UNIVERSITY OF JAMMU

(NAAC ACCREDITED A + GRADE UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

NOTIFICATION

(23/Sept/Adp/87)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Competent Bodies, has been pleased to authorize the adoption of the revised Syllabi and Courses of Studies of **Master of Technology (M.Tech.) in Mechanical Engineering for Semester I to IV** under Credit Based System (as given in the Annexure) for the Examinations to be held in the years indicated against each Semester as under:-

Branch	Semester	For the Examination to be held in the years
Mechanical	**Semester-I**	**December 2023, 2024, 2025**
	Semester-II	**May 2024, 2025, 2026**
	Semester-III	**December 2024, 2025, 2026**
	Semester-IV	**May 2025, 2026, 2027**

The Syllabi of the course are available on the University Website: www.jammuuniversity.ac.in.

Sd/-
DEAN ACADEMIC AFFAIRS

No. F.Acd/III/23/10054-10060
Dated:14/09/2023
Copy for information & necessary action to:-

1. Dean Faculty of Engineering
2. Principal, GCET
3. C.A to the Controller of Examinations
4. Joint/Assistant Registrar (Exams Prof./Eval. Prof./Confidential)
5. Incharge University Website

14/Sept/23
Assistant Registrar (Academic)
14/9/23 14/09/23

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 1st Semester Mechanical Engineering

For Examinations to be held in the December 2023, 2024, 2025

Contact Hours/Week: 21

S. No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks	
			L	T	P		Internal	External
1	MTME101	Research Methodology	3	1	0	4	25	75
2	MTME102	Advanced Operations & Maintenance Engineering	3	1	0	4	25	75
3	MTME103	Advanced CAD Modeling and 3-D Printing	3	1	0	4	25	75
4	MOOC500	NPTEL	3	0	0	3	100	-
5	**Elective-I**		3	1	0	4	25	75
	MTME121	Flexible Manufacturing Systems						
	MTME122	Quality Control and Reliability						
	MTME123	Condition Monitoring and Fault Diagnosis						
6	MTME111	Advanced CAD Modeling Lab	0	0	2	1	50	-
Total Credits						**20**	**250**	**300**

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 2nd Semester Mechanical Engineering

For Examinations to be held in the May 2024, 2025, 2026

Contact hours: 26

S. No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks	
			L	T	P		Internal	External
1	MTME201	Industrial Tribology	3	1	0	4	25	75
2	MTME202	Quantitative Methods and Operations Research	3	1	0	4	25	75
3	MTME203	Industrial AI	3	1	0	4	25	75
4	**Elective-II**		3	1	0	4	25	75
	MTME221	Advanced Engineering Materials						
	MTME222	Additive Manufacturing						
	MTME223	Tool and Cutter Design						
4	MTME211	eMaintenance Lab	0	0	4	2	100	-
5	MTME212	Industrial AI LAB	0	0	4	2	100	-
6	MTME213	Research Seminar	-	-	2	1	50	-
Total Credits						**21**	**350**	**300**

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 3rd Semester Mechanical Engineering

For Examinations to be held in the December 2024, 2025, 2026

Contact Hours/Week: 32

S. No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks	
			L	T	P		Internal	External
1	MTME301	Design of Experiment	3	1	0	4	25	75
2	**Elective-III**		3	1	0	4	25	75
	MTME321	Robotics						
	MTME322	Industrial Automation						
	MTME323	Mechatronics						
3	MTME311	Dissertation-I	-	-	20	10	250	-
4	MTME312	Design of Experiment Lab	0	0	4	2	100	-
Total Credits						**20**	**400**	**150**

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 4th Semester Mechanical Engineering

For Examinations to be held in the 2025, 2026, 2027

Contract Hours/Week: 38

S. No	Subject Code	Subject	Teaching Hours/ Week			Credit	Marks	
			L	T	P		Internal	External
1	MTME411	Dissertation-II **(Students have to submit the final project report at the end of the semester which will be evaluated followed by a seminar, presentation and viva -voice examination)**	-	-	38	19	300	150
Total Credits						**19**	**450**	

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1st SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: RESEARCH METHODOLOGY
COURSE NO.: MTME101
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in social sciences and business management context. Research scholars would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Once equipped with this knowledge, participants would be well-placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Develop understanding of the basic framework of research process by exploring various research designs and techniques.
CO2	Identify various data collection, processing and analysis methods.
CO3	Develop an understanding of the ethical dimensions of conducting applied research.

