tucker Condition	7
UNIT II	Single-variable Optimization Techniques: Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval-halving Method, Fibonacci Method, Golden-section Method, Quadratic Interpolation Method, Newton Method, Quasi-Newton Method, Secant Method	6
UNIT III	Multi-variable Optimization Techniques: Evolutionary Optimization Method, Simplex Search Method, Pattern Search Method, Conjugate Direction Method, Steepest Descent Method, Newton's Method, Conjugate Gradient Method, Davidon-Fletcher-Powell Method	6
UNIT IV	Constrained Optimization Techniques: Interior Penalty Function Method, Exterior Penalty function Method.	6
UNIT V	Genetic Algorithm, Simulated Annealing, Artificial Neural Networks	6
UNIT VI	Theory of Constraints: Introduction to TOC, Optimized Production Technology (OPT), Nine principles of OPT, Five Focusing Steps (The 5FS) of TOC, Capacity Constrained Resources and the Time Buffer, Modeling the Time Buffer, Modeling Return-On-Investment (ROI) in TOC, Comparison of TOC and Local Optimization Approaches	7
	Total	38

REFERENCE BOOKS :

1. Deb K (2004). Optimization for Engineering Design: Algorithms and Examples, Prentice Hall of India.
2. Dennis J Jr, Schnabel R (1996). Numerical Methods for Unconstrained Optimization and Nonlinear Equations, Society for Industrial and Applied Mathematics.
3. Rao S (1996). Engineering optimization, Theory and Practice, New Age International Publishers
4. Ravindran A, Ragsdell K and Reklaitis G (2006). Engineering Optimization: Methods and Applications, 2nd edition, John Wiley and Sons Inc.
5. Goldratt, E. M. and Cox, J. (2004). The Goal: A Process of Ongoing Improvement. 3rd Edition, North River Press. ISBN-10: 0884271781, ISBN-13: 978-0884271789
6. Dettmer, H. William (1997). Goldratt's Theory of Constraints: A Systems Approach to Continuous Improvement, American Society for Quality. ISBN 0873893700, 9780873893701

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC6	**Research Methodology and IPR**	02	00	00	02

Course Learning Objectives:

CLO 1: To understand the role of research methodology, literature review process and formulation of a research problem

CLO 2: To understand data collection methods and statistical tools for data analysis

CLO 3: To learn technical writing skills required for research

CLO 4: To create awareness about intellectual property rights and research ethics

Course Outcomes:

Student will be able to:

CO 1: Understand the role of research methodology in Engineering

CO 2: Understand literature review process and formulation of a research problem

CO 3: Understand data collection methods and basic instrumentation

CO 4: Learn various statistical tools for data analysis

CO 5: Learn technical writing skills required for research

CO 6: Create awareness about intellectual property rights and patents

	Subject: Research Methodology and IPR	**L**
UNIT I	Definition of research, Characteristics of research, Types of research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Overview of research methodology in various areas, Introduction to problem solving, basic research terminology such as proof, hypothesis etc	5
UNIT II	Literature review, sources of literature, various referencing procedures, Identifying the research areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determining the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution	5
UNIT III	Important steps in research methods: Observation and Facts, Laws and Theories, Development of Models, Developing a research plan: Exploration, Description, Diagnosis and Experimentation	5
UNIT IV	Static and dynamic characteristics of instruments, calibration of various instruments, sampling methods, methods of data collection, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation	5
UNIT V	Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes,	5
UNIT VI	IPR and ethics in Research: Intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.	5
	Total	30

Reference Books:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Ltd., 2011.
2. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd, 2004.
3. C.R. Kothari ,"Research Methodology: Methods and Trends", New Age International,2004
4. S.D. Sharma , "Operational Research", Kedar Nath Ram Nath & Co.,1972
5. B.L. Wadehra,"Law Relating to Patents,Trademarks, Copyright Designs and Geographical Indications", Universal Law Publishing, 2014.
6. Donald Cooper, Pamela Schindler, "Business Research Methods", McGraw-Hill publication, 2005.

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC7	**Computer Aided Design Lab**	00	00	02	01

Pre-requisites:

1. Knowledge of mechanical engineering drawing and design

Course Learning Objectives:

CLO1. To apply the concept of computer aided design.

CLO2. To identify hardware and software requirement of CAD systems.

