Quest for Excellence

MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABD

An Autonomous Institute Affiliated to
Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad, Maharashtra (India)

M.Tech (Mechanical) Syllabus
2021-22

Chairman Board of Studies
Mechanical Engineering
MIT Aurangabad
(An Autonomous Institute)

Chairman Academic Council
MIT Aurangabad
(An Autonomous Institute)

Maharashtra Institute of Technology, Aurangabad
(An Autonomous Institute)

FACULTY OF SCIENCE AND TECHNOLOGY

Syllabus Structure w.e.f. 2022-2023 (Choice Based Credit System)

M. Tech. (Mechanical Engineering)

Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MTM 101	Research Methodology and IPR	3	1	-	15	15	20	50	-	-	100	3	-	1	4
MTM 102	Machine Stress Analysis	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 103	Advances in Materials	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 104	Advanced Thermodynamics	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 121-123	Professional Elective-I	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 111	Lab -I	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTM 112	Lab -II	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTM 113	Lab-III (MATLAB)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTM 114	Seminar	-	-	4	-	-	-	-	-	50	50	-	2	-	2
Total (Semester-I)		**15**	**1**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**

Semester-II															
Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MTM 141	Advanced Optimization Techniques	3	1	-	15	15	20	50	-	-	100	3	-	1	4
MTM 142	Advanced Machine Design	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 143	Advanced Manufacturing Processes	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 144	Computational Fluid Dynamics	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 161-163	Professional Elective-II	3	-	-	15	15	20	50	-	-	100	3	-	-	3
MTM 151	Lab –IV (Optimization Programming or software)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTM 152	Lab –V (CFD software)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTM 153	Lab-VI (Advanced MATLAB)	-	-	2	-	-	-	-	25	-	25	-	1	-	1
MTM 154	Minor Project (Problem Based Learning)	-	-	4	-	-	-	-	-	50	50	-	2	-	2
	Total (Semester-II)	**15**	**2**	**10**	**75**	**75**	**100**	**250**	**75**	**50**	**625**	**15**	**5**	**1**	**21**
M. Tech (First Year)															
	Grand Total	**30**	**3**	**20**	**150**	**150**	**200**	**500**	**150**	**100**	**1250**	**30**	**10**	**2**	**42**

MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial

Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MTM 201	MOOC Course	3	-	-	-	-	-	100	-	-	100	3	-	-	3
MTM 211	Dissertation-I	-	-	18	-	-	-		50	100	150	-	9	-	9
	Total (Semester-III)	3		18				100	50	100	250	3	9	-	12

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Tutorial	Practical	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
MTM251	**Dissertation II**	-	-	24	-	-	-	-	100	100	200	-	12	-	12
	Total (Semester IV)	-	-	24	-	-	-	-	100	100	200	-	12	-	12
M.Tech Second Year															
	Grand Total	3	-	42	-	-	-	100	150	200	450	3	21	-	24

MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial

Professional Elective-I

Course Code	Course Name
MTM 121	Kinematics: Dynamics and Synthesis
MTM 122	Smart Manufacturing
MTM 123	Advanced Heat Transfer

Professional Elective-II

Course Code	Course Name
MTM 161	Finite Element Method
MTM 162	Reliability and Maintenance Engineering
MTM 163	Refrigeration and Cryogenics Systems

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science and Technology) Syllabus of M. Tech. (Mechanical Engineering) Semester-I	
Course Code: MTM 101 Course: Research Methodology & IPR **Teaching Scheme:** Theory: 3 Hrs/week Tutorial: 1 Hr./week	Credits: 3-1-0 (4) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Unit-1	**Research Problems and Research Design** Meaning of research, types of research, steps in involved in research process, criteria of good research, importance of ethics in research, codes and policies for research ethics. Selection of research problem, steps involved in defining research problem, need for research design, types of research designs, basic principles of experimental design, formal and informal experimental design. (05 Hrs)
Unit-2	**Sampling Design** Need for sampling, steps in sampling design, different types of sampling designs, sampling distributions, concept of central limit and standard error, sources of errors, population mean and proportion, sample size calculations, tests of measurements for validity, reliability and practicality. (05 Hrs)
Unit-3	**Data collection, Processing and Analysis** Methods for collection of data, selection of data collection method, data processing operations, statistics in research, confidence level, measures of central tendency, dispersion, asymmetry and relationship. Spearman's and Pearson's coefficient of correlation, simple & multiple regression analysis, analysis of variance (ANOVA), factor analysis methods. (08 Hrs)

