



**CHAITANYA BHARATHI
INSTITUTE OF TECHNOLOGY (A)**

Kokapet(Village), Gandipet, Hyderabad, Telangana-500075. www.cbti.ac.in



COMMITTED TO
RESEARCH,
INNOVATION AND
EDUCATION

44
years

R20:

Department Vision

To be the destination for aspiring young minds to become globally competitive, enlightened, innovative, immediate contributors to the industry and successful in higher studies in the field of mechanical engineering.

Department Mission

1. To impart quality and innovative education in mechanical engineering with basic and specialised training, internships to meet the current and emerging needs of the industry.
2. To prepare the students for successful professional career by inculcating ethical, entrepreneurial and leadership qualities.
3. To foster Research and Development environment by disseminating knowledge and technology by involving the students in publications, sponsored projects and consultancy.

PEOs of M.E. (CAD/CAM)

1. Graduates will become professional contributors in the industry related to the area of CAD/CAM.
2. Graduates will excel in Research, Development and Consultancy
3. Graduates will become Entrepreneurs in CAD/CAM industry.

PSOs of M.E. (CAD/CAM)

1. Apply and analyze the concepts of design engineering to provide solution for emerging needs in Mechanical Engineering.
2. Demonstrate use of design and analysis software tools to solve real world problems.
3. Develop and implement new ideas on product design with modern CAD/CAM tools, while ensuring global trends and best manufacturing practices.

M.E. Program Outcomes (PO's)

1. **PO 1:** An ability to independently carry out research /investigation and development work to solve practical problems
2. **PO 2:** An ability to write and present a substantial technical report/document
3. **PO 3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
4. **PO 4:** Ethics: apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice


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5. **PO 5:** Project management and finance: demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member and leader in a team. to manage projects and in multidisciplinary environments
6. **PO 6:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technology

R19:

Department Vision

To be the destination for aspiring young minds to become globally competitive, enlightened, innovative, immediate contributors to the industry and successful in higher studies in the field of mechanical engineering.

Department Mission

1. To impart quality and innovative education in mechanical engineering with basic and specialised training, internships to meet the current and emerging needs of the industry.
2. To prepare the students for successful professional career by inculcating ethical, entrepreneurial and leadership qualities.
3. To foster Research and Development environment by disseminating knowledge and technology by involving the students in publications, sponsored projects and consultancy.

PEOs of M.E. (CAD/CAM)

4. Graduates will become professional contributors in the industry related to the area of CAD/CAM.
5. Graduates will excel in Research, Development and Consultancy
6. Graduates will become Entrepreneurs in CAD/CAM industry.

PSOs of M.E. (CAD/CAM)

4. Apply and analyze the concepts of design engineering to provide solution for emerging needs in Mechanical Engineering.
5. Demonstrate use of design and analysis software tools to solve real world problems.
6. Develop and implement new ideas on product design with modern CAD/CAM tools, while ensuring global trends and best manufacturing practices.

R16:

Department Vision

To be a Pace Setter in the field of mechanical Engineering by providing conducive environment for understanding and applying its principles to cater the needs of Society

Department Mission

To impart quality & innovative technical education to the students of mechanical engineering for their professional achievements in consultancy, R&D and to become successful entrepreneur enabling them to serve the society in general and the industry in particular

PEOs of M.E. (CAD/CAM)


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1. Will become professional contributors in the industry related to the area of CAD/CAM
2. Will excel in research & development and consultancy
3. Will become entrepreneurs in CAD/CAM industry. POs describe what students are expected to know or be able to do by the time of graduation from the program.

PSOs of M.E. (CAD/CAM)

1. Apply and analyze the concepts of design engineering to provide solution for emerging needs in Mechanical Engineering.
2. Demonstrate use of design and analysis software tools to solve real world problems.
3. Develop and implement new ideas on product design with modern CAD/CAM tools, while ensuring global trends and best manufacturing practices.


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Department Of Mechanical Engineering

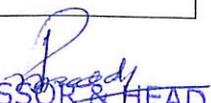
Course Outcomes Statements for ME (CAD-CAM)-R20

S.no.	Course		Course Outcomes Statements
	Code	Name	
1	20ME C101	COMPUTER AIDED MODELING AND DESIGN	1. Understand the design process, visualize models through graphics standards and apply principles of computer graphics like geometric transformations, windowing and clipping
			2. Recognize various wireframe entities and model them
			3. Apply surface modelling techniques for generating various parts
			4. Differentiate various solid modelling techniques
			5. Understand various advanced modelling concepts like parametric and variational modelling , feature based design, interference detection
2	20ME C102	COMPUTER INTEGRATED MANUFACTURING	1. Select the necessary computing tools for development of product
			2. Use appropriate database systems for manufacturing a product and store the same for future use
			3. Use modern manufacturing techniques and tools including principles of networking
			4. Apply the concepts of lean manufacturing and agile manufacturing
			5. Apply the latest technology of manufacturing systems and software for the development of a product.
3	20ME E101	ADVANCED MACHINE DESIGN	1. Predict failure of engineering components using failure theories
			2. Identify and explain the types of fractures of engineered materials and their characteristic features
			3. Understand LEFM approach
			4. Estimate life of components using stress life and strain life
			5. Categorize different types of surface failure
4	20ME E102	ADVANCED VIBRATIONS AND ACOUSTICS	1. Predict response of a SDOF system, damped or undamped, subjected to simple harmonic excitations. They will be able to obtain Step Response Spectrum of SDOF systems for such excitations
			2. Write differential equations of motion for MDOF systems, should be able to obtain the Eigen-values and mode shapes of natural vibrations and response to harmonic excitations, able to measure damping in the system using logarithmic decrement and half power method

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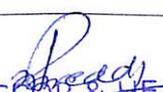
			3. Obtain the frequency and mode shapes for string, rod and beam using continuous systems.
			4. Understand basic concept of acoustics, source of models, and measuring of noise.
			5. Understand vibration and noise measuring instruments.
5	20ME E103	OPTIMIZATION TECHNIQUES	1. Formulate a linear programming problems (LPP)
			2. Build and solve Transportation Models and Assignment Models.
			3. Apply project management techniques like CPM and PERT to plan and execute project successfully
			4. Apply queing and inventory concepts in industrial applications
			5. Apply sequencing models and game theory in industries
6	20ME E104	AUTOMATION	1. Conceptualize and design automated flow lines.
			2. Implement line balancing concepts in production and assembly lines
			3. Understand and develop automated material handling systems for plant operations.
			4. Design, implement and use and appropriate automated inspection facility.
			5. Design and develop an automated production system for manufacturing a product using futuristic technologies
7	20ME E105	DESIGN FOR MANUFACTURING AND ASSEMBLY	1. Understand the product development cycle
			2. Know the manufacturing issues that must be considered in the mechanical engineering design process
			3. Know the effect of manufacturing process and assembly operations on the product
			4. Know the principles of assembly to minimize the assembly time
			5. Be familiar with tools and methods to facilitate development of manufacturing mechanical designs
8	20ME E106	INDUSTRIAL ROBOTICS	1. Principle of working of a robot , types and prepare specifications for various requirements..
			2. Transformations, kinematics of robots to find out the position and orientation.
			3. Singularities, avoiding singularities while designing, find jacobian and trajectory planning of a robot to prepare the robot for various tasks
			4. dynamic analysis using various formulations and design the robots