Unit 1: Research Methodology: An Introduction, Nature and Objectives of Research, Types of Research, Research Methods and Methodology, defining a Research Problem, Techniques involved in Defining a Problem. Alternative approaches to the study of the research problem and problem formulation. Formulation of hypothesis, Feasibility, preparation and presentation of research proposal.

(09 hours)

Unit 2: Statistical Analysis: Introduction to statistical analysis: Probability and probability distributions; binomial, Poisson, exponential and normal distributions and their applications.

(09 hours)

Unit 3: Sampling and Scaling Techniques: Sampling: Primary and secondary data, their collection and validation, methods of sampling: Simple random sampling, stratified random sampling and systematic sampling, Attitude Measurement land Scales: Issues, Scaling of attitude, deterministic attitudes, measurement models, summative models, multidimensional scaling.

(09 hours)

Unit 4: Methods of Data Analysis: Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation, Tests of significance based on normal, t and chi square distributions. Analysis of variance.

(09 hours)

Unit 5: Basic Principles of design of experiments, completely randomized and randomized block designs. Edition, tabulation & testing of hypotheses, interpolation of results, presentation, styles for figures, tables, text, quoting of reference and bibliography. Use of software for statistical analysis like SPSS, Mini Tab or MAT Lab, Report writing, preparation of thesis, use of software like MS Office.

(09 hours)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. "Research Methodology", C.R. Kothari, Wiley Eastern.
2. "Formulation of Hypothesis", Willkinson K.P, L Bhandarkar, Himalaya Publication, Bombay.
3. "Research in Education", John W Best and V. Kahn, PHI Publication
4. "MATLAB, An introduction with Applications", Amos Gilat, O'Reilly Media,2003.
5. Booth, Colomb and Williams. The Craft of Research, University of Chicago Press, Chicago & London, 2003.
6. John W. Creswell. Research Design, Sage Publications, New Delhi, Third Edition, 2009.

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1ST SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: ADVANCED OPERATIONS & MAINTENANCE ENGINEERING
COURSE NO.: MTME102
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: This course provides the necessary knowledge, understanding and skills for the future to those learners who wish to start a fulfilling career as technician in the area of operations and maintenance engineering. Learners will have the opportunity to learn basic scientific and mathematical methods to apply in subjects such as thermodynamics and heat engines. Learners will be exposed to the different materials used in common engineering situations and their properties. This qualification not only provides access to more specialist units but it also broadens and deepens the learners' experience in preparation for the real world at work. This course includes work related training and practice.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Explain maintenance objectives and functions and determine failure probability, survival probability and age specific failure rates of equipment and components.
CO2	Determine the optimal overhaul/repair/replacement maintenance policy for an equipment subject to breakdown and to determine optimal interval between preventive replacements for individual and group replacement of equipment.
CO3	Explain different maintenance systems and the steps involved in establishing a maintenance plan and designing a technically sound preventive maintenance and lubrication program.

Detailed Syllabus

Unit 1: Importance of Maintenance, Definition of Maintenance and objectives, Modelling of an industrial plant, Principles of Planned Preventive Maintenance (PM), Total Productive Maintenance, Industrial case studies and issues with customization. **(9 hours)**

Unit 2: Availability, Effectiveness and User Requirements, Concept and definitions for system effectiveness, Mean Time between Failure (MTBF) and Mean Time to Repair (MTTR), Failure rate and distribution, FMECA and FTA techniques, Reliability Centred Maintenance (RCM), Human System Integration (HSI), Testing and Evaluation, Data collection and management/interpretation of data. **(9 hours)**

Unit 3: Introduction to failure analysis, Failure modes, Machinery component failures, Case studies of machine failures, Introduction to condition-based maintenance, Machine condition monitoring techniques, Statistical data analysis and machine health diagnosis. **(9 hours)**

Unit 4: The principles of work planning and work control, Asset and facilities maintenance requirements planning, Maintenance resources and capability planning, Inventory and supply chain management, Human Factors in Maintenance, Optimising Scheduled, unscheduled and condition-based maintenance, financial control in maintenance, Maintenance Management Systems, Industrial case studies. **(9 hours)**