Unit-4	**Hypothesis Test and Report Writing** Concept of research hypothesis, concept of testing of hypothesis, Parametric tests (z, t, F and chi-square tests), Hypothesis testing of means and correlation coefficient, Non parametric tests, significance of research report writing, types of reports, structure of the research report, steps in report writing, precautions and ethics in writing report. (07 Hrs)				
Unit-5	**Introduction to IPR** Origin and evolution of IPR to its present form and use, Different Tools of IPR and what is the nature of these rights, Balancing Rights and Responsibilities, Societal implications of IPR (05 Hrs)				
Unit-6	**Patents** Concept of inventions/discoveries, patents protect; benchmarks for patentability of inventions; Exceptions to patentability; Patenting issues in Biotechnology and computer based inventions, process to apply for patents in India and in other countries around the world, The steps to granting of a patent; Opposing grant of a patent; term of a patent; rights of a patent holder; challenging validity of a patent licensing of patent rights; using patent rights in the market place; compulsory license. (06 Hrs)				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Research Methodology: Methods and Techniques	C. R. Kothari and G. Garg	New Age International, 2019	4th Edition
	2	Research Methodology	R. Pannerselvam	PHI Learning, 2014	2nd Edition
	3	Research Methodology-	D. Napolean	Laxmi	1st Edition

		As Theoretical Approach	& B. Narayan	Publications, 2014	
	4	Research Methods and Statistics	Bernard C. Beins & Maureen A. McCarthy	Pearson Education Inc., 2012	1st Edition
	5	Research Methods Handbook	Stuart MacDonald & Nicola Headlam	CLES	1st Edition
	6	Intellectual Property Rights--Unleashing the Knowledge Economy	Ganguli Prabuddha	Tata McGrawHill, 2001	1st Edition
	7	Intellectual Property Rights	Neeraj Pandey and Khushdeep Dharni	PHI Learning, 2014	1st Edition
	8	Fundamentals of Intellectual Property Rights	Ramakrishna B	Notion Press, 2017	1st Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code:MTM102 Course: Machine Stress Analysis **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit-1	**Theory of Elasticity:** Plane Stresses and plane Strain: Plain stress, Plain strain, and stress and strain at a point, differential equations of equilibrium, boundary conditions, compatibility equations, and Airy's stress function. **Two dimensional problems in rectangular coordinates:** Solutions by polynomials, end effects, Saint Venant's principle. Two dimensional problems in polar coordinates: General equations in polar coordinates, Stress distribution symmetrical about axis, Strain components in polar coordinates. (08 Hrs)
Unit-2	**Applications of Energy Methods:** First and Second theorems, Castigliano's theorem, applications for analysis of loaded members to determine deflections and reactions at support. (04 Hrs)
Unit-3	**Theory of Torsion:** Torsion of Prismatic bars of non-circular cross sections, Thin walled hollow and rectangular cross sections, Saint Venant's theory, Prandtle's membrane analogy, Kelvin's fluid flow analogy, Wraping of cross sections. (06 Hrs)
Unit-4	**Experimental Stress Analysis:** Stress analysis by Mechanical, Optical and electrical strain gauges, strain rosette, whole field methods, Moire fringe method, brittle coatings for strain indication.

	(06 Hrs)
Unit-5	**Shear Centre and Unsymmetrical Bending:** Shear centre for beams of different cross sections, bending and deflections of beams subjected to unsymmetrical bending. (06 Hrs)
Unit-6	**Contact Stresses:** Hertz's contact stresses, expression for principle stresses, deflection of bodies in point contact, stress in bodies in point and line contacts (06 Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1	Theory of Elasticity	Timoshenko & J. N. Goodier	McGraw Hill Publications	1st Edition
2	Theory of Elasticity	Sadhu Singh	Khanna Publisher	1st Edition
3	Advanced Mechanics of Materials	Seely and Smith	John Wiley & Sons Publications	2nd Edition
4	Advanced Strength of Materials	Den Hartog J.P.	Dover Publications.	1st Edition
5	Strength of Materials	Nash W.	McGraw Hill Publications.	6th Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code:MTM103 Course: Advances in Manufacturing **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit 1	**Powder Metallurgy** Development and scope of powder metallurgy, characterization of metal powders, relationship between physical properties and particle size/ shape, particle interaction and size control, powder manufacturing techniques, powder mixing and blending, dry and colloidal processing, reduction, electrolysis and atomization processes, compacting and sintering and other consolidation techniques (06 Hrs)
Unit 2	**Composite Materials and their Engineering Applications** Types of composites and their advantages. Types of reinforcements: glass, boron, carbon, organic and ceramic fibers, their structure, properties and processing. Types of matrix materials: polymer, metal and ceramic matrices, their structure, properties and processing. Wettability and interface bonding. Composite manufacturing and processing techniques. Introduction to Nano-composites and applications. Mechanical properties, thermal properties and load transfer in composites. Elastic behavior, Fracture, fatigue and creep behavior of composites. Tribological and electrical performance of composites. Degradation of composites due to various environmental conditions and corrosion resistance of composites. Designing with composites. Engineering applications of composites (08 Hrs)
Unit 3	**Functional Materials**