			5. Working of sensors and controllers for finding position and orientation, analyze robot vision for image acquisition and processing and plan for various tasks and programming
9	20ME M103	RESEARCH METHODOLOGY AND IPR	1. Define research problem, review and assess the quality of literature from various sources
			2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
			3. Collect the data by various methods: observation, interview, questionnaires
			4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
			5. Understand apply for patent and copyrights
10	20CE A101	DISASTER MITIGATION AND MANAGEMENT	1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
			2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
			3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
			4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
			5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management
11	20EE A101	SANSKRIT FOR TECHNICAL KNOWLEDGE	1. Develop passion towards Sanskrit language
			2. Decipher the latent engineering principles from Sanskrit literature
			3. Correlates the technological concepts with the ancient Sanskrit history.
			4. Develop knowledge for the technological progress
			5. Explore the avenue for research in engineering with aid of Sanskrit
12	20EC A101	VALUE EDUCATION	1. Gain necessary Knowledge for self-development.
			2. Learn the importance of Human values and their application in day to day professional life.
			3. Appreciate the need and importance of interpersonal skills for successful career and social life


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			4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
			5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood
13	20IT A101	PEDAGOGY STUDIES	1.illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
			2. Examine the effectiveness of pedagogical practices.
			3. Understand the concept, characteristics and types of educational research and perspectives of research.
			4. Describe the role of classroom practices, curriculum and barriers to learning..
			5. Understand Research gaps and learn the future directions
14	20EG A101	ENGLISH FOR RESEARCH PAPER WRITING	1. Interpret the nuances of research paper writing.
			2. Differentiate the research paper format and citation of sources.
			3. To review the research papers and articles in a scientific manner.
			4. Avoid plagiarism and be able to develop their writing skills in presenting the research work
			5. Create a research paper and acquire the knowledge of how and where to publish their original research papers
15	20EG A102	INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS	1. Understand the making of the Indian Constitution and its features.
			2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
			3. Have an insight into various Organs of Governance - composition and functions.
			4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
			5. Understand Electoral Process, special provisions
16	20EG A103	STRESS MANAGEMENT BY YOGA	1. Understand yoga and its benefits.
			2. Enhance Physical strength and flexibility.
			3. Learn to relax and focus.
			4. Relieve physical and mental tension through asanas
			5. Improve work performance and efficiency
17	20EG A104	PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS	1. Develop their personality and achieve their highest goal of life.
			2. Lead the nation and mankind to peace and prosperity.
			3. Practice emotional self regulation.
			4. Develop a positive approach to work and duties.
			5. Develop a versatile personality
18	20ME C104	INTEGRATED DESIGN AND MANUFACTURING	1. Generate complex components in the part module and assemble them by using suitable constraints..
			2. Generate engineering drawing and apply size, form and

		G LAB	positional tolerances on the drawing
			3. Write part programs using G and M codes for lathe and milling operations for various components.
			4. Differentiate additive and subtractive methods of manufacturing and their integration to build the component
			5. Gain confidence to operate the 3d printing machine
19	20ME C105	VIBRATION AND ACOUSTICS LAB	1. Predict response of a SDOF system, damped or undamped, subjected to simple harmonic excitations. They will be able to obtain Step Response Spectrum of SDOF systems for such excitations
			2. Measure damping in the system using logarithmic decrement and half power method.
			3. Obtain the frequency and mode shapes for beam using continuous systems
			4. Understand basic concept of acoustics, source of models, and measuring of noise.
			5. Understand vibration and noise measuring instruments.
20	20ME C106	FINITE ELEMENT TECHNIQUES	1. Apply FE method for solving field problems using virtual work and potential energy formulations
			2. Analyze linear problems like axial, truss and beam, torsional analysis of circular shaft
			3. Analyze 2D structural problems using CST element and analyze the axi-symmetric problems with triangular elements. Write shape functions for 4 node quadrilateral, isoparametric elements and apply numerical integration and Gaussian quadrature to solve the problems.
			4. Evaluate the eigen values and eigen vectors for stepped bar, formulate 3 D elements, check for convergence requirements
			5. Solve linear 1 D and 2 D heat conduction and convection heat transfer problems, Use of Fea software ANSYS for engineering solutions
21	20ME C107	MECHANICAL DESIGN AND ANALYSIS	1. Apply knowledge of mathematics, sciences and computations in solving the stresses & strains in pressure vessels
			2. Demonstrate the ability to identify, formulate and solve problems for a given flat plate bending applications
			3. Design a system for a component to meet the desired needs of fracture mechanics
			4. Understand, solve various Eigen value and Eigen vectors and will understand different mode extraction methods to calculate frequencies
			5. Understand methods in solving single degree freedom dynamic analysis problems
22	20ME E206	COMPUTATIONAL FLUID DYNAMICS	1. Derive CFD governing equations and turbulence models
			2. Apply elliptical, parabolic and hyperbolic PDEs and forward, backward and center difference methods
			3. Understand errors, stability, consistency and develop O,H and Cgrid generated models
			4. Evaluate the use of Crank-Nicolson, Implicit and Explicit methods and analyze problem by Jacobi, Gauss Seidel and ADI methods