Unit 5: Introduction to the Diagnostics, PHM/CBM Design with emphasis on holistic life cycle design; Requirements, Metrics, and Cost Benefit; business intelligence, and system design for support solution, Systems thinking for FMECA and PHM/CBM modelling process; Fault Detection and Isolation Approaches; and wider reliability and maintainability management, Advanced R&D in PHM Algorithms; PHM/CBM Reasoning Methods and Examples; Prognostic Algorithm Approaches and Examples in relation to the design of a support solution. **(9 hours)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
2. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1st SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: ADVANCED CAD MODELING & 3D-PRINTING
COURSE NO.: MTME103
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: This course will demonstrate how to use 3D printing software to create digital designs that can be turned into physical objects. It will also demonstrate how 3D scanners work to turn physical objects into digital designs. This course is hands-on in nature and will provide step-by-step instructions to guide you through two popular 3D modeling programs. Learners who complete this course will be able to use 3D software to design a wide variety of objects for both personal and professional use.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Demonstrate knowledge of key historical factors that have shaped manufacturing over the centuries.
CO2	Explain current and emerging 3D printing applications in a variety of industries and describe the advantages and limitations of each 3D printing technology.
CO3	Evaluate real-life scenarios and recommend the appropriate use of 3D printing technology.

Detailed Syllabus

Unit 1: Advanced solid modeling operations, Modeling of parts with complex shapes and freeform surfaces, Diverse and unconventional methodologies for CAD work, Mechanical Drawing Modelling operations for sheet metal parts.

(9 hours)

Unit 2: Modern CAD system for high quality CAD models with complex shapes, 3D CAD models, CAD models for additive manufacturing.

(9 hours)

Unit 3: Introduction & History of 3D- Printing, Need for the compression in Product development Growth of 3DPrinting Industry.

(9 hours)

Unit 4: Classification of 3D- Printing, Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

(9 hours)

Unit 5: Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

(9 hours)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. Paul F. Jacobs: "Stereo lithography and other RP & M Technologies", SME, NY 1996.
2. Flham D. T & Dinjoy S.S "Rapid Manufacturing" Verlog London 2001.
3. Rapid automated by Lament wood. Indus press New York
4. Terry Wohlers "Wohler's Report 2000" Wohler's Association 2000.
5. Rapid prototyping materials by Gurumurthi, IISc Bangalore.
6. Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1ST SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: NPTEL
COURSE NO.: MOOC 500
DURATION OF EXAM: 3 HOURS

CREDITS: 03

L	T	P	Marks	
			External	Internal
3	0	0	0	100

The department shall offer the SWAYAM/NPTEL course (12 weeks) out of the list of courses offered by the SWAYAM around the time of commencement of the semester. However, the selected NPTEL course should not be similar to the regular courses offered as a part of the department curriculum.

The overall monitoring of the NPTEL course will be under the supervision of the teacher incharge of the department.

The NPTEL/SWAYAM certification course comprises of Assignments (25%) and Proctor Examination (Online examination MCQ's based = 75%) conducted at the end of the semester by IIT Madras as per the schedule.

The marks obtained by the student in the NPTEL/SWAYAM certification course will be tabulated by the concerned department.

Note: In case the student does not pass the certification exam or remains absent in the proctor examination, no certificate will be given to the candidate by the NPTEL and the student will be deemed to have failed in the course. The examination of the said NPTEL course will be taken by the department concerned in the next semester under the supervision of Examination Cell of GCET Jammu. The paper will be of 75 marks and assignment marks will be carried forward from the previous semester.

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1ST SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: FLEXIBLE MANUFACTURING SYSTEMS
COURSE NO.: MTME121
DURATION OF EXAM: 3 HOURS

CREDIT: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: The course will cover the practical integration of individual pieces of automation and various levels of electronic control to create stand-alone automated fabrication and assembly systems. Theory modules of the course will present the various types of communication interfacing required, the various levels of machine hierarchy, the human skills and knowledge levels needed to achieve a successful CIM operation. Included will be a study of product design requirements for parts, feeding and automated assembly and the effects of component quality on automated assembly. The learner will integrate a variety of manufacturing equipment to create, program and operate a automated manufacturing cell and an automated material handling cell (AMHC). This cell is joined to the AMHC. Flexible Manufacturing Systems (FMS) will be presented. Students will evaluate the requirements of implementing an FMS.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Understand different types of manufacturing available today such as the Special Manufacturing System, the Manufacturing Cell, and the Flexible Manufacturing System (FMS).
CO2	Learn the fundamentals of computer assisted numerical control programming and programming languages, the automated flow lines.
CO3	Summarize the concepts of modern manufacturing such as JIT, supply chain management and lean manufacturing etc.

