Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

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दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४. २६०९४८७
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जा.क्र./शि.वि/अं.म./ 608 दिनांक:— ०७/१०/२०२५

प्रति,

१. मा. संचालक / प्राचार्य,
सर्व संलग्नीत अभियांत्रीकी महाविद्यालये,
शिवाजी विद्यापीठ, कोल्हापूर

२.प्र. संचालक,
स्कुल ऑफ इंजिनिअरींग ॲण्ड टेक्नॉलॉजी,
शिवाजी विद्यापीठ, कोल्हापूर

३.प्र. संचालक,
यशवंतराव चव्हाण स्कुल ऑफ रुरल डेव्हलपमेंट,
शिवाजी विद्यापीठ, कोल्हापूर

विषय:— एम. टेक अभ्यासक्रमातील किरकोळ दुरुस्तीबाबत.

संदर्भ:— १.एसयु/बीओएस/सायन्स&टेक/३१७ व ५३४ दि.२३/५/२०२५ व दि.४/९/२०२५
२.एसयु/बीओएस/सायन्स&टेक/५३९ दि.०८/०९/२०२५

महोदय,

उपरोक्त संदर्भिय विषयास अनुसररुन आपणास आदेशान्वये कळविण्यात येते की, शैक्षणिक वर्ष २०२५—२६ पासून लागू करण्यात आलेल्या खालील **एम.टेक** अभ्यासक्रमामध्ये किरकोळ दुरुस्ती करण्यात आलेली आहे.

Sr.	Course/Syllabus	Sr.	Course/Syllabus
1	Enargy Technology (ON)	6	Rural Technology (ON)
2	Computer Science and Technology (ON)	7	Computer Science and Engineering (OFF)
3	Electronics and Telecommunication (ON)	8	Mechanical (CAD/CAM/CAE) (OFF)
4	Environmental Science and Technology (ON)	9	Electronics and Telecommunication Engineering (OFF)
5	Food Technology (ON)		

सोबत सदर अभ्यासक्रमाची प्रत जोडली आहे. तसेच विद्यापीठाच्या https://www.unishivaji.ac.in (NEP-2020@suk/ Online syllabus) या संकेस्थळावर ठेवण्यात आला आहे. सदर दुरुस्ती ही शैक्षणिक वर्ष २०२५—२६ पासून लागू राहील.

सदर अभ्यासक्रम सर्व संबधित विद्यार्थी व शिक्षकांच्या निदर्शनास आणून द्यावेत ही विनंती.

कळावे.

आपला विश्वासू,

डॉ. एस. एम. कुबल
उपकुलसचिव

सोबत — अभ्यासक्रमाची प्रत,

प्रत :— **माहितीसाठी व पुढील योग्यत्या कार्यवाहीसाठी**

मा. संचालक, परीक्षा व मुल्यमापन मंडळ	प्र. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा
अध्यक्ष, संबंधित अभ्यास /अस्थायी मंडळ	इतर परिक्षा ४ विभागास.
परीक्षक नियुक्ती ए व बी विभागास.	संलग्नता टी. १ व टी. २ विभागास
पीजी प्रवेश विभागास	पीजी सेमिनार विभागास
संगणक केंद्र / आयटी सेल	पात्रता विभागास

Shivaji University

Vidya Nagar, Kolhapur, Maharashtra 416004

M. Tech.
(CAD/CAM/CAE) Curriculum Structure

and Syllabus

2025-26 onwards

Program Outcomes

PO1: Demonstrates in-depth knowledge and understanding of the chosen engineering discipline.

PO2: Analyzes complex engineering problems, evaluates information, and forms well-reasoned conclusions.

PO3: Identifies, formulates, and solves complex engineering problems using appropriate methods and tools.

PO4: Conducts research, analyzes data, and interprets findings to contribute to the advancement of knowledge.

PO5: Effectively utilizes modern engineering tools, software, and technologies.

PO6: Works effectively as a team member and leader in multidisciplinary environments.

PO7: Demonstrates knowledge of project management principles and applies them to engineering projects.

PO8: Effectively communicates technical information both orally and in writing.

PO9: Recognizes the need for continuous learning and professional development.

PO10: Applies ethical principles and understands the societal impact of engineering solutions.

SHIVAJI UNIVERSITY, KOLHAPUR
Department of Technology
M. Tech. CAD/CAM/CAE Course Structure Semester-I
Applicable From Academic Year 2025-26

Semester-I

Sr. No	Course Code	Course Title	Teaching Scheme (Hours/Week)				Evaluation Scheme			
							Theory		Practical	
			L	T	P	Credit	Scheme	Max. Marks	Scheme	Max. Marks
1	MECADAC1	Research Methodology	2	-	-	2	-	-	IE	50
2	MECADC11	Computer Aided Design & Manufacturing	3	-	-	3	IE	40	-	-
							ESE	60	-	-
3	MECADC12	Advanced Machine Design	3	-	-	3	IE	40	-	-
							ESE	60	-	-
4	MECADC13	Advanced Finite Element Analysis	3	-	-	3	IE	40	-	-
							ESE	60	-	-
5	MECADE1	Elective – I	3	-	-	3	IE	40	-	-
							ESE	60	-	-
6	MECADOE1	Elective – II (Open Elective)	3	-	-	3	IE	40	-	-
							ESE	60	-	-
7	MECADC14	Seminar – I	-	-	2	1	-	-	IE	50
8	MECADC15	Design & Analysis Laboratory I	-	-	2	1	-	-	IE	50
9	MECADC16	CAD/CAM Laboratory I	-	-	2	1	-	-	IE	50
Total			**17**	**-**	**6**	**20**	**-**	**500**	**-**	**200**
Total Contact hours per week=23*										

Elective-I

Sr. No	Course Title
1	Mechatronics System Design
2	Advances in CAD/CAM/CAE Engineering
3	Theory of Elasticity And Plasticity
4	Design of Hydraulic and Pneumatic systems

Elective II (Open Elective): Choose from following list

Sr. No	Course Title	Branch
CSEOE11	Advanced Operating Systems	Computer Science and Engineering
CSEOE12	Internet of Things	
CSEOE13	Data Analytics	
ETCOE11	Advanced Communication System	Electronics & Telecommunication Engineering
ETCOE12	Reconfigurable Computing	
ETCOE13	VLSI Testing & Testability	

Open Elective-
Minimum number of students for selection of Elective – 4
Maximum number of students for selection of Elective - 24 *

Semester-II

Sr. No	Subject Code	Subject Title	Teaching Scheme				Examination Scheme			
			L	T	P	Credit	Theory		Practical	
1	MECADAC 2	Intellectual Property Rights	2	-	-	2			IE	50
2	MECADC21	Rapid Manufacturing	3	-	-	3	IE	40	-	-
							ESE	60	-	-
3	MECADC22	Computational Methods	3	-	-	3	IE	40	-	-
							ESE	60	-	-
4	MECADC23	Modeling and Simulation	3	-	-	3	IE	40	-	-
							ESE	60	-	-
5	MECADE2	Elective-III	3	-	-	3	IE	40	-	-
							ESE	60	-	-
6	MECADOE 2	Elective-IV (Open Elective)	3	-	-	3	IE	40	-	-
							ESE	60	-	-
7	MECADC24	Compressive Viva	-	-	2	1	-	-	IE	50
8	MECADC25	Design & Analysis Laboratory II	-	-	2	1	-	-	IE	50
9	MECADC26	Seminar – II	-	-	2	1	-	-	IE	50
Total			**17**	**-**	**6**	**20**	**-**	**500**	**-**	**200**
Total Contact hours per week=23*										

Sr. No	Elective-III
1	Nanotechnology
2	Wiring and Harness System in Automobile
3	Computational Fluid Dynamics.
4	CAD/CAM/CAE Practices in metal forming

Elective IV (Open Elective): Choose from following list

Sr. No	Elective-IV (Open Elective)	Branch
CSEOE21	Geographical Information Systems	Computer Science and Technology
CSEOE22	Natural Language Processing	
CSEOE23	Block chain Technology	
ETCOE21	MIMO Systems	Electronics & Telecommunication Engineering
ETCOE22	Satellite Communication	
ETCOE23	Smart and Phased Array Antenna Design	

Open Elective-
Minimum number of students for selection of Elective – 4
Maximum number of students for selection of Elective - 24 *

Semester-III

Sr. No	Subject Code	Subject Title	Teaching Scheme				Examination Scheme			
			L	T	P	Credit	Theory		Practical	
1	MECADC31	Industrial Training	-	-	2*	5**	-	-	IE	50
							-	-	EOE	50
3	MECADC32	Dissertation Phase-I	-	-	2*	15	-	-	IE	100
							-	-	EOE	100
Total			**-**	**-**	**-**	**20**	-	-	-	**300**
Total Contact hours per week=4*										

*Students are expected to do self-study for two hours as per the guidance given by the Project Guide and report to the department once a week. Hence contact hours to be taken as two for the calculation of contact hours.

** Industrial Training of 8 to 12 weeks at the end of First Year
OR
Industrial training will be split in two slots of four weeks during semester III

Evaluation at end of III semester on the basis given report and Presentation to concern Guide

Semester-IV

Sr. No	Subject Code	Subject Title	Teaching Scheme				Examination Scheme			
			L	T	P	Credit	Theory		Practical	
1	MECADC41	Dissertation Phase-II	-	-	4*	20	-	-	IE	150
							-	-	EOE	150
Total			-	-	-	20		-	-	300
Total Contact hours per week=4*										

*Students are expected to do self-study for four hours as per the guidance given by the project Guide and report to the department once in a week.

Hence contact hours to be taken as four for the calculation of contact hours.

Note:
$: Minimum 40% marks required in ESE as passing head.
• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

IE – Internal Evaluation,
IPE – Internal Practical Evaluation,
IOE– Internal Oral Evaluation,

ESE –End Semester Examination,
EPE–External Practical Examination,
EOE–External Oral Examination

SEMESTER-I

Class, Part & Semester	:	**First Year M. Tech (CAD/CAM/CAE),Part I, Sem-I**					
Course Title	:	Research Methodology			***Course Code*:**	:	MECADAC1
Teaching Scheme (Hours)	:	Lecture:	2 Hrs/week		***Total Credits***	:	2
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	:	IE=50	ESE = NIL	Grand Total=NIL	***Duration of ESE***	:	—
Revision:	:	Fourth			***Month***	:	July2025
Pre-requisites *(if any)*	:	The student should be familiarize with basic of research.					
Course Domain	:	Audit Course					

Course Rationale: This course aims to lay a foundation for your research. The goal is to help you to design and develop your future research projects.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	This course aims to lay a foundation for your research. The goal is to help you to design and develop your future research projects.	1.	To understand basic concepts of research and its methodologies
2.	Familiarize Research Design.	2.	To select and define appropriate research problem and parameters
3.	Introduce measurement and scaling techniques in research.	3.	To apply Measurement and Scaling Techniques
4.	Familiarize methods of data collection and analysis	4.	To use Methods of Data Collection and Analysis
5.	Introduce techniques of hypotheses, parametric or standard tests	5.	To apply techniques of hypotheses, parametric Or standard tests
6.	Help to analyze variance and co-variance	6.	Present and defend research ideas using Analysis of Variance and Co-variance

Curriculum Content	**Hours**
Unit-I Research Methodology: An Introduction, Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques involved in Defining a Problem	5

Unit II Research Methodology:	
Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling	4
Unit III Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques.	4
Unit IV Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method, Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation	4
Unit V Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters, Limitations of the tests of Hypotheses,. Chi-square Test, Comparing Variance, As a non-parameteric Test, Conversion of Chi to Phi, Caution in using Chi-square test	4
Unit VI Analysis of Variance and Co-variance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA, Assumptions in ANOCOVA, Multivariate Analysis Technique, Classification of Multivariate Analysis, factor Analysis, R-type Q Type factor Analysis, Path Analysis	5

Suggested list of Tutorials and Assignments: As suggested by the course teacher	
Suggested Text Books:	
1.	"Research Methodology", C.R. Kothari, Wiley Eastern.
2.	"Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell
Suggested Reference Books:	
1.	"Formulation of Hypothesis",Willkins on K.P,L Bhandarkar,Hymalaya Publication,Bombay.
2.	"Research in Education",JohnW Best andV. Kahn,PHIPublication.
3.	"Research Methodology-A step by step guide for beginners",Ranjit Kumar, Pearson Education
4.	"Management Research Methodology-Integration of principles, methods and Techniques",K.N. Krishna swami and others, Pearson Education

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1		2								
CO2				3						
CO3				2						
CO4				3						
CO5				3						
CO6				3						

Level of Mapping as: Low 1, Moderate 2,High 3

Class, Part & Semester	**:**	**First Year M. Tech (CAD/CAM/CAE), Part-I, Sem-I**					
Course Title	**:**	**Computer Aided Design & Manufacturing**			***Course Code*:**	**:**	MECADC11
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hr/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Design)					

Course Rationale: The Computer Aided Design & Manufacturing (CAD/CAM) course equips students with the knowledge and skills to design products and control manufacturing processes using advanced computer software and technologies. It bridges the gap between design and production, enhancing efficiency, precision, and innovation in modern engineering and manufacturing industries.

Course Outcomes

1. CO1: Understand and analyze the role of CAD in mechanical engineering design.
2. CO2: Develop and evaluate mathematical representations of curves and surfaces.
3. CO3: Apply solid modeling techniques and data exchange formats in engineering design.
4. CO4: Analyze the construction and operational principles of CNC machine tools.
5. CO5: Create and optimize CNC part programs using G & M codes and modern tooling systems.
6. CO6: Utilize CAM software for computer-aided CNC part programming and tool path optimization.

Curriculum Content	**Hours**
Unit -I Introduction to CAD. Role of CAD in Mechanical Engineering, Design process, software tools for CAD, Scan Conversion, Geometric modelling. Transformations in Geometric Modelling Introduction, Translation, Scaling, Reflection, Rotation in 2D and 3D. Homogeneous representation of transformation, Concatenation of transformations.	6
Unit -II Representation of Curves Analytic Curves, Composite Ferguson curves, Hermite Cubic Splines, curve Trimming and Blending, Bernstein polynomials, Bezier Curves, Bezier-subdivision, Degree elevation, Composite Bezier, Splines, B-spline basis functions, Properties of basic functions, Knot Vectors, NURBS. Representation of Surfaces Parametric representation, Planer, Sweep surfaces, Surface of revolution, Bi-linear , lofted, Coon‘s patch, Hermite, Bezier, B-Spline surfaces, Developable surfaces, Surfaces of revolution, Intersection of surfaces, Surface modelling.	7
Unit -III Design of Solids Solid entities, Boolean operations, B-rep of Solid Modelling, CSG approach of solid modelling, Data exchange formats, Geometric Modeling using Point Clouds, Reverse Engineering. Feature Based Modeling Feature recognition, types of features, feature recognition schemes, feature recognition methods, Artificial Intelligence for feature recognition	7

Unit IV Introduction to CAM: - CNC machine tools, Principle of operation of CNC, Construction features including structure, drive system, tool-work movement actuation system, Work holding features, Tool holding features, Feedback system, machine control system, 2D and 3D machining on CNC.	5
Unit V CNC Part Programming - Detailed Manual part programming on Lathe and Machining centers using G & M codes, FAPT programming (FANUC) CNC Tooling:-Modern cutting tool materials and their applications, ISO Nomenclature of tools and tool grades, Different types of tools and tool holders used on CNC Machines, parameters for selection of configuration of cutting tools, Modular tools and fixtures, use of pallets for work holding, palletizing of fixtures. Process planning using CNC machines: Differences with respect to conventional machines; Design for manufacturing and assembly - Concept with case studies.	8
Unit VI Computer aided CNC part programming – Introduction to common CNC controllers like FANUC, SIEMENS, MAZAK etc., Generation of tool path, generation of G & M codes, Optimization of tool path (to reduce machining time), (Features available on a typical CAM software).	7
Suggested Text Books:	
1.	"Computer-Aided Design and Manufacturing" by Mikell P. Groover
2.	CAD/CAM: Computer-Aided Design and Manufacturing" by Mikell P. Groover and Emory W. Zimmers Jr.
Suggested Reference Books:	
1.	Geometric Modeling: Michael E. Mortension, John Wiley.
2.	Mathematical Elements of Computer Graphics: Rogerand Adams,McGraw Hill.
3.	CAD CAM Theory and Practice:I. Zeid, McGraw Hill.
4.	Computer Aided Engineering Design, Saxena and Sahay, Anamaya N .Delhi
5	Jon Stenerson and Kelly Curran―Computer Numerical Control‖, Prentice-Hall of India Pvt. Ltd. New Delhi,2008
6	Ibrahim Zeid ―CAD/CAM – Theory and Practice Mc Hill, International edition,1998
7	P. N. Rao ―CAD/CAM principles and operations, Tata McGraw Hill
8	Reference Manuals of FANUC, Siemens, Mazak, etc. Thomas M. Crandell ―CNC Machining and Programming, Industrial PressISBN-0-8311-3118-7

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3		3			2	2	2
CO2	3	3	3	3	3			2	2	2
CO3	3	3	3	3	3			2	2	2
CO4	3	3	3		3	2	2	2	2	2
CO5	3	3	3		3	2	2	2	2	2
CO6	3	3	3		3	2	2	2	2	2

Level of Mapping as: Low 1, Moderate 2 ,High3

Class, Part & Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Advanced Machine Design**			***Course Code*:**	**:**	MECADC12
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Design)					

Course Rationale: An Advanced Machine Design course focuses on the principles and techniques for designing complex mechanical systems, incorporating advanced materials, kinematics, dynamics, and optimization for efficient and innovative solutions in engineering applications.