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			5. Solve conduction and convection problems using FVM.
23	20ME E107	MECHANICS OF COMPOSITE MATERIALS	1. Understand different types of composites and their fabrication methods.
			2. Characterize a UD lamina using micromechanics.
			3. Analyze a given laminate for strains and stress.
			4. Decide the failure of a UD lamina.
			5. Design simple composite beams and plates
24	20ME E108	FRACTURE MECHANICS	1. Analyze the fracture mechanism
			2. Gain familiarity with the different modes of failure under the presence of crack
			3. Establish specimen size in accordance with the standard procedures
			4. Distinguish between Plane stress fracture toughness and Plane strain fracture toughness
			5. Accomplish the relationship between crack propagation and stress intensity factor
25	20ME E109	MULTI BODY DYNAMICS	1. Derive equations of motion for interconnected bodies in multi-body systems with three dimensional motions.
			2. Implement and analyze methods of formulating equations of motion for interconnected bodies.
			3. Write programs to solve constrained differential equations for analyzing multi-body systems.
			4. Simulate and analyze all types of static and dynamic behaviors of the multi-body systems including the kineto-static analysis.
			5. Lead team projects in academic research or the industry that require modeling and simulation of multi-body systems
26	20ME E110	TRIBOLOGY IN DESIGN	1. Understand surface topography and model a rough engineering surface.
			2. Understand friction and wear aspects of machine.
			3. Decide upon lubricants and lubrication regimes for different operating conditions.
			4. Understand Hertz contact and rough surface contact.
			5. Select material/surface properties based on the tribological requirements
27	20ME E111	FAILURE ANALYSIS AND DESIGN	1. Apply the concepts of design processes
			2. Provide solutions by inventive problem solving techniques
			3. Develop reliable and robust design
			4. Analyze the behavior of buckling of cylinders under various loading conditions
			5. Predict the fracture behavior under static and fatigue loads , apply the crack propagation concepts , fracture toughness of weld metals
28	20CE A101	DISASTER MITIGATION AND MANAGEMENT	1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
			2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
			3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management

			4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
			5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management
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			4. Develop knowledge for the technological progress
			5. Explore the avenue for research in engineering with aid of Sanskrit
30	20EC A101	VALUE EDUCATION	1. Gain necessary Knowledge for self-development.
			2. Learn the importance of Human values and their application in day to day professional life.
			3. Appreciate the need and importance of interpersonal skills for successful career and social life
			4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
			5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood
31	20IT A101	PEDAGOGY STUDIES	1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
			2. Examine the effectiveness of pedagogical practices.
			3. Understand the concept, characteristics and types of educational research and perspectives of research.
			4. Describe the role of classroom practices, curriculum and barriers to learning.
			5. Understand Research gaps and learn the future directions.
32	20EG A101	ENGLISH FOR RESEARCH PAPER WRITING	1. Interpret the nuances of research paper writing.
			2. Differentiate the research paper format and citation of sources.
			3. To review the research papers and articles in a scientific manner.
			4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
			5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.
33	20EG A102	INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS	1. Understand the making of the Indian Constitution and its features
			2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
			3. Have an insight into various Organs of Governance - composition and functions.
			4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
			5. Understand Electoral Process, special provisions

34	20EG A103	STRESS MANAGEMENT BY YOGA	1.Understand yoga and its benefits.
			2. Enhance Physical strength and flexibility.
			3. Learn to relax and focus.
			4. Relieve physical and mental tension through asanas
			5. Improve work performance and efficiency.
35	20EG A104	PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS	1. Develop their personality and achieve their highest goal of life.
			2. Lead the nation and mankind to peace and prosperity.
			3. Practice emotional self-regulation.
			4. Develop a positive approach to work and duties.
			5. Develop a versatile personality.
36	20ME C108	COMPUTER AIDED ENGINEERING LAB	1. Understand the applications of one and two-dimensional elements
			2. Solve engineering problems
			3. Find buckling factors
			4. Understand industrial applications of forming and sheet metal operations
			5. Find fracture toughness
37	20ME C206	COMPUTATIONAL FLUID DYNAMICS LAB	1.Analyze laminar flow problems in plates and pipes
			2. Solve steady and unsteady flow past a cylinder
			3. Perform analysisfor free and forced convection
			4. Evaluate the effect of angle of attack and velocity on NACA aerofoil
			5. Simulate compressible flow in a nozzle, premixed combustion
38	20MEC 109	MINI PROJECT WITH SEMINAR	1.Formulate a specific problem and give solution
			2. Develop model/models either theoretical/practical/numerical form
			3. Solve, interpret/correlate the results and discussions
			4. Conclude the results obtained
			5. Write the documentation in standard format
39	20MEE112	ADVANCED FINITE ELEMENT METHOD	1.Demonstrate understanding of FE formulation for isoparametric element.
			2. Understand to evaluate the stresses in the elements.
			3. Model effectively and checks the parameters to get the converged solution and verify the solutions.
			4. Demonstrate use of FE formulation to shell elements and analyse for buckling loads.
			5. Solve nonlinear problems with a FE formulation.

40	20MEE113	DIGITAL MANUFACTURING AND DESIGN	1. Understand the concept of digital manufacturing, technology and its potential in modern manufacturing process.
			2. Design and manufacture sophisticated parts using subtractive manufacturing including metal-based additive manufacturing.
			3. Implement and manage digital factory by adopting virtual manufacturing
			4. Analyse the role of product life cycle and database management systems in manufacturing systems.
			5. Understand the concepts of digital design and shape digitization in manufacturing
41	20MEE114	PRODUCT DESIGN AND PROCESS PLANNING	1. Design and process of a product.
			2. Implement reliability techniques, IPR and value engineering.
			3. Understand and develop appropriate manufacturing techniques.
			4. Implement Ergonomic concepts and productivity techniques.
			5. Use computers in product design and process planning.
42	20CEO101	COST MANAGEMENT OF ENGINEERING PROJECTS	1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
			2. Determine the critical path of a typical project using CPM and PERT techniques.
			3. Prepare a work break down plan and perform linear scheduling using various methods.
			4. Solve problems of resource scheduling and levelling using network diagrams.
			5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.
43	20EEO101	WASTE TO ENERGY	1. Understand the concept of conservation of waste
			2. Identify the different forms of wastage
			3. Chose the best way for conservation to produce energy from waste
			4. Explore the ways and means of combustion of biomass
			5. Develop a healthy environment for the mankind
44	20CSO101	BUSINESS ANALYTICS	1. Identify and describe complex business problems in terms of analytical models.
			2. Apply appropriate analytical methods to find solutions to business problems that achieve stated objectives.
			3. Interpret various metrics, measures used in business analytics.
			4. Illustrate various descriptive, predictive and prescriptive methods and techniques.
			5. Model the business data using various business analytical methods and techniques.
			6. Create viable solutions to decision making problems.
45	20ME C110	INDUSTRIAL PROJECT / DISSERTATION	1. Students will be exposed to self-learning various topics.
			2. Students will learn to survey the literature such as books, national/