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the apply the concept of computer aided design.
2. Identify hardware and software requirement of CAD systems.

At least Five practical's based on syllabus of Computer Aided design.

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC8	**Computer Aided Manufacturing Lab**	00	00	02	01

Course Learning Objectives:

1) To learn the working of NC and CNC Machines.
2) To learn the part programming of NC/CNC Machines.

Course Outcomes:

After the completion of course students will be able to…

1. Understand the basics the working of NC and CNC Machines.
2. Understand to evaluate the part programming of NC/CNC Machines.

At least Five practical's based on syllabus of Computer Aided Manufacturing

M.Tech. First Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
1SMTCC9	**Mechatronics - Lab**	00	00	02	01

Course Learning Objectives:

1) To learn the working of Hydraulic System.
2) To learn the working of Pneumatic System.

Course Outcomes:

After the completion of course students will be able to…

1) To understand the working of Hydraulic System.
2) To understand the working of Pneumatic System.

At least Five practical's based on syllabus of Mechatronics.

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC1	**Finite Element Analysis**	03	00	00	03

Pre-requisites:
Knowledge of mechanical engineering design and CAD modeling

Course Learning Objectives:

CLO 1: To study the basic Concepts of Finite Element Analysis
CLO 2: To study Elements and Formulation Techniques
CLO 3: To understand and analyze plates, 2D and 3D solids.

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the basic Concepts of Finite Element Analysis.
2. Understand the properties of elements and its formulation techniques.
3. Formulation and Analysis of plates, 2D and 3D solids.
4. Understand for selection of 1D, 2D & 3D elements.
5. Understand and apply the FEA Techniques for heat transfer and fluid mechanics.
6. Understand the applicability of Finite element analysis software.

	Finite Element Analysis	**L**
UNIT I	**Introduction** Introduction: basic Concepts of Finite Element Analysis, Introduction to Elasticity, Steps in Finite Element Analysis, application of boundary conditions. General procedure of FEM: Discretization, element shapes, interpolation functions, shape functions, element stiffness matrix, Global stiffness matrix and its properties	6
UNIT II	**Properties of Elements and Formulation Techniques** Element Properties: Natural Coordinates, Triangular Elements, Rectangular Elements, Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoparametric Elements Finite Element Formulation Techniques: Virtual Work and Variational Principle, Galerkin Method, Displacement Approach, Stiffness Matrix.	6
UNIT III	**Finite Element Analysis of Plates** FEA for Plates: Introduction to Plate Bending Problems, Finite Element Analysis of Thin Plate Finite Element Analysis of Thick Plate, Finite Element Analysis of Skew Plate, Introduction to Finite Strip Method	7
UNIT IV	**Finite Element Analysis for 2D & 3D Solids** FEA for Two Dimensional Solids: Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements Numerical Evaluation of Element Stiffness, Computation of Stresses, Axisymmetric Element. FEA for Three Dimensional Solids: Finite Element Formulation for 3 Dimensional Elements.	6
UNIT V	**Applications in Heat Transfer and Fluid Mechanics** Application of FEA in Heat Transfer and Fluid Mechanics: FEA of 2-D single variable problems, application of Heat transfer, fluid mechanics.	6

UNIT VI	**Finite Element Analysis Packages** Software's in FEA: Introduction and study of open source FEA packages. Comparison related to software features and applications, Processing and Post Processing.	7
		38

TEXT BOOKS:

1. Fundamentals of Finite Element Analysis; by David V. Hutton (Tata McGraw Hill)
2. Introduction to Finite Elements in Engineering; by Tirupathi R. Chandrupatla, Ashok D. Belegundu (Prentice-Hall India)
3. A First Course in the Finite Element Method; by Daryl L. Logan (Thompson, Brks/Cole).

REFERENCE BOOKS:

1. The Finite Element Method in Engineering; by S.S. RAO (ELSEVIER)
2. Textbook of finite Element Analysis; by P. Seshu (Prentice-Hall India)
3. Finite Element Analysis: Theory and Application with ANSYS; by Saeed Moaveni (Pearson)

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC2	**Robotics and Robot Applications**	03	00	00	03

Pre-requisites:

Basic Knowledge of Robotics

Course Learning Objectives:

CLO 1: To study the basic Robot Configurations

CLO 2: To study levels of Control and Understand the robot Transformations

CLO 3: Robot Industrial applications

Course Outcomes:

At the end of course, Learner will be able to

CO1: Distinguish the types of Robot Configurations anticipate the work extremities of the robot motion.