Course Objectives:		***Course Outcomes :*** Students will be able to	
1.	To revise the fundamentals of stress analysis and vibration analysis.	1.	Explain the concept of elasticity, and the difference between stress and strain.
2.	To lay a strong foundation for design analysis.	2.	Explain the terms: isotropic, orthotropic and an isotropic, as applied to materials.
		3.	Explain the terms: plane stress and plane strain.
		4.	Use the concepts of principal stress and principal strains.
		5.	Use the basic tensor notations, the stress, strain and inertia tensors, and the irreduction to principal axes.
		6.	Apply the analytical procedures involved in strain gauge measurements, in particular the transformation equations.
		7.	Solve basic problems in two dimensional elasticity using Airy's stress function.

Curriculum Content	**Hours**
Unit I **Analysis of Stress**: State of stress at a point, stress components on an arbitrary plane, principal stresses, Mohr's circle, plane stress, differential equations of equilibrium, boundary conditions.	7
Unit II **Analysis of Strain**: State of strain at a point, dilation, plane strain, compatibility conditions.	6

Unit III **Stress-Strain Relations**: Generalizes Hooke's Law, relations between elastic constants, displacement equations of equilibrium.	6
Unit IV **Theories of Failure**: Theory of dislocations, Maximum principal stress theory, maximum shear stress theory, maximum elastic strain theory, octahedral shearing stress theory, distortion energy theory, Mohr's theory, significance of theory of failure, use of factor of safety in design, selection of materials for engineering applications.	7
Unit V **Energy Methods**: Elastic strain energy, Maxwell-Betti-Rayleigh reciprocal theorem, Castigliano's theorems, strain energy due to axial force, shear force, torsion, bending moment, theory of virtual work. Axi-symmetric Problems: Thick-walled cylinders, shrink fits, rotating discs.	7
Unit VI **Fatigue Considerations in Design** : Variable loads- basic concepts; Load and Stress variations- different patterns; Cyclic stressing/straining- material response and the origin of fatigue failure; S-N curve - fatigue strength and endurance limit; Factors influencing fatigue, endurance strength modification factors; Fatigue stress concentration; Effect of mean stress- Goodman and Soderberg relations; Design approach to fatigue- design for infinite and finite life; Design of members under combined loading.	7

TERM WORK

Minimum six assignments based on the above topics including two exercises involving analysis and design modification for critical components using reverse engineering approach. (e.g. need to change material specifications of a connecting rod, etc.)

Suggested Text Books:

1.	"Mechanical Engineering Design" by J.E. Shigley, Charles R. Mischke, and Richard G. Budynas
2.	"Design of Machine Elements" by V.B. Bhandari
3.	"Machine Design: An Integrated Approach" by Robert L. Norton

Suggested Reference Books:

1.	Advanced Solid Mechanics–L S Srinath,Tata McGraw-Hill
2.	Theory of Elasticity (Third Edition)–S P Timoshenko,J N Goodier, McGraw- Hill
3	Elements of Vibration Analysis– L Meirovitch ,McGraw-Hill
4	Design of Machine Elements –M. F.Spotts &T.E. Shoup, Pearson Education
5	Mechanical Engineering Design–Joseph E.Shigley& Chales R.Mischke, McGraw Hill
6	Engineering Design–George B.Dieter, McGraw Hill
7	Machine Design,An Integrated Approach–RobertL.Norton, Pearson Education
8	Mechanical Analysis & Design –ArhurH. Burr & John B.Chetham, Prentice Hall India
9	Fundamentals of Machine Component Design–Robert C.Juvinall & Kurt M. Marshel, John Wiley &Sons
10	Mechanical Vibrations (FourthEdition)–S S Rao,Pearson Education
11	Fundamentals of Mechanical Vibrations–S Graham Kelly, McGraw-Hill
12	Mechanical Vibrations–G.K.Groover , Nemch and & Brothers,Roorkee.
13	Fundamentals of Machine Component Design –R. C.Juvinall

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2		2			2	1	1
CO2	3	2	2		2			2	1	1
CO3	3	2	2		2			2	1	1
CO4	3	3	3		2			2	1	1
CO5	3	3	3		2			2	1	1
CO6	3	3	3		2			2	1	1
CO7	3	3	3	2	2			2	1	1

Level of Mapping as: Low 1,Moderate 2,High 3

Class, Part & Semester	**:**	**First Year M. Tech (CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Advanced Finite Element Analysis**			***Course Code*:**	**:**	MECADC13
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	A basic understanding of vectors, matrices and partial differential equations for thermal and mechanical problems.					
Cour Domain	**:**	Core (Design)					

Course Rationale: The Advanced Finite Element Analysis course equips students with in-depth knowledge and practical skills to model, analyze, and interpret complex engineering problems using advanced FEA techniques and software tools.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To provide the mathematical foundations of the finite element formulation for engineering applications	1.	The students will understand the Finite Element Formulation of Plate and Shell Elements and its application.
2.	To expose students to some of the recent trends and research are as infinite element analysis.	2.	The students will be able to gain knowledge in material & geometric non- and plasticity.
		3.	The students will be able to solve problems under dynamic conditions by applying various techniques.
		4.	The students can arrive at the solutions for fluid mechanics and heat transfer problems.
		5.	The students will acquire knowledge in error norms, convergence rates and refinement.
		6.	The students will solve real world engineering problems using FEA.

Curriculum Content	**Hours**
Unit I **Introduction to Finite Element Method:** Basic Concept, Historical Background, engineering applications, general Description, comparison with other methods	6
Unit II **Integral Formulation and Variation Methods:** Need for weighted-integral forms, relevant mathematical concepts and formulate, weak formulation of boundary value problems, variational methods, Rayleigh-Ritz method and weighted residual approach	6

Unit III **Finite Element Techniques:** Module boundary value problem, finite element decartelization, element shapes, sizes and node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solutions, post processing, Compatibility and completeness requirements, convergence criteria, higher order and isoperimetric elements, natural coordinates, Lagrange and Hermit Polynomials	7
Unit IV Applications to Solid and Structural Mechanics Problems: External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis symmetric and three dimensional stress strain problems, strain displacement relations, boundary conditions compatibility equations, analysis of trusses, frames and solid of revolution, computer programs. Applications to Heat Transfer Problems: Variational approach, Galerikn approach one dimensional and two dimensional steady state problems for conduction, convection and radiation, transient problems	7
Unit V **Applications to Fluid Mechanics Problems:** In viscid incompressible flow, potential function and stream function formulation, incompressible viscous flow, stream function, velocity-pressure and stream function vorticity formulation, solution of incompressible and compressible fluid film lubrication problems, Additional Applications: Steady state and transient field problem.	7
Unit VI **Parameters Affecting Accuracy of the FEA results:** How to validate and check accuracy of FEA results, Computational accuracy: strain energy norm, residuals, Reaction forces and moments; convergence test, Average and un average stress difference. Correlation with actual testing: strain gauging-stress comparison; natural frequency comparison; Dynamic response comparison, temperature and pressure distribution comparison.	7

Suggested Text Books:	
1.	"The Finite Element Method: Its Basis and Fundamentals" by O.C. Zienkiewicz, R.L. Taylor, and J.Z. Zhu
2	Finite Element Procedures by Bathe, Prentice-Hall.
3	"Concepts and Applications of Finite Element Analysis" by Robert D. Cook, David S. Malkus, Michael E. Plesha, and Robert J. Witt
Suggested Reference Books:	
1.	Finite Element Analysis–Theory & Practice by Fagan (Longman Scientific & Technical)
2.	Fundamentals of Finite Element Analysis, David Hutton, TMH
3.	Finite Element Method versus Classical Methods,-H.S.Govinda Rao, New Age International Publishers
4.	An Introduction to Finite Element Analysis by J.N.Reddy, (Tata McGraw-Hill Pub.Co.)
5.	The Finite Element Method: Linear Static and Dynamic Finite Element Analysis by T.J.R.Huges, Dover Publications,2000
6.	Finite Element Analysis by P.Seshu(PHI)
7.	Practical Finite Element Analysis–Nitin Gokhale (Finite ToInfinite, Pune)
8.	Introduction to Finite Elements in Engineering by Chandrupatala and Belegundu.
9.	Concepts & Application of Finite Element Analysis by R.D.Cook,D.S.Malku,(John Wiley& Sons)
10	The Finite Element Methods,3/e–Sienkiewicz (Tata McGraw Hill).

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	3			2	2	2
CO2	3	2	3	2	3			2	2	2
CO3	3	3	3	2	3			2	2	2
CO4	3	3	3	2	3			2	2	2
CO5	3	2	3	2	3			2	2	2
CO6	3	3	3	2	3			2	2	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part & Semester	**:**	**First Year M.Tech(CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Mechatronics System Design (Elective-I)**			***Course Code*:**	**:**	MECADE1
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Design)					

Course Rationale: The Mechatronics System Design course integrates mechanical, electrical, and computer engineering principles to design and develop intelligent systems and automated solutions for modern engineering applications.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To study components of mechatronic systems and the integration for various applications.	1.	1. Upon completion of this course, the Students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.
		2.	2.Understand the fundamentals of mechatronic systems in a synergistic framework
		3.	3.Design and develop intelligent engineered products and processes to solve challenging technological problems.
		4.	4.Design and simulate mechatronic systems using microcontrollers and programmable logic controllers
		5.	5.Develop innovative approaches and an entrepreneurial mind set to problem solving
		6.	6.Can develop data handling and data acquisition system etc.

Curriculum Content	**Hours**
Unit I **Introduction:** Introduction to mechatronic system, evolution, scope and components of mechatronic systems, mechatronics in product and measurement system, control system and modes of control, traditional design and mechatronic design	6

Unit II **Actuators, Sensors and Transducers:** Hydraulic, pneumatic and electrical actuators and their system modeling, performance terminology, system modeling of sensors; displacement, position and proximity sensors,velocity and acceleration sensors,flow sensors, force sensors, Temperature sensors, ultrasonic and fiber-optic sensors, selection of sensor, piezo-Electric sensors.	7

Unit III **Hardware Components :** Number systems in Mechatronics, binary logic, Karnaugh map minimization, transducer signal conditioning process, principals of analogue and digital signal conditioning, protection ,filtering, operational and instrumentation amplifiers and the irgains, analogue to digital and digital to analogue conversion, multiplexers, pulse modulation.	7
Unit IV **Programmable Logic Controller:** Review of logic gates, basic structure, features, input/output processing, programming, functional block diagram (FBD), ladder diagram, logic functions, latching, sequencing, jumps, internal relays, counters, shift registers, master and jump control, data handling, data movement, data comparison, arithmetic operations, code conversion, analog input and output, applications for automation, diagnostics and condition monitoring	7
Unit V **Microcontroller:** Comparison between microprocessor and microcontroller, organization of microcontroller system,architecture of MCS51controller,pin diagram of 8051 addressing modes, programming of 8051, interfacing input and output devices, interfacing D/A converters and A/D converters, Various applications for automation and control purpose.	6
Unit VI **Real-Time Interfacing applications :** Introduction, Elements of Data Acquisition and Control System, Overview of I/O Process, Installation of the I/O Card and Software, Installation of the application Software, Examples, Over framing. Advanced Applications in Mechatronics**:** Mechatronic control in automated manufacturing, Artificial Intelligence in mechatronics, Fuzzy Logic application in Mechatronics, Micro sensors in Mechatronics, Case studies of Mechatronic systems	7

Suggested list of Tutorials and Assignments:

Suggested Text Books:

1.	"Mechatronics: Principles and Applications" by Godfrey C. Onwubolu
2.	"Introduction to Mechatronics and Measurement Systems" by David G. Alciatore and Michael B. Histand
3.	"Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" by W. Bolton

Suggested Reference Books:

1.	Mechatronics,3/e ---W. Bolton(Pearson Education)
2.	Mechatronics-Dan Necsulescu (Pearson Education)
3.	The 8051 Microcontroller :Architecture,ProgrammingandApplications,2/e—Kenneth J. Ayala (Penram International)
4.	Mechatronics: Principles, Concepts and Applications-N.P. Mahalik(TMH)
5.	Introduction to Mechatronics & Measurement Systems –David G.Alciatore & Michael B. Histand(TMH)
6.	Process Control & Instrumentation Technology–Critis D. Johnson(Pearson Education)
7.	Mechatronics System Design-Devdas Shetty, Richard A.Kolk(Thomson)
8.	Computer Control of Manufacturing Systems –Yoram Koren(Mc Graw Hill)
9.	Automated Manufacturing Systems: Sensors, Actuators-S. Brain Morriss(Mc Graw Hill)
10.	Industrial Automation–David W. Pessen (John Wiley &Sons)
11.	99Examples of Pneumatic Applications–FESTO Controls Pvt. Ltd. Bangalore.

12.	Modular Pick and Place Device– FESTO Controls Pvt. Ltd. Bangalore.
13.	Rationalization with Handling Technology– FESTO Controls Pvt. Ltd. Bangalore.
14.	Rationalization with Small Workpiece Feeding-FESTO Controls Pvt. Ltd. Bangalore.
15.	Sensors for Handling & Processing Pechnology-FESTO Controls Pvt. Ltd. Bangalore.
16.	Sensors in Production Engg.-FESTO Controls Pvt. Ltd. Bangalore.
17.	Handbook of Industrial Automation–RichardL. Shell & Ernest L. Hall(Marcel Decker Inc.)

Course Outcome and Program Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	3	2	1	2	2	2
CO2	3	2	2	1	2	1	1	2	2	2
CO3	3	3	3	2	3	2	2	2	2	3
CO4	3	2	3	2	3	2	1	2	2	2
CO5	2	2	2	1	2	3	3	2	3	3
CO6	2	2	3	2	3	2	1	2	2	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part &Semester	**:**	**First Year M.Tech(CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Advances in CAD/CAM/CAE Engineering (Elective-I)**		***Course Code*:**	**:**	MECADE1	
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week	***Total Credits***	**:**	3	
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total =100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth		***Month***	**:**	July2025	
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Design)					

Course Rationale: The Design & Development of CAD/CAM/CAE Engineering course provides comprehensive knowledge and hands-on experience in computer-aided design, manufacturing, and engineering analysis to enhance product development and innovation in engineering industries.

Course Objectives : The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To understand the methodologies for development of CAD/CAM/CAE Software and its customization.	**1.**	Analyze and apply advanced concepts in computer-aided design (CAD), including parametric modeling, geometric modeling, and feature-based design techniques.
		2.	Demonstrate proficiency in computer-aided manufacturing (CAM) processes, including toolpath generation, CNC programming, and simulation of machining operations.
		3.	Evaluate and implement CAE techniques such as finite element analysis (FEA), computational fluid dynamics (CFD), and multi-physics simulations for design validation and optimization.