Detailed Syllabus

Unit 1: Introduction: Introduction to Manufacturing Systems, Different types of manufacturing systems, Volume Variety relationships for understanding manufacturing systems.

(9 hours)

Unit 2: Flexibility and automation: Different types of flexibility in manufacturing, Different types of FMS buildingblocks., Work station, Storage retrieved system, material handling systems, computer control system.

(9 hours)

Unit 3: Machining system of FMS: Horizontal machining Centers, Vertical machining Centers, Integrated Material Handling, Automated Guided Vehicles, Automatic Storage and Retrieved System.

(9 hours)

Unit 4: Group technology: Part classification and coding, production flow analysis, Machine Cell design, Computer Aided Process Planning.

(9 hours)

Unit 5: JIT System: Characteristics of JIT pull method, small lot sizes, work station loads, flexible work force, line flow strategy. Supply chain management, Preventive maintenance - Kanban system, value engineering, MRP, JIT, lean manufacturing, quality concepts and management.

(9 hours)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entiresyllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Books recommended:

1. Automation, Production Systems and Computer integrated Manufacturing by MP. Groover.
2. Hand-book of Flexible Manufacturing Systems by Nand K. Jha.
3. Flexible Manufacturing Systems by Joseph Talavage.

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

BRANCH: MECHANICAL ENGINEERING
CLASS: M. TECH 1st SEMESTER
COURSE TITTLE: QUALITY CONTROL & RELIABILITY
COURSE NO.: MTME122
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: This course introduces students to concepts and methods of modern statistical quality control. Students learn to apply standard quality control tools. They learn the theoretical statistical concepts that justify the use of particular quality control tools in particular situations. They learn theory and methods for analyzing the performance of different quality control tools. The use of appropriate software for statistical and quality analysis is taught, and is necessary for successful completion of some homework assignments. Issues of ethics and professional responsibility and their relation to product quality are discussed. Reliability Engineering is designed for practicing engineers, this course focuses on teaching you to increase product reliability. The course covers such topics as model product failure times, analyzing data to determine reliability characteristics, and other general data driven decisions to insure a reliable product.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Understand the concepts of reliability and maintainability and use control charts to analyze for improving the process quality.
CO2	Describe different sampling plans.
CO3	Acquire basic knowledge of total quality management.

Detailed Syllabus

Unit 1: Introduction: Concept of quality, Need, Factor influencing quality, Types of quality, Quality control, Cost of quality control, Quality assurance, Benefits, Modern concept, Inspection and quality control, Quality characteristics, Quality circles with case study.

(9 hours)

Unit 2: Statistical Concepts and Control Charts: Review of fundamental statistical concept, Frequency distribution, Central tendency, measures of dispersion, Probability distributions, statistical quality control, Theory of control charts, Control charts for variables and attributes (X, R, P, np and C chart), their advantages and disadvantages, Applications.

(9 hours)

Unit 3: Total Quality Management: Introduction, Concept of Total quality, Quality function deployment tools for continuous quality improvement with case study, ISO 9000:2000 family of standards, Six sigma: DMAIC and its comparison with ISO system.

(9 hours)

Unit 4: Reliability: Introduction, Factors effecting Reliability, Failure and its types, Failure curve, reliability and its management, MTBF, MTTF, Relationship b/w reliability failure rate and MTBF, and its characteristics, reliability predictions and analysis, System reliability analysis, Reliability test and life testing plans, Types of test, Maintainability and Availability.

(9 hours)

Unit 5: Reliability Design: Design for reliability, design process, assessment methodology, reliability allocation, reliability improvement, selection of components to improve system reliability. Breakdown time distribution.

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Books Recommended:

1. Statistical Quality control by R.C. Gupta.
2. Modern Methods for Quality Control and Improvement by Harrism; M. Wadsworth.
3. Statistical Quality control by E.L. Grant.
4. Reliability Mathematics by B.L. Ams Tadter.
5. Fundamental of Quality Control and Improvement by Amitava Mitra.
6. Reliability Engineering and Tero technology by A.K. Gupta.