		PHASE - I	international refereed journals and contact resource persons for the selected topic of research.
			3. Students will learn to write technical reports.
			4. Students will develop oral and written communication skills to present.
			5. Student will defend their work in front of technically qualified audience.
46	20MEC111	INDUSTRIAL PROJECT / DISSERTATION PHASE - II	1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
			2. Students will be able to design and develop an experimental set up/ equipment/test rig.
			3. Students will be able to conduct tests on existing set ups/equipment's and draw logical conclusions from the results after analysing them
			4. Students will be able to either work in a research environment or in an industrial environment.
			5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community


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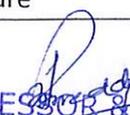
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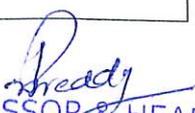
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Course Outcomes Statements for ME (CAD-CAM)-R19

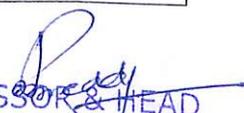
S.no.	Course		Course Outcomes Statements
	Code	Name	
1	19MEC 101	COMPUTER AIDED MODELING AND DESIGN	1. Understand the design process, visualize models through graphics standards and apply principles of computer graphics like geometric transformations, windowing and clipping
			2. Recognize various wireframe entities and model them
			3. Apply surface modelling techniques for generating various parts
			4. Differentiate various solid modelling techniques
			5. Understand various advanced modelling concepts like parametric and variational modelling , feature based design, interference detection
2	19MEC 102	COMPUTER INTEGRATED MANUFACTURING	1. Select the necessary computing tools for development of product
			2. Use appropriate database systems for manufacturing a product and store the same for future use
			3. Use modern manufacturing techniques and tools including principles of networking
			4. Apply the concepts of lean manufacturing and agile manufacturing.
			5. Apply the latest technology of manufacturing systems and software for the development of a product
3	19MEE 101	ADVANCED MACHINE DESIGN	1. Predict failure of engineering components using failure theories
			2. Identify and explain the types of fractures of engineered materials and their characteristic features
			3. Understand LEFM approach
			4. Estimate life of components using stress life and strain life
			5. Categorize different types of surface failure


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4	19MEE 102	ADVANCED VIBRATIONS AND ACOUSTICS	1. Predict response of a SDOF system, damped or undamped, subjected to simple harmonic excitations. They will be able to obtain Step Response Spectrum of SDOF systems for such excitations
			2. Write differential equations of motion for MDOF systems, should be able to obtain the Eigen-values and mode shapes of natural vibrations and response to harmonic excitations, able to measure damping in the system using logarithmic decrement and half power method.
			3. Obtain the frequency and mode shapes for string, rod and beam using continuous systems.
			4. Understand basic concept of acoustics, source of models, and measuring of noise.
			5. Understand vibration and noise measuring instruments
5	19MEE 103	OPTIMIZATION TECHNIQUES	1. Formulate a linear programming problems (LPP)
			2. Build and solve Transportation Models and Assignment Models.
			3. Apply project management techniques like CPM and PERT to plan and execute project successfully
			4. Apply queing and inventory concepts in industrial applications
			5. Apply sequencing models and game theory in industries
6	19MEE 104	AUTOMATION	1. Conceptualize and design automated flow lines.
			2. Implement line balancing concepts in production and assembly lines
			3. Understand and develop automated material handling system suitable for plant operations.
			4. Design, implement and use and appropriate automated inspection facility.
			5. Design and develop an automated production system for manufacturing a product using futuristic technologies
7	19MEE 105	DESIGN FOR MANUFACTURIN G AND ASSEMBL	1. Understand the product development cycle
			2. Know the manufacturing issues that must be considered in the mechanical engineering design process
			3. Know the effect of manufacturing process and assembly operations on the product
			4. Know the principles of assembly to minimize the assembly time

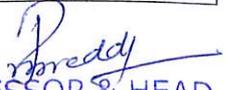

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			5. Be familiar with tools and methods to facilitate development of manufacturing mechanical designs
8	19MEE 106	INDUSTRIAL ROBOTICS	<p>1. Principle of working of a robot , types and prepare specifications for various requirements.</p> <p>2. Transformations, kinematics of robots to find out the position and orientation.</p> <p>3. Singularities, avoiding singularities while designing, find jacobian and trajectory planning of a robot to prepare the robot for various tasks</p> <p>4. dynamic analysis using various formulations and design the robots</p> <p>5. Working of sensors and controllers for finding position and orientation, analyze robot vision for image acquisition and processing and plan for various tasks and programming.</p>
9	19MEC 103	RESEARCH METHODOLOGY AND IPR	<p>1. Define research problem, review and asses the quality of literature from various sources</p> <p>2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs</p> <p>3. Collect the data by various methods: observation, interview, questionnaires</p> <p>4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square</p> <p>5. Understand apply for patent and copyrights</p>
10	19CEA 101	DISASTER MITIGATION AND MANAGEMENT	<p>1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels</p> <p>2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan</p> <p>3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management</p> <p>4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same</p> <p>5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various</p>
11	19EEA 101	SANSKRIT FOR TECHNICAL	1. Develop passion towards Sanskrit language


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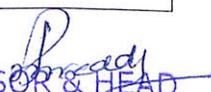
		KNOWLEDGE	<p>2. Decipher the latent engineering principles from Sanskrit literature</p> <p>3. Correlates the technological concepts with the ancient Sanskrit history.</p> <p>4. Develop knowledge for the technological progress</p> <p>5. Explore the avenue for research in engineering with aid of Sanskrit</p>
12	19ECA 101	VALUE EDUCATION	<p>1. Gain necessary Knowledge for self-development</p> <p>2. Learn the importance of Human values and their application in day to day professional life.</p> <p>3. Appreciate the need and importance of interpersonal skills for successful career and social life</p> <p>4. Emphasize the role of personal and social responsibility of an individual for all-round growth.</p> <p>5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood</p>
13	19ITA 101	PEDAGOGY STUDIES	<p>1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.</p> <p>2. Examine the effectiveness of pedagogical practices.</p> <p>3. Understand the concept, characteristics and types of educational research and perspectives of research.</p> <p>4. Describe the role of classroom practices, curriculum and barriers to learning.</p> <p>5. Understand Research gaps and learn the future directions</p>
14	19EGA 101	ENGLISH FOR RESEARCH PAPER WRITING	<p>1. Interpret the nuances of research paper writing</p> <p>2. Differentiate the research paper format and citation of sources.</p> <p>3. To review the research papers and articles in a scientific manner</p> <p>4. Avoid plagiarism and be able to develop their writing skills in presenting the research work</p> <p>5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.</p>
15	19EGA 102	INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS	<p>1. Understand the making of the Indian Constitution and its features.</p> <p>2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies..</p> <p>3. Have an insight into various Organs of Governance - composition and functions</p> <p>4. Understand powers and functions of</p>