Curriculum Content	**Hours**
Unit I **Introduction to Software Development:** Customization, Application Programming Interface (API), macros, scripts.	6

Unit II **Tools for Customization:** Object Oriented Programming (OOP), OLE interfaces in CAD/CAM software, Use of general programming interfaces like VB, VBS, VC++ ,JAVA, Open GL programming and System dependent programming interfaces like,Visual LISP (AutoCAD), GRIP (Unigraphics), Pro-Programming (Pro-Engineer), CATIA, SOLID WORKS etc.	6
Unit III **Computer-based System Engineering:** System engineering process, Software product development life cycle, software processes, software development project management, software prototyping	7
Unit IV **Rapid Development:** Core issues in rapid development, rapid development languages, life cycle planning and customer oriented development	7
Unit V **Solid Modeling Algorithms:** Euler operations, basic solid modeling algorithms Parametric Modeling: Computer Aided Process Planning, Parametric Modeling	7
Unit VI **Automated Solid Modeling using Customization:** Creating 2D, 3D and solid entities through API, Editing 2D, 3D and solid entities through API, Design and development of user interfaces- icons, menus, dialog boxes, integrating databases with CAD, creating bill of material or parts list, automated assembly modeling through customization, automated drafting and dimensioning using customization, creating automated animations using API and animation software.	7

Suggested Text Books:	
1.	"CAD/CAM: Computer-Aided Design and Manufacturing" by Mikell P. Groover and Emory W. Zimmers Jr.
2.	"CAD/CAM/CIM" by P. Radhakrishnan, S.Subramanyan, and V.Raju
Suggested Reference Books:	
1.	Rapid Development,-Steve McConnel, Micro soft Press
2.	Software Engineering– Ian Sommerville, Pearson Education
3.	Computer Graphics–Foley,VanDam, etal,Pearson Education
4.	Open GL Programming Guide –Mason Wooetal,
5.	Advanced AutoCAD–George Omura
6.	Customizing Auto CAD–Shyam Tickoo, Thomson Learning
7.	CATIA-Shyam Tickoo, Thomson Learning
8.	Solid Modelling–Martti Mantilya, Computer Science Press
9.	Solid Works API Using V B and C++-Custom Programming Unlimited LLC
10.	GRIP Programming Manuals for Unigraphics –Vol.I & II
11.	User Function Programming Manuals for Unigraphics –Vol.I,II & III User Manuals for CATIA

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3		3			2	2	
CO2	2	2	3		3		2	2	2	
CO3	3	3	3	3	3			2	2	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part & Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Theory of Elasticity And Plasticity (Elective-I)**		***Course Code*:**	**:**	MECADE1	
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week	***Total Credits***	**:**	3	
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth		***Month***	**:**	July2025	
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Design)					

Course Rationale: The Theory of Elasticity and Plasticity course provides a fundamental understanding of material behavior under stress, focusing on elastic and plastic deformation to support advanced structural and mechanical design analysis.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Analyze different types of stresses and strains in solids under various loading conditions.	1.	1. Analyze and predict stress and strain in elastic and plastic materials under different loading conditions.
2.	Develop skills to use differential equations and boundary conditions to solve elasticity problems.	2.	2. Apply mathematical and computational methods to solve elasticity and plasticity problems in engineering structures.
		3.	3. Understand and utilize yield criteria and plastic flow concepts to assess material behavior beyond the elastic limit.

Curriculum Content	**Hours**
Unit I **Analysis of Stress** Basic concepts: Body force, Surface Force, Stresses, Components of Stresses, State of stress at a point, Stress components on an arbitrary plane, Principal stresses, Shear stresses, Stress transformation, Mohr's circle in 3D, Plane stress, Differential equations of equilibrium, Boundary conditions, Stress invariants, Octahedral stresses, Decomposition of a state of stress.	7
Unit II **Analysis of Strain** Deformation, Strain displacement relations, Strain components, State of strain at a point, Dilatation, Compatibility conditions, Plane strain.	6
Unit III **Stress-Strain relations** Generalized Hookes Law in terms of elastic constants, Relations between elastic constants, Displacement equations of equilibrium, Saint Venants principle	6

Unit IV **Two dimensional problems in Cartesian co-ordinates** Airy‘s stress function, Biharmonic equilibrium equations, Investigation for simple beam problems: (a) Bending of a cantilever beam with end load. (b) Simply supported beam with uniform load. **Analysis of axi-symmetric problems and Torsion** Axi-symmetric problems: General equations in polar co-ordinates, Thick-walled cylinder subjected to external and internal pressure, Rotating disc as a 2D problem, Shrink fits Torsion: Torsion of prismatic (circular and elliptical cross-section) bars, Soap film analogy, Membrane analogy	7
Unit V **Energy Methods** Concept of elastic strain energy, Strain energy due to axial force, shear force, torsion, bending moment, Principle of superposition, Maxwell-Betti-Rayleigh reciprocal theorem, Castigliano‘s theorems, Principle of virtual work.	7
Unit VI **Plasticity** Basic concepts and yield criteria ; Plastic stress-strain relations, Prandtl- Rouss Saint Venant, Levy-Von Mises, Experimental verification of the Prandtl- Rouss equation Upper and lower bound theorems and corollaries, Application to problems: Uniaxial tension and compression, Stages of plastic yielding, Elasto-plastic analysis of torsion and bending problems, torsion of a bar of oval section (Sokoloskey's method), problems of spherical and axial symmetry, slip lines and plastic flow, strain hardening.	7

Suggested Text Books:	
1.	Sadhusingh,—Theory of Elasticity ‖, Khanna Publishers, New Delhi, Fourth Edition, 2012.2.
2.	WangC.T.,—Applied Elasticity ‖,McGrawHill,NewDelhi,1990.
3.	L.D. Landauand E.M. Lifshitz,—Theory of Elasticity,Vikas Publishing House Private.Ltd, New Delhi.
4.	T.G. Sitharam,—Applied Elasticity, Interline Publishing.
5.	Phillips, Durelliand Tsao,—Analysis of Stress and Strain McGrawHill BookCompany.
6.	Introduction to the Theory of Plasticity for Engineers-Haffman and Sachs,LLC,2012.
7.	Theory of plasticity-J Chakrabarty, Butterworth,2006.
8.	Plasticity for Mechanical Engineers -Johnson and Mellor,Van Nostrand,1966
Suggested Reference Books:	
1.	S. P. Timoshenkoand J N Goodier,—Theory of Elasticity ,McGraw Hill Book Company.
2.	L.S. Srinath,—Advanced Mechanics of Solid,Tata McGraw Hill Book Company.
3.	Richard G Budynas,—Advanced Strength and Applied Stress Analysis, McGrawHill, New Delhi, Second Edition,2011.
4.	Engineering Plasticity-Theory and Application to Metal Forming Process -R.A. C .Slater, McMillan Press Ltd.,1977
5.	Theory of Plasticity and Metal forming Process -Sadhu Singh, Khanna Publishers, Delhi, 1999.

Course Outcome and Program Outcome Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2			2	2	2
CO2	3	3	3	2	3			2	2	2
CO3	3	3	3	2	2			2	2	3

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part &Semester	**:**	**First Year M. Tech (CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Design of Hydraulic and Pneumatic systems (Elective-I)**			***Course Code*:**	**:**	MECADE1
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credit s***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Thermal)					

Course Rationale: The Design of Hydraulic and Pneumatic Systems course equips students with the knowledge and skills to design, analyze, and troubleshoot fluid power systems used in industrial automation and machinery.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To know the advantages and applications of Fluid Power Engineering and Power Transmission System.	1.	1. Identify hydraulic and pneumatic components.
2.	To learn the Applications of Fluid Power System in automation of Machine Tools and others Equipment's.	2.	2.Ability to design hydraulic and pneumatic circuits
		3.	3.Demonstrate good grounding in the subject area of fluid power
		4.	4. Appreciate the circuits and feel the advantages over the similar mechanical systems 5: Gain knowledge regarding the use of special control and regulation element.
		5.	6.Demonstrate good grounding in the subject area of fluid power

Curriculum Content	**Hours**
Unit I **Oil Hydraulic Systems:** Hydraulic power generators, Selection and specification of pumps, pump characteristics.	6
Unit II **Hydraulic Actuators :** Linear and Rotary Actuators-selection, specification and characteristics**.**	6
Unit III **Control and Regulation Elements:** Pressure, Direction and flow control valves, Relief valves, Non-return and safety valves, Actuation systems.	7

Unit IV **Hydraulic Circuits:** Reciprocation, quick return, Sequencing, synchronizing circuits, Accumulator circuits, Industrial circuits, Press circuits ,Hydraulic milling machine, Grinding, planning, Copying, Forklift, Earth mover circuits, Design and selection of components, Safety and emergency mandrels	7
Unit V **Pneumatic Systems and Circuits:** Pneumatic fundamentals, Control elements, Position and pressure sensing, Logic circuits, Switching circuits, Fringe conditions modules and these integration, Sequential circuits, Cascade methods, Mapping methods, Step counter method, Compound circuit design - combination circuit design.	7
Unit VI **Installation, Maintenance and Special Circuits:** Pneumatic equipment's, Selection of components, Design calculations, Application, Fault finding, Hydro pneumatic circuits, Use of microprocessors for sequencing, PLC, Low cost automation, Robotic circuits.	7

Suggested Text Books:	
1.	"Fluid Power with Applications" by Anthony Esposito
2.	"Design of Hydraulic Systems" by Esposito and Hoffman
3.	"Pneumatic Systems: Principles and Maintenance" by S.R. Majumdar
Suggested Reference Books:	
1.	Antony Espossito,"Fluid power withApplications",PrenticeHall,1980.
2.	Dudleyt, A. Pease and John J.Pippenger,"Basic Fluid Power",PrenticeHall,1987.
3.	Andrew Parr,"Hydraulic and Pneumatics",(HB),JaicoPublishingHouse,1999.
4.	Bolton. W."Pneumatic and Hydraulic Systems ", Butterworth-Heineman,1997.
5.	WebReferences:1.www.pneumatics.com2.www.fluidpower.com.tw

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	2	3		2					
CO2	3	3	3		3					
CO3	3	2	2		2					
CO4	2	2	2		2					1
CO5	3	2	2		3					
CO6	3	2	2		2					

Level of Mapping as: Low1, Moderate 2, High 3

Elective–II

Class, Part& Semester	**:**	**First Year M. Tech (CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Elective-II (Open Elective) Advanced Operating Systems**			***Course Code*:**	**:**	CSEOE11
Teaching Scheme (Hours)	**:**	Lecture:	03 Hrs/week		***Total Credits***	**:**	03
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**	Basic Knowledge of Computer Architecture, Operating Systems and Computer Networking is required					
Course Domain	**:**	Elective-I					

Course Rationale: The course aims to provide students with a solid foundation in distributed computing concepts, principles, and techniques. It prepares them to understand and tackle the complexities of Developing and managing distributed systems in various domains.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Provide the knowledge of principles and concepts of distributed computing systems, Models, design issues and environments.	**1.**	1.Explain the fundamental concepts, principles, and models underlying distributed computing systems
2.	Give the knowledge of communication Protocols, algorithms and Distributed Shared	**2.**	2.Distinguish the fundamentals of message Passing, remote procedure calls and design and implementation Issue of DSM
	Memory used in distributed systems.		
3.	Provide the knowledge of synchronization mechanisms, distributed algorithms for Consensus, mutual exclusion, and coordination**.**	**3.**	3.Analyze the fundamentals of distributed algorithms for consensus, mutual exclusion, And coordination used in distributed systems.
4.	Provide the Knowledge of Resource Management and Process Management in Distributed system.	**4.**	4.Analyze the fundamentals of Load balancing and Load-Sharing approach used in distributed Systems for task assignment.
5.	Familiarize the students about Distributed File Systems and Security.	**5.**	Discuss the distributed file systems and their design principles for data replication , fault tolerance, data consistency, scalability, Cryptography and Digital Signatures,
6.	Introduce the students the Case study of commercial distributed system.	**6.**	Apply their theoretical knowledge, deepen their understanding for real-world challenges in the design and implementation of distributed systems**.**

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	1	2								
CO2	1	2	2		1					
CO3	1	1	2	2						
CO4	1	1	1	1	2	2				
CO5	1	1	1	1	1	2	3	3		
CO6	1	1	1	1	1	2	2	2	1	1

Level of Mapping as: Low1, Moderate 2, High 3

Curriculum Content	**Hours**
Unit I-Distributed Computing System Fundamentals Introduction to distributed computing systems. Models, popularity, distributed operating system. Design issues of distributed operating system. Distributed computing environment.	04
Unit II-Communication Techniques in Distributed Computing Systems **Message Passing**: Features of a good message-passing system. Issuesin IPCby Message Passing. Synchronization, Buffering, Multidatagram Messages. Encoding and Decoding of Message Data, process addressing, failure handling, group communication. **Remote Procedure Calls**: RPC model. Implementing RPC mechanism. Stubgeneration, RPC messages, marshaling arguments and results. Server management. Parameter-passing semantics, call semantics. Communication protocols for RPCs, Client-Server Binding, Exception handling. Security, Special types of RPC, RPC in heterogeneous Environments, lightweight RPC. **Distributed Shared Memory:** General Architecture of DSM systems. Design and implementation Issues of DSM. Granularity, Structure of Shared Memory Space, Consistency models, Replacement strategy, Thrashing	12
Unit III-Synchronization Clock synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms	04
Unit IV-Resource and Process Management **Resource Management**: Features of global scheduling algorithm. Task assignment approach, Load –balancing and Load-Sharing approach. **Process Management**: Introduction, Process Migration, Threads	08
Unit V-Distributed File System and Security Issues **Distributed File Systems**: Features of Good DFS, File models, File- Accessing models. File-Sharing Semantics. File-Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions, Design principles, **Case study**: DCE Distributed File Service. **Security**: Potential Attacks to Computer systems, Cryptography, Authentication, Access Control, Digital Signatures, Design Principles, Case Study: DCE Security service	08
Unit VI-Case Study Case study of any commercial distributed system	03

Suggested list of Tutorials and Assignments: This Couse consists of a set of minimum 5to6 Tutorials based on the following topics

1. Introduction to Distributed Computing Systems
2. Message Passing and Remote Procedure Call and DSM
3. Synchronization in Distributed Computing Systems
4. Source and Process Management
5. Distributed File System and Security
6. Case Study of Distributed Computing Systems

Suggested Text Books :

1.	"Distributed Operating Systems Concepts and Design",P.K. Sinha, PHI.

Suggested Reference Books:

1.	"Modern Operating System",Singhal
2.	"Distributed Systems Concepts and Design",G. Coulouris,J. Dollimore & T. Kindberg
3.	"Modern Operating Systems",A.S. Tanenbaum, PHI.

Class, Part & Semester	**:**	**First Year M.Tech (CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Elective-II (Open Elective) Internet of Things**			***Course Code*:**	**:**	CSEOE12
Teaching Scheme (Hours)	**:**	Lecture:	3Hrs/week		***Total Credits***	**:**	3
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(If any)*	**:**	Basic Knowledge of Distributed System, Basic Knowledge of Java Programming, Basic Knowledge of Programming of application for mobile devices.					
Course Domain	**:**	Elective					

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Explain the fundamental principles of IoT, its architecture, and its role in modern Technology ecosystems.	**1.**	Identify and understand the unique charterships and components of IoT
2.	Explore hardware components like sensors, actuators, microcontrollers ,and IoT boards (e.g., Arduino, Raspberry Pi)	**2.**	Compare various development board ardino, Raspberry Pi, Beagle bone.
3.	Provide hands-on training on IoT plat for mssuchas A WSIoT,GoogleCloudIoT,orAzure IoT.	**3.**	Design a middle ware for IoT.
4.	Discuss IP addressing, IP v6, and IoT-Specific networking challenges.	4.	Analyze various protocols for IoT.
5.	Introduce methods for collecting, processing ,and storing data from IoT devices.	**5.**	Compare various IoT communication technologies and design various IoT applications.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3		2			2		2		3
CO2	3	3							2	
CO3	3		3					2		
CO4	3			2						2
CO5	3			2		2		2		2

Level of Mapping as:Low1, Moderate 2,High 3

Curriculum Content	**Hours**
Unit I-FUNDAMENTAL OF INTERNET OF THINGS(IoT) Definition and characteristics of IoT, Technical building blocks of IoT, Device, Communication technologies, Data, Physical design of IoT, IoT enabling technologies, IoT issues and challenges-Planning, costs and quality, security and privacy risks,	06
Unit II-IoT DESIGN METHDOLOGY IoT systems management, IoT Design methodology: Specifications, Integration and Application development	06
Unit III-COMMUNCATION OF IoT IoT protocols: MQTT, CoAP, XMPP and AMQT, IoT communication models, IoT communication technologies:Bluetooth,LTE-A,DTLS,Zigbee,Zwave,NFC,LiFi,Wi-Fi,Interfacing ofWi-Fi,RFID, Zigbee, NFC with development board.	06
Unit IV-BULIDING IoT WITH RASPBERRY AND GALILEO/ARUNIDO Physical device, Raspberry PI Interfaces: Programming -APIs/Packages, Web services, Intel Galileo Gen2 with Arduino: Interfaces, Arduino IDE, Programming APIs and Hacks, IoT standards, Cloud Computing for IoT, Bluetooth Low energy, Beacons.	06
Unit V-THE INTERNET OF THINGS TO THE WEB OF THINGS Resource-oriented Architectures and Best Practices-Designing REST fulsmart things-web enabling, constrained devices-the future web of things.	06
Unit VI- IoT APPLICATIONS AND CASE STUDIES Various real time applications of IoT, case studies: smart agricultural: characteristics and applications- scarecrow, smart irrigation system, crop water management, integrated pest management, sensor based filed and resource mapping, remote equipment monitoring. e-health: characteristics of e-health and applications-monitoring of health parameters, smart medicine box, elderly people monitoring, challenges, smart metering, smart home automation, smart cards, IoT in sports, IoT in smart cities/Transportation, smart parking.	06

Suggested Text Books:	
1.	Arshdeep Bahga, Vijay Madisetii,"Internet of Things-Ahandson approach", Universities Press.
2.	Berend Scholz-Reiter, Lorain Michahelles."Architecting the Internet of Things", Springer.
Suggested Reference Books	
1.	Cuno P fister,Getting started with the Internet of Things,O'ReillyMedia.
2.	Internet of Things: converging technologies for smart environments and intergerned ecosystems, Dr, Ovidiu Vermesan, Dr.Peter
3.	"The Internet of Things Connecting Objectsto the web" Hakima Chaouchi,Willy Publications.
4.	"Intel®GalileoandIntel®GalileloGen2:APLFeatures and Ardunio Projects for Linux Programmers",Manoel Carlos Ramon Apress.