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1st SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: CONDITION MONITORING & FAULT DIAGNOSIS
COURSE NO.: MTME123
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: The course deals with detection of fault conditions based on measurements of vibration made on rotary machines in various industries. Detection of sources of vibration will be made based on the amplitude spectra and phase relationships of vibrations of individual machine parts, using the envelope of technology in detecting recurring events with low levels of the measured signal and processing of high-frequency signal in the range of acoustic emission.

COURSE OUTCOMES **At the end of the course student will be able to:**	
CO1	Understand the signal processing techniques Fourier analysis, Hilbert transforms, practical FFTanalysis.
CO2	Understand data Acquisition, Vibration instrumentation and transducers, Fluid Film and RollingElement Bearing with Condition Monitoring.
CO3	Perform condition Monitoring of Machines & Case studies.

Detailed Syllabus

Unit 1: Introduction to maintenance and condition-based maintenance: Definition, system approach, objectives, responsibilities of maintenance department, maintenance strategies, principles of maintenance, concepts ofmaintainability, availability and reliability, implementation of CBM, comparison of CBM with other maintenance techniques and case studies (overview).

(9 hours)

Unit 2: Introduction to condition monitoring: Basic concept, techniques - visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, crack monitoring, thickness monitoring, noise and sound monitoring. Basic signal processing techniques, Probability distribution and density, Fourier analysis, Hilbert Transform, Cepstrum analysis, Digital filtering, Deterministic / random signal separation, Time-frequency analysis.

(9 hours)

Unit 3: Vibration Monitoring: Introduction, vibration data collection, techniques, instruments, transducers, selection, measurement location, time domain analysis, frequency domain analysis, time-frequency domain analysis and commonly witnessed machinery faults diagnosed by vibration analysis.

(9 hours)

Unit 4: Rotating and reciprocating machines: Vibration signals from rotating and reciprocating machines – signal classification, signals generated by rotating machines, signals generated by reciprocating machines. Mechanical faultdiagnosis Wear monitoring and lubricant analysis - sources of contamination, techniques, Spectrometric Oil Analysis Procedure (SOAP) and ferrography. **(9 hours)**

Unit 5: Nondestructive testing techniques: Measurement of surface and subsurface flaws – liquid penetrant inspection, eddy current inspection, radiographic inspection, ultrasonic inspection. **(9 hours)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. Robert Bond Randall – Vibration-Based Condition Monitoring – Industrial, Aerospace and Automotive applications,John Wiley & Sons Ltd., 2011
2. R.A.Collacot – Mechanical Fault Diagnosis – Chapman and Hall Ltd., 1977.
3. ISTE Course material on Condition Monitoring.
4. R.C.Mishra, K.Pathak – Maintenance Engineering and Management, Prentice Hall ofIndia Pvt. Ltd., 2002.
5. K. P. Soman, K. I. Ramachandran, N. G. Resmi – Insight into wavelet from theory to practice, Third Edition, Prentice Hall of India, ISBN: 978-81-203-4053-4
6. Dr. K.Balaveera Reddy, ISTE Summer School on Machinery Diagnostics and Preventive Maintenance, KREC, Surathkal, June 19-25, 1995.

M. Tech Mechanical Engineering 1st Semester Examinations to be held in the Year December 2023, 2024, 2025

CLASS: M. TECH 1st SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: ADVANCED CAD MODELING LAB
COURSE NO.: MTME111
DURATION OF EXAM: 3 HOURS

CREDITS: 01

L	T	P	Marks
			Internal
0	0	2	50

Course Overview:
This course will help understand how 3D printing is being applied across a number of domains, including design, manufacturing, and retailing. It will also demonstrate the special capabilities of 3D printing such as customization, self-assembly, and the ability to print complex objects. This course will also provide an overview of design thinking and how you can use this framework to develop ideas.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Build complex engineering assemblies in plastic material with less process planning.
CO2	Design and fabricate working models for the conceptual testing applications and micro-sizedmodels for the functional testing applications.
CO3	Identify and correct the problems in STL files during modelling.

