Program and Course Structure
School of Engineering and Technology
Department of Mechanical Engineering
Program: M.Tech Mechanical Engineering
Program code: SET0616
(Batch: 2019-2021)

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

Vision of the School of Engineering and Technology

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship to provide sustainable solution to the needs of the society

Mission of the School Engineering and Technology

1. To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conducive and enriching learning environment.
2. To produce technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.
3. To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.
4. To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counseling.

1.2.1 Vision and Mission of the Department of Mechanical Engineering

Vision of the Department of Mechanical Engineering

To be a centre of learning for preparing professional mechanical engineers, having passion for innovation, entrepreneurship and research, to provide a sustainable solution to the needs of the society

Mission of the Department of Mechanical Engineering

M1. To offer a curriculum that prepares students with knowledge, skills and ethical values for exploring professional practices.

M2. To train students in to global leaders through industry driven and research oriented teaching-learning pedagogy.

M3. To groom students into globally competent professionals and entrepreneurs, who are sensitive to the issues of environment, energy, and emergent needs of the society.

M4. To equip students with necessary skills to contribute innovatively in creating knowledge through higher learning.

1.3 Program Educational Objectives (PEO)

1.3.1 Program Educational Objectives (PEO) M.Tech Mechanical Engineering

The Educational Objectives of M.Tech Mechanical Engineering are:

PEO1: Graduates will be excel in applying knowledge of production engineering to create novel products and solutions for complex problems.

PEO2: Graduates will be able to understand and explore the behaviour of existing and new materials suitable for the design and development of products.

PEO3: Graduates will be able to apply the knowledge of industrial engineering to recognize, comprehend, analyze and to solve complex real life problems.

PEO4: Graduates will be able to build up the adequate communication skills, proficient personality and moral esteems to be a good human beings, responsible citizens and capable experts.

PEO5: Graduates will be capable of applying relevant skills of research and development and other creative/ innovative efforts in their professional career.

1.3.3 Program Outcomes (PO's)

PO1: Apply the engineering knowledge of mechanical engineering practices such as design, manufacturing, thermal sciences, automation and industrial engineering to the solution of complex mechanical systems.

PO2: Identify, formulate, solve and analyse the mechanical system such as machine tools, press tools and thermal systems such as IC engines, refrigeration, air-conditioning and power generating systems.

PO3: Conceptualize and evaluate the mechanical engineering aspects and select feasible solution using modern industrial management techniques and quality assurance systems considering safety, environment, and other realistic constraints.

PO4: Develop the skills of good researchers to work on a problem, starting from the scratch, to research in to literatures, methodologies, techniques, tools and conduct experiments and interpret data.

PO5: Make use of modern engineering tools, software and equipment to analyse and complex mechanical engineering problems.

PO6: Demonstrate the traits of manager in handling engineering projects, related finance and coordinate work force towards achieving desired goals.

PO7: Perceive the traits of professional integrity and ethics, and demonstrate the responsibility to implement the research outcome for sustainable development of the society.

PO8: Communicate effectively to comprehend and write effective reports following engineering standards.

PO9: Demonstrate the skills of presenting the work unequivocally before scientific community and exchange the scientific thoughts.

PO10: Recognize the need for and ability to engage in life-long learning in the broadest context to work in research laboratories and multidisciplinary environments.

School of Engineering and Technology

M.Tech-Mechanical Engineering

Batch: 2019-2021

TERM: I

S. No.	Course Code	Course Name	Teaching Load			Credits
			L	T	P	
THEORY COURSES						
1.	MME122	Finite Element Methods with Matlab	3	0	0	3
2.	PE I	Program Elective I	3	1	0	3
3.	PE II	Program Elective II	3	0	0	3
4.	PE III	Program Elective III	3	0	0	3
5.	MME104	Advanced Materials Engineering	3	0	0	3
PRACTICAL/VIVA-VOCE/JURY						
6.	MPI787	Design and Modeling Tool Lab	0	0	4	2
7.	MMP122	Finite Element Methods with Matlab	0	0	2	1
TOTAL CREDITS						**19**

School of Engineering and Technology

M.Tech-Mechanical Engineering

Batch: 2019-2021

TERM: II

S. No.	Course Code	Course Name	Teaching Load			Credits
			L	T	P	
THEORY COURSES						
1.	PE IV	Program Elective IV	3	1	0	4
2.	PE V	Program Elective V	3	1	0	4
3.	PE VI	Program Elective VI	3	1	0	4
4.	PE VII	Program Elective VII	3	0	0	3
5.	PE VIII	Program Elective VIII	4	0	0	4
6.	MRM001	Research Methodology	2	0	0	2
PRACTICAL/VIVA-VOCE/JURY						
7.	MPI786	Experimental Design and Analysis Lab	0	0	4	2
8.	CCU101	Community Connect	0	0	4	2
9.	MPI788	Automation Lab	0	0	2	1
TOTAL CREDITS						**26**

School of Engineering and Technology

M.Tech-Mechanical Engineering

Batch: 2019-2021

TERM: III

S. No.	Course Code	Course Name	Teaching Load			Credits
			L	T	P	
PRACTICAL/VIVA-VOCE/JURY						
1.	MME691	Seminar	-	-	-	2
2.	MME693	Dissertation-I	-	-	-	10
TOTAL CREDITS						**12**

School of Engineering and Technology

M.Tech-Mechanical Engineering

Batch: 2019-2021

TERM: IV

S. No.	Course Code	Course Name	Teaching Load			Credits
			L	T	P	
PRACTICAL/VIVA-VOCE/JURY						
1.	MME694	Dissertation-II	-	-	32	16
TOTAL CREDITS						**16**

List of Program Electives: B.Tech- Mechanical Engineering with Specialization in Production and Industrial Engineering:

Elective 1: MPI112- Advanced Manufacturing Techniques (3-0-0) 3
Elective 2: MME114- Industrial Robotics (3-1-0) 4
Elective 3: MPI101- Production and Inventory Decisions (3-0-0) 3
Elective 4: MPI107- Computer Integrated Manufacturing Systems (3-0-1) 4 (Lab)
Elective 5: MME118- Smart Manufacturing (4-0-0) 4
Elective 6: MME015- Supply Chain Management (4-0-0) 4
Elective 7: OEM015- Renewable Energy & Energy Management (3-0-0) 3
Elective 8: MME127- Advance Operations Research (4-0-0) 4

List of Program Electives: B.Tech- Mechanical Engineering with Specialization in Machine Design:

Elective 1: MME121- Mechanics of Composite Materials (3-0-0) 3
Elective 2: MME114- Industrial Robotics (3-1-0) 4
Elective 3: MME123- Advanced Machine Design (3-0-0)3
Elective 4: MME119- Machine Tool Design (3-1-0) 4
Elective 5: MEP120- Fracture Mechanics (4-0-0) 4
Elective 6: MPI107- Computer Integrated Manufacturing Systems (3-0-1) 4 (Lab)
Elective 7: OEM015- Renewable Energy & Energy Management (3-0-0) 3
Elective 8: MME124- Design For Manufacture And Assembly (4-0-0) 4

List of Program Electives: B.Tech- Mechanical Engineering with Specialization in Fluid and Thermal Engineering:

Elective 1: MME010- Advanced Power Plant Engineering (3-0-0) 3
Elective 2: MME102- Heat and Mass Transfer (3-1-0) 4
Elective 3: MME108- Advance Mechanics of Fluids (3-0-0) 3
Elective 4: MME125- Gas Turbine and Compressors (4-0-0) 4
Elective 5: MME126- Advanced Thermodynamics (3-0-1) 4 (Lab)
Elective 6: MME115- Refrigeration & Air-Conditioning and Cryogenics Engineering (4-0-0) 4
Elective 7: OEM015- Renewable Energy & Energy Management (3-0-0) 3
Elective 8: MME128- Solar Energy Technology (4-0-0) 4

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: I**
1	Course Code	MME 122
2	Course Title	Finite Element Method with MATLAB
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Program Core
5	Course Objective	This course provides an introduction to Finite Element Method with a focus on 1D and 2D problems in structures, heat transfer, static and dynamics as well as writing algorithm for problem solving using MATLAB
6	Course Outcomes	On successful completion of this course, students will be able to CO1: Formulate the basic principles of elasticity, equilibrium, energy and virtual work. CO2: Formulate the finite element characteristics for solving complex structural and thermal problems CO3: Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer CO4: Analyze the various static and dynamic structural problems by formulating appropriate finite element method. CO5: Analyze the various fluid and heat transfer problems by formulating appropriate finite element method. CO6: Solve the complex engineering problem based on finite element formulations using MATLAB.
7	Course Description	This course introduces finite element methods for the analysis of solid, structural, fluid and heat transfer problems. Applications of finite element methods, modelling and analysis of problems, and interpretation of numerical results.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Review of elasticity, mathematical models for structural problems,
	B	Equilibrium of continuum-Differential formulation

	C	Energy Approach-integral formulation, Principle of virtual work-Variational formulation.		
	Unit 2	**Finite element formulation**		
	A	Philosophy and general processes of finite element method.		
	B	Concept of discretisation and Interpolation.		
	C	Formulation of finite element characteristic matrices and vectors, Compatibility, Assembly and boundary condition.		
	Unit 3	**Analysis of one dimensional Structural problems**		
	A	Formulation of stiffness matrix, mass matrices and lumped load vectors.		
	B	Introduction to higher order elements and their advantages and disadvantages		
	C	Static and dynamic analysis of one dimensional axial and beam problems		
	Unit 4	**Analysis of Two dimensional Structural Problems:**		
	A	Shape functions in two dimensions, natural coordinates, Isoparametric representation, Concept of Jacobian.		
	B	Triangular and Quadrilateral elements for membrane elements.		
	C	Quadrilateral elements for plate bending elements		
	Unit 5	**FEM in Heat Transfer and Fluid Mechanics problems:**		
	A	Finite element solution for one dimensional heat conduction with convective boundaries.		
	B	Formulation of element characteristics and simple numerical problems		
	C	Finite element applications in one dimensional potential flows; Formulation based on Potential function and stream function.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Seshu P, Textbook of Finite Element Analysis, PHI. 2004		
	Other References	1 Reddy, J.N., Finite Element Method in Engineering, Tata McGraw Hill, 2007. 2. Singiresu S.Rao, Finite element Method in Engineering, 5ed, Elsevier, 2012 3. Zeincowicz, The Finite Element Method for Solid and Structural Mechanics, 4th Edition, Elsevier 2007. 4. Young W Kwon and Hyochoong Bang, The finite element method using MATLAB, 2ed, CRC Press, London. 2000.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: I**
1	Course Code	MMP 122
2	Course Title	Finite Element Method with MATLAB Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Program Elective
5	Course Objective This course provides an introduction to Finite Element Method with a focus on 1D and 2D problems in structures, heat transfer, static and dynamics as well as writing algorithm for problem solving using MATLAB	
6	Course Outcomes On successful completion of this course, students will be able to CO1: Formulate the basic principles of elasticity, equilibrium, energy and virtual work. CO2: Formulate the finite element characteristics for solving complex structural and thermal problems CO3: Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer CO4: Analyze the various static and dynamic structural problems by formulating appropriate finite element method. CO5: Analyze the various fluid and heat transfer problems by formulating appropriate finite element method. CO6: Solve the complex engineering problem based on finite element formulations using MATLAB.	
7	Course Description This course introduces finite element methods for the analysis of solid, structural, fluid and heat transfer problems. Applications of finite element methods, modelling and analysis of problems, and interpretation of numerical results.	
8	Outline syllabus	CO Mapping