Class, Part& Semester	**:**	**First Year M.Tech(CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Elective-II(Open Elective) Data Analytics**			***Course Code*:**	**:**	CSEOE13
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	:	3
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**	Basic knowledge of programming concepts and familiarity with Python programming language. Basic knowledge of mathematics and statistics					
Course Domain	**:**	Core					

Course Rationale: It allows researchers to understand the information gathered, test hypotheses, and draw conclusions. Analysis is the process of interpreting raw data through logical reasoning and applying various Statistical and analytical techniques to understand patterns, relationships, and trends with in the data.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Discuss fundamentals of data analytics, discuss constraints for data collection. Give opportunity to explore different types of Data sets and features.	**1.**	Identify and assess the opportunities, needs and constraints for data collection, and explore various types of datasets and features.
2.	Equip students with different data analytics Techniques using python.	**2.**	Analyze the business issues that data science and Analytics can address and resolve.
3.	Foster correlated data analysis, regression analysis and other techniques related to it.	**3.**	Identify the methods by which data can be collected, stored, secured, analyzed, interpreted, forecasted, visualized, reported and applied in a business environment
4.	Introduce decision tree and cluster analysis concepts. Introduce basic clustering algorithms.	**4.**	Describe how data can be interpreted beyond its basic analysis to tell a story relevant and meaningful to its organization, and how these stories can be utilized to gain competitive Advantage through strategic application
5	Discuss social media analysis, leaning models And validation rules in it.	**5.**	Design case studies on social media analytics.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	1		2						
CO2	1	2	2	2	3					
CO3	1	2	2	3	3					
CO4	1	3	2	3	3					
CO5	1	2	3	3	3					

Level of Mapping as: Low1, Moderate 2 ,High3

Curriculum Content	**Hours**
Unit I: Fundamentals of Data Analytics Data Analytics Basics, Data Types, Analytics Types, Data Analytics Steps: Data Pre-Processing, Data Imputation, Data Cleaning, Data Transformation, Data Visualization, and Data Engineering. Descriptive, Predictive, and Prescriptive Analytics.	**8**
Unit II: Data Analytics with Python Data Analytics using Python, Statistical Procedures, Web Scrapingin Python, Advance danalytics, NumPy, Pandas, SciPy, Matplotlib	**8**
Unit III: Correlated Data Analysis Analysis of Variance and Co-Variance, ANOVA results, Chi-Square Statistical Test, Examine Regression results, Regressing Analysis, Linear Regression and its analysis, Logistic Regression and its analysis	**7**
Unit IV : Decision Trees and Cluster Analysis Decision Tree Problem Analysis, Decision tree Construction, Decision Tree Algorithms; Applications of Cluster Analysis, Definition of Cluster, representing clusters, Clustering Techniques,K-MeansAlgorithmforClustering,AdvantagesandDisadvantagesofK-Means Clustering.	**9**
Unit V: Social Media Analytics Data sets, Analysis of Social Network Data set Features, Learning Models and Validation, Association Rule Mining, artificial Neural Networks for web analytics.	**8**

Suggested Text Books/Reference Books/Manual	
1	Anil Maheshwari,"Data Analytics made accessible,"AmazonDigitalPublication,2014.
2	Song, PeterX.-K, "Correlated Data Analysis: Modeling, Analytics, and Applications", Springer-VerlagNewYork2007
3	GlennJ. Myatt, WayneP .Johnson, "Making Sense of DataI: Apractical Guide to Exploratory Data Analysis and DataMining",Wiley2009
Reference Books	
1	Thomas H. Davenport, Jeanne G. Harris and Robert Morison,"Analyticsat Work: Smarter Decisions,BetterResults",HarvardBusinessPress,2010
2	Rachel Schutt, CathyO' Neil, "Doing Data Science",O' REILLY, 2006.
3	Shamanth Kumar Fred Morstatter Huan Liu"Twitter Data Analytics",Springer-Verlag,

Class, Part &Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-I**					
Course Title	**:**	**Advanced Communication System (Elective-II)**			***Course Code*:**	**:**	ETCOE11
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE=60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	Analog and Digital Communication					
Course Domain	**:**	Communication					

Course Rationale*:* Advanced Communication refers to the utilization of sophisticated technologies to enable seamless connectivity and interaction between various devices and systems, leading towards a more interconnected global community.

Course Objectives: The Course teacher will		*Course Outcomes:* Students will be able to	
1.	Provide understanding of advanced concepts of data communication.	1	Understand the concepts and technologies Used in the data communication domain.
2.	Along with basics it also covers the protocols like USART, USB, I2C , CAN etc.	2	Understand the various protocols used in the various data communication applications.
3	Provide student with theoretical background and applied knowledge so that they can design an optimum Single and multi-carrier communication system under given power, spectral and Error performance constraints.	3	Get knowledge about latest trends in the data communication field
4	Analyze the error performance of Digital modulation techniques.	4	Analyze the design parameters of a single And multi-carrier communication system.
5		5	Use mathematical tools to analyze the Performance of communication systems.
		6	Use probability theory and stochastic Processes in communication system applications.

Curriculum Content	**Hours**
Unit I Digital Modulation Schemes: BPSK,QPSK,8PSK,16PSK,8QAM,16QAM,DPSK– Methods, Bandwidth Efficiency, Carrier Recovery, Clock Recovery.	6

Unit II Multiplexing: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Multiplexing Application, SMDS Switching: Circuit Switching, Packet Switching, Message Switching. Networking and Interfacing Devices: Repeaters, Bridges, Routers, Gateway, Other Devices.	7
Unit III Basic Concepts of Data Communications, Interfaces and Modems: Data Communication Networks, Protocols and Standards, CAN, UART, USB, I2C, I2S, Line Configuration, Topology,TransmissionModes,DigitalDataTransmission,DTE-DCEinterface,Categoriesof Networks – TCP/IP Protocol suite and Comparison with OSI model.	7
Unit IV Error Correction: Types of Errors, Vertical Redundancy Check(VRC),LRC,CRC, Checksum, Error Correction using Hamming code Data Link Control: Line Discipline, Flow Control, Error Control Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocols, Bit-Oriented Protocol, Link Access Procedures.	7
Unit V Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Avoidance(CSMA/CA),Controlled Access-Reservation Polling-Token Passing.	6
Unit VI Channelization, Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA), Orthogonal Frequency-Division Multiplexing (OFDM) and Orthogonal Frequency-Division Multiple Access (OFDMA).	7
Suggested list of Tutorials and Assignments: As suggested by the course teacher	
Suggested Text Books:	
1.	Data Communication and Computer Networking-B.A.Forouzan,2ndEd.,2003,TMH.
2.	Advanced Electronic Communication Systems-W.Tomasi,5thEd.,2008,PEI
Suggested Reference Books:	
1.	Data and Computer Communications - William Stallings, 8thEd., 2007, PHI.
2.	Data Communication and Tele Processing Systems - T. Housely ,2nd Ed, 2008, BSP.
3.	Data Communications and Computer Networks - Brijendra Singh, 2nd Ed., 2005, PHI.
4.	Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
5.	Manufacturers Device data sheets

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3									
CO2	2	3							2	
CO3				2						2
CO4			2			3				3
CO5	2	2							3	
CO6		2				2				

Level of Mapping as : Low1, Moderate2, High3

Class, Part & Semester	**:**	**First Year M. Tech (CAD/CAM/CAE), Part I, Sem - I**					
Course Title	**:**	**Reconfigurable Computing (Elective -II)**			***Course Code*:**	**:**	ETCOE 12
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	FP GA Basics					
Course Domain	**:**	**Design and Computing**					

Course Rationale: Reconfigurable (adaptive) computing is a novel yet important research field investigating the capability of hardware to adapt to changing computational requirements such as emerging standards, late design changes, and even to changing processing requirements arising at run-time. Reconfigurable computing thus benefits from a)the programmability of software similar to the V on Neumann computer and b) the speed and efficiency of parallel hardware execution.

Course Objectives : The Course teacher will able to		***Course Outcomes:*** Students will be able to	
1.	Make students to understand various computing architectures	**1.**	Understand the concept of reconfigurable computing and its integration on computing platforms.
2.	Provide students the concept of handling issues of reconfigure computing	**2.**	Design, implement and analyze reconfigurable systems in the recent Application domains using HDL.
3.	Provide students implementation approaches of FPGA design in view of reconfiguration	**3.**	Use advanced EDA tools to simulate and synthesize HDL codes for reconfigurable architectures.
4.		**4.**	get familiar with the possibilities and rapidly growing interest in adaptive hardware and corresponding design techniques
5.		**5.**	Analyze the existing Reconfigurable Processing Fabric (RPF) Architectures

Curriculum Content	**Hours**
Unit I Domain of RC: General Purpose Computing, Domain-Specific Processors, Application-Specific Processors, Reconfigurable Computing, Fields of Application. Architecture of Field Programmable Gate Arrays	6

Unit II Reconfigurable Processing Fabric (RPF) Architectures: Fine grained, Coarse-Grained, Integration of RPF into Traditional Computing Systems. Early systems of Reconfigurable computing: PAM, VCC, Splash, PRISM, Teramac, Cray, SRC, non-FPGA research, other issues.	7
Unit III Contexts, Context switching; Area calculations for PE Efficiency, ISP, Hot Reconfiguration; Case study. Architectures for existing multi FPGA systems, Arrays for fast computations, CPLDs, FPGAs, Multi context, Partial Reconfigurable Devices; TSFPGA, DPGA, Mattrix; Best suitable approach for RD; Case study Reconfiguration Management: Reconfiguration, Configurationarchitectures,managingreconfigurationprocess,reducingreconfigurationtime, configuration security.	7
Unit IV RC Applications: Implementing applications with FPGAs, various applications and use of reconfiguration: Video Streaming, , Distributed arithmetic, Adaptive Controller, Adaptive cryptographicsystems,SoftwareDefinedRadio,High-PerformanceComputing,Automatic target recognition systems.	7
Unit V Implementation: Integration, FPGA Design Flow, System On A Programmable Chip: Introduction to SoPC, Adaptive Multiprocessing on Chip. Reconfiguration Project Design Approaches: J-Bit, Modular, Early Access, Vivad.	7
Unit VI Software challenges in System on chip; Test ability challenges; Case studies. Modeling, Temporal partitioning algorithms, Online temporal placement, Device space management.	6
Suggested list of Tutorials and Assignments : As suggested by the course teacher	
Suggested Text Books:	
1.	Wolf Wayne, FPGA Based System Design, Pearson Edu, 2004.
2.	Hauck Scott, Dehon A, "Reconfigurable Computing: The Theory and Practice of FPGA - Based Computation", Elsevier.
Suggested Reference Books:	
1.	Viva do Partial Reconfiguration. Pdf: user guide 909 by Xilinx Revision: 04/06/2016
2.	Maya Gokhale, Paul Ghaham, "Reconfigurable Computing", Springer Publication.
3.	Bob da Christophe, "Introduction to Reconfigurable Computing : Architectures, Algorithms, and Applications", Springer.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3			2				2		
CO2		3				2			2	
CO3				2						
CO4			2					3		
CO5		3			2					2
CO6										

Level of Mappingas:Low1, Moderate2, High3

Class, Part & Semester	**:**	**First Year M. Tech (CAD/CAM/CAE), Part I, Sem-I**					
Course Title	**:**	**VLSI Testing & Testability (Elective -II)**			***Course Code*:**	**:**	ETCOE 13
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=1 00	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	Basic knowledge in the following areas : digital design, optimization algorithms, and computer architecture.					
Course Domain	**:**	**VLSI**					

Course Rationale: VLSI testing verifies the functionality and detects defects in integrated circuits, while testability focuses on making designs easier to test, improving efficiency and reducing costs.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Introduce design process in VLSI	1.	Accept challenges in VLSI Testing at different abstraction levels
2.	Teach the logical and Fault simulation models	2.	Understand fault models for generation of test vectors
3.	Make students to learn techniques for design of testability	3.	Calculate observability and controll ability Parameters of circuit
4.	Make students to study hardware and software verification issues for testing	4.	Enhance testability of a circuit. Use simulation techniques for designing and Testing of VLSI circuits

Curriculum Content	**Hours**
Unit I Introduction to the concepts and techniques of VLSI (Very Large Scale Integration) design verification and testing, VLSI testing process and test equipment, test economics and product quality	7
Unit II	7
Fault modeling, testing and verification in VLSI design process, test methods, logic and fault simulation, modeling circuits for simulation, algorithms for true- value simulation and Algorithms for fault simulation.	
Unit III Statistical methods for fault simulation, testability measures, combinational circuit generation, sequential circuit test generation, memory test.	6

Unit IV Fault Simulation Application and Methods: Fault Simulation, Fault Simulation Applications, Fault Simulation Technologies. Test pattern Generation Methods and Algorithm: Test Generation Basics, Controllability and Observability, Random Test Generation.	6
Unit V Design for testability, Scan and Boundary scan architectures, Built-in Self-test (BIST) and current-based testing, analog test bus standard, System test and core-based design, ATPG, Embedded core test fundamentals.	7
Unit VI Design verification techniques based on simulation, analytical and formal approaches. Functional verification. Timing verification. Formal verification. Basics of equivalence checking and model checking. Hardware emulation.	7
Suggested list of Tutorials and Assignments: A suggested by the course teacher	

Suggested Text Books:	
1.	Bushnell ML, Agrawal VD, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers.
2.	A bramovici M, Breuer MA and Friedman AD, "Digital systems and Testable Design", Jaico Publications.
Suggested Reference Books:	
1.	Crouch AL, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall.
2.	KropfT, "Introduction to Formal Hardware Verification," Springer Publications
3.	Niraj K. Jha, Sandeep Gupta, Testing of Digital Systems, 1st edition, Cambridge University Press, 2003. ISBN:0521-77356-3
4.	M. Abramovici, M.A. Breuerand A.D. Figriieta, Digital Systems Testing and Testable Design, Wiley-IEEE Press,1994, ISBN:978-0-7803-1062-9.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3					2				
CO2		3		2					1	
CO3				2		3				
CO4	3		2						2	
CO5						2				
CO6										

Level of Mapping as : Low 1, Moderate 2, High 3

Class, Part & Semester	:	**First Year M. Tech (CAD/CAM/CAE), Part I, Sem-I**					
Course Title	:	**Seminar - I**			***Course Code*:**	:	ME CAD C 14
Teaching Scheme (Hours)	:	Practical :	2 Hrs/week		***Total Credits***	:	1
Evaluation Scheme (Marks)	:	IE= 50 Marks	EOE= ---	Total= 50 marks	***Duration of EPE***	:	----
Revision:	:	Fourth			***Month***	:	July 2025
Pre-requisites *(if any)*	:	Advance Technology Studies					
Course Domain	:	Technology Exchange					

Course Rationale: Seminar-I course is designed to prepare students for their thesis research by developing critical skills in literature review, technical communication, and presentation. It encourages independent learning and helps students identify research gaps and formulate focused research problems, laying a strong foundation for advanced study and innovation in their field.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To enhance communication skills through effective presentation and discussion of technical topics.	1	Demonstrate the ability to conduct literature surveys and critically analyze technical papers related to their research area.
2.	To foster independent learning and the ability to identify and formulate research problems for advanced study.	2	Develop skills to identify research gaps and formulate problem statements for their thesis work.

Curriculum Content

Seminar - I should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation.

Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approval by the guide and endorsement of the Head of Department.