Detailed Syllabus

1. Review of CAD Modeling Techniques and Introduction to 3D printing.
2. Generating STL files from the CAD Models & Working on STL files.
3. Modeling Creative Designs in CAD Software.
4. Processing the CAD data in Catalyst software (Selection of Orientation, Supports generation, Slicing, Tool path generation).
5. Sending the tool path data to FDM RP machine.
6. Fabricating the physical part on FDM RP machine.
7. Removing the supports & post processing (cleaning the surfaces).
8. Modeling of Resin and Metal Parts in CAD Software.
9. STL File Manipulation (stitching, orientation, scaling, etc.,)
10. Slicing of corrected STL files in EOS RP Tools Software.
11. Fabrication of Resin parts on MSL RP Machine.
12. Post curing of Fabricated Resin parts.

Note: Laboratory work will be evaluated on internal scheme with following components:

1. Lab. Work (Continuous Assessment)	**70%**
2. Viva	**30%**

M. Tech Mechanical Engineering 2nd Semester Examinations to be held in the Year May 2024, 2025, 2026

CLASS: M. TECH 2nd SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: INDUSTRIAL TRIBOLOGY
COURSE NO.: MTME201
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: This course helps the learners to get expertise in the field of tribology and applications of tribology in various fields. Tribology is the science and technology of friction, wear and lubrication which makes a vital contribution to almost every area of industrial activity as friction an wear are present in all moving parts of any equipment of industry

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Develop a solution oriented approach by in depth knowledge of Industrial Tribology.
CO2	Address the underlying concepts, methods and application of Industrial Tribology.
CO3	Identify different areas of Industrial Tribology and find the applications of all the areas in day to daylife.

Detailed Syllabus

Unit 1: Introduction: Definition and Scope of tribology, Contact of solids, nature of surfaces, surface topography,surface interactions and characterization, micro and nano tribology, surface roughness measurement techniques.

(9 hours)

Unit 2: Friction and Wear: Types, laws, modern theories, dry sliding friction, temperature of sliding surface,Mechanism of rolling friction, friction instabilities, measurement of friction. Classification, theories of adhesive,abrasive, surface fatigue and corrosives wear, erosive, cavitation and fretting wear, wear models, wear ofmiscellaneous machine components such as gears, plain bearings and rolling element bearings, ASTM standards for wear measurement, wear resistant materials, wear resistant components, Study of abrasion in grinding, lapping and honing. **(9 hours)**

Unit 3: Lubrication Theories: Lubrication regimes: hydrodynamic lubrication, hydrostatic lubrication, elastohydrodynamic lubrication, boundary lubrication, squeeze films, turbulent lubrication. Reynold's equation, Pressure distribution, load carrying capacity, friction forces in oil film and co-efficient of friction in journal bearing.

(9 hours)

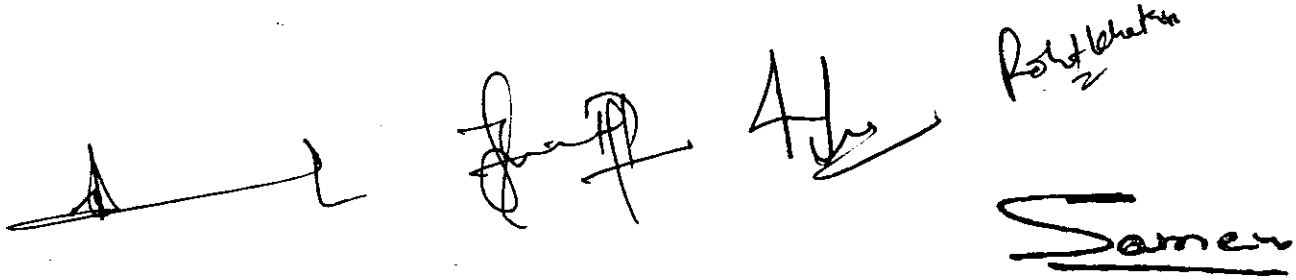
Unit 4: Bearing Design: Clearance in journal bearing, minimum film thickness, Sommerfeld Number. Oil grooves andflow of oil in axial and circumferential grooves, cavitation and turbulence in oil bearing. Heat generation and cooling of bearing. Design of air bearing and other gas bearings. **(9 hours)**

Unit 5: Applications: Application of tribology in manufacturing processes, Metal machining, Metal cutting, Tool wear,Action of lubricants, Friction welding, Extrusion process. **(9 hours)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. Basu S K., Sengupta A N., Ahuja B. B., Fundamentals of Tribiology PHI 2006.
2. Mujumdar B. C., Introduction to Tribiology Bearings, S. Chand company Pvt. Ltd 200 3.
3. Industrial Tribology, Tribology failures and their analysis, Dr. B.S. Prabhu