			Municipalities, Panchayats and Co-operative Societies.
			5. Understand Electoral Process, special provisions
16	19EGA 103	STRESS MANAGEMENT BY YOGA	1. Understand yoga and its benefits.
			2. Enhance Physical strength and flexibility.
			3. Learn to relax and focus.
			4. Relieve physical and mental tension through asanas
			5. Improve work performance and efficiency
17	19EGA 104	PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS	1. Develop their personality and achieve their highest goal of life.
			2. Lead the nation and mankind to peace and prosperity.
			3. Practice emotional self regulation.
			4. Develop a positive approach to work and duties.
			5. Develop a versatile personality
18	19MEC 104	INTEGRATED DESIGN AND MANUFACTURING LAB	1. Generate complex components in the part module and assemble them by using suitable constraints.
			2. Generate engineering drawing and apply size, form and positional tolerances on the drawing
			3. Write part programs using G and M codes for lathe and milling operations for various components.
			4. Differentiate additive and subtractive methods of manufacturing and their integration to build the component
			5. Gain confidence to operate the 3d printing machine
19	19MEC 105	VIBRATION AND ACOUSTICS LAB	1. Predict response of a SDOF system, damped or undamped, subjected to simple harmonic excitations. They will be able to obtain Step Response Spectrum of SDOF systems for such excitations
			2. Measure damping in the system using logarithmic decrement and half power method.
			3. Obtain the frequency and mode shapes for beam using continuous systems.
			4. Understand basic concept of acoustics, source of models, and measuring of noise.
			5. Understand vibration and noise measuring instruments.
20	19MEC 106	FINITE ELEMENT TECHNIQUES	1. Apply FE method for solving field problems using virtual work and potential energy formulations
			2. Analyze linear problems like axial, truss and beam, torsional analysis of circular shaft
			3. Analyze 2D structural problems using CST element and


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			<p>analyze the axi-symmetric problems with triangular elements. Write shape functions for 4 node quadrilateral, isoparametric elements and apply numerical integration and Gaussian quadrature to solve the problems.</p> <p>4. Evaluate the eigen values and eigen vectors for stepped bar, formulate 3 D elements, check for convergence requirements</p> <p>5. Solve linear 1 D and 2 D heat conduction and convection heat transfer problems, Use of FEA software ANSYS for engineering solutions</p>
21	19MEC 107	MECHANICAL DESIGN AND ANALYSIS	<p>1. Apply knowledge of mathematics, sciences and computations in solving the stresses & strains in pressure vessels</p> <p>2. Demonstrate the ability to identify, formulate and solve problems for a given flat plate bending applications</p> <p>3. Design a system or a component to meet the desired needs of fracture mechanics</p> <p>4. Understand, solve various Eigen value and Eigen vectors and will understand different mode extraction methods to calculate frequencies</p> <p>5. Understand methods in solving single degree freedom dynamic analysis problems</p>
22	19MEE 206	COMPUTATIONAL FLUID DYNAMICS	<p>1. Derive CFD governing equations and turbulence models</p> <p>2. Apply elliptical, parabolic and hyperbolic pdes and forward, backward and center difference methods</p> <p>3. Understand errors, stability, consistency and develop O,H and C grid generated models</p> <p>4. Evaluate the use of Crank-Nicolson, Implicit and Explicit methods and analyze problem by Jacobi, Gauss Seidel and ADI methods</p> <p>5. Solve conduction and convection problems using FVM.</p>
23	19MEE 107	MECHANICS OF COMPOSITE MATERIALS	<p>1. Understand different types of composites and their fabrication methods</p> <p>2. Characterize a UD lamina using micromechanics.</p> <p>3. Analyze a given laminate for strains and stress.</p> <p>4. Decide the failure of a UD lamina.</p> <p>5. Design simple composite beams and plates.</p>
24	19MEE 108	FRACTURE MECHANICS	<p>1. Analyze the fracture mechanism</p> <p>2. Gain familiarity with the different modes of failure under the presence of crack</p> <p>3. Establish specimen size in accordance with the standard procedures</p> <p>4. Distinguish between Plane stress fracture toughness and Plane strain fracture toughness</p> <p>5. Accomplish the relationship between crack propagation and stress intensity factor</p>

25	19MEE 109	MULTI BODY DYNAMICS	1. Derive equations of motion for interconnected bodies in multi-body systems with three dimensional motions.
			2. Implement and analyze methods of formulating equations of motion for interconnected bodies
			3. Write programs to solve constrained differential equations for analyzing multi-body systems.
			4. Simulate and analyze all types of static and dynamic behaviors of the multi-body systems including the kineto-static analysis
			5. Lead team projects in academic research or the industry that require modeling and simulation of multi-body systems
26	19MEE 110	TRIBOLOGY IN DESIGN	1. Understand surface topography and model a rough engineering surface.
			2. Understand friction and wear aspects of machine.
			3. Decide upon lubricants and lubrication regimes for different operating conditions
			4. Understand Hertz contact and rough surface contact.
			5. Select material/surface properties based on the tribological requirements
27	19MEE 111	FAILURE ANALYSIS AND DESIGN	1. Apply the concepts of design processes
			2. Provide solutions by inventive problem solving techniques
			3. Develop reliable and robust design
			4. Analyze the behavior of buckling of cylinders under various loading conditions
			5. Predict the fracture behavior under static and fatigue loads , apply the crack propagation concepts , fracture toughness of weld metals
28	19CEA 101	DISASTER MITIGATION AND MANAGEMENT	1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
			2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
			3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
			4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
			5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management
29	19EEA 101	SANSKRIT FOR TECHNICAL KNOWLEDGE	1. Develop passion towards Sanskrit language
			2. Decipher the latent engineering principles from Sanskrit literature


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			3. Correlates the technological concepts with the ancient Sanskrit history.
			4. Develop knowledge for the technological progress
			5. Explore the avenue for research in engineering with aid of Sanskrit
30	19ECA 101	VALUE EDUCATION	1. Gain necessary Knowledge for self-development
			2. Learn the importance of Human values and their application in day to day professional life.
			3. Appreciate the need and importance of interpersonal skills for successful career and social life
			4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
			5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.
31	19ITA 101	PEDAGOGY STUDIES	1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
			2. Examine the effectiveness of pedagogical practices.
			3. Understand the concept, characteristics and types of educational research and perspectives of research.
			4. Describe the role of classroom practices, curriculum and barriers to learning.
			5. Understand Research gaps and learn the future directions.
32	19EGA 101	ENGLISH FOR RESEARCH PAPER WRITING	1. Interpret the nuances of research paper writing.
			2. Differentiate the research paper format and citation of sources.
			3. To review the research papers and articles in a scientific manner.
			4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
			5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.
33	19EGA 102	INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS	1. Understand the making of the Indian Constitution and its features.
			2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
			3. Have an insight into various Organs of Governance - composition and functions.
			4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
			5. Understand Electoral Process, special provisions
34	19EGA 103	STRESS MANAGEMENT BY YOGA	1. Understand yoga and its benefits.
			2. Enhance Physical strength and flexibility.
			3. Learn to relax and focus.