The student has to deliver a seminar talk infront of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	3	2		1	2	2	1
CO2	2	3	3	3	2		1	2	3	1

Level of Mapping as : Low1, Moderate2, High3

Class, Part & Semester	:	**First Year M. Tech (CAD/CAM/CAE), Part I, Sem-I**					
Course Title	:	**Design & Analysis Laboratory-I**			***Course Code*:**	:	ME CAD C 15
Teaching Scheme (Hours)	:	Practical:	2Hrs/week		***Total Credits***	:	1
Evaluation Scheme (Marks)	:	IE = 50 marks	EOE=-----	Total = 50	***Duration of EPE***	:	----
Revision:	:	Fourth			***Month***	:	July 2025
Pre-requisites *(if any)*	:						
Course Domain	:	Core (Design)					

Course Rationale : The Design & Analysis Laboratory-I course provides hands-on experience in applying design principles and computational analysis tools to evaluate and optimize mechanical components and systems.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To provide hands-on experience in using CAD and CAE software tools for design and analysis of mechanical components.	1.	Use CAD and CAE software to model, simulate, and analyze mechanical components effectively
2.	To develop skills in applying computational methods for stress, strain, and thermal analysis of engineering structures.	2.	Interpret and validate analysis results to make informed design decisions.
3.	To enhance the ability to interpret simulation results and validate them with theoretical concepts.	3.	Develop practical skills in solving real-world engineering problems using computational tools.

List of Experiments

Minimum eight assignments are to be completed on following are a using appropriate software.

1.	Structural Analysis
2.	Thermal Analysis
3.	Fluid Flow Analysis
4.	Coupled Field Analysis
5.	Modal Analysis

- Minimum two problems shall be solved with hand calculations.
- In addition to above a visit to some facility where any of the above is actually used to prepare report of the same

Suggested Text Books / Reference Books / Manual

1.	"Engineering Design: A Project-Based Introduction" by Clive L. Dym, Patrick Little, Elizabeth Orwin, and Richard J. Doyle
2.	The Finite Element Method in Engineering by S. S. Rao
3.	"Mechanical Engineering Design" by J.E. Shigley, Charles R. Mischke, and Richard G. Budynas

4	"Machine Design: An Integrated Approach" by Robert L. Norton
5.	"Introduction to Finite Element Analysis Using MATLAB® and Abaqus" by Amar Khennane

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	3			2	2	1
CO2	2	3	3	2	2			2	2	1
CO3	2	3	3	2	3	2		2	3	2

Level of Mapping as : Low1, Moderate2, High3

Class, Part & Semester	**:**	**First Year M.Tech (CAD/CAM/CAE), Part I, Sem-I**					
Course Title	**:**	**CAD/CAM Laboratory - I**			***Course Code*:**	**:**	ME CAD C16
Teaching Scheme (Hours)	**:**	Practical:	2 Hrs / week		***Total Credits***	**:**	1
Evaluation Scheme (Marks)	**:**	IE=50	EOE=--- Marks	Total=50 marks	***Duration of EPE***	**:**	----
Revision:	**:**	Fourth			***Month***	**:**	July 2026
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Design)					

Course Rationale: The CAD/CAM Laboratory-I course offers practical training in computer-aided design and manufacturing software, enabling students to create, simulate, and fabricate engineering models effectively.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To learn graphics software	1.	Operate graphics software for various Cad applications.
2.	To perform various CAD operations using software	2.	Carry out programming for optimization of design.
3.	To learn programming for analysis of mechanical elements	3.	Use customized software for real application of CAD.

List of Experiments

Sr. No.	**Experiments**
1.	Introduction to Modeling software: 2D drawing and drafting using sketcher workbench – 2 drawings 3D modeling and drafting using 3D features – 5models Assembling and drafting of 2 assemblies with interference checking. Surface modeling – 4 exercises
2.	Computer aided manufacturing: CNC Lathe – 4exercises CNC Machining Center – 4exercises Generation of tool path, generation of NC code, Optimization of tool path (to reduce machining time) using any CAM software.
3.	Co-ordinate Measuring Machine: Case study: Inspection of a component using different probes, generation of report and interface (for example - Gears, Housings, Flywheels, Walls of machine structure, etc.)

Suggested Text Books / Reference Books / Manual

1.	"CAD/CAM: Computer-Aided Design and Manufacturing" by Mikell P. Groover and Emory W. Zimmers Jr.
2.	"CAD/CAM Theory and Practice" by Ibrahim Zeid
3.	"Solid Works 2023 for Designers" by Prof. Sham Tickoo
4.	"Computer-Aided Manufacturing" by Michael P. Groover

Course Outcome and Program Outcome Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2		3	2		2	1	
CO2	3	3	3	2	3			2	2	
CO3	3	2	3	2	3	1		2	2	1

Level of Mapping as: Low1, Moderate 2, High 3

Semester-II

Class, Part & Semester	:	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-II**				
Course Title	:	**Intellectual Property Rights**			***Course Code*:**	: MECADAC2
Teaching Scheme (Hours)	:	Lecture: 2 Hrs/week Tutorial: -- Hrs/week			***Total Credits***	: 2
Evaluation Scheme (Marks)	:	IE=50	ESE= Nil	Grand Total=50	***Duration of ESE***	: —-
Revision:	:	Fourth			***Month***	: July2025
Pre-requisites *(if any)*	:	Basic Legal Awareness, Digital Literacy				
Course Domain	:	Audit Course				

Course Rationale: The course on Intellectual Property Rights (IPR) is designed to provide students with an in-depth understanding of the importance of intellectual property in fostering innovation, creativity, and economic development. As the global economy becomes increasingly knowledge-driven, protecting and managing intellectual property is critical for individuals, organizations, and nations.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	Provide a comprehensive understanding of the concept, origin, and types of Intellectual Property Rights(IPR)and their significance In the global context.	1	Explain the fundamental concepts, origin, and significance of various types of Intellectual Property Rights (IPRs) in Protecting innovations and creations.
2	Introduce the legal framework of IPR, including the TRIPS agreement and its relationship with the WTO	2	Apply the knowledge of patent laws, registration procedures, and infringement Remedies in the protection of inventions and technologies
3	Familiarize students with the processes and laws related to patents, copyrights, and trademarks, along with their infringements And remedies	3	Demonstrate an understanding of copyright laws, including software copyrights, piracy issues, and the Remedies for in fringement.
4	Understand the significance of designs, geographical indications, and layout designs, as well as the irprotection under International and national laws.	4	Analyze and manage issues related to trademarks, including registration, infringement, and offenses in cyber space, Such as domain name disputes.
5	Explore the legal provisions and ethical considerations related to the Information Technology Act, 2000, including cybercrime, e-commerce, and digital signatures.	5	Evaluate the legal framework for design protection, including the Semiconductor Integrated Circuits Layout Design Act and international conventions.

6	Develop the ability to identify, register, and manage intellectual property rights in various domains, including traditional knowledge and modern technologies.	6	Assess the implications of the Information Technology Act, 2000, particularly in the areas of e-governance, e-commerce, digital signatures, and Combating cybercrime.

Curriculum Content	**Hours**
Unit I Introduction to IPR: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights, Introduction to TRIPS and WTO, Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade; Secret and trade dress, Design, Layout Design, Geographical Indication, Plant. Varieties and Traditional Knowledge	5
Unit II Patent Rights and Copy Rights— Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties	5
Unit III CopyRight—Origin,Definition&TypesofCopyRight,Registrationprocedure,Assignment & license, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software	4
Unit IV Trade Marks: Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks,Infringement&Remedies,OffencesrelatingtoTradeMarks,PassingOff,Penalties. Domain Names on cyber space	4
Unit V Design- Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000**.**	4
Unit VI BasicTenentsOfInformationTechnologyAct-2000, IT Act-Introduction, E-Commerce And legal provisions,E-Governanceandlegalprovisions,DigitalsignatureandElectronic Signature. Cybercrimes.	5

Suggested Text Books	
1.	Intellectual Property Rights and the Law, Gogia Law Agency, by Dr. G.B.Reddy
2.	LawrelatingtoIntellectualProperty,UniversalLawPublishingCo,byDr.B.L.Wadehra
3.	IPR by P. Narayanan
Suggested Reference Books:	
1.	Law of Intellectual Property, Asian Law House, Dr.S.R. Myneni.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1						2		2		
CO2						3	3	2		
CO3						3	2			
CO4						3	2			
CO5						3	2			
CO6						3	2	2		

Level of Mapping as: Low1 ,Moderate 2, High 3

Class, Part &Semester	**:**	**First Year M.Tech (CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Rapid Manufacturing**			***Course Code*:**	**:**	MECADC21
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Production)					

Course Rationale: This course equips students with skills in advanced digital fabrication techniques to accelerate product development and production. It prepares learners to meet modern industry demands by integrating innovative manufacturing technologies for efficiency and flexibility.

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.	1.	Understand history, concepts and terminology of additive manufacturing
		2.	Apply the reverse engineering concepts for design development
		3.	Understand the variety of additive manufacturing techniques
		4.	Design and develop newer tooling models
		5.	Analyse the cases relevant to mass customization and some of the important research challenges associated with AM.

Curriculum Content	**Hours**
Unit I **Design Potential of Rapid Manufacturing:** Definition of rapid manufacturing (RM), rapid prototyping (RP) and rapid manufacturing, areas of application. Conventional design for manufacturing and assembly (DFM, DFMA), impact of RM on DFA and DFMA, Geometrical freedom, design complexity/ optimization, parts consolidation, body fitting customization and multiple assemblies manufactured as one, Customer input and customization, CAD environment For RM	6

Unit II **RM Processes:** Liquid based processes, Powder based processes and Solid based processes; RP Processes : Process overviews, STL file Generation, File Verification & Repair, Build File Creation, Part Construction, Part Cleaning and finishing, Process Strength & limitations, Classes of RP systems: 3D Printers, Enterprise Prototyping centers, Direct digital tooling, Direct digital manufacturing, system classification, Stereo lithography, SL with photo polymerization, SL with liquid thermal polymerization, Selective Laser Sintering, Fused deposition modeling, Laminated object manufacturing, Laser powder forming.	7
Unit III Issues,viscousflow,photo-polymerization,sintering,infiltration,mechanical properties, Materials for RM processes, Prototype properties: Material properties, color, dimensional accuracy, stability, surface finish, machinability, environmental resistance, operational properties; functionally graded materials (FGM composites), processing technologies for FGMs, laser sintering, thermal and mechanical properties of FGM, Deposition systems and applications.	7
Unit IV **Applications of RP & RM:** Design, Concept Models, Form and fit checking, Ergonomic Studies, Functional testing, CAD data verification, Automotive applications- Parts of racing cars, Applications in Aerospace industry, Construction industry, Retail industry, Archeology, Paleontology and forensic science, miniaturization.	7
Unit V **Rapid Tooling:** Mold making, Metal spraying, Rapid tooling for die, squeeze and permanent mold casting, Rapid manufacturing of sheet metal forming tools, casting pattern plates by rapid tooling, RP for series production investment casting.	7
Unit VI **Management Issues of RM:** Machine costs for RM, material cost, labour cost, comparison of cost of RM with cost of injection molding; Cost of manufacturing by RM, overheads, stock and WIP, location and distribution, supply chain management in RM	6

Suggested Text Books:	
1.	"Rapid Manufacturing: An Industrial Revolution for the Digital Age" by Andreas Gebhardt
2.	"Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" by Ian Gibson, David W. Rosen, and Brent Stucker
3.	"Additive Manufacturing: Materials, Processes, Quantifications and Applications" by Rafiq Noorani
Suggested Reference Books:	
1.	Rapid Manufacturing: An Industrial Revolution for the Digital Age Editors N. Hopkinson, R.J.M. Hague and P.M. Dickens, (2006) John Wiley & Sons, Ltd., ISBN-10 0-470-01613-2
2.	FrankW.Liou,RapidPrototyping&engineeringapplications,CRCPress,ISBN978-0-8493-3409-2
3.	RapidPrototypingtheory&practice,ManufacturingSystemEngineeringSeries,AliK.Kamarani, Springer Verlag
4.	Rapid Prototyping-casebook, J.A. McDonalds, C.J. Ryall,Wiley Eastern

5.	Rapid&VirtualPrototyping&applications,C.E.Bocking,AEWRennie,WileyEastern
6.	CarmenGabrielaBĂCILĂ*,Zoltan-GaborBAKI-HARI,"TheMainApplicationsofRapidTooling,‖RECENT,Vol.8,nr.3a(21a), November,2007
7.	JohnF.Wallace,DavidSchwam,‖Rapidmanufacturingofsheetmetalformingtools,‖CaseWestern Reserve University
8.	A.Pereira,J.A.Pérez,J.L.Diéguez,G.PeláezandJ.E.Ares,—Designandmanufactureofcasting pattern plates‖, by rapid tooling, Archives of Materials Science, Vol. 29, No. 1-2, 2008 63
9.	UsingRPforSeriesProductionInvestmentCastings,TomMueller,ExpressPattern
10.	Mechanical Vibrations(Fourth Edition)–SSRao, Pearson Education
11.	Fundamentals of Mechanical Vibrations –S Graham Kelly, McGraw-Hill
12	Mechanical Vibrations–G.K. Groover, Nemchand &Brothers, Roorkee.
13.	Fundamentals of Machine Component Design –R.C.Juvinall

Course Outcome and Program Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2			2			1	2	1
CO2	3	3	3	2	2			2	2	2
CO3	3	2	2		3			1	2	1
CO4	3	3	3		3	2	2	2	2	2
CO5	2	3	2	3	2			2	3	3

Level of Mapping as : Low 1, Moderate 2, High 3

Class, Part & Semester	:	**First Year M.Tech (CAD/CAM/CAE),Part I, Sem-II**					
Course Title	:	**Computational Methods**			***Course Code*:**	:	MECADC22
Teaching Scheme (Hours)	:	Lecture:	3 Hrs/week		***Total Credits***	:	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	:	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	:	2hrs
Revision:	:	Fourth			***Month***	:	July2025
Pre-requisites *(if any)*	:						
Course Domain	:	Core					

Course Rationale: This course introduces students to essential computational techniques for solving complex engineering and scientific problems. It builds skills in algorithm development, numerical analysis, and software tools to enhance problem-solving efficiency.

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	To familiarize students with computational methods in engineering problems.	1.	Solve systems of linear and non-linear equations using numerical techniques.
2.	To expose the students to numerical solutions of partial.	2.	Apply numerical techniques for integrating complicated functions.
3.	To apply finite element method for nonlinear and structural dynamic problem.	3.	Understand and use of regression method for curve fitting.
		4.	Analyze boundary value problems.
		5.	Numerical solutions of partial differential equations Parabolic, elliptical method

Curriculum Content	**Hours**
Unit I **Introduction:** Numerical methods, Systems of linear equations: Matrix notation, Determinants and inversion, Iterative methods, Relaxation methods. Solution of non-linear equations: Bisection method, Newton's method, computer programs.	6
Unit II **Curve fitting and approximation of functions:** Least square approximation, fitting of non-linear curves by least squares, regression analysis, multiple linear regression, nonlinear regression, computer programs.	7
Unit III **Numerical integration:** Newton-Cotes integration formulas, Trapezoidal Rules, Simpson's rules, Gaussian quadrature- One point, Two point, Three point, Adaptive integration.	7

Unit IV **Boundary value problems**: Characteristic value problems: Shooting method, Derivative boundary conditions, Rayleigh–Ritz method, and Characteristic value problems.	7
Unit V **Numerical Differentiation :** Introduction to finite difference approximations, Derivation of generalized finite difference approximation of any order and accuracy, truncation error analysis, Richardson's extrapolation	7
Unit VI **Numerical solutions of partial differential equations:** Parabolic, Explicit method, Implicit Method, Crank-Nicolson method, , Elliptic PDE , Laplace's equation, Iterative methods Poisson equation, Derivative boundary conditions, ADI method. Hyperbolic partial differential equations: Method of characteristics, Wave equation, finite difference method, stability, wave equation in two space dimensions, computer programs.	6

Suggested Text Books:	
1.	Gupta S.K.(1995) Numerical Methods for Engineers, New Age International.
2.	Chapra S.C. and Canale R.P.(2006) Numerical Methods for Engineers, 5th Ed; McGraw Hill.
Suggested Reference Books:	
1.	Numerical Solution of Partial Differential Equations, K. W. Morton and D. F. Mayers, Cambridge University Press
2.	The finite Difference Methods in Partial Differential Equations, A. R. Mitchell and D. F. Griffiths, John Wiley
3.	J.B. Doshi, Differential Equations for Scientists and Engineers, Narosa, 2010
4.	Kreyszig, Erwin, I.S., Advanced Engineering Mathematics, Wiley, 1999
5.	C. F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education Asia, New Delhi, Sixth Edition, 2006.

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2			2	2	
CO2	3	2	3	2	2			2	2	
CO3	3	2	2	2	2			2	2	
CO4	3	3	3	3	2			2	2	
CO5	3	3	3	3	2			2	2	

Level of Mapping as :Low 1, Moderate 2, High 3

Class, Part & Semester	:	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	:	**Modeling and Simulation**			***Course Code*:**	:	MECADC23
Teaching Scheme (Hours)	:	Lecture:	3 Hrs/week		***Total Credits***	:	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	:	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	:	2hrs
Revision:	:	Fourth			***Month***	:	July2025
Pre-requisites *(if any)*	:						
Course Domain	:	Core (Design)					

Course Rationale: This course develops students ability to model real-world systems and analyze their behavior using simulation techniques. It enhances decision-making and design optimization across engineering and scientific applications.