	List of Experiments			
	Experiment 1	Introduction to interface of MATLAB limited to use of finite element formulation and analysis.		
	Experiment 2	Formulation of finite element simulation of static and dynamic responses of uniform rod using MATLAB.		
	Experiment 3	Computation of finite element simulation of static and dynamic responses of uniform beam using MATLAB		
	Experiment 4	Formulation of finite element simulation of static analysis of uniform rectangular plate using MATLAB.		
	Experiment 5	Formulation of finite element simulation of dynamic analysis of uniform rectangular plate using MATLAB.		
	Experiment 6	Computation of finite element simulation of buckling analysis of uniform beam subjected to axial load using MATLAB		
	Experiment 7	Formulation of finite element simulation of buckling analysis of uniform rectangular plate subjected to in-plane loading using MATLAB.		
	Experiment 8	Computation of finite element simulation dynamic analysis of rotating uniform beam using MATLAB		
	Experiment 9	Formulation of finite element simulation of heat transfer problem of uniform rod using MATLAB.		
	Experiment 10	Computation of finite element simulation dynamic analysis of tapered beam using MATLAB		
	Mode of examination	Practical		
	Weightage Distribution	CA	MTE	ETE
		60%	0%	40%
	Text book/s*	1. Young W Kwon and Hyochoong Bang, The finite element method using MATLAB, 2ed, CRC Press, London. 2000.		
	Software	MATLAB		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: PIE(Mechanical Engineering)		**Semester: I**
1	Course Code	MME112
2	Course Title	Advanced Manufacturing Techniques
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. To present the fundamentals of advanced manufacturing techniques 2. To prepare students to apply their understanding of advanced manufacturing processes based on Mechanical, Chemical & Electro-Thermal Energy.
6	Course Outcomes	On successful completion of this course students will be able to CO1: Analyze the characteristics of Ultrasonic machining, Abrasive jet machining and water jet machining. CO2: Explain various chemical processes in advance manufacturing techniques. CO3: Classify non-traditional manufacturing processes according to the source of energy. CO4: Elaborate the various HERF process. CO5: Discuss various advanced casting processes. CO6: Determine the various advance machining processes.
7	Course Description	This course introduces students to learn about various non-conventional machining process. These processes are generally used when traditional methods are not technically or economically feasible like machining of very hard or tough materials, machining of very complex shapes and to obtain high surface finish and accuracy in manufacturing process.
8	Outline syllabus	
	Unit 1	**Advanced Machining Process (Mechanical)**
	A	Introduction, Need of advanced manufacturing processes,
	B	Mechanical machining, Types - Ultrasonic machining (USM), Abrasive Jet Machining (AJM), Parametric Analysis of USM & AJM.
	C	Water Jet Machining (WJM). Operating principle, Process parameters, Applications & Limitations. Introduction to micromachining
	Unit 2	**Advanced Machining Process(Chemical)**
	A	Electro chemical machining, Chemical material removal, its types.
	B	Electro chemical machining (ECM), Operating principle

	C	Process parameters, Applications & Limitations.		
	Unit 3	**Advanced Machining Process (Electro-Thermal)**		
	A	Thermo electrical machining, Types, Electrical discharge machining (EDM), Electrical discharge wire cutting (EDWC).		
	B	Electron beam machining (EBM), Operating principle, Process parameters, Applications & Limitations		
	C	Laser materials processing, Laser types, Processes. Laser beam machining (LBM), Applications – Limitations		
	Unit 4	**High Energy Rate Forming**		
	A	Introduction to HERF		
	B	Explosive forming, Hydro-forming.		
	C	Electro hydraulic forming, Electromagnetic forming		
	Unit 5	**Advanced Casting Processes**		
	A	Pressure Die Casting, Vacuum die casting,		
	B	Centrifugal casting, Shell mould casting, Investment casting		
	C	Introduction to Powder metallurgy and its application.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Pandey,P.C and Shan, H.S. , “Modern Machining Process”, 2014.		
	Other References	2. Ghosh, A. and Mallik, A.K. , “Theory of Mechanisms and Machines”, 1988. 3. P K Mishra, "Non-Conventional Machining", Narosa India Publication, a Text Book", 2007 4. Abdel, H. and El-Hofy, G. “Advanced Machining Processes”, McGraw-Hill, USA, 2005		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: I**
1	Course number	MME114
2	Course Title	Industrial Robotics
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Department Elective
5	Course Objective	1. To be familiar with the automation and brief history of robot and applications. 2. To give the student familiarities with the kinematic motion related to robots. 3. To give knowledge about robotic machine vision system. 4. To learn about Robot Manipulators and it's applications. 5. To give knowledge about Robot Planning, Installation and Safety Procedures.
6	Course Outcomes	After successful completion of this course students should be able to: CO1: apply the knowledge of the automation and brief history of robot and applications. CO2: Analyze the kinematic motions of robot. CO3: classify about robotic grippers and their design concepts. CO4: Demonstrate machine vision system of robots. CO5: Explain the principles of various Sensors and their applications in robots. CO6: Create and analyze an industrial manipulator
	Course Description	This course covers all aspects of mobile robot systems design and programming from both a theoretical and a practical perspective. The basic subsystems of control, localization, mapping, perception, and planning are presented. For each, the discussion will include relevant methods from applied mathematics. aspects of physics necessary in the construction of models of system and environmental behavior, and core algorithms which have proven to be valuable in a wide range of circumstances. This also includes various applications of robotics engineering.
7	Outline syllabus	

7.01	**Unit 1**	**Robotics Introduction**		
7.02	A	Evolution of Robots and Robotics, Laws of Robotics		
7.03	B	Role of robotics in automated manufacturing system, Robot anatomy		
7.04	C	Robot classifications and specifications, Manipulation and Control.		
7.05	**Unit 2**	**Robot Kinematics & Gripper Mechanism**		
7.06	A	Robot kinematics, forward and reverse transformation, homogeneous transformations		
7.07	B	Fundamental Rotation matrices, Kinematic modeling of the manipulator, Denavit-Hartenberg Notation.		
7.08	C	Robot end-effectors, mechanical, magnetic, and vacuum grippers, gripping forces RCC and design features of grippers.		
7.09	**Unit 3**	**Robotic vision systems & Application of Robots**		
7.10	A	Robot vision and their interfaces, Machine Vision Applications		
7.11	B	Applications of robots in materials handling, Inspection		
ff7.12	C	Welding, spray painting and finish coating, Parts Mating & Parts Joining Operations.		
7.13	**Unit 4**	**Robot Manipulators, Actuators and Drives**		
7.14	A	Types of Robot Manipulators, Application of Robot Manipulators, Construction of a Robot Manipulatotor		
7.15	B	Characteristics of actuating systems, Comparison of actuating systems		
7.16	C	Hydraulic Actuators , Pneumatic, Actuators, Electric Actuators, Robotic Drives		
7.17	**Unit 5**	**Robot Sensors and Robot Safety**		
7.18	A	Sensors in Robotics, classification of Robotic sensors, Acoustic sensors Optical Sensors, Pneumatic Sensors.		
7.19	B	Touch Sensors, Force Sensors, Force Sensing Wrist and its applications		
7.20	C	Robot Planning and Installation, Robot Safety, Need of Robot Safety.		
8	Course Evaluation			
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
9	References			
9.1	Text book	1.Groover, M.P., “Industrial Robotic Technology - Programming and Application”, McGrawhill		
9.2	Other references	**Reference Books and Monographs**		
		1. Koren, Y. ,“Robotics for Engineers”, McGrawhill. 2. Deb, S.R., “Robotics Technology and Flexible Automation” Tata Mc Graw Hill Elwood S Bufa and Rakesh K Sarin “ Modern Production/Operations Management”, Wiley India Edition, Reprint 2009		

School: SET		Batch : 2019-2021
Program: M.Tech		Current Academic Year: 2019
Branch: ME		Semester: I
1	Course number	MPI 101
2	Course Title	Production and Inventory Decisions
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
5	Course Objective	The objective of PID is to equip the learner with the knowledge and skills necessary to be able to perform in one of the many disciplines associated with production and inventory management such as planning, Demand forecasting, Production planning and control inventory control, materials planning etc.
6	Course Outcomes	After successful completion of this course students should be able to: CO1. Identify the principles and applications relevant to Production and operations of manufacturing/service firms. CO2. Forecast situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making. CO3. Explain how Enterprise Resource Planning and MRPII systems are used in managing operations. CO4. Plan and contribute to manufacturing and business operations. CO5. Demonstrate the managerial responsibility for Operations and inventory management. CO6. Apply planning, control, and inventory management in real-life complex problem
7	Outline syllabus	
7.01	**Unit 1**	**INTRODUCTION**
7.02	A	An Overview of production systems,
7.03	B	Production management objectives
7.04	C	Manufacturing strategy, Technological innovations in Manufacturing
7.05	**Unit 2**	**FORECASTING**
7.06	A	The forecasting process
7.07	B	Monitoring and controlling the forecasting system
7.08	C	multi-item forecasting
7.09	**Unit 3**	**PLANNING ACTIVITIES**

7.10	A	Aggregate Planning Strategies and methods		
7.11	B	The Master Production Schedule,		
ff7.12	C	Planning of material requirements - MRP, Manufacturing Resources Planning		
7.13	**Unit 4**	**CONTROL ACTIVITIES**		
7.14	A	Capacity planning and control		
7.15	B	Production Activity control, , Scheduling in Manufacturing,		
7.16	C	Theory of constraints and synchronous manufacturing.		
7.17	**Unit 5**	**INVENTORY MANAGEMENT**		
7.18	A	Basic Inventory systems, Inventory systems under risk,		
7.19	B	Distribution inventory management,		
7.20	C	Just - in - time systems and Lean manufacturing		
8	Course Evaluation			
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
8.2	MTE	One, 20 percent		
8.3	End-term examination: 50%			
9	References			
9.1	Text book	1. Lee J.Krajewski,Larry P.Ritaman," Operations Management ",Addison-Wesley,2000.		
9.2	Other references	Reference Books and Monographs Seetharama L.Narasimhan,Dennis W.McLeavy,Peter J .Billington, ." Producion planning and inventory control ", PHI. Averetle E Adam, Jr Ronaald J. Ebert “Production and operational management, PHI Elwood S Bufa and Rakesh K Sarin “ Modern Production/Operations Management”, Wiley India Edition, Reprint 2009 Shailendra Kale, “Production and Operations Management”, TMH Education		

School: SET		**Batch : 2019-2021**	
Program: M.Tech		**Current Academic Year: 2019**	
1	**Course No.**	MPI107	
2	**Course Title**	**Computer Integrated Manufacturing Systems**	
3	**Credits**	4	
4	**Contact Hours (L-T-P)**	3-0-1	
5	**Course Objective**	This course will provide in-depth coverage of Computer Integrated Manufacturing. It contains a high proportion of hands-on study, particularly in the areas of Computer Aided Design/Computer Aided Manufacturing (CAD/CAM), and Computer Numerical Control (CNC).	
6	**Course Outcomes**	On successful completion of this module students will be able to CO 1- identify the types of production and various costs involved in manufacturing with its analysis. CO 2 – Analyse and solve the design problems of different type of transfer mechanism. CO 3 – Demonstrate the CNC turning & milling Programme and get knowledge about industrial robot. CO 4 – Design and analysis of automatic storage and retrieval system CO 5 – Explain various automated Inspection methods. CO 6 Apply the system modelling tools in CIM and the fundamental concepts of data communications for computer integrated manufacturing.	
7	**Outline syllabus:**		
7.01	MPI107.A	**Unit A**	**Introduction and Automated Flow Lines**
7.02	MPI107.A1	Unit A Topic 1	Types of production - Functions - Automation strategies.
7.03	MPI107.A2	Unit A Topic 2	Production economics - Costs in manufacturing
7.04	MPI107.A3	Unit A Topic 3	Break-even-analysis.
7.05	MPI107.B	**Unit B**	**Automated flow lines**
7.06	MPI107.B1	Unit B Topic 1	Transfer mechanism - Buffer storage
7.07	MPI107.B2	Unit B Topic 2	Analysis of transfer lines - Line unbalancing concept
7.08	MPI107.B3	Unit B Topic 3	Automated assembly systems.
7.09	MPI107.C	**Unit C**	**Numerical Control**
7.10	MPI107.C1	Unit C Topic 1	NC-CNC Programming
7.11	MPI107.C2	Unit C Topic 2	Part programming , DNC - Adaptive control
7.12	MPI107.C3	Unit C Topic 3	Robot anatomy - Specifications - End effectors – Sensors, Robot cell design.
7.13	MPI107.D	**Unit D**	**AUTOMATED HANDLING AND STORAGE**
7.14	MPI107.D1	Unit D Topic 1	Automated material handling systems
7.15	MPI107.D2	Unit D Topic 2	AS/RS