CO2: Understand the operations and requirements of end effectors.

CO3: Understand the principles and applications of Robot Sensors.

CO4: Know the levels of Control and Understand the robot Transformations.

CO5: Know the Robot Industrial applications and able to specify the technical details of robot.

CO6: To study the Robot requirements of various processing operations.

	Robotics and Robot Applications	**L**
UNIT I	**Introduction:** Definition, need, robot classification, terminology and systems, benefits and limitations. Robot system: Robot physical configuration, work spaces, basic robot motions.	6
UNIT II	End effectors: Grippers and Toolings- Types , Applications, Construction and Operation.	6
UNIT III	Robot sensors: Contact and Non-Contact types. Vision, Tactile , Proximity, Force, Torque, voice, Vision Sensors. Work cell control and interlocks.	7
UNIT IV	Robot control and Types of Robot control systems. Robot arm kinematics: Homogenous transformation matrix.	6
UNIT V	Robot Industrial applications: Part Handling, Part Building and Part Processing. General considerations and problems. Robot Specifications.	6
UNIT VI	Robot Processing applications: Welding, Spray coating and other processing operations, assembly, inspection, robots in FMS.	7
		38

REFERENCE BOOKS:

1) Handbook of Industrial robotics.
2) Aures R.U. & Miller S.M.- Robotics applications and social implications.

3) Tanner W.R. – Industrial Robots Vol.-1 & Vol.-2.
4) Groover M.P. and Zimmer E.W.- Computer Aided Design and Manufacturing

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC3	**Rapid Prototyping and Tooling**	03	00	00	03

Pre-requisites:

1. Students should have a knowledge of Rapid Prototyping

Course Learning Objectives:

CLO1:To Understand the process of product development and concept of Rapid Prototyping.
CLO2: To Know the Stereolithography and FDM processes of 3D Printing.
CLO3: To Understand the Concept, process and Applications of Laser sintering.
CLO4: To Know the LOM and BPM processes of 3D Printing.
CLO5: To Understand and apply the concept of Reverse Engineering and Rapid Tooling.
CLO6: To Slicing Process and File formats, Softwares for 3D printing.

Course Outcomes:

At the end of course, Learner will be able to

CO1:Understand the process of product development and concept of Rapid Prototyping.
CO2: Know the Stereolithography and FDM processes of 3D Printing.
CO3: Understand the Concept, process and Applications of Laser sintering.
CO4: Know the LOM and BPM processes of 3D Printing.
CO5: Understand and apply the concept of Reverse Engineering and Rapid Tooling.
CO6: Slicing Process and File formats ,Softwares for 3D printing.

	Rapid Prototyping and Tooling	**L**
UNIT I	**Introduction**: Need for time compression in product development, Product development conceptual design, Development, Detail design, Rapid Prototyping, Applications of RP. Stereolithography system: Principle, Process parameters, Process details, Machine details, Applications.	6
UNIT II	**Fusion deposition modeling:** Principle, Process parameters, Process details, Machine details, Applications.	6
UNIT III	**Laser sintering systems**: Principle, Methods and Processes, Process parameters, Process details, Machine details, Applications.	7
UNIT IV	**Laminated object manufacturing**: Principle, Process parameters, process details, Machine details, Applications. Laser engineering net shaping (lens): Ballistic Particle Manufacturing (BPM).	6
UNIT V	**Introduction to rapid tooling**, Direct and indirect method, Rapid tooling techniques-vacuum casting, DMLS, etc. Introduction to reverse engineering.	6
UNIT VI	**3D printing principle**, Commercial software for RP, Slicing the Model, STL file generation. Post Processing for Printed Parts.	7
		38

REFERENCE BOOKS:

1. Pham, D.T. & Dimov.S.S., “Rapid manufacturing”, Springer -Verlag, London, 2001.
2. Terry wohlers, “Wohlers Report 2007”, Wohlers Associates, USA, 2007.
3. Ghosh A., “Rapid Protopyping: A Brief Introduction”, Affiliated East West,
4. Kenneth G. Cooper, “Rapid Prototyping Technology: Selection and Application”, CRC Press, 2001.
5. Chua Chee Kai, Leong Kah Fai, Lim Chu -Sing, “Rapid Prototyping: Principles and Applications”, World Scientific, 2003.