Course Objectives:		***Course Outcomes:*** Students will be able to	
1.	This subject will give an exposure to the students about plastics and the various manufacturing technologies available for their fabrication.	1.	1. Understand basic probability and statistics.
		2.	2. Understand the principle of modeling, basic simulation modeling and role & advantages of simulation.
		3.	3. Understand different techniques of system simulation and dynamics.
		4.	4. Understand the concept of simulation of Mechanical systems

Curriculum Content	**Hours**
Unit I **Introduction:** A review of basic probability and statistics, random variables and their properties, Estimation of means variances and correlation.	6
Unit II **Physical Modeling:** Concept of System and environment, Continuous and discrete systems, Linear and non-linear systems, Stochastic activities, Static and Dynamic models, Principles of modelling, Basic Simulation modelling, Role of simulation in model evaluation and studies, advantages of simulation.	7
Unit III **System Simulation:** Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages.	7

Unit IV **System Dynamics:** Growth and Decay models, Logistic curves, System dynamics diagrams. Probability Concepts in Simulation: Stochastic variables, discrete and continuous probability functions, Random numbers, Generation of Random numbers, Variance reduction techniques, Determination of length of simulation runs.	7
Unit V **Simulation of Mechanical Systems:** Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic and pneumatic systems. **Simulation of Manufacturing Systems:** Simulation of waiting line systems, Job shop with material handling and Flexible manufacturing systems, Simulation software for manufacturing, Structure and development of expert systems.	7
Unit VI **Neural Network Modeling of Systems only with Input-output Database:** Neurons, architecture of neural networks, knowledge representation, learning algorithm. Multilayer feed forward network and its back propagation learning algorithm, Application to complex engineering systems and strategy for optimum output.	6

Suggested Text Books:	
1.	Simulation Modeling and Analysis, Averill Law, Elsevier
2.	Principles Of Modeling And Simulation by John A Sokolowski and Catherine M Banks, John Wiley
3.	Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation", 2nd Edition. Academic press 2000
Suggested Reference Books:	
1.	Theory of Modeling and Simulation, Bernard P. Zeigler, Alexandre Muzy, Ernesto Kofman, Elsevier
2.	Ogata K " Modern control Engineering" 3 rd edition. Prentice hall of India 2001

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2		2			2	3	
CO2	2	3	3		3			2	2	
CO3	2	3	3		3			2	2	
CO4	2	3	3		3			2	2	

Level of Mapping as: Low1, Moderate 2, High 3

Elective-III

Class, Part &Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-II**				
Course Title	**:**	**Nano Technology**		***Course Code*:**	**:**	MECADE2
Teaching Scheme (Hours)	**:**	Lecture: 3 Hrs/week Tutorial: -- Hrs/week		***Total Credits***	**:**	3
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60 Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth		***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**					
Course Domain	**:**	Core				

Course Rationale: This course introduces the principles and applications of nanotechnology, focusing on the manipulation of materials at the nanoscale. It equips students with the knowledge and skills to innovate in fields like electronics, medicine, and materials scienc*e*

Course Objectives: The Course teacher will		***Course Outcomes :***Students will be able to	
1.	To understand the concepts and context of MEMS and nanotechnology	1.	Recognize the history, background and the nature of the Nano science and technology.
		2.	State the different type of nanostructures and analyze the top down and bottom up approach for nano- scale device preparation and differentiate the different properties of nano materials.
		3.	Distinguish the functionality of nanostructures and their characteristic evaluation, self-assembly and its application towards controlling the structure.
		4.	Recognize the surface modification of nanoparticles by surface functionalization and their application.

Curriculum Content	**Hours**
Unit I **Introduction:** Micro-Electro-Mechanical Systems (MEMS), Microsystems and their products, miniaturization, applications, mechanical MEMS, thermal MEMS, micro-opto electro-mechanical systems, magnetic MEMS, radio frequency (RF) MEMS, micro fluidic systems, bio and chemo devices, Nanotechnology – definition, nanoscale, consequences of the nanoscale for technology and society, need and applications of nano electromechanical systems(NEMS)	6

Unit II **Micro Fabrication Processes &Materials:** Materials for MEMS –substrate and wafers, silicon as a substrate material, crystal structure, single crystal and polycrystalline, mechanical properties, silicon compounds, silicon piezo-resistors, gallium arsenide, quartz, piezo-electric crystals, polymers, packaging materials; **Fabrication Processes** – Bulk micro-manufacturing, photolithography, photoresists, structural and sacrificial materials, X-ray and electron beam lithography, Thin film deposition spin coating, thermal oxidation, chemical vapour deposition (CVD), electron beam evaporation, sputtering; Doping diffusion, ion implantation; Etching wet etching, dry etching; Surface micromachining, bulk vs. surface micromachining; Wafer bonding glass-frit, anodic and fusion bonding; LIGA process and applications.	7
Unit III **Micro sensors and actuators:** Sensing and actuation, Chemical sensors, Optical sensors, Pressure sensors, Thermal sensors – thermopiles, thermistors, micro machined thermocouple probes, thermal flow sensors, MEMS magnetic sensor, Piezoelectric material as sensing and actuating elements – capacitance, piezo mechanics, Piezo actuators as grippers, micro grippers, micro motors, micro valves, micro pumps, micro accelerometers, micro fluidics, shape memory alloy based optical switch, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever**.**	7
Unit IV **Microsystem Design:** Design constraints and selection of materials, selection of manufacturing process, selection of signal transduction technique, electromechanical system and packaging.	6
Unit V **Nanomaterials:** Molecular building blocks to nanostructures – fullerenes, nanoscaled bimolecular, chemical synthesis of artificial nanostructures, molecular switches and logic gates, nano composites; Carbon nanotubes - structure, single walled, multi walled, properties of carbon nanostructures and their synthesis, Potential applications of nano-structures.	6
Unit VI **Nano finishing Techniques**: Abrasive flow machining, magnetic abrasive finishing, magneto rheological finishing, elastic emission machining, ion beam machining, chemical mechanical polishing, Nan manipulation, Nanolithography, Top-down versus bottom –up assembly, Visualization, manipulation and characterization at the Nanoscale; Applications - in Energy, Tribology, Informatics, medicine, etc	7

Suggested Text Books:

1.	"Introduction to Nanotechnology" by Charles P. Poole Jr. and Frank J. Owens
2.	"Nanotechnology: Principles and Practices" by Sulabha K. Kulkarni
3.	"Principles of Nanotechnology: Molecular-Based Study of Condensed Matter in Small Systems" by G. Ali Mansoori

Suggested Reference Books:

1.	BharatBhushan(Ed.),(2004),HandbookofNanotechnology,Spinger-VerlagBerlinHeidelberg New York, ISBN 3-540-01218-4
2.	Hsu,Tai-Ran,(2003),MEMS&MICROSYSTEMS:Design&Manufacture,TMH,ISBN:0-07-048709-X
3.	Mahalik, N.P.,(2007),MEMS,TMH,ISBN:0-07-063445-9
4.	Mahalik,N.P.(Ed.)(2006),Micromanufacturing&Nanotechnology,SpringerIndiaPvt.Ltd.,ISBN: 978-81-8128-505-8 (Distributed by New Age International, New Delhi)
5.	Nanosystems:MolecularMachinery,Manufacturing&Computation,KEDrexler,(Wiley), (1992), ISBN0471575186

6.	P. Rai- Choudhury, Handbook of Microlithography, Micro machining & Microfabrication,SPIE,1997.
7.	David Ferry, Transports in Nanostructures, Cambridge University Press, 2000.
8.	Poole,Charles&Owen,FrankJ.,-IntroductiontoNanotechnology,Wiley(India)Pvt.Ltd.ISBN: 978-81-265-10993
9.	VariousInternetresources:www.nanotechweb.org,www.nano.gov,www.nanotec.org.uk

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2			2			1	2	1
CO2	3	3	3	2	2			2	2	2
CO3	3	2	2		3			1	2	1
CO4	3	3	3		3	2	2	2	2	2
CO5	2	3	2	3	2			2	3	3

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part & Semester	**:**	**First Year M.Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Wiring and harness system in automobile**			***Course Code*:**	**:**	MECADE2
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core (Automobile)					

Course Rationale: This program is designed to provide wire harness students with a balanced foundation of theoretical knowledge and practical skills in cable design.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Understand wires, cables, and harnesses in the electronics industry.	1.	Understand the fundamentals of automotive wiring and harness systems, including components, materials, and standards.
2.	Understand the trade-offs in materials used in these applications.	2.	Develop skills to design, assemble, and troubleshoot wiring harnesses for various vehicle systems.
3.	Understand and mitigate issues in wire harness in the electronics industry.	3.	Apply safety protocols and best practices in automotive electrical system assembly and repair.
4.	Understand wire terminations and cable shielding in the electronics industry.	4.	Utilize tools and testing equipment to ensure the functionality and reliability of wiring harnesses in automobiles.
5.	Understand how to read and create wiring diagrams according to cable types.		

Curriculum Content	**Hours**
Unit I **Introduction:** Introduction & Background, Understanding Wire Harnesses, Applications of Wire Harnesses Manufacturing processes of Wire Harnesses, Essential Tool & Equipment's ,Electrical Harness Design ,Electrical Harness Assembly Workbench Bottom Toolbar	6
Unit II **Electrical Harness Design** DefiningGeometricBundles,InstallingGeometricBundles,DefiningGeometric Bundle sin Context ,Defining Geometric Bundles on Surfaces ,Multiple Bundle Segments within a Geometric Bundle, Defining, Bundle, Bundles on Curves, Modifying Multi-Branchables bonding glass-frit, anodic and fusion bonding; LIGA process and applications.	7
Unit III Supports ,Supports ,inside the Geometrical Bundle ,Supports Outside the Geometrical Bundle Adding Supports, Removing Supports ,Multi-Position Supports, Adaptive Supports, Position Bundles in Supports ,Local Slack	7

Unit IV Modifying Protective Covering, Protective Covering with Supports, Protective Covering with Adaptive Supports, Adjusting Protective Coverings, FLEX Algorithm , FLEX Algorithm with Constrained Length	6
Unit V Geometrical Bundle Analysis ,Related Objects ,Inertia ,Measurements, Geometrical bundle Equivalents ,Clash Analysis ,Modifying Geometric Bundles	6
Unit VI **Electrical Flattening** Harness Flattening Parameters, Extracting, Extract with Supports Flattening, Flattening Orientation, Flattening Scaling, Roll, Synchronization	7

Suggested Text Books:	
1.	"Electric Cables Handbook" by G.F. Moore: This handbook, while covering electric cables broadly, includes essential information relevant to selecting and working with wires and cables in harness design.
2.	Automobile Engineering Electrical Systems by Kirpal Sing.
3.	"Automobile Electrical and Electronic Systems" by Tom Denton.
4.	"Automotive Electrical and Electronic Systems" by Bosch.

Suggested Reference Books:	
1.	"Understanding Automotive Electronics" by William Ribbens.
2.	CATIA V5-6R2015 for Designers , by Tickoo, Sham, author
3.	"Automotive Handbook" by Robert Bosch, "Modern Electrical Equipment of Automobiles" by A.W. Judge, and "Automobile Electrical Equipment" by W.H. Crouse
4.	"Guide to Wire Harness Design, Development, and Manufacturing": This online resource offers a comprehensive overview of the wire harness lifecycle, including design steps, component selection, materials, testing, and manufacturing considerations.

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2		3			2	1	2
CO2	2	3	3		3	2		2	2	2
CO3	2	2	2		2			2	2	3
CO4	2	2	3		3			2	2	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part &Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Computational Fluid Dynamics**			***Course Code*:**	**:**	MECADE2
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credit s***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**						
Course Domain	**:**	Core					

Course Rationale: This course provides a comprehensive understanding of computational techniques for analyzing fluid flow and heat transfer. It equips students with skills to model, simulate, and solve complex fluid dynamics problems using advanced software tools

Course Objectives:		***Course Outcomes:*** Students will be able to	
1	This course aims to introduce numerical modeling and its role in the field of heat, fluid flow and combustion it will enable the students to understand the various discretization methods and solving methodologies and to create confidence to solve complex problems in the field of heat transfer and fluid dynamics.	1	On successful completion of this course the student will be able to apply the concepts of CFD to analyze the fluid flow and heat transfer in thermal systems.
2	To develop finite volume discredited forms of the CFD equations.		
3	To formulate explicit &implicit algorithms for solving the Euler Equations &Navies Strokes Equations.		

Curriculum Content	**Hours**
Unit I **Introduction:** CFD as the third dimension of fluid mechanics. Numerical Discretization methods such as Finite Difference, FEM and FVM. Why FVM as preferred method in CFD.	9
Unit II **Basic Equations of Fluid Dynamics:** Potential flow, Nonlinear Potential flow, in viscid flows and viscous flows. Navier Stokes equations. Primitive variable Vs. Conservation form. Dimensional form Vs Non dimensional form**.**	6
Unit III **Numericalmethodsforconvection-Diffusionequations:**Upwindingandcentral difference schemes, Stability condition in terms of Courant number	9

Unit IV **Numerical methods for Inviscid flow:** Characteristic form of equations, flux difference splitting. Application to 2-D flow such as flow through a nozzle	7
Unit V **Numerical methods for Incompressible flows:** The continuity equation divergence constraint, Poisson equation for pressure schemes such as SIMPLE due to Patankar and Spalding.	6

Suggested Text Books:	
1.	"Computational Fluid Dynamics: The Basics with Applications" by John D. Anderson Jr.
2	"An Introduction to Computational Fluid Dynamics: The Finite Volume Method" by H.K. Versteeg and W. Malalasekera
3	"Computational Fluid Mechanics and Heat Transfer" by Richard H. Pletcher, John C. Tannehill, and Dale Anderson
4	"Numerical Heat Transfer and Fluid Flow" by Suhas V. Patankar
Suggested Reference Books:	
1.	ComputationalFluidDynamics– TheBasicswithApplications,JohnD.Anderson,Jr.,McGraw Hill International Editions,
2.	Computational Fluid Dynamics –The Finite Volume Method, H.K. Versteeg and W. Malalasekara, Longman Scientific &Technical
3.	Computational Fluid Mechanics and Heat Transfer, John C.Tannehill, Dale A. Anderson and Richard H. Pletcher, Taylor & Francis, Reprint2010.
4.	ComputationalMethodsforFluiddynamics:Vol1and2,CAJ Fletcher, Springer Verlag, 1987
5.	Numerical Heat Transfer & Fluid Flow, Suhas V. Patankar, Taylor &Francis.
6.	ComputationalFluidDynamicsVol1and2,K.A.HoffmannandS.T.Chiang, Engineering Education System

Course Outcome and Program Outcome Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	3	1	1	2	2	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part & Semester	**:**	**First Year M.Tech (CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**CAD/CAM/CAE Practices in metal forming**			***Course Code*:**	**:**	MECADE2
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs

Revision:	**:**	Fourth	***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**				
Course Domain	**:**	Core			

Course Rationale: This course introduces the integration of CAD, CAM, and CAE technologies to optimize metal forming processes. It equips students with practical skills to design, simulate, and manufacture metal components efficiently and accurately.