7.16	MPI107.D3	Unit D Topic 3	Carousel storage
7.17	MPI107.E	**Unit E**	**INSPECTION METHODS**
7.18	MPI107.E1	Unit E Topic 1	Contact methods
7.19	MPI107.E2	Unit E Topic 2	Non- contact methods
7.20	MPI107.E3	Unit E Topic 3	Automated Inspection

8	**Course Evaluation**			
8.1	Course work: 30%			
8.11	Mode of examination	Theory		
8.12	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
8.2	MTE	One, 20 percent		
8.3	End-term examination: 50 marks			
9.1	Text book	1. Mikell P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing," PHI, 1995.		
9.2	Other References	1. Weatherall, "Computer Intergrated Manufacturing: A Total Company Strategy," 2nd edition, 1995. 2. Ronald G. Askin, "Modeling and analysis of Manufacturing Systems," John Wiley & Sons, 1993.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: II**
1	Course Code	MPI 107
2	Course Title	**Computer Integrated Manufacturing Systems Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	To impart knowledge about the integration of interdisciplinary fields of computer aided design, computer aided manufacturing. Undergoing this lab the students will learn to use the CNC machines efficiently for manufacturing desired products and knowledge of programming and use of CNC tooling.
6	Course Outcomes	After successfully completion of the course the students will able to CO 1 Acquire knowledge on how to prepare program in CNC Machine. CO 2 – Impart knowledge on how to prepare program in CNC turning machine CO 3 – Prepare a turned sample operate CNC turning machine CO 4 – Apply software for simulation of milled parts in CNC CO 5 – Infer on how to prepare program in CNC milling machine CO 6 - Apply the concepts of machining and select appropriate cutting tools for CNC milling and turning equipment, set-up, program, and operate CNC milling and turning equipment.
7	Course Description	This course will help to develop Programming skills and crate an component for required drawing, Simulate the prepared part programme using available simulation software's. and prepare the parts on CNC machines.
8	Outline syllabus	
	Experiment 1	To study the operational procedure for CNC turning and milling.
	Experiment 2	Develop a CNC program for step turning and simulate
	Experiment 3	Develop a CNC program for taper turning and simulate

	Experiment 4	Develop a part program for linear feature and simulate on CNC Milling		
	Experiment 5	Develop a part program for circular interpolation and simulate on CNC milling.		
	Experiment 6	Develop a part program for drilling and simulate on CNC milling.		
	Experiment 7	To write a program to perform the Circular pocketing operation on the given work piece.		
	Mode of examination	Practical		
	Weightage Distribution	CA	MTE	ETE
		60%	0%	40%
	Text book/s*	1. CAD/CAM: computer aided design and manufacturing by Groover Mikell P, Zimmer W Emory 2. Computer Numerical Control-Turning and Machining centers by Quesada Robert		
	Reference	Manuals provided in the lab		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: II**
1	Course Code	MME118
2	Course Title	Smart Manufacturing
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	1. To familiarize students with applications Of various quality control tools used in industrial engineering 2. To provide students an understanding of lean manufacturing process. 3. To teach the basics of Industry 4.O. 4. To teach students the basics of Industry 4.O applications in modern manufacturing industry.
6	Course Outcomes	CO1: Apply the basic concepts of quality engineering in industry. CO2: Illustrate the statistical process tools in an actual manufacturing plant. CO3: Explain the basic concepts of Lean manufacturing. CO4: Compare Internet of things and Industrial internet of things CO5: Elaborate the Industry4.O Applications in Manufacturing Industry. CO6: Identify the various quality management tools.
7	Course Description	The objective of this course is to make the students realize about the various concepts of quality engineering, statistical tools, lean manufacturing and applications industry 4.O and IiOT. After learning this course the student will be able to implement all these techniques in an industry to help his as well as the industries growth in the market.
8	Outline syllabus	
	Unit 1	**Quality Tools**
	A	Benchmarking – Reasons to Benchmark, Benchmarking Process,
	B	Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function
	C	Total Productive Maintenance (TPM) – Concept, Improvement Needs,
	Unit 2	**Statistical Process Control**
	A	The seven tools of quality
	B	Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability
	C	Concept of six sigma, New seven Management tools.
	Unit 3	**Lean Manufacturing**
	A	Introduction to Lean Manufacturing, Industry Examples

	B	Lean Manufacturing Tools and Techniques, Overview of the Toyota Production System (TPS		
	C	Lean Manufacturing Company Application, Lean Manufacturing Tools & Techniques application.		
	Unit 4	**Industry 4.O**		
	A	Concept of Internet of things, Industrial internet of things, IT & OT Convergence		
	B	Requirements of Industry 4.0 concepts		
	C	Virtual and Augmented reality in Industry4.O, Digital twins in Industrial IoT and Industry 4.O		
	Unit 5	**Industry4.O Applications in Manufacturing Industry**		
	A	Rise of Collaborative robot (COBOT), Edge Computing & IoT, Industrial Data Space.		
	B	Logistics4.O, Industrial Iot gateways		
	C	IioT Cybersecurity Risks and evolution, Iiot communication and connectivity technology, Maintenance and asset management with IioT.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Industrial Engineering and Production Management- Martand Telsang- S.Chand & CO.		
	Other References	1. Samuel Eilon, "Elements of Production Planning and control", Universal Book Corp., 1999. **2.** Buffa, E.S., "Modern Production/Operations Management", John Wiley sons, 2003 **3.** Elsayed A Elsayed, Thomas O. Boucher, “Analysis and control of Production System”, Prentice Hall, 2002.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: II**
1	Course Code	MME015
2	Course Title	Supply Chain Management
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Department Elective
5	Course Objective	1. To familiarize students with various drivers and metrics of supply chain management system 2. To provide students an understanding of different types of supply chain networks 3. To teach the basics of economics in supply chain management system 4. To teach students the basics of cross functional supply chain metrics
6	Course Outcomes	After successful completion of this course students should be able to: CO1: explain basic terminology and supply chain operations in the context of today's business environment. CO2: design the supply chain networks. CO3: manage inventory effectively and planning policy, demand variability, forecasting and lead time on inventory level and cost. CO4: improve in transportation and logistics in supply chain operations. CO5: perceive the importance of strategic supply chain alliances and the impact of information Technology in SCM. CO6: develop supply chain which is financially and environmentally sustainable
7	Course Description	The objective of SCM is to introduce the major building blocks, major functions, major business processes, performance metrics, major decisions (strategic, tactical, and operational) and role of IT in supply chain Management.
8	Outline syllabus	
	Unit 1	**INTRODUCTION**
	A	Understanding the Supply Chain
	B	Supply Chain Performance: Achieving Strategic Fit and Scope
	C	Supply Chain Drivers and Metrics
	Unit 2	DESIGNING THE SUPPLY CHAIN NETWORK
	A	Designing Distribution Networks
	B	Network Design in the Supply Chain
	C	Network Design in an Uncertain Environment
	Unit 3	PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN
	A	Managing Economies of Scale in a Supply Chain: Cycle Inventory
	B	Managing Uncertainty in a Supply Chain: Safety Inventory

	C	Determining the Optimal Level of Product Availability		
	Unit 4	DESIGNING AND PLANNING TRANSPORTATION NETWORKS		
	A	The Role of Transportation in a Supply Chain		
	B	Modes of Transportation		
	C	Trade-Offs in Transportation Design		
	Unit 5	MANAGING CROSS-FUNCTIONAL DRIVERS IN A SUPPLY CHAIN		
	A	Sourcing Decisions in a Supply Chain		
	B	Information Technology in a Supply Chain		
	C	Coordination in a Supply Chain, Sustainability in SCM		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Chopra, Sunil; Meindl Peter and Kalra Dharam vir; Supply chain Management, Pearson Publcation		
	Other References	1. Scharj, P.B., Lasen,T.S., Managing the global supply chain, Viva books, New Delhi, 2000. 2. Ayers, J.B., Hand book of supply chain management, The St.Lencie press, 2000. 3. Nicolas, J.N., Competeive manufacturing management-continuous improvement, Lean production, customer focussed quality, McGraw Hill, NY, 1998. 4.. Steudel, H.J. and Desruelle, P., Manufacturing in the ninetees-How to become a mean , lean and world class competitor, Van Nostrand Reinhold, NY, 1992.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: II**
1	Course Code	OEM015
2	Course Title	Renewable Energy and Energy Management
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Open Elective
5	Course Objective	To develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the areas of renewable energy. to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the areas of non-conventional energy
6	Course Outcomes	1. Identify the current worldwide energy usage and its impact on climate. 2. Compare the various renewable energy sources (solar, wind, hydro, wave, tidal and bio energy). 3. Design of windmills and its site selection 4. Create and utilize a biogas plant and classify the geothermal plants 5. Evaluate and construct energy management system 6. Develop a habit where energy conservation and energy management is a way of life.
7	Course Description	This course provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the areas of renewable and non-conventional energy
8	Outline syllabus	
	Unit 1	**Solar Energy**
	A	The sun as source of energy, direct solar energy utilization; solar thermal applications – water heating systems
	B	space heating and cooling of buildings, solar cooking, solar ponds, solar green houses
	C	solar thermal electric systems; solar photovoltaic power generation; solar production of hydrogen
	Unit 2	**Energy from Oceans and Hydro Power**

	A	Wave energy generation – energy from waves; wave energy conversion devices; advantages and disadvantages of wave energy		
	B	Tidal energy – basic principles; tidal power generation systems; estimation of energy and power; advantages and limitations of tidal power generation; Ocean thermal energy conversion (OTEC)		
	C	Methods of ocean thermal electric power generation. Classification of small hydro power (SHP) stations; description of basic civil works design considerations; turbines and generators for SHP; advantages and limitations		
	Unit 3	**Wind Energy**		
	A	Basic principles of wind energy conversion		
	B	Design of windmills; wind data and energy estimation		
	C	Site selection considerations		
	Unit 4	**Biomass and Geothermal Energy**		
	A	Energy plantation; biogas generation; types of biogas plants; applications of biogas; energy from wastes		
	B	Origin and nature of geothermal energy; classification of geothermal resources		
	C	schematic of geothermal power plants; operational and environments problems		
	Unit 5	**Energy conservation management**		
	A	The relevance of energy management profession; general principles of energy management and energy management planning		
	B	application of Pareto's model for energy management; obtaining management support; establishing energy data base; conducting energy audit;		
	C	evaluating and implementing feasible energy conservation opportunities; energy audit report; monitoring, evaluating and following up energy saving measures/projects		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Non-Conventional Energy resources, B H Khan, Mc Graw Hill Companies. 2. Renewable Energy Sources and Emerging Tech, by D P Kothari, K C Singal and R Ranjan, EEE		
	Other References	1. 'Renewable energy resources'. John W Twidell and Anthony D Weir. 2. 'Renewable energy – power for sustainable future'. Edited by Godfrey Boyle. Oxford		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: II**
1	Course code	MME127
2	Course name	Advanced Operations Research
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Objective	The objective of this course is to provide a scientific basis to the managers of an organization for solving problems involving interaction of the components of the system, by employing a system approach by a team of experts drawn from different disciplines, for finding a solution which is in the best interest of the organisation as a whole.
6	Course Outcomes	After successful completion of this course students should be able to: 1: Formulate and solve mathematical model (advanced linear programming problem) for a physical situations like production, distribution of goods and economics 2: Apply Dynamic programming in real world practical problems. 3: Demonstrate queuing theory and inventory management problems 4: Design the best strategy using decision making methods under uncertainty and game theory. 5. Develop cost effective solutions for network problems using PERT/CPM techniques. 6. Compare various solutions applying decision making techniques for complex problems
7	Outline syllabus	
7.01	**Unit 1**	**Advanced Topics in Operations Research**
7.02	A	Formulation of Linear Programming Problems, Graphical solution
7.03	B	Simplex procedure for maximization and minimization, Duality concept
7.04	C	Integers Programming
7.05	**Unit 2**	**Dynamic Programming**
7.06	A	Dynamic Programming Approach, Formulation of Dynamic Programming problems
7.07	B	Optimum solution of dynamic Problems
7.08	C	Application of dynamic Programming
7.09	**Unit 3**	**Queuing & Inventory Models**
7.10	A	**Queuing Model:** Introduction, Kendall's notation, Classification of queuing models, Sequencing of n jobs and 2 & 3 machines, 2 jobs and m machines
7.11	B	**Inventory control:** Introduction, models of inventory,
7.12	C	fixed order quantity system, periodic quantity system EOQ model.