	Definition of functional materials. Light-sensitive (photochromic) materials, Temperature-sensitive (thermochroic) materials, Chemical-sensitive (chemo chromic) materials, Self-healing materials, Magnetic-sensitive materials and magnetorheological fluids, Shape-Memory Alloys, Invar alloys. Functional materials for computer memory devices and optical media storage devices, Multiferroic materials and their applications in sensors and actuators, Carbon based materials: CNTs, CQD, Fullerenes, Graphite, RGO, GNP. (06 Hrs)
Unit 4	**Application of Nanomaterials and Nanocomposites** Applications in Biomedical, Solar and Energy storage, Biomedical-Drug delivery, Bone replacement; Sensors – gas sensor, Metal adsorption and recovery, Bio-molecule detectors; Energy storage and conversion - Super capacitors, Solar cells, Energy generators; Electronics; Self-cleaning & Self-healing paints, Nano-engineering of cement-based materials, Agricultural Nanotechnologies. (06 Hrs)
Unit 5	**Materials Characterization,** Scope and methods used for materials characterization. Need, Working principle, Components, Description and Applications of different characterization techniques such as Microscopy, Compositional analysis, Chemical analysis, Structural analysis, Thermal analysis, Mechanical property evaluation, Fractography. (06 Hrs)
Unit 6	**Materials Recycling and Waste Management** Recycling of different classes of materials, Solid Waste Regulations, Waste generation, Waste characterization, Physical properties of Waste, Waste separation and processing: Composting, Landfills, Incineration, etc. (04 Hrs)

References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1	Material Science and Engineering: An	William D. Callister Jr.	Wiley Ltd.	10th Edition

		Introduction	and David G. Rethwich		
	2	Concise Encyclopedia of Magnetic and Superconducting Materials (Advances in Materials Sciences and Engineering)	J. Evetts (ed.)	Perganon Press	2nd Edition
	3	Advances in Materials and their applications	Rama Rao P. (ed).	Wiley Eastern Ltd.	1st Edition
	4	Nano: The essentials	Pradeep T.	McGraw Hill	1st Edition
	5	Nano Technology	Wilson M.	Taylor & Francis Inc	1st Edition
	6	Material Science and Engineering: An Introduction	William D. Callister Jr. and David G. Rethwich	Wiley Ltd.	10th Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code:MTM104 Course: Advanced Thermodynamics. **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit 1	**Equation of State:** State postulate for simple system and equation of state, ideal gas equation, deviation from ideal gas, equation of state for real gases, generalized compressibility chart, law of corresponding state. (06 Hrs)
Unit 2	**Law of Thermodynamics:** Equation of the first law of the thermodynamics, application of the first law to Flow & Non Flow system, reversible & irreversible processes with ideal and real gases, Statement of second law, Genralised Carnot cycle, Entropy & Exergy, Free energy and tied energy, Thermodynamics potential functions, Availability, Losses of maximum useful work, Nerst's heat theorem. (06 Hrs)
Unit 3	**Changes in States of Gases at their Transferences:** Throttling process, Joule Thomson effect, Temperature of braking, Mixtures of ideal & real gases, Mixing of flowing gases, mixing of gases at constant volume. (06 Hrs)
Unit 4	**Thermodynamic Property Relations:** Partial differentials, Maxwell relations, Clapeyron equation, general relations for du,dh,ds and C_v and C_p, Joules Thomson coefficient, change in enthalpy, internal energy and entropy of real gases. (06 Hrs)
Unit 5	**Chemical Thermodynamics** chemical reaction- fuels and combustion, enthalpy of formation and enthalpy of combustion, first law analysis of reacting systems,