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC4PE3A	**Professional Elective – III : Flexible Manufacturing Systems**	03	00	00	03

Pre-requisites:

1. Students should have a knowledge of Industrial Engineering, various automated material handling and storage system.

Course Learning Objectives:

CLO1. To study functions of FMS, FMS host and area controller function distribution.
CLO 2. To study the development and implementation of FMS.
CLO 3. To study various automated material handling and storage system.
CLO4. To study the Modelling and analysis of FMS.

Course Outcomes:

At the end of course, Learner will be able to

1. Understand functions of FMS, FMS host and area controller function distribution.
2. Able to develop and implement FMS.
3. Understand AGV System.
4. Understand automated material handling and storage system.
5. Analysed storage system performance.
6. Modelling and analysis of FMS.

	Flexible Manufacturing Systems (Professional Elective III)	**L**
UNIT I	**FMS an overview:** Types and configuration, concept, types of flexibility and performance measures, functions of FMS.	6
UNIT II	**Development and implementation of FMS:** Planning phases, integration, system configuration, FMS layout.	6
UNIT III	FMS project development steps. FMS hostand area controller function distribution.	7
UNIT IV	**Automated material handling and storage:** Functions- types- analysis of material handling equipments, design of conveyors and AGV systems.	6
UNIT V	**Automated Storages:** Storage system performance- AS/RS- Carausal storage system- WIP storage system- interfacing handling, storagewith manufacturing.	6
UNIT VI	Modeling and Analysis of FMS: Analytical, heuristic, queuing, simulation and petrinet modeling techniques- scope, applicability and limitations.	7
		38

REFERENCE BOOKS:

1. Groover M.P.- Automation, Production Systems and CIM.
2. Ranky P.G.- The Design and Operation of FMS.
3. Parrish D.J.- Flexible Manufacturing.

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC4PE3B	**Professional Elective - III : Industrial Automation**	03	00	00	03

Pre-requisites:

1. Students should have a knowledge of Automation Engineering

Course Learning Objectives:

CLO1. To study the Automation in production systems
CLO 2. To study Industrial Control Systems
CLO 3. To study Automated Manufacturing Systems
CLO4. To study the Modelling and Simulation for Plant Automation
CLO5. To study the Industrial Control Applications
CLO6. To Identify the various Intelligent Controllers

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the Automation in production systems
2. Understand the Industrial Control Systems
3. Understand Automated Manufacturing Systems
4. Analysed the Modelling and Simulation for Plant Automation
5. Apply the concept of Industrial Control Applications
6. Identify the various Intelligent Controllers

	Professional Elective III : Industrial Automation	**L**
UNIT I	**Introduction to Industrial Automation:** Automation in production systems, Opportunities of automation and computerization in a production system, Automated manufacturing systems, Computerized manufacturing support systems, reasons for automating, automation principles and strategies, basic elements of an automated system, advanced automation functions, levels of automation.	6
UNIT II	**Industrial Control Systems:** Process industries, discrete manufacturing industries, continuous and discrete control, computer process control and the forms of computer process control, sensors, actuators and other control system components.	6
UNIT III	**Automated Manufacturing Systems:** Fundamentals of automated production lines, applications of automated production lines, transfer lines, automated assembly systems.	7
UNIT IV	**Modelling and Simulation for Plant Automation:** Need of system modeling, uses of system simulation, mathematical modeling of a plant, model evaluation and improvement, modern tools for modeling and simulation of systems, applications.	6
UNIT V	**Industrial Control Applications:** Introduction, cement plant, thermal power plant, water treatment plant, irrigation canal management, steel plant, etc.	6
UNIT VI	**Intelligent Controllers:** Introduction, model based controllers, predictive control, artificial intelligence based systems, expert controller, fuzzy logic system, fuzzy controller, fuzzy logic tools, artificial neural networks, neural controllers, VLSI implementation of neural	7

	networks, neuro-fuzzy control systems.	
		38

REFERENCE BOOKS:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by M. P. Groover, Pearson Education Pub.
2. Computer-Based Industrial Control, by Krishna Kant, Prentice Hall of India.