7.13	**Unit 4**	**Decision Theory and theory of games**		
7.14	A	Decision making under certainty and uncertainty,		
7.15	B	Decision tree		
7.16	C	Theory of games-definition, pure and mixed strategy, algebraic and graphical Methods.		
7.17	**Unit 5**	**Network Models**		
7.18	A	Basic concept, Rules for drawing the network diagram,		
7.19	B	Applications of CPM and PERT techniques.		
7.20	C	Cost analysis and crashing the network		
8	Course Evaluation			
8.1	Mode of examination	Theory		
8.11	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
8.3	End-term examination: 50%			
9	References			
9.1	Text book	1. Hira & Gupta, Operations Research, S. Chand & Co. New Delhi, 2007.		
9.2	Other references	1. Sharma,J.K., Operations Research: Theory and Application, McMillan India Publication. New Delhi, 3rd Edition. 2. Taha, H.A., Introduction to Operation Research, PHl Publication, 9th edition. 3. Tripathy, Production and Operation Management, Scitech Publication, 2007 edition. 4. Rajgopal, K., Operation Research, PHI Learning Pvt Ltd., 1st Edition, 2012. 6. Paneerselvam, R., Operation Research, PHI Learning Pvt Ltd.,2nd Edition, 2009. 7. Use MATLAB Software– MATLAB R2011b; Version 8.1, and Microsoft Office Excel 2007 or2012.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: II**
1	Course Code	MME121
2	Course Title	Mechanics of Composite Materials
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	1. To describe the characteristics and the manufacturing principles of composite laminates 2. To understand the micro-macro analyses of composite materials. 3. To perform hygro-thermo-elastic analyses for the determination of the stress and strain state in a multi-axial laminate 4. To understand the bending-twisting-extensional coupling in symmetrical and unsymmetrical laminates. 5. To establish the failure criteria for laminates based on failure of individual lamina in a laminate.
6	Course Outcomes	CO1: Describe various types of composite materials and their manufacturing processes. CO2: Demonstrate an understanding of isotropic, transversely isotropic, orthotropic, and anisotropic material behaviour using generalized Hooke's law. CO3: Apply various micro-mechanics models to evaluate the macroscopic properties including stiffness and strength of the composites. : Demonstrate the fundamental building components for composite systems under hygrothermal environment. CO5: Analyze laminates using classical laminated plate theories and demonstrate an understanding of stacking sequence, lamina properties, ply orientation, and lamina geometric properties on stiffness of the laminate. CO6: Estimate the failure loads of the composite laminates subjected to various loading using various failure theories.
7	Course Description	This course provides students a background in modern lightweight composite materials which are being used in an ever-increasing range of applications

		and industries. Basic knowledge of composites will allow engineers to understand the issues associated with using these materials, as well as gain insight into how their usage differs from metals, and ultimately be able to use composites to their fullest potential. Topics covered include: current and potential applications of composite materials, fibers, matrices, manufacturing methods for composites, review of elasticity of anisotropic solids, micromechanics of continuous and discontinuous fiber systems, laminated plate analysis, static analyses of laminated composites, edge effects in laminates and both macroscopic and microscopic failure analysis of composite materials and laminates.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Introduction to composite materials and its limitations
	B	Classifications of composite materials
	C	Manufacturing techniques for polymer, metal and ceramic matrix composite materials
	Unit 2	**Macro mechanical analysis of laminated composite materials**
	A	Macro mechanical analysis of a lamina -linear elastic stress-strain characteristics of fiber-reinforced material.
	B	Plane stress relations in a global coordinate system, Transformation relations-transformed reduced compliances & stiffness
	C	Effects of free thermal strains and moisture strains
	Unit 3	**Micro mechanical analysis of laminated composite materials**
	A	Micromechanical analysis of a lamina, Volume and mass fractions, Density, and Void content
	B	Prediction of engineering properties using micromechanics, Material properties of the fiber and matrix
	C	Experimental techniques for evaluating mechanical properties of composite materials
	Unit 4	**Classical Lamination Theory**
	A	Kirchhoff Hypothesis, Laminate nomenclature, Laminate strains and displacements, Implications of the Kirchhoff hypothesis.
	B	Laminate stresses & strains -Stress distributions through the thickness
	C	Force and moment resultants-Laminate stiffness matrix: ABD matrix, Classification of laminates and their effect on the ABD matrix, Elastic couplings.
	Unit 5	**Theories of Failures of Laminates**
	A	Symmetric laminates, Cross-ply laminates, Angle ply laminates, Antisymmetric laminates, Balanced laminate, Quasi-isotropic laminates.
	B	Failure theories for fiber-reinforced materials, Maximum stress criterion, Tsai-Wu criterion
	C	Environmental effects- Effect of laminate classification on the unit thermal force and moment resultants
	Mode of examination	Theory

	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Autar, K. Kaw, Mechanics of Composite Materials, Taylor & Francis, 2006.		
	Other References	1. Robert Millard Jones, Mechanics of composite materials, Taylor & Francis, 1999 2. Laszlo, P. Kollar, George, S. Springer, Mechanics of composite structures, Cambridge University Press, 2003.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: I**
1	Course Code	MME 119
2	Course Title	Machine Tool Design
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	1. To provide a thorough understanding and application of the concepts of design of machine tools. 2. To gain the knowledge of critical functional and operational requirements of different types of machine tools. 3. To gain adequate understanding on tool designer's aims and objectives. 4. To develop skills for designing machine components and machine tools.
6	Course Outcomes	CO1: Infer basic motions involved in a machine tool. CO2: Design and Analyze systems for specified speeds and feeds. CO3: Design of machine tool structure, bed, table and ram CO4: Design of drives and power screws.. CO5: Design of spindles and supports. CO6: Analysis of stress in design of various parts of machine tool
7	Course Description	To impart the fundamental notions of the machine tools including the different types, construction, applications and their technological capabilities. To provide exposure to the systematic methods for solving the problems of designing machine tools and their components by exploring the various design aspects of machine tools elements like transmissions, structures, materials, kinematics, dynamics and construction of machine tools, etc.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Parameters defining working motions of a machine tool
	B	Machine tool drives, Mechanical transmission and its elements, General requirements of machine tool design
	C	Engineering design process applied to machine tools
	Unit 2	**Regulations of Speed and Feed Rates**
	A	Aim of speed and feed rate regulation
	B	Design of speed box, Design of feed box
	C	Classification of speed and feed boxes
	Unit 3	**Design of Machine Tool Structures**

	A	Design criteria for machine tool structures, Materials of machine tool structures, Static and dynamic stiffness		
	B	Design of beds, columns and housings		
	C	Design of bases, tables and rams		
	Unit 4	**Design of Guideways and Power Screws**		
	A	Functions and types of Guideways, Design criteria and calculations for slideways		
	B	Design of aerostatic and anti-friction slideways		
	C	Design of power screws		
	Unit 5	**Design of Spindles and Spindle Bearings**		
	A	Functions of spindle unit and its requirements		
	B	Design calculations of spindles		
	C	Design of anti-friction and sliding bearings		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Gupta, V., "Mechanics of Materials", Narosa publishing house, 1st Edition		
	Other References	1. Ryder, G.H., "Strength of Materials", Macmillan(2002),3rd Edition 2. Download MD Solids software(http://www.mdsolids.com/download.htm)		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: I**
1	Course Code	MME123
2	Course Title	Advance Machine Design
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	1. To understand the the fatigue of materials. 2. To understand the role of mean stress and factors influences S-N curve. 3. To understand how to estimate the life using strain life approach and properties. 4. To understand the concept of residual stresses 5. To understand types of surface failure.
6	Course Outcomes	C01: Interpret the conept of modes of failure (macroscopic and microscopic features in fatigue fracture and the concept of fatigue design model & methods.) CO2: Analyze statistical nature of fatigue using S-N approach. CO3:Interpret monotonic stress-strain behaviour of material and its life estimation by Ɛ-N approach. CO4:Estimate residual stresses and understand the concept of statistical aspects of fatigue. CO5: Analyze dynamic contact stresses and surface fatigue strength. CO6: Interpret the concept of fatigue under various load condition
7	Course Description	The course focuses on applied engineering design, with a view to producing products that are safe, reliable, and economical. It offers in-depth coverage of today's most common analytical methods of fatigue design and fatigue life predictions/estimations for metals.
8	Outline syllabus	
	Unit 1	**Introduction and Fatigue of Materials**
	A	Role of failure prevention analysis in mechanical design ,Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory
	B	High cycle and low cycle fatigue, Fatigue design models ,Fatigue design methods ,Fatigue design criteria, Fatigue testing, Test methods and standard test specimens
	C	Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features.
	Unit 2	**Stress-Life (S-N) Approach**
	A	S-**N** curves, Statistical nature of fatigue test data, General S-N behavior
	B	Mean stress effects, Different factors influencing S-N behaviour, S-N curve representation and approximations