M. Tech Mechanical Engineering 2nd Semester Examinations to be held in the Year May 2024, 2025, 2026

CLASS: M. TECH 2ND SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: QUANTITATIVE METHODS & OPERATIONS RESEARCH
COURSE NO.: MTME202
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	Marks	
			External	Internal
3	1	0	75	25

Course Overview: This course enables the students to formulate some real-life linear programming problems and identifying the characteristics of linear programming problems. This will provide a basic understanding of the quantitative techniques to analyze and examine the results with the proposed recommendations for decision makingin order to incorporate in the organizations. This course is designed to include the fundamentals of operation research for reporting and exploring mathematical software to solve the proposed models. This course is designed to prepare students to handle responsible roles in business analytics to apply mathematical tools to solve the optimization problems.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
CO2	Build and solve Transportation Models and Assignment Models.
CO3	Design new simple models, like: CPM, MSPT to improve decision –making and develop criticalthinking and objective analysis of decision problems.

Detailed Syllabus

Unit 1: Role of quantitative methods in decision making. Probability and decision making, decision making under uncertainty, the value of additional information, Bayes theorem. Probability models and decision making.

(9 hours)

Unit 2: Sample survey methods. Methods of measuring and forecasting business changes, index numbers, time series analysis. Markov Chain Analysis. Background of Operations Research, classification of problems in operations research, phases of operations research study.

(9 hours)

Unit 3: Linear programming, formulation of mathematical models, solution of linear programming problems involvingdesign of product mix, resource allocation, transportation and assignment by graphical, simplex and dual simplex methods, Duality theorem and applications, use of computer to solve linear programming problems.

(9 hours)

Unit 4: Dynamic programming, principles of optimality, characteristics of dynamic programming problem, deterministic programming models for solution of investment problem, allocation problem, production scheduling and equipment replacement problem, probabilistic dynamic programming. Games theory, mini max - minimum pure strategies, mixed strategies and expected pay off, solution of 2x2, 2xn, mx2 games, Brown's algorithm.

(9 hours)

Unit 5: Queuing theory notation and assumptions, Poisson's queuing models, non-Poisson queuing models, queues in series, queuing decision models, Application to scheduling and maintenance problems.

(9 hours)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entiresyllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Reference Books:

1. Quantitative Techniques in management Vohra, N.D Tata McGraw Hill 1995
2. Principles of Operations Research Wagner H.M Prentice Hall 1982
3. Operations Research Hira D.S & Gupta P.K, S. Chand & Co. 1995
4. Operations Research Taha, H.A Macmillan Pub. Co. 1972
5. Quantitative Methods Ahuja, K.K, Kalyani Publisher 1990
6. Operations Research for Business and Economics ,Gopikuttan, Himalya Publishers

M. Tech Mechanical Engineering 2nd Semester Examinations to be held in the Year May 2024, 2025, 2026

CLASS: M. TECH 2ND SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: INDUSTRIAL AI
COURSE NO.: MTME203
DURATION OF EXAM: 3 HOURS

CREDIT: 04

L	T	P	MARKS	
			External	Internal
3	1	0	75	25

Course Overview: This course will survey the aspects of intelligence exhibited in biological systems and algorithmic approaches to mimic it. Material will include theoretical and applicative treatment of inductive learning, reinforcement learning, artificial neural networks and knowledge representation. This course will help the learners to revolutionise manufacturing in many ways by delivering insights to reduce unplanned machine downtime, increase production throughput, reduce maintenance costs, and deliver an increase in quality.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO1	Understand advance analytics and machine learning topics.
CO2	Apply AI to commercial and real world problems and create human like abilities like sight, learning, conversatio and creativity in machines.
CO3	Use modern technology, techniques, software and methodologies.

Detailed Syllabus

Unit 1: Introduction: Introduction to Industrial artificial intelligence, History of AI, Proposing and evaluating Industrial AI applications, Demonstration: AI Industrial Use cases.

(9 hours)

Unit 2: Machine learning, Supervised, unsupervised learning, Regression -- linear, logistic, Classification – decisiontrees, SVM, Model performance evaluation, PCA, Clustering – k-means, hierarchical clustering, Semi-supervised methods.