Course Objectives:		***Course Outcomes:*** Students will be able to	
1	To study the use of computers in metal forming operations: planning and optimization	**1**	Student should understand methods of analysis.
		2	StudentshouldunderstandapplicationofCAD/ CAM/CAEinmetalformingprocesses

Curriculum Content	**Hours**
Unit I **1.Introduction:**-Process Modeling, The finite element method, Solid formulation and hollow formation, metal forming and FEM Metal forming Processes:-Introduction, Metal forming operations as a system, Classification and Description of metal forming processes, Casting process Analysis and Technology in Metal Forming:- Introduction, Flow stress of metals, Friction in metal forming, Temperatures in metal forming, Impression and closed die forging, Hot extrusion of Rods and Shapes, Cold forging and extrusion, Rolling of strip, plate and shapes, Drawing of Rod, wire, shapes and Tubes, Sheet metal forming, fine blanking	9
Unit II **Plasticity and Visco-plasticity**: Introduction, Stress, strain and strain rate, The yield criteria, Equilibrium and Virtual work rate principle, Plastic potential and flowrate, Strain Hardening, Effective stresses and Effective strain, Visco-plasticity.	8
Unit III **MethodofAnalysis:**Introduction,UpperBoundmethod,HillsGeneralMethod,FEM Analysis Technology in Metal Casting: Introduction, Cast ability of important Ferrous and Non- ferrous metal, Shrinkage, Effect of Temperature, Effect of composition. Finite Element Method**:** Introduction, Finite Element Procedures, Elements and shape function, Element strain rate matrix, Elemental stiffness equation, Numerical integrations, Assemblage and Linear matrix solver, Boundary conditions, Direct / Iteration method, Time investment and Geometry updating, Rezoning.	9

Unit IV **Plane–Strain Problems:** Introduction, Finite Element formulation, Closed die forging with flash, Sheet Rolling, Plate Bending, Side pressing. Axi-symmetric Isothermal Forging**:** Introduction, Finite Element formation, Pre-form design method, Die design, Shell nosing at room temperature, Plane strain rolling, Axially Symmetric forging**.**	7
Unit V **Steady State Processes of Extrusion and Drawing:** Introduction, Method of Analysis, Bar Extrusion, Bar Drawing, Multi pass bar drawing and Extrusion, Applications to process. design Sheet Metal Forming**:** Introduction, Plastic Anisotropy, In-plane deformation process,Axi- symmetric but of plane deformation, Axi-symmetric Punch stretching and deep drawing process, Sheet metal forming of General shapes, Square – cup drawing process. **MetalCasting:**Introduction,CastingDesign,FEAanalysis,Die/patternDesign, Casting Simulation–Gating Design, Die/Pattern manufacture	7
Suggested list of Tutorial sand Assignments: A suggested by the course teacher	
Suggested Text Books:	
1.	"Metal Forming Analysis" by Taylan Altan and A. Ngaile
2.	"Numerical Simulation of Metal Forming Processes: Theory, Methods and Applications" by Hans Peter Wüthrich and Hansjörg Fluri
3.	"Metal Forming: Technology and Process Modelling" by S. Anwar and G. K. Lal
Suggested Reference Books:	
1.	Mechanical Metallurgy(2/e)–by Dieter(McGrawHill)
2.	Metal Casting–Dr.B.Ravi–(Prentice Hall of India)
3.	Metal Forming& Finite Element Method–by Shiro Kobjashi Oxford University
4.	Technology of Metal Forming Processes,-Surender Kumar(EEE)(PHI)
5.	Theory of Plasticity-Amitav Chakraborty, McGrawHill

Course Outcome and Program Outcome Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	1	1	2	2	1
CO2	2	2	3	2	3	2	2	2	2	1

Level of Mapping as: Low1, Moderate 2, High 3

Elective-IV (Open Elective)

Class, Part& Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Elective- IV (Open Elective) Geographical Information Systems**			***Course Code*:**	**:**	CSEOE21
Teaching Scheme (Hours)	**:**	Lecture:	03Hrs/week		***Total Credits***	**:**	03
Evaluation Scheme(Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 Hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**	Database					
Course Domain	**:**	**Open Elective**					

Course Rationale: By studying GIS, student will gain the skills to harness the power of spatial data and technology, contributing to better decision-making, improved efficiency, and sustainable development across sectors has geography, computer science, environmental studies, urban planning, public health, and many other fields**.**

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	Introduce fundamentals of GIS, Spatial Data, Spatial Data Modeling, and Attribute Data Management to the students.	**1**	Demonstrate a solid understanding of fundamental GIS concepts, including spatial data models, coordinate systems, map projections, and the basic components of a GIS.
2	Provide the knowledge of Data, Input, Editing and Data Analysis to the students.	**2**	Effectively use GIS tools to perform tasks such as data collection, data management, spatial analysis, And data visualization**.**
3	Introduce to the students about Analytical Modelling in GIS, From New Mapsto Enhanced decisions	**3**	Gather, preprocess, and structure data from field surveys, remote sensing, and other sources for analysis.
4	Provide the knowledge of Development of Computer methods for handling spatial data to the students.	**4**	Conduct spatial analysis using GIS techniques such as spatial querying, overlay analysis, proximity analysis, spatial interpolation, network analysis
5	Provide the knowledge of Data quality issues, Human and Organizational issues to The students.	**5**	Learn to acquire, preprocess, manipulate, convert, integrate, and assess vector and raster data quality.
6	Provide the knowledge about GIS project Design and Management to the students.	**6**	Use GIS tools to address spatial challenges in urban planning, environmental management, and resource management.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	1	2		1						
CO2	1	1	2	1	1					
CO3	1	2	1	2	1	2				
CO4	1	1	1	1	1	2				
CO5	1	1	1	1	1	2	3	3		
CO6	1	1	1	1	1	2	2	2	1	1

Level of Mapping as: Low1, Moderate 2, High 3

Curriculum Content	**Hours**
Unit I- Introduction to GIS, Spatial Data, Spatial Data Modeling, Attribute Data Management.	6
Unit II-Data, Input, Editing, Data Analysis.	6
Unit III- Analytical Modelling in GIS. Output: From New Maps to Enhanced decisions.	7
Unit IV-Development of Computer methods for handling spatial data**.**	6
Unit V-Data quality issues, Human and Organizational issues.	6
Unit VI-GIS project Design and Management, Future of GIS.	6

SuggestedlistofTutorialsandAssignments: ThisCouseconsistsofasetofminimum5to6 Tutorials based on the following topics:

1. Introduction to GIS
2. Data Input Editing and Analysis
3. Analytical Modelling in GIS
4. Spatial Analysis
5. Spatial Data Collection
6. Geospatial Python Programming

Suggested Text Books:

1.	"AnIntroductiontoGeographicalInformationSystems",IanHeywood,SarahCornelius&Steve Carver, Pearson Education.

Class, Part& Semester	**:**	**First Year M.Tech(CAD/CAM/CAE), Part I, Sem-II**					
Course Title	**:**	**Elective-IV (Open Elective) Natural Language Processing**			***Course Code*:**	**:**	CSEOE22
Teaching Scheme (Hours)	**:**	Lecture:	3Hrs/week		***Total Credits***	**:**	3
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 Hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**	Proficiency in at least one programming language, such as Python, is essential For implementing NLP algorithms and working with libraries like NLTK, SpaCy, and Hugging Face.					
Course Domain	**:**	**Open Elective**					

Course Rationale: Natural Language Processing (NLP) is one of the most important technologies of the information age.it gives deep understanding of the fundamental concepts of NLP and its role in current and emerging technologies. Understanding complex language utterancesisal so inckuded in addition course Discusses syntactic parsing, sematic parsing and machine translation issues.

Course Objectives : The Course teacher will		***Course Outcomes:*** Students will be able to	
1	Introduce the fundamental concepts and techniques of Natural Language Processing, including syntax, semantics, and pragmatics.	**1**	Acquire knowledge of the fundamental mathematical models and algorithms in the field of NLP.
2	Provide an understanding of language models, parsing methods, and linguistic structures used in NLP systems.	**2**	Apply these mathematical models and algorithms in application in software design and implementation of NLP.
3	Develop skills in applying statistical and machine learning methods for text analysis And language understanding.	**3**	Apply deep learning models to solve machine translation and conversion problems.
4	Enable students to build applications such as sentiment analysis, machine translation, text summarization, and question answering Using NLP techniques.	**4**	Apply deep structured sematic models on information retrieval and natural language application.
5	Familiarize students with state-of-the-art NLP tools, frameworks, and libraries for solving real-world problems.	**5**	Acquire knowledge of the design and implementations issues in various NLP application such as information extraction and machine translation.
6	Explore recent advancements in NLP, Including transformer-based models and their applications in various domain.	**6**	Explore recent advancements in NLP

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1		2	2							
CO2			2		2					
CO3			3		3					
CO4		2	2		2					
CO5			2		2					
CO6			3		3					

Level of Mapping as: Low1, Moderate 2, High 3

Curriculum Content	**Hours**
Unit I-INTRODUCATION NLP tasks in syntax, semantics and pragmatics. Applications such as information extraction, question answering and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the filed.	6
Unit II-LANGUAGEMODELS Theroleoflanguagemodels.SimpleN-grammodels.Estimatingparametersandsmoothing evaluating language models.	6
Unit III- PART OF SPEECHTAGGING AND SEQUIENCE LABELING Stochastic formal isms and tree banks, efficient parsing for context free grammars(CFG),statistical parsing and probabilistic CFGs (PCFGs), lexicalized PCFGs, neural shift reduce dependency parsing.	6
Unit IV- SYNTACTIC PARSING Grammar formalisms and tree banks, efficient parsing for context-free grammars(CFGs),statistical parsing and probabilistic CFGs (PCFGs), lexicalized PCFGs, neural shift reduce dependency parsing.	6
Unit V-SEMATIC ANALYSIS Lexical semantics and word sense disambiguation, computational semantics, sematic role labeling and sematic parsing.	4
Unit VI- INFORMATION EXTRACTION(IE) Named entity reorganization and relation extraction, IE using sequence labeling **MACHINE TRANSLATION (MT)** basic issues in MT, statistical translation, word alignment, phrase-based translation and synchronous grammars case study of typical NLP applications using deep learning.	8

Suggested Text Books:
Daniel jurafsky and james H Martin Speech and language processing, Person Education.
Suggested Reference Books:
James A. Natural language understanding, Person Education.
Bharti A.,Sangal R.,Chaitnya Natural Language processing: apaninianpe rspective, PHI
Siddiqui T., Tiwary U. S., Natural Language Processing and Information retrieval, OUP.
Applications of deep learning for natural language processing https://machinelearningmastery.com/apllications-of-deep-learning-for-natural-language-processing.

Class, Part& Semester	**:**	**First Year M.Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Elective-IV (Open Elective) Block Chain Technology**			***Course Code*:**	**:**	CSEOE23
Teaching Scheme(Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
Evaluation Scheme(Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2 Hrs
Revision:	**:**	Fourth			***Month***	**:**	July 2025
Pre-requisites *(if any)*	**:**	Expertise In Programming, Basic Knowledge of Computer, Cryptography, Networking, Concurrent or Parallel Programming					
Course Domain	**:**	**Open Elective**					

Course Rationale: Block chain is an emerging technology platform for constructing decentralized apps and data storage. This platform's central concept is that it enables the creation of a distributed and replicated ledger of events, transactions, and data generated by various IT processes, with strong cryptographic assurance soft amper resistance, immutability, and verifiability. Even when untrusted people are participants of distributed apps with the ability to transact on the network, public blockchain systems allow us to ensure these qualities with over whelming probabilities. Even though blockchain technology is best known for its Use in the implementation of crypto currencies like Bit Coin and Ethereum.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	Summarize the cryptographic building Blocks of block chain Technology	1.	Discuss the cryptographic building blocks of block chain Technology
2.	Describe fundamental concepts of block chain Technology	2.	Explain the fundamental concepts of block chain Technology
3.	Analyze basic blockchains. Develop simple applications using Solidity language on Ethereum platform.	3.	Compare basic blockchains. Develop simple applications using Solidity language on Ethereum platform.
4.	Discuss the concepts of general and Decentralized block chain applications	4.	Discuss the concepts of general and decentralized Block chain applications
5.	Identify and discuss the concepts of general And decentralized blockchain applications	5.	Explain Discuss the concepts of general and Decentralized blockchain applications
6.	Summarize privacy and security issues in blockchain	6.	Summarize privacy and security issues in blockchain

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	2			1						
CO2	2	1		1						
CO3	2	2	2	2	2					
CO4	2	2	2		1					
CO5	2	2			2					
CO6	2	2	2	2	2					

Level of Mapping as: Low1, Moderate 2, High 3

Curriculum Content	**Hours**
Unit-I Introduction History of Blockchain - Types of Blockchain, Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Blockchain based cryptocurrency, Technologies Borrowed in Blockchain - hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.	7
Unit II Basic Distributed Computing Atomic Broadcast, Consensus, Byzantine Models of fault tolerance **Basic Crypto primitives:** Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, publickey crypto, verifiable random functions, Zero-knowledge systems	7
Unit III Blockchain Technology versions **Blockchain1.0:** Bitcoin blockchain ,the challenges,and solutions,proof of work, Proof of stake, alteratives to Bitcoin consensus,Bitcoin scripting language and their use **Blockchain2.0**: Ethereum and Smart Contracts: Components of Ethereum Ecosystem-Ethereum Programming Languages: Runtime Byte Code,Blocks and Blockchain,The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs Ethereum Smart Contracts Blockchain3.0: Hyperledger fabric, the plug and play platform and mechanisms in permissioned Blockchain	6
Unit IV Blochchain Technology Applications Introduction to Decentralized Applications, Blockchain Mining,Whisper,Swarm,Forks.Medical Record Management System. Domain Name Service and future of Blockchain	6
Unit V Case Studies of Blockchain in Cogaitive Applications IBM Block Chain, Blockchain in Healthcare Innovation,Al Marketplaces,Investment Macagemont Platforms, Future of Al and Block Chain	6

Unit VI Privacy, Security issues in Blockchain Pseudo-anonymity vs .anonymity, Z Cash and Zk-SNARKS for anonymity preservation,attacks on Blockchains-such as Sybil attacks, selfishmining ,51%attacks--advert of algorand and Sharding based consensus algorithms to prevent these	7

Suggested Text Books:	
1.	Artemis Caro,"Blockchain: The Beginners Guide the Understanding the Technology Behind Bitcoin & Crypto currency", Create Space Independent Publishing Platform
2.	Scott Marks,"Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the Revolutionary Blockchain Technology", Create Space Independent
3	Arvind Narayanto, Joseph Boansas, Beward Felton, Andrew Miller and Stevia Soldiered,"Bitcoinand Crypto currency Technology: A Comprehensive Introduction", Princeton University Press
Suggested Reference Books:	
1.	Mark Watney,"Blockchain for Beginners".
2.	Alwyn Bishop, "Blockchain Technology Explained".
3.	J.H. Huiwitz, M. Kaufman, A. Boales, Cognitive Computingde Big Data Analyses", Wiley Publication.
4.	MOOC/ NPTEL Courses: • NPTEL Course Introduction to Block Chain Technology& Applications" https://nptol.sc.in/exucsss/106/104/106?04220Y • NPTEL Course Architecture* UselCases" ws-hoptel.ag.in/courses/106/10S/106105184

Class, Part & Semester	**:**	**First Year M. Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**MIMO System(Elective-IV)**			***Course Code*:**	**:**	ETCOE21
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	**Digital Communications, Signals and Systems, Wireless communications**					
Course Domain	**:**	**Communication**					

Course Rationale: To learn about MIMO communication systems, capacity of MIMO, space time coding scheme and MIMO in 4G/5G wireless communications with available technology and schemes

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	Impart in depth knowledge about MIMO	1	Understand SIMO,MISO, MIMO in-depth
2	Impart in depth knowledge about MIMO channel capacity	2	Understand random MIMO channels, Capacity of i.i.d., Rayleigh fading MIMO Channel scapacity.
3	Impart in depth knowledge about *Space- Time codes*	3	Understand Alamouti space- time codes, Space-time block codes, Space- time trelliscodes, Space-time turbo codes.
4	Impart in depth knowledge about *MIMO detection, Advances in MIMO wireless communication*	4	Understand *MIMO detection, Advances in MIMO wireless communication,* Spatial modulation, cognitive radio, multiuser MIMO, MIMO Systems for 5G wireless.

Curriculum Content	**Hours**
Unit I *Introduction*: Diversity-multiplexing trade-off, transmit diversity schemes, advantages and applications of MIMO systems	6

Unit II *Analytical MIMO channel models*: Uncorrelated, fully correlated, separately correlated and keyhole MIMO fading models, parallel decomposition of MIMO channel. *Power allocation in MIMO systems*: Uniform, adaptive and near optimal power allocation.	7
Unit III *MIMO channel capacity*: Capacity for deterministic and random MIMO channels, Capacity of i.i.d., separately correlated and keyhole Rayleigh fading MIMO channels.	6
Unit IV *Space-Time codes*: Advantages, code design criteria, Alamouti space- time codes, SER analysis of Alamouti space-time code over fading channels, Space-time block codes, Space-time trellis codes, Performance analysis of Space-time codes over separately Correlated MIMO channel, Space-timeturbo codes.	7
Unit V *MIMO detection*: ML,ZF,MMSE,ZF-SIC,MMSE-SIC,LR based detection	7

Unit VI *Advances in MIMO wireless communications*: Spatial modulation, MIMO based Cooperative communication and cognitive radio, multiuser MIMO, cognitive-fem to cells and large MIMO systems for 5G wireless.	6
Suggested list of Tutorials and Assignments: A ssuggested by the course teacher	
Suggested Text Books:	
1.	"Fundamentals of Wireless Communication" by David Tse and Pramod Viswanath
2.	"MIMO Wireless Communications" by Ezio Biglieri, Robert Calderbank, Anthony Constantinides, Andrea Goldsmith, Arogyaswami Paulraj, and H. Vincent Poor
Suggested Reference Books:	
1.	B. Clerckx and C.Oestges, MIMO wireless networks, Elsevier Academic Press,2nd ed.,2013.
2.	T.M. Dumanand A. Ghrayeb, Coding for MIMO communication systems, John Wiley and Sons,2007.
3.	N. Costa and S. Haykin, Multiple-input multiple-output channel models, John Wiley &Sons, 2010.
4.	J.Choi, Optimal Combining & Detection, Cambridge University Press, 2010.
5.	A. Chokhalingamand B. S. Rajan, Large MIMO systems, Cambridge University Press, 2014.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	1	1	1				1		
CO2	2	1	1	1				1		
CO3	2	1	1	1				1		
CO4	3	1	1	1				1		
CO5										
CO6										

Level of Mapping as: Low 1, Moderate 2,High 3

Class, Part &Semester	**:**	**First Year M.Tech(CAD/CAM/CAE), Part I , Sem-II**					
Course Title	**:**	**Satellite Communication (Elective-IV)**			***Course Code*:**	**:**	ETCOE22
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs

Revision:	**:**	Fourth	***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	Satellite communication			
Course Domain	**:**	Communication			

Course Rationale: This course provides an introduction to the fundamental so for bital mechanics and launchers, link budgets, modulation, coding, multiple access techniques, propagation effects, and earth terminals. This course provides an understanding how analog and digital technologies are used for satellite communications networks. They will gain skills for performance improvement for different available satellites by calculating power Budgets

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	Impart in depth knowledge of orbital mechanism.	**1**	Visualize the architecture of satellite systems means of high speed, high range communication system.
2	Impart in depth knowledge of link budgets, modulation, coding, multiple Access techniques, propagation effects, and earth terminals.	**2**	State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, Modulation and multiple access schemes.
3	Impart in depth knowledge power budget.	**3**	Solve numerical problems related to orbital motion and design of link budget For the given parameters and conditions.