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC5PE4A	**Professional Elective - IV : Industrial Product Design**	03	00	00	03

Pre-requisites:

1. Manufacturing Technology/Processes

Course Learning Objectives:

CLO1 To understand modern product design and product development processes
CL02 To understand and explain the concept of Industrial design and robust design concepts.
CLO3 To understand the concept of Design for manufacture and assembly.
CLO4 To understand the legal factors, social issues, engineering ethics related to product design.

Course Outcomes:

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

CO1 Use the Product Design and Development Process, as a means to manage the development of an idea from concept through to production.
CO2 Assess the customer requirements in product design.
CO3 Apply structural approach to concept generation, concept selection and concept testing.
CO4 Identify various aspects of design such as industrial design, design for manufacture, assembly, and product architecture.
CO5 Explain various principles and technologies used for the preparation of prototype models of products.
CO6 Explain legal factors, social issues, engineering ethics related to intellectual property rights.

	Professional Elective IV : Industrial Product Design	**L**
UNIT I	Introduction: Characteristics of Successful Product Development, Challenges of Product Development, Development processes and organizations: Adapting the Generic Product Development Process, Product Development Process FlowsProduct Planning : Product Planning Process	6
UNIT II	Customer Needs: Importance, process of identification of customer needs Product Specifications: Establishing Target Specifications, Setting the Final Specifications	6
UNIT III	Concept Generation: Five-Step Method Concept Selection: Methodology, Concept Testing	7
UNIT IV	Product Architecture: Implications of the Architecture, Establishing the Architecture Industrial Design: Need for Industrial Design, Impact of Industrial Design, The Industrial Design Process	6
UNIT V	Selection of Materials and Processes, Design for Manufacturing: DFM Process Product Design for Manual Assembly Prototyping: Principles of Prototyping, Prototyping Technologies	6
UNIT VI	Robust Design: Design of Experiments, Robust Design Process Patents and Intellectual Property: Introduction to Intellectual Property, Overview of Patents, preparing an invention disclosure – (patent application)	7
		38

TEXT BOOKS:

Product Design and Development, Karl T. Ulrich, Steven D. Eppinger ISBN 978-0-07-802906-6 TATA McGraw-Hill Education

Product Design for Manufacture and Assembly, Geoffrey Boothroyd, Peter Dewhurst, Winston Knight ISBN: 0-8247-0584-X

REFERENCE BOOKS:

Selection and Use of Engineering Material, J.A. Charles, F.A.A. Crane, J.A.G. Furness ISBN:-13:978-81-312-0173-2 Elservier Publishers

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC5PE4B	**Professional Elective - IV : Simulation Theory and Applications**	03	00	00	03

Pre-requisites:

Knowledge of Operation Research Techniques and

Course Learning Objectives:

CLO 1: To study the basic Concepts of Simulation theory

CLO 2: To study simulation techniques and its application

CLO 3: To study Queuing Systems, Random Number generations.

CLO4: To study of Simulation Tools and Language.

Course Outcomes:

At the end of course, Learner will be able to

1. Understand the basic Concepts of simulation.
2. Understand the concept of simulation and modeling of real time systems.
3. Understand the simulation techniques and its application.
4. Understand the Queuing Systems.
5. Understand the Random Number generations.
6. Understand the Simulation Tools and Language.

	Professional Elective IV : Simulation Theory and Applications	**L**
UNIT I	**Introduction** System and System Environment, Components of System, Discrete and Continuous System, System Simulation, Model of a System, Types of Model, Use of Differential and Partial differential equations in Modeling, Advantages, Disadvantages and Limitations of Simulation, Application Areas, Phases in Simulation Study	6
UNIT II	**Simulation Techniques** System simulation: The techniques of simulation, Monte Carlo method, comparison of simulation and analytical methods, Analog computers and methods, hybrid computer, simulators.	6
UNIT III	**Simulation of Continuous and Discrete System** Continuous system simulation languages, system dynamics, growth models, logistic curves, multi-segment models, probability concepts in simulation, system simulation, events, representation of time, arrival pattern.	7
UNIT IV	**Random Numbers** Random Numbers and its properties, Pseudo Random Numbers, Methods of generation of Random Number, Tests for Randomness - Uniformity and independence, Random variate Generation.	6

UNIT V	**Analysis of simulation output** Estimation method, simulation run statistics, replications of runs, elimination of initial bias, batch means, regenerative techniques, time series analysis, spectral analysis, auto regression. Applications of simulation in manufacturing	6
UNIT VI	**Simulation of Computer Systems** Simulation Tools, Simulation Languages: GPSS, Case Studies of different types of Simulation Models and Construction of sample mathematical models	7
		38

TEXT BOOKS:

1. Geoffrey Gordon- System Simulation
2. Narsingh Deo- System Simulation with Digital Computers.
3. Naylor T.H. et. Al.- Computer Simulation Techniques.