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			4. Relieve physical and mental tension through asanas
			5. Improve work performance and efficiency
35	19EGA 104	PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS	1. Understand the applications of one and two-dimensional elements
			2. Solve engineering problems
			3. Find buckling factors
			4. Understand industrial applications of forming and sheet metal operations
			5. Find fracture toughness
36	19MEC 206	COMPUTATIONAL FLUID DYNAMICS LAB	1. Analyze laminar flow problems in plates and pipes
			2. Solve steady and unsteady flow past a cylinder
			3. Perform analysis for free and forced convection
			4. Evaluate the effect of angle of attack and velocity on NACA aerofoil
			5. Simulate compressible flow in a nozzle, premixed combustion
37	19MEC 109	MINI PROJECT WITH SEMINAR	1. Formulate a specific problem and give solution
			2. Develop model/models either theoretical/practical/numerical form
			3. Solve, interpret/correlate the results and discussions
			4. Conclude the results obtained
			5. Write the documentation in standard format
38	19MEE 112	ADVANCED FINITE ELEMENT METHOD	1. Demonstrate understanding of FE formulation for linear problems in solid mechanics
			2. Understand behaviour of elastic-plastic materials and viscoplasticity, Use of Newton- Raphson method for solving nonlinear equations of equilibrium
			3. Understand flow rules and strain hardening, loading and unloading conditions, Drucker's stability postulates, J2 flow of theory of plasticity
			4. Demonstrate use of FE formulation to solve the problems of large deformation of structures under loads
			5. Solve contact problems by using the techniques of non-linear FEM
39	19MEE 113	PRODUCT DESIGN AND PROCESS PLANNING	1. Design and process of a product.
			2. Implement reliability techniques, IPR and value engineering.
			3. Understand and develop appropriate manufacturing techniques.

			4. Implement Ergonomical concepts and productivity techniques.
			5. Use computers in product design and process planning
40	19MEE 114	THEORY OF ELASTICITY AND PLASTICITY	1. Describe concepts of stress and strain.
			2. Estimate principle components, normal & stress components, deviatoric and hydrostatic components of a given stress or strain tensor.
			3. Compute the stress tensor for a given stress tensor and vice versa for isotropic and orthotropic materials under various conditions.
			4. Express the stress strain relations of plastic deformation
			5. Compute load required in various bulk deterministic processes such as forging, rolling, extrusion, wire drawing with various methods and compose them.
41	19MEO 101	INDUSTRIAL SAFETY	1. Identify the causes for industrial accidents and suggest preventive measures.
			2. Identify the basic tools and requirements of different maintenance procedures.
			3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
			4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc
			5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc
42	19MEO 102	INTRODUCTION TO OPTIMIZATION TECHNIQUES	1. Formulate a linear programming problems (LPP)
			2. Build and solve Transportation Models and Assignment Models.
			3. Apply project management techniques like CPM and PERT to plan and execute project successfully
			4. Apply queing and inventory concepts in industrial applications
			5. Apply sequencing models in industries
43	19MEO 103	COMPOSITE MATERIALS	1. Classify and characterize the composite materials.
			2. Describe types of reinforcements and their properties.
			3. Understand different fabrication methods of metal matrix composites.
			4. Understand different fabrication methods of polymer matrix composites.
			5. Decide the failure of composite materials.
44	19CEO 101	COST MANAGEMENT OF ENGINEERING	1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.

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		PROJECTS	<p>2. Determine the critical path of a typical project using CPM and PERT techniques</p> <p>3. Prepare a work break down plan and perform linear scheduling using various methods.</p> <p>4. Solve problems of resource scheduling and leveling using network diagrams.</p> <p>5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.</p>
45	19EEO 101	WASTE TO ENERGY	<p>1. Understand the concept of conservation of waste</p> <p>2. Identify the different forms of wastage</p> <p>3. Chose the best way for conservation to produce energy from waste</p> <p>4. Explore the ways and means of combustion of biomass</p> <p>5. Develop a healthy environment for the mankind</p>
46	19MEC 110	DISSERTATION PHASE - I	<p>1. Students will be exposed to self-learning various topics.</p> <p>2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.</p> <p>3. Students will learn to write technical reports.</p> <p>4. Students will develop oral and written communication skills to present.</p> <p>5. Student will defend their work in front of technically qualified audience.</p>
47	19MEC 111	DISSERTATION PHASE - II	<p>1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools</p> <p>2. Students will be able to design and develop an experimental set up/ equipment/test rig.</p> <p>3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.</p> <p>4. Students will be able to either work in a research environment or in an industrial environment</p> <p>5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community</p>

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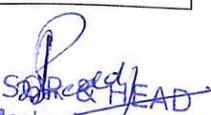
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Course Outcomes Statements for ME (CAD-CAM)-R16

S.no	Course		Course Outcomes Statements
	Code	Name	
1	16MEC 101	AUTOMATION	1. Ability to conceptualize and design automated flow lines
			2. Ability to implement line balancing concepts in production and assembly lines
			3. Ability to understand and develop automated material handling system suitable for plant operations
			4. Ability to design, implement and use and appropriate automated inspection facility
			5. Ability to understand and develop automated material handling system suitable for plant operations
			6. Ability to design, implement and use and appropriate automated inspection facility
2	16MEC 102	COMPUTER AIDED MODELING AND DESIGN	1. apply design concepts in design , analysis and can visualize the models through the graphics standards
			2. implement Various transformations on geometric models for manipulation
			3. recognize various wireframe entities and model them
			4. apply surface modeling techniques for the generating various parts and implement
			5. differentiate various solid modeling techniques
			6. apply various advanced modeling concepts and calculate the interference between mating objects
3	16MEC 103	COMPUTER INTEGRATED MANUFACTURING	1. the basic of CIM, Concurrent engineering, communication matrix, product development cycle, collaborative product development
			2. to create the manufacturing database and store and retrieve data from database
			3. the product design, design for manufacturability and design for assembly concepts, types of computer aided process planning
			4. the CIM technologies such as cellular manufacturing, shop-floor control and flexible manufacturing systems
			5. the importance of principles of networking, topology, network devices, selection of network technology, different models of CIM
			6. to apply the concepts of lean manufacturing, agile & web based manufacturing to product life cycle and process plan during the development of a product.