	C	Constant life diagrams, Fatigue life estimation using S-N approach.		
	Unit 3	**Strain-Life(S-N)approach**		
	A	Monotonic stress-strain behavior ,Strain controlled test methods ,Cyclic stress-strain behavior		
	B	Strain based approach to life estimation, Determination of strain life fatigue properties		
	C	Mean stress effects, Effect of surface finish, Life estimation by ε-N approach		
	Unit 4	**Residual Stress and Statistical Aspects of Fatigue**		
	A	Production of Residual Stresses and Fatigue Resistance, Relaxation of Residual Stresses, Measurement of Residual Stresses, Stress Intensity Factors for Residual Stresses		
	B	Definitions and quantification of data scatter, Probability distributions, Tolerance limits		
	C	Regression analysis of fatigue data ,Reliability analysis		
	Unit 5	**Fatigue from Variable Amplitude Loading and Surface Failure**		
	A	Spectrum loads and cumulative damage, Damage quantification and the concepts of damage fraction and accumulation		
	B	Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods		
	C	Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatigue spherical contact, Cylindrical contact, General contact, Dynamic contact stresses, Surface fatigue strength.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1.**Metal Fatigue in engineering**, Ralph I. Stephens, Ali Fatemi, Robert .R. Stephens, Henry o. Fuchs, John wiley Newyork, Second edition. 2001. 2. **Failure of Materials in Mechanical Design,** Jack. A. Collins, John Wiley, Newyork 1992. 3. **Machine Design**, Robert L. Norton, Pearson.		
	Other References	1. **Fatigue of Materials,** S.Suresh, Cambridge university press, Cambridge, U.K. 2. **Fundamentals of Metal Fatigue Analysis,** Julie.A.Benantine Prentice Hall,1990 3. **Fatigue and Fracture,** ASM Hand Book, Vol 19,2002		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: II**
1	Course Code	MME120
2	Course Title	Fracture Mechanics
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	• Introduce students to the concepts of materials fracture and failure analysis; and • Equip them with knowledge on how to design against catastrophic failures and skills required in carrying out failure analysis
6	Course Outcomes	CO1: Apply the concepts of fracture mechanics to predict brittle fracture. CO2: Identify and describe the basic fracture and fatigue mechanisms CO3: Use the concepts of Linear Elastic Fracture Mechanics on brittle materials. CO4: Students shall be able to identify the plane stress and plane strain conditions based on the shape and size of plastic zones. CO5: Understand the relation among crack tip opening displacement, SIF and ERR and application of such parameters for ductile and brittle materials CO6: Familiarize the experimental techniques to determine the critical values of parameters at crack tip
7	Course Description	This course is an elective, designed for students interested in building knowledge and technical expertise in the principles governing: (1.) design of engineering materials against crack induced fracture in service applications, (2.) diagnosis of cause(s) and mechanisms of failure, and (3.) experimental techniques for characterizing fractures. The course covers the fundamental types of fracture and their characteristic features, fracture modes and theories of fracture mechanics (the efforts of Griffith, Irwin etc will be highlighted).
8	Outline syllabus	
	Unit 1	**Introduction**

	A	Fracture mechanics principles: Introduction and historical review, Sources of micro and macro cracks. Stress concentration due to elliptical hole, Strength ideal materials, Griffith's energy balance approach		
	B	Fracture mechanics approach to design. NDT and Various NDT methods used in fracture mechanics, Numerical problems		
	C	The Airy stress function. Complex stress function. Solution to crack problems. Effect of finite size. Special cases, Elliptical cracks, Numerical problems.		
	Unit 2	**Determination of SIF and Plain Strain Fracture Toughness**		
	A	Introduction, analysis and numerical methods, experimental methods, estimation of stress intensity factors		
	B	Plasicity effects, Irwin plastic zone correction. Dugdale approach. The shape of the plastic zone for plane stress and plane strain cases, Plastic constraint factor. The Thickness effect, numerical problems		
	C	Plane strain fracture toughness test, The Standard test. Size requirements. Non-linearity. Applicability.		
	Unit 3	**Elastic –Plastic Fracture Mechanics**		
	A	The energy release rate, Criteria for crack growth. The crack resistance (R curve). Compliance, J integral. Tearing modulus. Stability		
	B	Fracture beyond general yield. The Crack-tip opening displacement. The Use of CTOD criteria.		
	C	Experimental determination of CTOD. Parameters affecting the critical CTOD. Use of J integral. Limitation of J integral.		
	Unit 4	**Dynamics and Crack Arrest**		
	A	Crack speed and kinetic energy. Dynamic stress intensity and elastic energy release rate.		
	B	Crack branching. Principles of crack arrest. Crack arrest in practice		
	C	Dynamic fracture toughness		
	Unit 5	**Fatigue Crack propagation and Applications of Fracture Mechanics**		
	A	Crack growth and the stress intensity factor. Factors affecting crack propagation		
	B	Variable amplitude service loading, Means to provide fail-safety, Required information for fracture mechanics approach		
	C	Mixed mode (combined) loading and design criteria		
	Mode of examination			
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Elementary Engineering Fracture Mechanics - David Brock, Noordhoff. Elements Of Fracture Mechanics – Prashant Kumar.		
	Other References	Fracture Mechanics-Fundamental and Application - Anderson, T.L CRC press1998.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Regular**
1	Course Code	MME 124
2	Course Title	Design for Manufacture and Assembly
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Elective
5	Course Objective	DFM involves designing for the ease of manufacture of a product's constituent parts. It is concerned with selecting the most cost-effective materials and processes to be used in production, and minimising the complexity of the manufacturing operations. DFA involves design for a product's ease of assembly. It is concerned with reducing the product assembly cost and minimising the number of assembly operations.
6	Course Outcomes	CO1: Apply the principles of limits and tolerances in design and assembly of mechanical parts. CO2: Apply design principles while processing the products through casting processes. CO3: Demonstrate the fundamental design principles applied in the metal extrusion processes. CO4: Apply design principles while processing the products through machining processes CO5: Demonstrate the fundamental assembly principles applied in mechanical assembled systems. CO6: Apply the knowledge of design and assembly principles with case studies.
7	Course Description	DFM involves designing for the ease of manufacture of a product's constituent parts. It is concerned with selecting the most cost-effective materials and processes to be used in production, and minimising the complexity of the manufacturing operations. DFA involves design for a product's ease of assembly. It is concerned with reducing the product assembly cost and minimising the number of assembly operations.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Geometric tolerances and Feature tolerances Dimensioning
	B	Assembly limits- Datum features- Tolerance stacks.
	C	Selection of Materials and Manufacturing process, Design requirements
	Unit 2	**Design for Casting**

	A	Design of castings based on parting line considerations, minimizing core requirements		
	B	Metal injection moulded parts: Processes and suitable materials		
	C	Design recommendations for metal injection-molded parts.		
	Unit 3	**Design for Metal Extrusion**		
	A	Design recommendation for metal extrusion and stamping		
	B	Design recommendation for fine blanked parts and Rolled formed section		
	C	Design for Forging: Forging processes, Suitable materials and Design recommendations		
	Unit 4	**Design for Machining**		
	A	Economics of machining Features to facilitate machining-surface finish.		
	B	Review of relationship between attainable tolerance grades and different machining processes.		
	C	Design for Turning, drilling and milling.		
	Unit 5	**Design for Assembly**		
	A	Design for Assembly principles and process		
	B	Design for Welding, Brazing and Soldering		
	C	Design for Joining of Plastics		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Boothroyd, G., Peter Dewhurst, Winston A. Knight, Product Design for Manufacture and Assembly, Third Edition, CRC Press, Taylor &Francis 2010.		
	Other References	1. Bralla James G., Hand Book of Product Design for Manufacturing, McGraw Hill. 1986. 2. G. Boothroyd, P. Dewhurst and W. Knight, Product Design for Manufacture and Assembly, Mercel Dekker Inc. New York, 2002.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: 1st**
1	Course Code	MME010
2	Course Title	Advance Power Plant Engineering
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	
5	Course Objective	To provide students an understanding of various energy resources, their economic implications, present Indian scenario, working of various conventional power plants and their analysis and nonconventional power generation.
6	Course Outcomes	On successful completion of this module students will be able to: CO1. Examine the Rankine Cycle and its various modifications. CO2. Model the hydroelectric power plant CO3. Analyse Gas Turbine plant CO4. Design Nuclear Power Plant CO5. Create the thermal energy storage systems CO6. Predict the suitability of a power generation system for different locations.
7	Course Description	This course focuses on the different methods of power generation, their merits, demerits and limitations. It also focuses on working and analysis of various renewable energy generation systems and future trends in power generation science.
8	Outline syllabus	
	Unit 1	**Introduction and Steam Power Plant**
	A	Load curves, Terms and definitions, Performance and operating characteristics of power plants, tariff methods of electrical energy
	B	Rankine cycle, rankine cycle with reheat and regeneration, Cogeneration of power and process heat,
	C	Binary vapour cycle, coupled cycle, Combined vapour cycle
	Unit 2	**Hydroelectric Power Plant**
	A	Introduction, Hydrological cycle, Hydrograph. Selection of site for hydroelectric power plant.
	B	Flow duration curve, storage capacity, optimization of hydro thermal mix, Layout of a hydroelectric power plant
	C	Elements of hydroelectric power plant, classification of hydroelectric power plant.
	Unit 3	**Gas turbine power plant**
	A	Simple gas turbine, assumptions of ideal cycle analysis, site selection, open

		cycle and close cycle arrangements, cycle efficiency		
	B	Basic requirements of the working medium, properties of various working medium, Brayton cycle, gas turbine with heat exchanger, intercooler		
	C	Gas turbine with reheat and regeneration Gas Turbine fuels, gas turbine materials, Gas turbine-Steam turbine plant		
	Unit 4	**Nuclear Power Plant**		
	A	Nuclear fuels, Nuclear energy, Main components of nuclear power plant layout, site selection		
	B	Nuclear reactors-types		
	C	Radiation shielding, Radio-active waste disposal, Safety aspects.		
	Unit 5	**Thermal Energy Storage and Solar Thermal Power**		
	A	Introduction Classification and Characteristics of Storage Systems, Chemical Energy Storage, Sensible Heat Storage,		
	B	Latent-Heat or Phase-Change Storage, Cool Thermal Energy Storage, principle of solar thermal power generation, Solar Tower Power Station, Parabolic trough Power Plants		
	C	Dish/Stirling System, Solar Updraft Tower Power Plants, Solar Pond Power Plants		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book(s)*	1. Nag, P.K., Power Plant Engineering, Tata Mcgraw Hill Education Private Limited,2010		
	Other References	1. Elanchezhian C., Saravanakumar L., Vijaya Ramnath B., Power Plant Engineering, I.K. International Publishing House Pvt., Limited, 2007 2. Sharma P.C., Power Plant Engineering, S. K. Kataria & Sons, 2009 Download Intergraph software from http://intergraph.com		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: I**
1	Course Code	MME102
2	Course Title	Heat and Mass Transfer
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	1. Students will understand the basic concepts of conduction, convection and radiation heat transfer. 2. Students will understand how to formulate and be able to solve one and two dimensional conduction heat transfer problems. Solution techniques will include both closed form and numerical methods. Convection effects will be included as boundary conditions and applications of Numerical Methods 3. Students will understand the fundamentals of the relationship between fluid flow, convection heat transfer and mass transfer. 4. Students will apply empirical correlations for both forced and free convection to determine values for the convection heat transfer coefficient. They will then calculate heat transfer rates using the coefficients. 5. Students will understand the basic concepts of radiation heat transfer to include both black body radiation and gray body radiation.
6	Course Outcomes	After the successful completion of course students will be able to: 1. Formulate heat conduction equation for different modes of heat transfer 2. Solve 2D and three-dimensional heat conduction problems 3. Elaborate finite difference and finite volume methods. 4. Analyze free and forced convection problems. 5. Apply the concepts of radiation heat transfer for enclosure analysis. 6. Create mathematical model for mass transfer.
7	Course Description	A student achieving a passing grade in this course will be able to do basic calculations involving heat and mass transfer as is typical for a mechanical engineer. This includes conduction, convection and radiation heat transfer as well as heat exchanger design.
8	Outline syllabus	
	Unit 1	**Basic heat transfer:**
	A	Review of basic heat transfer: Introduction to Conduction, convection and radiation heat transfer.
	B	1-D Steady State Heat Conduction: Fins with variable cross-section, generalized equation for fins, Fins of parabolic and triangular profiles, Transient in lumped systems.