Curriculum Content	**Hours**
Unit I Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks	6
Unit II Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.	7

Unit III Satellite sub- systems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC&M),Attitude and orbit control system (AOCS),Communication sub-system, power sub-systems ,antenna sub-system.	7
Unit IV Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.	7
Unit V Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget	7

And C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.	
Unit VI Modulation and Multiple Access Schemes used in satellite communication. Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.	6

Suggested list of Tutorials and Assignments: A suggested by course teacher

Suggested Text Books:

1.	"Principles of Satellite Communication" by Vijay K. Garg

Suggested Reference Books:

1.	Timothy Prattand Others,"Satellite Communications",WileyIndia,2nd¬edition,2010.
2.	S.K. Raman," Fundamentals of Satellite Communication" ,Pearson Education India,2011.
3.	TriT.Ha,"Digital Satellite Communications",TataMcGrawHill, 2009
4.	Dennis Roddy,"Satellite Communication",McGrawHill,4thEdition,2008

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	2	1					1		
CO2	3	2	1					1		
CO3	3	2	1					1		
CO4										
CO5										
CO6										

Level of Mapping as:Low1, Moderate 2,High 3

Class, Part &Semester	**:**	**First Year M.Tech(CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Smart and Phase Array Antenna Design (Elective -IV)**			***Course Code*:**	**:**	ETCOE23
Teaching Scheme (Hours)	**:**	Lecture:	3 Hrs/week		***Total Credits***	**:**	3
		Tutorial:	-- Hrs/week				
Evaluation Scheme (Marks)	**:**	IE=40	ESE =60	Grand Total=100	***Duration of ESE***	**:**	2hrs
Revision:	**:**	Fourth			***Month***	**:**	July2025
Pre-requisites *(if any)*	**:**	**Antenna theory**					

Course Domain	:	**Communication**

Course Rationale :In this course students shall learn basics as well as advanced phase are antennas. They shall learn radiation pattern of two point sources, Dolf Tche by schef array, Pattern Synthesis for Linear and Planar Arrays, Methods of Pattern Optimization/Adaptive Arrays, various antennas and their feed mechanism,

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1	Teach radiation pattern of two point Sources for various distances and phases.	1	Shall understand how to obtain radiation pattern of two point sources for various cases.
2	Teach Pattern Synthesis for Linear And Planar Arrays	2	Understand Pattern Synthesis for Linear And Planar Arrays
3	Teach Adaptive antennas	3	Understand Adaptive antennas.
4	Teach various antennas and their feed Mechanism for array antenna design	4	Understand various antennas and their Feed mechanism for array antenna design

Curriculum Content	**Hours**
Unit I Array of two point sources, Linear broad side array with non uniform amplitude distributions, Dolf Tchebyscheff distribution	6
Unit II Pattern Synthesis for Linear and Planar Arrays Linear Arrays and Planar Arrays with Separable Distributions, Fourier Transform Method, Schelkunov's (Schelkunoff's) Form, Woodward Synthesis, Dolph-Chebyshev Synthesis, Taylor Line Source Synthesis, Modified sinpz/pz Patterns, Bayliss Line Source Difference Patterns.	7
Unit III Methods of Pattern Optimization/Adaptive Arrays Pattern Optimization, Adaptive Arrays, Generalized S/N Optimization for Sidelobe Cancelers, Phased and Multiple-Beam Arrays, Operation as Side lobe Canceler, Fully Adaptive Phased or Multiple-Beam Arrays, Wideband Adaptive Control	6

Unit IV Elements for Phased Arrays, Array Elements, Polarization Characteristics of Infinitesimal Elements in Free Space, Electric Current (Wire) Antenna Elements, Effective Radius of Wire Structures with Noncircular Cross Section, The Dipole and the Monopole, Special Feeds for Dipoles and Monopoles, Dipoles Fed Off-Center, The Sleeve Dipole and Monopole,The Bowtie and Other Wideband Dipoles, The Folded Dipole ,Microstrip Dipoles, Other Wire Antenna Structures, Broadband Flared-Notch, Vivaldi, and Cavity-Backed Antennas, Aperture Antenna Elements, Slot Elements, Waveguide Radiators, Ridged Waveguide Elements, Horn Elements, Microstrip Patch Elements, Microstrip Patch, The Balanced Fed Radiator of Collings Elements for Alternative Transmission Lines, Elements and Row(Column)Arrays for One-DimensionalScan,WaveguideSlotArrayLineSourceElements,PrintedCircuit Series-Fed Arrays, Elements and Polarizers for Polarization Diversity	7

Unit V Special Array Feeds for Limited Field-of-View and Wideband Arrays Multiple-Beam Systems, Beam Crossover Loss, Orthogonality Loss and the Stein Limit, Multiple-Beam Matrices and Optical Beam formers, Antenna Techniques for Limited Field-of-View Systems, Minimum Number of Controls, Periodic and Aperiodic Arrays for Limited Field of View,	7
Unit VI Constrained Network for Completely Overlapped Subarrays, Reflectors and Lenses withArrayFeeds,PracticalDesignofaDual-TransformSystem,WidebandScanning Systems, Broadband Arrays with Time-Delayed Offset Beams, Contiguous Time-Delayed Subarrays for Wideband Systems, Overlapped Time-Delayed Sub arrays for Wideband Systems	7

Suggested list of Tutorials and Assignments: As suggested by the course teacher

Suggested Text Books:

1.	"Adaptive Antennas and Phased Arrays for Radar and Communications" by Alan J. Fenn
2.	"Smart Antenna Engineering" by Jie Li and Petre Stoica

Suggested Reference Books:

1.	Phased array antenna hand book by Robbert J. Mailbox
2.	"Smart Antennas" by Joseph C. Liberti Jr. and Theodore S. Rappaport
3.	"Adaptive Antennas and Phased Arrays for Radar and Communications" by Alan J. Fenn
4.	"Smart Antenna Engineering" by Jie Li and PetreStoica
5.	"Introduction to Adaptive Arrays" by Robert A. Monzingo, Thomas W. Miller, and Thomas H. W. Lee
6.	"Modern Antenna Design" by Thomas A. Milligan

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	3	1	1	1	1					
CO2	3	1	1	1	1	1				
CO3	3	1	1	1	1	1				
CO4	3	1	1	1	1	1				
CO5										
CO6										

Level of Mapping as:Low1, Moderate 2,High3

Class, Part & Semester	**:**	**First Year M. Tech (CAD/CAM/CAE),Part I, Sem-II**					
Course Title	**:**	**Compressive Viva**			**Course Code:**	**:**	MECADC24
Teaching Scheme (Hours)	**:**	Practical:	2Hrs/week		**Total Credits**	**:**	1
Evaluation Scheme (Marks)	**:**	IE=50 Marks	EOE=---	Total=50marks	**Duration of EPE**	**:**	----
Revision:	**:**	Fourth			**Month**	**:**	July 2025
Pre-requisites (if any)	**:**						
Course Domain	**:**	Core					

Course Rationale: The Compressive Viva Course is designed to systematically prepare students for oral examinations by enhancing conceptual clarity and boosting confidence. It focuses on targeted revision, mock vivas, and real-time feedback for effective performance.

Course Objectives: The Course teacher will		**Course Outcomes:** Students will be able to	
1.	To strengthen students' understanding of core concepts in CAD/CAM/CAE through comprehensive oral assessments.	1	Demonstrate in-depth understanding of fundamental and advanced concepts in CAD/CAM/CAE.
2.	To develop students' ability to effectively articulate technical knowledge and respond confidently under examination conditions.	2	Effectively communicate technical knowledge and reasoning during oral examinations.
3.	To integrate interdisciplinary knowledge and promote analytical thinking required for practical and research-based problem-solving.	3.	. Integrate and apply interdisciplinary knowledge to solve engineering problems.
4.	To prepare students for academic, industrial, and research-oriented oral evaluations by simulating viva scenarios.	4	Exhibit confidence, clarity, and critical thinking in responding to viva questions.
		5.	Prepare independently for academic and professional oral evaluations with a structured approach.

Curriculum Content

The students have to do preparation on all the subjects which they have studied in Ist and IInd semesters. The viva will be conducted by the external and internal examiners jointly and their appointments will be made by university. The thorough knowledge, preparation and subjects 'understanding will be assessed by the Examiners.

Course Outcome and Program Outcome Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	3	2	2	2	2	2
CO2	2	2	2	1	2	2	2	3	3	2
CO3	3	3	3	2	3	3	2	2	2	2
CO4	2	2	2	1	2	2	2	3	2	2
CO5	2	2	2	1	2	2	2	2	3	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part & Semester	:	**First Year M.Tech (CAD/CAM/CAE),Part I, Sem-II**					
Course Title	:	**Design & Analysis Laboratory-II**			***Course Code*:**	:	MECADC 25
Teaching Scheme (Hours)	:	Practical:	2 Hrs/week		***Total Credits***	:	1
Evaluation Scheme (Marks)	:	IE=50 marks	EOE=-----	Total=50	***Duration of EPE***	:	----
Revision:	:	Fourth			***Month***	:	July 2025
Pre-requisites *(if any)*	:						
Course Domain	:	Core (Design)					

Course Rationale: This course provides hands-on experience in advanced design and analysis tools, enabling students to apply theoretical knowledge to real-world engineering problems. It aims to enhance proficiency in simulation, modeling, and validation of mechanical systems using industry-relevant software.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To provide practical exposure to advanced CAD, FEA, and simulation tools for mechanical design and analysis.	1.	Apply advanced CAD and FEA tools to design and analyze mechanical components and systems.
2.	To develop the ability to model, simulate, and optimize mechanical components and systems	2.	Develop accurate 3D models and perform simulations under various loading and boundary conditions.
3.	To enhance skills in interpreting and validating analysis results for real-world engineering applications.	3.	Interpret simulation results to evaluate performance, strength, and reliability of designs.
		4.	Demonstrate proficiency in using industry-relevant software for solving complex design and analysis problems.

List of Experiments

Minimum eight exercises are to be completed on following topics using suitable software packages.

1.	Transient Thermal Analysis
2.	Dynamic Analysis
3.	Non-Linear Analysis
4.	Design Optimization through FEA(Two Exercises)
5.	Computational Fluid Dynamics(Optional)
6.	A composite project based on Exercises of Design & Analysis Laboratory I and II.

Suggested Text Books/Reference Books/Manual

1.	"Engineering Design: A Project-Based Introduction" by Clive L. Dym, Patrick Little, Elizabeth Orwin, and Richard J. Doyle
2.	The Finite Element Method in Engineering by S. S. Rao
3.	"Mechanical Engineering Design" by J.E. Shigley, Charles R. Mischke, and Richard G. Budynas
4	"Machine Design: An Integrated Approach" by Robert L. Norton
5	"Introduction to Finite Element Analysis Using MATLAB® and Abaqus" by Amar Khennane

Course Outcome and Program Outcome Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	2	3	2	2	2	2	2
CO2	2	2	3	2	3	2	2	2	2	2
CO3	2	3	3	2	3	2	2	2	2	2
CO4	2	2	3	2	3	2	2	2	2	2

Level of Mapping as: Low1, Moderate 2, High 3

Class, Part &Semester	:	**First Year M.Tech (CAD/CAM/CAE),Part I, Sem-II**					
Course Title	:	**Seminar-II**			***Course Code*:**	:	MECADC26
Teaching Scheme (Hours)	:	Practical:	2 Hrs/week		***Total Credits***	:	1
Evaluation Scheme (Marks)	:	IE=50 Marks	EOE=---	Total=50 marks	***Duration of EPE***	:	----
Revision:	:	Fourth			***Month***	:	July 2025
Pre-requisites *(if any)*	:	Advance Technology Studies					
Course Domain	:	Technology Exchange					

Course Rationale: The Seminar-II course fosters in-depth exploration of emerging topics in CAD/CAM/CAE, enhancing students' research and presentation skills. It encourages independent learning, critical analysis, and effective technical communication.

Course Objectives: The Course teacher will		***Course Outcomes:*** Students will be able to	
1.	To develop students' ability to research and critically analyze advanced topics in CAD/CAM/CAE.	1	Demonstrate the ability to research and critically evaluate advanced topics in CAD/CAM/CAE.
2.	To enhance technical communication skills through structured presentations and discussions.	2	Communicate technical information clearly and effectively through well-organized presentations.
3.	To encourage independent learning and in-depth understanding of current industry and research trends.	3.	Exhibit improved confidence and skills in public speaking and academic discussions.
4.	To build confidence in articulating complex ideas clearly and effectively to diverse audiences.	4	Apply independent learning strategies to stay updated with emerging trends and technologies.

Curriculum Content

Seminar - II should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department.

The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

Course Outcome and Program Outcome Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	3	2	2	2	3	2	2
CO2	2	2	2	2	2	2	2	3	2	2
CO3	2	2	2	2	2	2	2	3	3	2
CO4	2	2	2	2	2	2	2	2	3	3

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Level of Mapping as: Low1, Moderate 2, High 3

SHIVAJI UNIVERSITY,KOLHAPUR
First Year M. Tech(CAD/CAM/CAE),Part II, Semester- III
Applicable From AcademicYear2025-26

Sr. No	Subject Code	Subject Title	Teaching Scheme (Hours/week)				Examination Scheme			
							Theory		Practical	
			L	T	P	Credits	Scheme	Max. marks	Scheme	Max. marks
1	MECADC31	Industrial Training	-	-	2*	5**	--------	-------	IE	50
									EOE	50
2	MECADC32	Dissertation Phase-I	-	-	2*	15	--------	-------	IE	100
									EOE	100
		Total	-	-	4	20				300
Total Contact hours per week=4*										

Industrial Training

Industrial Training of 8 to 12 Weeks at the end of first year OR Industrial Training will be split into two slots of Four weeks during semester III. Evaluation at the end of third semester on the basis of given report and presentation to concern guide.

Dissertation Phase-I

The student shall be allowed to submit the dissertation phase I report only after the completion of minimum 50%work of the total project with intermediate/partial results of the dissertation project to the concern guide and the dissertation phase II report only after the full fledge demonstration of his/her work to the concerned guide. Assessment of the dissertation shall be based on design & implementation aspects, documentation & presentation skills, utility of the dissertation work & publications based on the same. For the dissertation phase I and phase II concern guide should guide to each student minimum for 2 hrs per week till the final submission of the dissertation of the concern student.

SHIVAJI UNIVERSITY,KOLHAPUR
First Year M. Tech(CAD/CAM/CAE),Part II, Semester- IV
Applicable From AcademicYear2025-26

Sr. No.	Subject Code	Subject Title	Teaching Scheme (Hours/week)				Examination Scheme			
							Theory		Practical	
			L	T	P	Credits	Scheme	Max. marks	Scheme	Max. marks
1	MECADC41	Dissertation Phase-II	-	-	4*	20	---	---	IE	150
									EOE	150
		Total	**-**	**-**	**4**	**20**	--	---		**300**
Total Contact hours per week=4*										

*Students are expected to do self-study for two hours as per the guidance given by the dissertation guide Guide and report to the department as per the schedule in the disseminated time table.

During Dissertation Phase–II students are expected to complete their respective dissertation in all respect and submit it to the University for the Further Procedures.

Note:
**For dissertation guiding 2hrs/week load will be considered for the designated dissertation guide (faculty member) of the program/department