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4	16MEC 104	COMPUTER AIDED MECHANICAL DESIGN AND ANALYSIS	1. Ability to apply knowledge of mathematics, sciences and computations in solving the stresses & strains in pressure vessels
			2. Demonstrate the ability to identify, formulate and solve problems for a given flat plate bending applications
			3. An ability to design a system or a component to meet the desired needs of fracture mechanics
			4. Students are able to understand and solve various Eigen value and Eigen vectors
			5. Students will understand different mode extraction methods to calculate frequencies 6. Student will understand numerical methods in solving multi degree freedom dynamic analysis problems
5	16MEC 105	FINITE ELEMENT TECHNIQUES	1. implement finite element formulations to axial and quadratic elements and solve problems with hand calculations numerically
			2. formulate numerically the truss, beam and frame elements and solve for deflection, strains and stresses
			3. formulate numerically the plane and axisymmetric triangular elements and quadrilateral elements then solve for deflections, strains and stresses in structural mechanics problems
			4. apply FE formulations to heat transfer of 1D and 2D elements and solve for temperature and heat flux in slabs, walls and plates
			5. apply FE formulations to dynamic analysis of 1D and 2D elements and solve for eigen values and eigen vectors in bars and beams 6. apply FE formulations to 3D solids, plates and for non linear problems
6	16MEC 205	COMPUTATIONAL FLUID DYNAMICS	1. derive CFD governing equations and turbulence models.
			2. apply elliptical, parabolic and hyperbolic PDEs and forward, backward and center difference methods .
			3. understand errors, stability, consistency and develop O,H and C grid generated models.
			4. evaluate the use of Crank-Nihcolson, Implicit and Explicit methods.
			5. analyze problem by Jacobi, Gauss Seidel and ADI methods.
			6. solve conduction and convection problems using FVM
7	16MEE101	FAILURE ANALYSIS AND DESIGN	1. design methodology and various aspects involved in design process
			2. different creative and inventive problem solving techniques
			3. different types of design process, concepts of reliable and safe design
			4. concept of buckling of cylinders under various loading conditions
			5. the fundamentals of fracture, fracture types and concepts of fatigue crack growth, fatigue life prediction and various


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			stress theories of failure vessels
			6. basic crack propagation concept, concepts of crack propagation under combined loading, fracture toughness of weld metals.
8	16MEE 102	INTEGRATED MECHANICAL DESIGN	1. Be able to know the importance of limits ,fits and tolerances and Testing standards for design and manufacturing
			2. Be able to do the complete design and analysis of shafts, bearings and casings by considering design and machining allowances according to standards and requirements.
			3. Be able to do the design and analysis of Different gears and gear boxes.
			4. Be able to do the design of brakes of machine tools, automobiles and mechanical handling equipments for dynamics and thermal aspects
			5. Be able to design of Mechanical handling equipments.
9	16MEE 102	ROBOTIC ENGINEERING	1. Students will be equipped with the brief history of robot configuration,subsystems,applicatios.
			2. Students will have good knowledge about robot end effectors and their design concepts.
			3. Understand different orientations of robot
			4. Students will be familiarized with the kinematic motions of robot and
			5. Able to solve the static and dynamic analysis of Planar robots
			6. Students will be equipped with the principles of various Sensors, their applications in robots and concept of robot vision
10	16MEE 103	PROGRAMMING METHODOLOGY AND DATA STRUCTURES	1. Different types of data storage and their structures
			2. Implementing the concepts with programming in 'C'
			3. Apply different sorting techniques in Mechanical engineering Applications
			4. Classify the different Data Structures
			5. differentiate between Linked lists,stacks and queues 6. Understand the concept of Trees and their traversals
11	16MEE 104	OPTIMIZATION TECHNIQUES	1. Formulate and solve Linear programming problem
			2. Apply different techniques to solve Non Linear programming problem
			3. Implement constrained optimization techniques

			4. Analyze dynamic programming and integer programming problems
			5. Develop schedule for projects and apply PERT/CPM techniques
			6. Apply Queuing theory to real life situations
12	16MEE105	VIBRATION ANALYSIS AND CONDITION MONITORING	1. Understand the Causes of Vibration and its effect on structures
			2. Understand Single degree and multi degree of freedom systems of steady state and transient characteristics of vibration, simple harmonic motion, periodic motion, peak to Peak, RMS and average values.
			3. Vibration measuring instruments, display and recording to elements, frequency analysis and filters, Vibration limits and standards;
			4. Know and be able to explain the aim and the basics of CM
			5. Be aware of some methods and procedures applied for general CM;
			6. Appreciate and understand the basic idea behind vibration-based structural health monitoring and vibration- based condition monitoring, know the general stages of CM
13	16MEE 107	ENGINEERING RESEARCH METHODOLOGY	1. define research problem
			2. review and asses the quality of literature from various sources.
			3. understand and develop various research designs.
			4. collect the data by various methods: observation, interview, questionnaires.
			5. analyze problem by statistical techniques: ANOVA, F-test, Chi-square
			6. improve the style and format of writing a report for technical paper/ Journal report
14	16MEE 108	TRIBOLOGY IN DESIGN	1. Have a knowledge of surface topography and can model a rough engineering surface
			2. Understand friction and wear aspects of machine
			3. decide upon lubricants and lubrication regimes for different operating conditions
			4. Understand Hertz contact and rough surface contact
			5. Ability to select material / surface properties based on the tribological requirements
			6. Analysis ability of different types of bearings for given load/ speed conditions
15	16MEE 109	ADVANCED MECHANICS OF MATERIALS	1. understand the analysis and deformation, stress-strain relations, failure theories
			2. analyze and design the columns