	C	Multi-Dimensional Conduction: Analytical and graphical methods for solving multidimensional problems		
	Unit 2	**Numerical Heat Transfer**		
	A	Finite Difference Method: Discretization, Backward, forward and Central differencing schemes, application of FDM to 1-D and 2-D heat conduction, Matrix inversion, Point by point iteration, line by line iterative method.		
	B	FDM applications for convective diffusion problems, Upwind differencing scheme, artificial diffusion, application of FDM to transient heat conduction, Explicit, implicit and semi-implicit method, concepts of consistency, stability and convergence analysis.		
	C	Finite Volume Method: Basic concept, flux balance, FVM for solving heat conduction problems, FVM formulation for convective diffusion, Compressible flow modeling. Introduction to commercial software such as ANSYS-Fluent.		
	Unit 3	**Convective Heat Transfer:**		
	A	Momentum and Energy Integral Equation, Thermal and hydrodynamic boundary layer thickness, Heat transfer in a circular pipe in laminar flow when constant heat flux and constant wall temperature to the wall of the pipe		
	B	convection correlations for turbulent flow in tubes, Flow over cylinders and spheres, Flow across tube bundles/banks		
	C	,Natural convection, Heat transfer from a vertical plate using the Integral method, Free convection in enclosed spaces, Mixed convection. Introduction to Boiling and Condensation Heat Transfer		
	Unit 4	**Heat Exchangers and Thermal Radiation**		
	A	Review of basic concepts, Tubular and plate type heat exchanger, Overall heat transfer coefficient, LMTD, correction factor,		
	B	Effectiveness, Introduction to design of heat exchangers.		
	C	Review of basics of surface radiation, non gray body, radiation shape factor, Hottel's Crossed String Method for finding shape factor, Radiosity and irradiation formulation, radiation shield and Gas radiation		
	Unit 5	**Mass Transfer**		
	A	Introduction, Fick's law, General equation of mass diffusion steady state		
	B	diffusion through a plain membrane, diffusion of water vapour through air, Mass transfer coefficient, convective mass transfer		
	C	boundary layer governing equations, momentum heat & mass transfer analogies, mass transfer correlations		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Fundamentals of Engineering Heat & Mass Transfer by R. C. Sachdeva, New Age Publishers 2. Heat and Mass Transfer by Y A Cengel and A J Ghajar, Mc Graw Hill.		
	Other References	1. Heat and Mass Transfer by F P Incropera, John Wiley & Sons Pte Ltd 2. Analysis of Heat and mass Transfer by E R G Eckert and R M Drake, Mc Graw Hill Book Company.		

School: SET		Batch : 2019-2021
Program: M.Tech		Current Academic Year: 2019
Branch: ME		Semester: I
1	Course Code	MME 108
2	Course Title	Advanced mechanics of fluids
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. To provide students an understanding of the basic tools for the analysis and solution of different types of flows, ranging from the ideal to the viscous flow 2. To familiarize students with mathematical concepts of gradient, divergence, tensor and vorticity, 3. To teach students the basic properties normally attributed to fluids such as density, compressibility and dynamic viscosity 4. To familiarize students the governing equations of fluid motion, viscous flow, transient flow and potential flow
6	Course Outcomes	On successful completion of this module students will be able to .1. Develop advance knowledge of the mechanics of fluids. 2. Model the fluids motion 3. Formulate the potential flow mathematical equation for viscous flow 4. Predict the behaviour of potential flows 5. Analyze the transient flow. 6. Apply the knowledge of fluid mechanics in complex fluid flow system
7	Course Description	This course is a survey of principal concepts and methods of fluid dynamics. Topics include mass conservation, momentum, and energy equations for continua; Navier-Stokes equation for viscous flows; Similarity and dimensional analysis; lubrication theory; boundary layers and separation; circulation and vorticity theorems; potential flow; introduction to turbulence; lift and drag; surface tension and surface tension driven flows.
8	Outline syllabus	
	Unit 1	**Basic Concepts and fundamental**
	A	Definition and properties of fluids**,** Fluid as continuum
	B	Langrangian and Eulerian description, Velocity and stress field
	C	Fluid statics, Fluid Kinematics
	Unit 2	**Governing Equations of Fluid Motion**
	A	Reynolds transport theorem, Integral and differential forms of governing equations
	B	mass, momentum and energy conservation equations
	C	Navier-Stokes equations, Euler's equation, Bernoulli's Equation
	Unit 3	**Viscous flow**
	A	Exact solution; plane Poiseuille and Coutte flows; Hagan- Poiseuille flow

		through pipes; flows with very small Reynold's numbers, Creeping flows. Stokes flow around a sphere		
	B	Flows with very large Reynold's numbers; elements of two dimensional boundary layer theory; displacement thickness and momentum thickness and energy thickness; skin friction		
	C	Blausius solution for boundary layer on a flat plate with & without pressure gradient; Von-Karman integral method. Drag on bodies; form drag and skin friction drag; profile drag and its measurement		
	Unit 4	**Potential Flows**		
	A	Revision of fluid kinematics, Stream and Velocity potential function, Circulation, Irrotational vortex, Basic plane potential flows		
	B	Uniform stream; Source and Sink; Vortex flow, Doublet, Superposition of basic plane potential flows,		
	C	Flow past a circular cylinder, Magnus effect; Kutta-Joukowski lift theorem; Concept of lift and drag		
	Unit 5	**Transition flows**		
	A	Transition from laminar to turbulent flows, Reynold's stresses, turbulent boundary layer over a flat plate		
	B	transition for flat plate flow, Intensity of turbulence. Boundary layer equations, Boundary layer thickness, Boundary layer on a flat plate, similarity solutions		
	C	Integral form of boundary layer equations, Approximate Methods, Flow separation, Entry flow into a duct		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	Introduction to fluid mechanics and Fluid Machines, S.K Som and G.Biswas.McGraw Hill Fluid Mechanics by Y A Cengel and M Cimbala, Mc Graw Hill Education		
	Other References	Boundary Layer Theory by Schlichting, Mcgraw Hill Fluid Mechanics and its applications, Gupta and Gupta, Willey Eastern		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: II**
1	Course Code	MME125
2	Course Title	Gas Turbine and Compressor
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Program Elective
5	Course Objective	1. Familiarity with common types of gas turbines and compressors 2. To develop knowledge of thermodynamic cycles of turbine and compressors 3. To develop Working knowledge of the basic operations, design requirements and, performance analysis of gas turbines and compressors
6	Course Outcomes	On successful completion of this module students will be able to: 1. Explain the working principle of gas turbine and classify various gas turbine cycles. 2. Analyse gas turbine cycle with heat exchanger, intercooler, reheat and regeneration. 3. Design the gas turbine. 4. Recommed the centrifugal compressor 5. Predict the performance of axial flow compressor 6. Improve the performance parameters of gas turbine and compressors
7	Course Description	This subject deals with the working and thermodynamics of gas turbine and compressors. This course covers ideal and actual cycle analysis of gas turbine, analysis of centrifugal and axial flow compressors.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Simple gas turbine, assumptions of ideal cycle analysis, open cycle and close cycle arrangements, cycle efficiency
	B	Basic requirements of the working medium, properties of various working medium,
	C	its applications , Comparison of gas turbine with reciprocating engine
	Unit 2	**Gas Turbine: Ideal cycle and Their Analysis**
	A	Heat exchange cycle, reheat cycle, reheat and heat exchange cycle
	B	Intercooled cycle, intercooled cycle with heat exchanger , intercooled with reheat cycle
	C	Intercooled cycle with reheat and heat exchanger, regenerative cycle
	Unit 3	**Gas Turbine: Practical Cycle and Their Analysis**

	A	Assumptions, compressor and turbine efficiency, pressure and flow loses		
	B	Heat Exchanger Effectiveness, polytropic efficiency		
	C	Effect of variable specific heat, mechanical losses, loss due to incomplete combustion, performance of actual cycle		
	Unit 4	**Centrifugal Compressors**		
	A	Essential parts of centrifugal compressor, principle of operation, ideal energy transfer,		
	B	Blades shape and velocity profile, analysis of flow through compressor, Losses in centrifugal compressor		
	C	Volute casting, performance parameters, compressor characteristics, Surging and choking		
	Unit 5	**Axial Flow Compressor**		
	A	Geometry and working principle, stage velocity triangle, work done factor		
	B	h-s diagram, compressor stage efficiency, performance coefficient, degree of reaction		
	C	Flow through blade rows, flow losses, stage losses, performance characteristics, comparison between axial and centrifugal compressor		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Ganesan, V., Gas Turbines, Tata McGraw-Hill		
	Other References	1. Cohen, H., Rogers, G.E.C., and Saravanamuttoo, H.I.H., Gas Turbine Theory, Longman Yahya, S.H. Turbines, Compressors and Fans, Tata McGraw-Hill		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Fluid & Thermal Engineering		**Semester: 02**
1	Course Code	MME126
2	Course Title	Advance Thermodynamics
3	Credits	4
4	Contact Hours (L-T-P)	3-0-1
	Course Status	
5	Course Objective	This course introduces advance concepts in thermodynamics. It is an extension to the introductory theory of energy analysis with strong emphasis on the concepts of enthalpy, exergy, reactive system and vapour power cycle.
6	Course Outcomes	On completion of this course student should be able to: 1. Develop the concepts of basic thermodynamics. 2. Apply the basic knowledge to model the thermodynamic relations 3. Analyse the efficiency, entropy and exergy of thermodynamic systems. 4. Simplify the equations of reactive system and analyze second law of thermodynamics 5. Design thermodynamic system for industry 6. Create the vapour and combined power system
7	Course Description	Advance Thermodynamics provides knowledge about thermodynamics laws, relations, compressibility, exergy transfer, first & second law analysis of reactive systems and statistical thermodynamics. It also provides knowledge about vapour power cycles and cogeneration.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Introduction of thermodynamics, Review of basic definitions, Thermodynamic properties and their units,
	B	Laws of thermodynamics, thermodynamic relations: Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve,
	C	Coefficient of volume expansion, Adiabatic & Isothermal compressibility.
	Unit 2	**Entropy &Exergy**
	A	Entropy as a property, Clausius inequality, principle of increase of entropy, change of entropy for an ideal gas and pure substance

	B	work potential of energy, reversible work and irreversibility, second law efficiency		
	C	exergy transfer by work, heat and mass		
	Unit 3	**Reactive System**		
	A	Combustion, enthalpy of formation and enthalpy of combustion, enthalpy and internal energy of system,		
	B	first Law analysis of reactingsystems, Adiabatic Flame temperature, absolute entropy and third law of thermodynamics,		
	C	Second Law analysis of reacting systems, second law efficiency of reactive system.		
	Unit 4	**Gas Mixtures& Statistical Thermodynamics**		
	A	Composition of gas mixture: mass and mole, p-v-T behavior of gas mixtures: ideal & real gases, properties of gas mixtures: ideal & real gases.		
	B	Quantum hypothesis, quantum system applied to system of particles,		
	C	wave particle duality, microstate and macro state.		
	Unit 5	**Vapour and combine power cycle**		
	A	Carnot vapour cycle, Rankine cycle: the ideal cycle for vapour power cycles		
	B	deviation of actual vapour power cycle from idealized one, ideal reheat rankine cycle, ideal regenerative rankine cycle,		
	C	cogeneration, combine cycle: mercury water binary vapour cycle.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book(s)*	1. Thermodynamics an engineering approach by Yunus A. Cengel& Michael A. Boels, Tata MacGraw Hill.		
	Other References	1. Basic & applied thermodynamics by P.K Nag, Tata MacGraw Hill. 2. Fundaments of engineering thermodynamics by Michael J. Moran & Howard N. Shapiro, John Wily & sons.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: II**
1	Course Code	MME 115
2	Course Title	Refrigeration , Air Conditioning & Cryogenic System
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	1. To teach students the principles of refrigeration and air conditioning. 2. To teach students how to calculate the cooling load for different applications. 3. To develop knowledge of different Refrigerants 4. To teach students different refrigeration & air conditioning equipment
6	Course Outcomes	On successful completion of this module students will be able to: 1. Classify different refrigeration system 2. Analyze the vapour absorption Refrigeration system 3. Appraise the low temperature Refrigeration System. 4. Estimate the Human comfort requirements in air conditioning system. 5. Modify the refrigeration & air conditioning equipment's 6. Evaluate the COP of refrigeration and air conditioning systems
7	Course Description	This course introduces the techniques and aspects of refrigeration and air conditioning as well the new alternative HFC s / HCs refrigerants, the cooling and heating load calculations for different applications and also the designing of refrigeration and air conditioning system for a particular application. .
8	Outline syllabus	
	Unit 1	**Vapour Compression**
	A	Evolving Vapour Compression Cycle from Basic Carnot Cycle Analysis,
	B	Multistage Vapour Compression Systems,
	C	Classification of Refrigerants, Refrigerant Properties, Eco Friendly Refrigerants
	Unit 2	**Absorption System and Steam Jet Refrigeration**
	A	Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems
	B	Aqua Ammonia & LiBr Systems,
	C	Steam Jet Refrigeration,
	Unit 3	**Low temperature Refrigeration (Cryogenics)**