(9 hours)

Unit 3: Reinforcement learning, choosing among machine learning techniques. Deep Learning, Neural networks and back-propagation, Industrial application of Machine Learning and Deep learning, Petri Nets, Markov chain

(9 hours)

Unit 4: Robotic and Intelligent systems: Sensing and Manipulation, Introduction to robotics, sensing, Manipulation, Human-robot interaction, Navigation and path planning, Learning and robotics: Reinforcement learning, Autonomous vehicles technologies and impacts, AI in the enterprise.

(9 hours)

Unit 5: AI and the future Industrial work, Appropriate uses of AI, The future of AI: Emerging developments.

(9 hours)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entiresyllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, 2015
2. Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press, 2014
3. Artificial Intelligence: Strategies and techniques for complex problems solving by George Luger, Addison-Wesley, 2003.
4. Artificial Intelligence - A Modern Approach by Stuart Russell & Peter Norvig, Prentice Hall.

M. Tech Mechanical Engineering 2nd Semester Examinations to be held in the Year May 2024, 2025, 2026

CLASS: M. TECH 2ND SEMESTER
BRANCH: MECHANICAL ENGINEERING
COURSE TITTLE: ADVANCED ENGINEERING MATERIALS
COURSE NO.: MTME221
DURATION OF EXAM: 3 HOURS

CREDITS: 04

L	T	P	MARKS	
			External	Internal
3	1	0	75	25

Course Overview: This course provides you with an in-depth understanding of the key factors that govern the design and selection of materials for use in advanced engineering applications, as well as their processing, properties and stability. Focusing on composites, advanced alloys and engineering ceramics, you will explore the technologies used in the manufacturing and processing of advanced materials and develop an understanding of the relationships between composition, microstructure, processing and performance.

COURSE OUTCOMES	
At the end of the course student will be able to:	
CO21A.1:	Recognize the conventional methods for processing of advanced composite materials
CO21A.2:	Understand the different types of phase diagrams and distinguish between the availablereinforcing fibre performances.
CO21A.3:	Describe the different imperfections and strengthening mechanisms in solids.

Detailed Syllabus

Unit 1: Introduction, Atomic Structure, Interatomic Bonding and Structure of Crystalline Solids:
Historical perspective of Materials Science. Why study properties of materials? Classification of materials. Advanced Materials, Future materials and modern materials, Atomic structure. Atomic bonding in solids, Crystal structures, Crystalline and noncrystalline materials. Miller indices. Anisotropic elasticity. Elastic behaviour of composites. Structure and properties of polymers. Structure and properties of ceramics.

(9 hours)

Unit 2: Imperfections in Solids and Strengthening Mechanisms: Point defects. Theoretical yield point. Line defects and dislocations. Interfacial defects. Bulk or volume defects. Atomic vibrations. Elastic deformation. Plastic deformation. Interpretation of tensile stress-strain curves Yielding under multiaxial stress. Yield criteria and macroscopic aspects of plastic deformation. Property variability and design factors. Mechanisms of strengthening in metals. Recovery, recrystallization and grain growth. Strengthening by second phase particles. Optimum distribution of particles.

(9 hours)

Unit 3: Diffusions and Dislocation: Diffusion mechanisms. Steady and non-steady state diffusion. Factors that influence diffusion. Non-equilibrium transformation and microstructure, Dislocation and plastic deformation.. Lattice resistance to dislocation motion. Fick's Law.

(9 hours)

Unit 4: Phase Diagrams: Equilibrium phase diagrams. Particle strengthening by precipitation. Precipitation reactions.Kinetics of nucleation and growth. The iron-carbon system. Phase transformations. Transformation rate effects and TTT diagrams. Microstructure and property changes in iron carbon system.

(9 hours)

Unit 5: Applications and Processing of Metals and Alloys, Polymers, Ceramics: Types of metals and alloys.Fabrication of metals. Thermal processing of metals. Heat treatment. Precipitation hardening. Types and applications of ceramics. Fabrication and processing of ceramics. Mechanical behaviour of polymers. Mechanisms of deformation and strengthening of polymers. Crystallization, melting and glass transition. Polymer types. Polymer synthesis and processing.

(9 hours)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entiresyllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Recommended Books:

1. Materials Science and Engineering, William D. Callister, Jr, John Wiley & sons, 07
2. Modern Physical Metallurgy and Material Engineering, Science, Process, application,
3. Smallman R.E., Bishop R J, Butterworth Heinemann, Sixth Ed., 1999.