REFERENCE BOOKS:

1. Gottfried B.S- Elements of Stochastic Process Simulation
2. Product Design & Manufacture by John Lindbeck , Prentice Hall International.
3. Integrated Product & Process Design by Edward Magrab, RC Press.

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC6	**Finite Element Analysis-Lab**	00	00	02	01

Pre-requisites:
Knowledge of mechanical engineering design and CAD modeling

Course Learning Objectives:

CLO 1: To study the basic Concepts of Finite Element Analysis
CLO 2: To study Elements and Formulation Techniques
CLO 3: To understand and analyze plates, 2D and 3D solids.

Course Outcomes:

At the end of course, Learner will be able to

1. Determine deflections and stresses under static loads on bars, trusses and beams.
2. Understand the properties of elements and its formulation techniques.
3. Formulation and Analysis of plates, 2D and 3D solids.
4. Analyze plate with hole for stresses and deflection
5. Calculate temperatures in steady state thermal analysis.

Practical's: At least **six** from the following list

1. Determine deflection and stresses of a loaded bar
2. Calculate the forces and stress in Trusses
3. Perform static structural analysis on corner bracket
4. Stress and deflection analysis in beams with different support conditions
5. Determine stresses and deflection in corner bracket
6. Stress analysis of flat plate with hole using 2D elements
7. Stress analysis of axi-symmetric components
8. Determine the thermal stresses of plate
9. Determine deflection and stresses by transient analysis on beam
10. Perform thermal analysis of a heat sink
11. Perform combined thermo-mechanical stresses analysis of on a bracket

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC7	**Robotics and Robot Applications lab**	00	00	02	01

Pre-requisites:

Basic Knowledge of Robotics and Robot Applications

Course Learning Objectives:

CLO 1: To Identify the basic Robot Configurations

CLO 2: To Operate the Control and Understand the robot Transformations

Course Outcomes:

At the end of course, Learner will be able to

CO1: Identify the basic Robot Configurations.

CO2: Understand the Operation of Control the Robot and

CO3: Understand Understand the robot Transformations.

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At least Six practicals based on syllabus of Robotics and Robot Applications

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC8	**Rapid Prototyping and Tooling - Lab**	00	00	02	01

Pre-requisites:
Basic Knowledge of Rapid Prototyping and Tooling

Course Learning Objectives:

CLO 1: To learn the basics Rapid Prototyping.
CLO 2: To learn the basics of tooling.

Course Outcomes:

At the end of course, Learner will be able to
CO1: Understand the basics of Rapid Prototyping.
CO2: Understand the basics of Tooling.

At least Six practicals based on syllabus of Rapid Prototyping and Tooling.

M.Tech. Second Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
2SMTCC9	**Mini Project & Seminar - 1**	00	00	04	02

Pre-requisites:

Basic Knowledge of Robotics and Robot Applications

Course Learning Objectives:

CLO 1: To Identify the specific problem and give solution.

CLO 2: To Solve, interpret/ correlate the results and discussions .

Course Outcomes:

At the end of course, Learner will be able to

CO1: Formulate a specific problem and give solution.

CO2: Develop model theoretical/ practical/ numerical form.

CO3: Solve, interpret/ correlate the results and discussions.

CO4: Conclude the results obtained and write the documentation in standard form.

Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original. Mini projects should have inter disciplinary/ industry relevance. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling. All the investigations are clearly stated and documented with the reasons/explanations. All the projects should contain A clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

M.Tech. Third Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
3SMTCC1	**Compulsary Internship Two months**	00	00	00	06

Pre-requisites: Nil

After Completion of 1st year, Students have to complete Internship of Two Months.

M.Tech. Third Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
3SMTCC2	**Seminar & Dissertation Phase -I**	00	00	08	04

M.Tech. Fourth Semester (CAD/CAM) AY 2024-25

Course Code	Course Title	L	T	P	C
4SMTCC	**Seminar & Dissertation Phase -II**	00	00	20	10