	A	Introduction, Limitations of vapor compression refrigeration system for production of low temperature		
	B	Cascade refrigeration system, solid carbon dioxide or dry ice		
	C	liquefaction of gases, Linde system for liquefaction of air, Clande system for liquefaction of air, Liquefaction of hydrogen		
	Unit 4	**Air Conditioning**		
	A	Psychometric processes using chart. Solar heat gain, study of various sources of the internal and external heat gains, heat losses, etc.		
	B	Internal heat gain , Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), ESHF, Apparatus dew point (ADP), Thermal analysis of human body		
	C	Inside and outside design conditions. Requirement of ventilation air, various sources of infiltration air.		
	Unit 5	**System Components and Accessories**		
	A	Types of Evaporators, Compressors, Condensers, Expansion Devices.		
	B	Fundamentals of air flow in ducts, Pressure drop calculations, Design ducts by velocity reduction method, Equal friction method and static regain method, Duct materials and properties		
	C	Types of fans and performance curve.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. C.P. Arora, Refrigeration and Air Conditioning, TMH..		
	Other References	1. Prasad Manohar, Refrigeration and Air Conditioning, New Age Publication. 2. Stoecker, W.F.; Jones, J.W., Refrigeration and Air conditioning, McGraw-Hill Publishing Company, 1982. 3. Dossat, Roy J., Principles of Refrigeration, Prentice Hall Publishing, 2001.		

School: SET		Batch : 2019-2021
Program: M.Tech		Current Academic Year: 2019
Branch: ME		Semester: II
1	Course Code	MME125
2	Course Title	Solar Energy Technology
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	This course enables the students 1. To Critically examine the technology of Solar energy systems that will be acceptable in a world faced with global warming, local pollution, and declining supplies of oil. 2.To Analyse both the devices and the overall systems 3. To facilitate the students a clear conceptual understanding of technical andcommercial aspects of Solar Power Development and Management. 4.To enable the students to develop managerial skills to assess feasibility of alternative approaches and derive strategies regarding Solar Power Development and Management
6	Course Outcomes	On successful completion of this course the students will be able to 1.Appraise the global scenario of solar energy 2.Design the layout of a solar thermal power plant and predict its performance 3. Evaluate the solar thermal conversion systems for high

		temperature applications. 4. Create the Photovoltaic Energy Conversion Systems for real life applications. 5. Select the suitable power plant on financial consideration. 6. Comply the national and international policy for a solar power system.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Global trend in solar energy; Relevance of solar thermal power generation
	B	Solar energy – source of energy, , quantum of energy
	C	Irradiance; Type of radiation – beam, diffuse, Total;
	Unit 2	**Solar thermal power plant**
	A	Solar thermal system – solar thermal power plant (parabolic and solar tower);
	B	Solar thermal power plant layout and working principle; Components of solar thermal power plant
	C	Design and performance, characteristics of different solar concentrator types suitable for thermal power generation.
	Unit 3	**Solar thermal conversion system for high temperature applications**
	A	Types of solar thermal conversion system used in high temperature application, Tracking of solar concentrators
	B	performance characterization of solar concentrators both line focus and point focus, Comparative analysis of the both mode focus system
	C	Optical design and concentration characteristics of line and point focus based system
	Unit 4	**Solar Technology**
	A	Solar technology – solar PV, solar thermal
	B	Solar resource availability in India – opportunities and challenges
	C	Solar PV power systems – roof top system, Global solar PV power trend

	Unit 5	**Solar power economics**		
	A	Solar thermal power economics; Global solar thermal power trend, Solar PV power economics		
	B	Comparison between solar PV power projects and solar thermal power projects		
	C	Issues of intermittency, storage and grid integration; solar power policies – World and India (RPO, REC); Solar Parks		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Winter C.J., Sizmann R.L., Vant-Hull L.L. (1991). Solar Power Plants: Fundamentals, Technology, Systems, Economics. Springer. ISBN: 3540188975. 2. Jordan P.G. (2013). Solar Energy Markets: An Analysis of the Global Solar Industry. Academic Press. ISBN: 0123977681.		
	Other References	1. Islam M.R., Rahman F., Xu W. (2016). Advances in Solar Photovoltaic Power Plants. Springer. ISBN: 3662505193 2. Sukhatme S.P. (2008). Solar Energy: Principles of Thermal Collection and Storage. Tata McGraw-Hill Education. ISBN: 0070260648.		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: I**
1	Course Code	MME104
2	Course Title	Advanced Material Engineering
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	1. To provide an understanding of the importance of materials in engineering 2. To develop knowledge of traditional and advanced materials used in engineering industries. 3. To provide students an understanding of latest developments and future directions in materials engineering 4. To develop knowledge of manufacturing methods of various engineering materials 5. To develop an understanding of properties and applications of various engineering materials. 6. Learn effectively for the purpose of continuing professional development and in a wider context throughout their career
6	Course Outcomes	On successful completion of this course the students will be able to Identify the various crystal structure and classify the advanced materials Discuss the characteristics and uses of polymers Analyze the unique properties and applications of ceramic materials Apply the principles of various mechanical testing on advanced engineering materials. Compile the list of composite materials for engineering applications based on the knowledge of its behaviour. Identify appropriate advanced materials for specific engineering applications
7	Course Description	This course focuses on the understanding of different engineering materials, their significance in engineering, methods of manufacturing, properties and applications.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Retrospective of materials science in Engineering; Classification and importance of materials, Traditional engineering materials
	B	Refresher of Miller indices for cubic and non-cubic systems.
	C	Modern engineering materials, Advanced materials, Biomaterials, Nano-materials, Future materials.
	Unit 2	**Polymers**
	A	Definitions and types of polymers, Synthesis, processing and fabrication of

		polymers,		
	B	Behaviour of polymers: Crystallization, melting, glass transition, Visco-elastic.		
	C	mechanisms of deformation and strengthening; Applications in structural, electrical and functional domains		
	Unit 3	**Ceramics**		
	A	Definitions and types of ceramics, Traditional and Advanced Ceramics,		
	B	Synthesis, Processing and fabrication of ceramics.		
	C	Fracture mechanics of structural ceramics, Applications in structural, electrical and functional domains.		
	Unit 4	**Composites**		
	A	Elastic behaviour of composites, anisotropic elasticity; orthotropic elasticity		
	B	Definition of composites, Elastic behaviour of composites; Types of matrices, reinforcement and interfaces;		
	C	Types of composites: PMCs, MMCs, CMCs, IMCs, SMCs and Nano-composites; Applications in natural, biological, structural and functional systems.		
	Unit 5	**Applications of Advanced materials**		
	A	Application of polymer material in structural, electrical and functional domains		
	B	Application of ceramics material in structural, electrical and functional domains		
	C	Application of composite in natural, biological, structural and functional systems.		
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. Callister'S Materials Science And Engineering: Indian Adaptation (W/Cd), by R.Balasubramaniam, Wiley India 2. Material Science and Engineering: W. F Smith, Hashmi and Ravi Prakash, McGraw Hill.		
	Other References	**1.** Introduction to Polymers, Robert J. Young, Peter A. Lovell, CRC Press. **1.** Introduction to Ceramics, W. David Kingery, H. K. Bowen, Donald R. Uhlmann, John Wiley & Sons. **3.** Composite Materials: Science and Engineering, Krishan Kumar Chawla, Springer. **4.** Biomaterials Science: An Introduction to Materials in Medicine, Buddy D. Ratner, Academic Press		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: I**
1	Course Code	MPI787
2	Course Title	Design and Modeling Tool Lab
3	Credits	2
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	This course is to impart fundamental knowledge to students on using Computer Aided Design and analysis software. Also to aware the students on how these tools are used in Industries in solving the real time problems.
6	Course Outcomes	CO1: Construct basic 2D sketch and part model by using draw, modify and power tools in Solidworks. CO2: Construct assembly and drawing of machine elements using Solidworks. CO3: Analyse normal stress distribution in various mechanical components using Solidworks CO4: Analyse thermal stresses of a mechanical component using Solidworks CO5: Simulate a mechanical system using Solidworks software.
7	Course Description	The course provides an in-depth understanding and skill of constructing 2-D drawings using well-known commercial CAD package, and integrating 3-D solid modeling techniques into simulation, and analysis animation of new designs using commercial CAD software. The students will have hands-on experience to create and assemble the components, analyse Structure, by using several different software packages.
8	Outline syllabus	
	List of Experiments	
	Experiment 1	Introduction to Solidworks and working with sketch mode
	Experiment 2	Working with creating features (Extrude & Revolve), Working Datum Planes
	Experiment 3	Working with advanced modeling tools (Sweep, Blend, Variable section Sweep, Swept Blend & Helical Sweep)
	Experiment 4	Creating Machine component by part modelling feature in solidworks
	Experiment 5	Creating assembly of engine component in solidworks
	Experiment 6	Creating exploded views and drawing of an assembly in solidworks

	Experiment 7	Creating assembly of flanged coupling in solidworks		
	Experiment 8	Introduction about the various analysis features in solidworks.		
	Experiment 9	Force analysis of a beam by in Solidworks		
	Experiment 10	Thermal analysis of Pin-Fin in Solidworks		
	Mode of examination	Practical		
	Weightage Distribution	CA	MTE	ETE
		60%	0%	40%
	Text book/s*	1. Thermal Analysis with SOLIDWORKS Simulation 2018 and Flow Simulation 2018 by Paul Kurowski		
	Software	Solidworks		

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: II**
1	Course Code	**MPI786**
2	Course Title	Experimental Design and Analysis Lab
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Compulsory
5	Course Objective	The objective of this course is to impart students a holistic view of the fundamentals of experimental designs, analysis tools and techniques, interpretation, applications using experimental design and analysis software.
6	Course Outcomes	On successful completion of the course, the student will be able to: CO1: Explain the fundamentals and applications of design of experiments. CO2: Utilize basic statistics including ANOVA and regression using Minitab/ DX7/R CO3: Apply the experimental designs such as RCBD, BIBD, Latin Square in practical problems using Minitab/DX7/R CO4: Apply factorial and fractional factorial designs in practical problems using Minitab/DX7/R software depending upon the availability of resources CO5: Construct statistical models, analyse the experimental data and results interpretation using Minitab/ DX7/R CO6: Analyze response of interest from an experimental data by using RSM/Taguchi using Minitab/ DX7/R
7	Course Description	This course demonstrates the formal, structured method for conducting single and multifactor experiments, modelling and optimization of process parameters. This course discusses about the integration of modern statistical software in real-world problems and case studies, and illustrates the efficacy of different experimental designs across the industries.
8	Outline syllabus	
	List of Experiments	
	Experiment 1	Perform a full DOE test matrix, in both randomized and blocked way. Build a model for the given exercise.
	Experiment 2	Exercise on multi-factor factorial design 1. Two factor factorial design

		2. Three factor factorial design		
	Experiment 3	Exercise on general two factor factorial design and blocking in 2^k factorial design		
	Experiment 4	Analyze and interpret the Taguchi's orthogonal designs and S/N ratio		
	Experiment 5	Exercise on robust parameter design		
	Experiment 6	Exercise on response surface design analysis 1. CCD 2. BBD		
	Mode of examination	Practical		
	Weightage Distribution	CA	MTE	ETE
		60%	0%	40%
	Softwares	DesignExpert, MINITAB, MATLAB		
	Text book/s*	1. Montgomery, D.C. (2009). Design and Analysis of Experiments. 2. Box, G.E.P., Hunter, J.S. and Hunter, W.G. (2005). Statistics for Experimenters. 3. Myers, R.H., Montgomery, D.C. and Anderson-Cook, C.M. (2009). Response Surface.		