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			3. determine the stresses due to asymmetric bending
			4. locate the shear centre of thin-walled sections.
			5. Determine the stresses in curved beams
			6. calculate the residual stresses in members under torsion/bending analyze the torsion of noncircular cross-sections.
16	16MEE 110	MECHANICS OF COMPOSITE MATERIALS	1. Classify the composites, types of reinforcements, matrices and phases.
			2. Recognize the fundamentals of orthotropic materials and mechanics of materials in micro and macro level.
			3. Understand different fabrication methods of composites.
			4. Demonstrate the fundamentals of directional stresses and strains. Transformation of stress and strain.
			5. Understand the failure of composites including fracture
			6. Analyze different types of composite structures using plate and shell theory
17	16MEE 111	THEORY OF ELASTICITY AND PLASTICITY	1. demonstrate the understanding of fundamentals stress and its concepts.
			2. understanding of concepts of strain
			3. solve the problems related to stress & strain and also their relations in isotropic materials
			4. to apply the constitutive equations, compatibility equation and equilibrium equations for problem solving
			5. apply plasticity relations for simple problems
			6. can choose and apply plasticity analysis methods
18	16MEE 112	EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS	1. Show the general principle of measurement
			2. Classify and apply different transducers for converting cutting forces into suitable signals
			3. State the design requirements of tool-force dynamometers
			4. Understand various surface measurement aspects
			5. Able to apply Taguchi methods for different optimization problems
19	16MEE 113	DESIGN FOR MANUFACTURE	1. understand constraints of manufacturing processes that limit design possibilities with respect to cycle time, material handling, and other factory costs
			2. design suitable manufacturing process capable of designing metallic components
			3. design suitable manufacturing process capable of designing non-metallic components
			4. design welded assembly, gear box assembly etc

			5. design suitable manufacturing process capable of designing the bolted, screwed, flanged connections etc.
			6. prepare a project or report applying DFM principles per an example from industry
20	16MEE 114	DATA BASE MANAGEMENT SYSTEMS	1. Understand the basic concepts and applications of database systems.
			2. Familiarized with commercial relational database system.
			3. Demonstrate an understanding of the relational data model
			4. Familiarized with indexing methods including B-tree, and hashing
			5. work successfully in a team by design and development of a database application
			6. Understand the basics of query evaluation techniques and and query optimization
21	16MEE 115	FRACTURE MECHANICS	1. Identify and explain the types of fractures of engineered materials and their characteristic features;
			2. Understand the differences in the classification of fracture mechanics (LEFM and EPFM)• and how their corresponding parameters can be utilized to determine conditions under which engineering materials will be liable to fail catastrophically in service;
			3. Understand and explain the mechanisms of fracture
			4. Appreciate the theoretical basis of the experimental techniques utilized for fracture
			5. Develop expertise on the experimental techniques utilized for fracture and failure analysis
			6. Learn simple LEFM testing methods for evaluating the fracture toughness of materials
22	16MEE 116	DESIGN OF PRESS TOOLS	1.classify types of presses, characteristics and their principles.
			2. understand the terminology in the design of Dies.
			3. understand Elements of shearing dies
			4. understand the basic concepts and principle involved in designing press tools.
			5. ne in a position to independently design various press tools which will cater to requirement of industry
			6. understand the different types of dies
23	16MEE 117	DESIGN OF DIES	1. Apply contemporary design principles when designing advanced moulds and dies;
			2. Assess the performance of a given tool design based on the design criteria;
			3. Evaluate the effects of a given tool design on the quality of the work.
			4. Describe the principles of clamping, drill jigs and computer aided jig design
			5. Design fixtures for milling, boring, lathe, grinding, welding;

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			<p>identify fixtures and cutting tools for NC machine tools</p> <p>6. Explain the principles of dies and moulds design</p>
24	16MEE 118	RAPID PROTOTYPING PRINCIPLES AND APPLICATIONS	<p>1. identify different process and key characteristics of RP technologies and commonly used RP systems</p> <p>2. describe various CAD issues for rapid prototyping and related operations for STL model generation and manipulation</p> <p>3. Explain and summarize typical rapid tooling processes for quick batch production of plastic and metal parts</p> <p>4. critically explore technologies used for rapid prototyping in terms of their parameters, application, limitations, cost, materials, equipment, outcomes and implications</p> <p>5. distinguish the types of Additive Manufacturing capabilities based on part geometry customer demands and CNC machine capabilities</p> <p>6. identify different post processing techniques involved after rapid prototyping.</p>
25	16MEE 119	Flexible Manufacturing Systems	<p>1. the understand the elements of flexible manufacturing system</p> <p>2. Students can independently develop the sequence of operations that are to be performed for manufacturing of a product</p> <p>3. understand the functioning of programmable logical controller</p> <p>4. understand Automated storage and retrieval systems</p> <p>5. understand the concept of just in time manufacturing</p> <p>6. understand the FMS design concept</p>
26	16MEE 120	NON-TRADITIONAL MACHINING AND FORMING	<p>1.the importance ,principles of various Non-traditional processes</p> <p>2.the processes of Thermal Metal Removal</p> <p>3.the parameters and chemistry of Electro chemical process</p> <p>4.the principles of Plasma Arc machining</p> <p>5.the principles of laser Beam and Electron Beam machining</p> <p>6.to make the comparison of conventional and high velocity forming methods</p>
27	16MEE 121	PRODUCT DESIGN AND PROCESS PLANNING	<p>1. Imparting basic foundation and advanced concepts about Design and Manufacturing Engineering.</p> <p>2. Root cause analysis of a design engineering problem through basic and engineering sciences.</p> <p>3. Understanding and learning of Manufacturing issues.</p> <p>4. Imparting research activities through curriculum.</p> <p>5. Solving complex design engineering problems. and apply latest engineering tools with advanced software knowledge .</p> <p>6 .Mechanical engineering solutions to green and sustainable development</p>

28	16MEC 106	CAD/CAM LABORATORY	1. use parametric CAD software for geometric modeling of mechanical designs
			2. visualize of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring
			3. apply of CAD computational analysis tools to engineering design.
			4. create a complete CAD documentation for an engineering design.
			5. model complex shapes including freeform curves and surfaces Explain the basic concepts of CNC programming and machining
			6. implement CNC programs for milling and turning machining operations
29	16MEC 107	COMPUTATIONAL LABORATORY	1. Use the tools like ANSYS in solving real time problems and day to day problems
			2. Apply the Finite Element Method for the calculation stresses, strains and deformations in any component
			3. critically evaluate the model results in comparison to simplified analytical solutions
			4. Versatility in using these tools for any engineering and real time applications.
			5. Gain knowledge on utilizing these tools for a better project in their curriculum
			6. Face industry with confidence in using these tools in their respective jobs
30	16MEC 110	MINIPROJECT GUIDELINES	1. Formulate a specific problem and give solution
			2. Develop model/models either theoretical/practical/numerical form
			3. Solve, interpret/correlate the results and discussions
			4. Conclude the results obtained and write the documentation in standard format


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