<table>
<tr><td colspan="2">School: SET</td><td>Batch : 2019-2021</td></tr>
<tr><td colspan="2">Program: M.Tech</td><td>Current Academic Year: 2019</td></tr>
<tr><td>1</td><td>Course Number</td><td>CCU101</td></tr>
<tr><td>2</td><td>Course Title</td><td>Community Connect</td></tr>
<tr><td>3</td><td>Credits</td><td>2</td></tr>
<tr><td>3.01</td><td>(L-T-P)</td><td>(0-0-2)</td></tr>
<tr><td>4</td><td>Learning Hours</td><td><table><tr><td>Contact Hours</td><td>60</td></tr><tr><td>Project/Field Work</td><td>40</td></tr><tr><td>Assessment</td><td>00</td></tr><tr><td>Guided Study</td><td>20</td></tr><tr><td>Total hours</td><td>60</td></tr></table></td></tr>
<tr><td>5</td><td>Course Objectives</td><td>1. To connect the students to the community.
2. To conduct survey of community people and record responses and identify the issues faced by the community.
3. To do detailed analysis of data collected in the survey and student will use their learning to propose suitable solution for these issues.
4. To enhance skills of students on communication, data analysis and report writing skills.
5.To conduct survey on general awareness.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td>1. Understand and acquire knowledge on different issues faced by the community in better way.
2. Analyze data and identify problems
3. Solve the complex problems efficiently
4. Construct documentation, data analysis and report on any project.
5. Estimate the engineering and societal values of the developed solution for the problem
6. Utilize technology-based knowledge to improvise the existing solution for the problem</td></tr>
<tr><td>7</td><td>Theme</td><td>Major Sub-themes for research:
1. Energy solutions, saving and management
2. Electronics solution in everyday life
3. Civil works like transportation, drainage, water, construction etc.
4. Agriculture and irrigation, crop production
5. IoT and smart solutions
6. Medical and Healthcare issues
7. Environmental issues
8. Security and surveillance
9. Education and skills
10. Waste management
11. Any other issues</td></tr>
</table>

8.1	**Guidelines for Faculty Members**	• Any one of the sub-themes can be taken as survey topics • It will be a group assignment. • There should be not more than 10 students in each group. • The faculty guide will guide the students to complete the survey and help the student in preparing final report. • The questionnaire should be well design by the school and it should carry at least 40 questions (Including demographic questions). • The faculty will guide each group of students to prepare the PPT. • Each group should **submit the report** to CCC-Coordinator signed by the faculty guide before one week of last date of instruction mentioned in the Academic Calendar. • The students have to send the hard copy of the **report and PPT**, and then only they will be allowed for ETE.
8.2	**Role of CCC-Coordinator**	The CCC Coordinator will supervise the whole process and assign students to faculty members.
8.3	**Layout of the Report**	Abstract (250 words) • Introduction • Literature review(optional) • Objective of the research • Research Methodology • Finding and discussion • Conclusion and recommendation • References • Note: Research report should base on primary data.
8.4	**Guideline for Report Writing**	**Title Page: The following elements must be included:** • Title of the article; • Name(s) and initial(s) of author(s), preferably with first names spelled out; • Affiliation(s) of author(s); • Name of the faculty guide and Co-guide **Abstract:** Each article is to be preceded by a succinct abstract, of up to 250 words, that highlights the objectives, methods, results, and conclusions of the paper. **Text: Manuscripts should be submitted in Word.** • Use a normal, plain font (e.g., 12-point Times Roman) for text. • Use italics for emphasis. • Use the automatic page numbering function to number the pages.

		• *Save your file in docx format* (Word 2007 or higher) or doc format (older Word versions) **Reference list:** The list of references should only include works that are cited in the text and that have been published or accepted for publication. The soft copy of final report should be submitted along with the **hard copy signed by faculty / guide and countersigned by HoD / Dean.** **The report will be subject to plagiarism check as per the guidelines given in the notification.**
8.5	**Format:**	**The report should be Spiral / softbound** The Design of the Cover page to report will be given by the Coordinator- CCC Cover page Acknowledgement Content Project report Appendices
8.6	**Important Dates:**	Students will complete their community survey before last instruction date of the running semester and submit the same to concern faculty member. (Each group should complete min 50 questionnaires). Faculty members should guide students for report writing. The students should submit the hard copy and soft copy of the report to CCC-Coordinator signed by the faculty guide. **The students should submit the soft copy of the PPT to CCC-Coordinator signed by the faculty guide before 1 week of final presentation.** **The final presentation and evaluation should be organised by the School before last instruction date.**
8.7	ETE	The students will be evaluated by panel of internal faculty members on the basis of their presentation.
9	**Course Evaluation**	
9.01	**Continuous Assessment**	**60%**
	Noting responses to the questionnaire	**20 Marks**
	Data analysis and Report Writing	**40 Marks**
9.02	**ETE (PPT presentation)**	**40%**

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Program: M.Tech	**Current Academic Year: 2019**	MPI 788
School: SET	**Batch : 2019-2021**	Automation lab
Program: M.Tech	**Current Academic Year: 2019**	1
School: SET	**Batch : 2019-2021**	0-0-2
Program: M.Tech	**Current Academic Year: 2019**	Compulsory
School: SET	**Batch : 2019-2021**	To understand the basic concepts of automation and robotics and different industrial application of PLC, CNC and Robot. The purpose of this laboratory is to train the students to be familiar with the software and hardware of PLC so that they can gain enough experiences to meet the demand of the automation era.
Program: M.Tech	**Current Academic Year: 2019**	CO1- Analyze the surface roughness using specific equipment CO2 - Study and analyze the CNC programming for different kind of machining and operation CO3 - Analyze the performance of Pick and Place robot by Teach Pendant Method CO4 – Demonstrate and Analyze different PLC application CO 5 - Study and analyze the controller of DC motor. CO6- Describe the working principles of various types of transducers and image processing techniques.
School: SET	**Batch : 2019-2021**	The objective of this laboratory enables the students to build a firm background in PLC hardware as well as software. Students learn about ladder logic programming, wiring different I/O's (analog and digital) with PLC programming. They acquire the practical skills sufficient to design and realize basic automation process.
Program: M.Tech	**Current Academic Year: 2019**	
School:	**Batch :**	

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<tr><td rowspan="11">SET
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School: SET</td><td>2019-2021</td><td colspan="3"></td></tr>
<tr><td>Current Academic Year: 2019</td><td colspan="3">Measurements of Surface roughness, Using Tally Surf / Mechanical Comparator</td></tr>
<tr><td>Batch : 2019-2021</td><td colspan="3">Develop the CNC program for grooving, drilling and boring a job of given dimension according to the specified dimensions using CNC Lathe.</td></tr>
<tr><td>Current Academic Year: 2019</td><td colspan="3">Pick and place operation of Robot in Teach Pendent method</td></tr>
<tr><td>Batch : 2019-2021</td><td colspan="3">PLC Application Trainer</td></tr>
<tr><td>Current Academic Year: 2019</td><td colspan="3">PLC Controlled Material Handling System</td></tr>
<tr><td>Batch : 2019-2021</td><td colspan="3">Speed control of DC motor.</td></tr>
<tr><td>Current Academic Year: 2019</td><td colspan="3">Study of various types of transducers.</td></tr>
<tr><td>Batch : 2019-2021</td><td colspan="3">Study of image processing technique.</td></tr>
<tr><td>Program: M.Tech</td><td>Current Academic Year: 2019</td><td colspan="3">Measurements of Surface roughness, Using Tally Surf / Mechanical Comparator</td></tr>
<tr><td>School: SET</td><td>Batch : 2019-2021</td><td colspan="3">Develop the CNC program for grooving, drilling and boring a job of given dimension according to the specified dimensions using CNC Lathe.</td></tr>
<tr><td>Program: M.Tech</td><td>Current Academic Year: 2019</td><td colspan="3">Practical</td></tr>
<tr><td rowspan="2">School: SET
Program: M.Tech</td><td rowspan="2">Batch : 2019-2021
Current Academic Year: 2019</td><td>CA</td><td>MTE</td><td>ETE</td></tr>
<tr><td>60%</td><td>0%</td><td>40%</td></tr>
<tr><td>School: SET</td><td>Batch : 2019-2021</td><td colspan="3">Book by A. K. Gupta, Jean Riescher Westcott, and Satish Kumar Arora</td></tr>
<tr><td>Program: M.Tech</td><td>Current Academic Year: 2019</td><td colspan="3">Manuals provided in the lab</td></tr>
</table>

School: SET		**Batch : 2019-2021**
Program: M.Tech		**Current Academic Year: 2019**
Branch: ME		**Semester: II**
1	Course Code	MRM001
2	Course Title	Research Methodology
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Compulsory
5	Course Objective	• To develop understanding of the basic framework of research process. • To develop an understanding of various research designs and techniques. • To identify various sources of information for literature review and data collection. • To develop an understanding of the ethical dimensions of conducting applied research. • Appreciate the components of scholarly writing and evaluate its quality.
6	Course Outcomes	CO1: Understand the mindset of a researcher CO2: Design a research plan CO3: Apply different methods for data collection CO4: Analyze the collected data CO5: Compile relevant data and prepare a report CO6: Understand the process of research; right from inception of idea to execution and documentation.
7	Course Description	The course aims to develop a research orientation among the scholars and to acquaint them with fundamentals of research methods. Specifically, the course aims at introducing them to the basic concepts used in research and to scientific social research methods and their approach. It includes discussions on sampling techniques, research designs and techniques of analysis.
8	Outline syllabus	
	Unit 1	**Introduction**
	A	Introduction to research – The role of research, research process overview
	B	Philosophies and the language of research theory building – Science and its functions, What is theory?, and The meaning of methodology
	C	Thinking like a researcher – Understanding Concepts, Constructs, Variables, and Definitions
	Unit 2	**Research Problem and Hypotheses**

	A	Defining the research problem, The importance of problems		
	B	Formulation of the research hypotheses, The importance of hypothesis		
	C	Experimental and Non-experimental research design		
	Unit 3	**Data Collection**		
	A	Field research, and Survey research		
	B	Methods of data collection– Secondary data collection methods		
	C	Methods of data collection– qualitative methods of data collection, and Survey methods of data collection		
	Unit 4	**Data Analysis**		
	A	Attitude measurement and scaling – Types of measurement scales; Questionnaire designing – Reliability and Validity		
	B	Sampling techniques – The nature of sampling, Probability sampling design, Non-probability sampling design, Determination of sample		
	C	Processing and analysis of data		
	Unit 5	**Report Writing**		
	A	Ethical issues in conducting research		
	B	Report generation and report writing		
	C	APA format – Title page, Abstract, Introduction, Methodology, Results, Discussion, References, and Appendices		
	Mode of examination			
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	• Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi • Bryman, Alan & Bell, Emma (2011). Business Research Methods (Third Edition), Oxford University Press.		
	Other References	• Kerlinger, F.N., & Lee, H.B. (2000). Foundations of Behavioural Research (Fourth Edition), Harcourt Inc. • Rubin, Allen & Babbie, Earl (2009). Essential Research Methods for Social Work, Cengage Learning Inc., USA.		