	adiabatic flame temperature chemical and phase equilibrium- criterion for chemical equilibrium, equilibrium constant for ideal gas mixtures, some remarks about Kp of ideal gas mixtures, fugacity and activity, simultaneous relations. Gibb's phase rule, third law of thermodynamics, Nerst heat. (06 Hrs)
Unit 6	**Gas Mixtures-** Mass and mole fractions, Dalton's law of partial pressure,Amagat's law, Kay's rule **Statistical Thermodynamics-** Fundamentals, equilibrium distribution, significance of Lagrangian multipliers, partition function for Canonical Ensemble, partition function for an ideal monatomic gas, equitpartition of energy, Bose Einsten statistics, Fermi-Dirac statistics. (06 Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1.	Thermodynamics	Y. A. Cengel	TMH	8th Edition
2.	Basic and Applied Thermodynamics	P.K.Nag	TMH	2nd Edition
3.	Advanced Thermodynamics	Kalyan Annamalai, Ishwar K.Puri.	CCRC PRESS	2nd Edition
4.	Thermodynamics	J P Holman	McGraw Hill	4th Edition
5.	Engineering Thermodynamics	Jones and Hawking	Join Wiley and Sons	1st Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code: MTM121 Course: Kinematics: Dynamics and Synthesis (Professional Elective-I) **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit 1	**Introduction:** Concepts related to kinematics and mechanism, degrees of freedom, Grubler's criteria, Transmission and deviation angles, Mechanical Advantage. (06 Hrs)
Unit 2	**Kinematic Synthesis:** Type, number and dimensional synthesis, Spacing of accuracy points, Chebyshev polynomials, Motion and function generation, Graphical synthesis with two, three and four prescribed motions and points. (06 Hrs)
Unit 3	**Position Analysis:** The complex number modelling in kinematic synthesis, The Dyad synthesis, Standard form, Freudentein's equation for three point function generation coupler curves, Robert's law, Cognates of the slider crank chain. (06 Hrs)
Unit 4	**Path Curvature Theory:** Fixed and moving centrode, inlection points and inflection circle, Euler'-savary Equation, Bobillier's and Hartsman Construction. (06 Hrs)
Unit 5	**Dynamic Force Analysis:** Introduction, Inertia force in linkages, Kineto static analysis by superposition and matrix approach, Time response of mechanisms, Force and moment balancing of linkages.

	(06 Hrs)				
Unit 6	**Spatial Mechanism:** Introduction to 3-dimentional mechanisms, Planar Finite, Rigid body and spatial transformation, Analysis of spatial mechanisms. (06 Hrs)				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Kinematic Analysis and Synthesis of Mechanisms	A.K. Mallik amd A Ghosh	CRC Press	1st Edition
	2.	Theory of Mechanisms	A.K. Mallik amd A Ghosh	East west Press	1st Edition
	3.	Mechanism Synthesis & Analysis	A H Soni	McGraw Hill	1st Edition
	4.	Kinematics and Dynamics of Plane Mechanisms	Jeremy Hirschhorn	McGraw Hill	1st Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code: MTM122 Course: Smart Manufacturing (Professional Elective-I) **Teaching Scheme:** Lecture: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit 1	**Introduction to smart manufacturing:** Smart Manufacturing, Comparison with conventional/legacy manufacturing, Pillars of Smart Manufacturing. (03 Hrs)
Unit 2	**Introduction to IoT:** IoT Enablers, Characteristics of IoT, Evolution of Connected Devices, Communication Technologies, Protocols, IoT applications, Baseline Technologies, IoT Networks, Sensing: Sensors, transducers, sensor classes, types, sensorial deviations, actuation: actuators, types. Introduction to M2M, Description of M2M Market Segments/Applications – Automotive, Smart Telemetry, Surveillance and Security, M2M Industrial Automation (09 Hrs)
Unit 3	**Cyber-Physical Systems** (CPS) in the real world, Basic principles of design and validation of CPS, IT and OT convergence, digital twins, Cloud Computing , Smart Cloud- Hyper scale Computing; Platform as a service (PaaS) and application platform as a service (aPaaS); Intelligent Analytics for smart machines. (06 Hrs)
Unit 4	**Smart design/fabrication:** Smart Design/Fabrication - Digital Tools, Product Representation and Exchange Technologies and Standards, Agile (Additive)

	Manufacturing Systems and Standards. Mass Customization, Smart Machine Tools, Robotics and Automation (perception, manipulation, mobility, autonomy). (06 Hrs)
Unit 5	**Smart Applications:** Online Predictive Modelling, Monitoring and Intelligent Control of Machining/Manufacturing and Logistics/Supply Chain Processes; Smart Energy Management of manufacturing processes and facilities. (06 Hrs)
Unit 6	**Smart and Empowered Workers:** Eliminating Errors and Omissions, Deskilling Operations, Improving Speed/Agility, Improving Information Capture/Traceability, Improving Intelligent Decision Making under uncertainty Assisted/Augmented Production, Assisted/Augmented Assembly, Assisted/Augmented Quality, Assisted/Augmented Maintenance, Assisted/Augmented Warehouse Operations and Assisted Training. (06 Hrs)

Reference

Sr. No.	Title	Author	Publication	Edition
1.	Smart Manufacturing Concepts and Methods	M. Soroush, M. Baldea	Elsevier	1st Edition
2.	M2M communications: A systems approach	D. Boswarthick O. Elloumi and O. Hersent	Wiley	1st Edition
3.	Designing the Internet of Things	A. McEwen and H. Cassimally	Wiley	1st Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code: MTM123 Course: Advanced Heat Transfer (Professional Elective-I) **Teaching Scheme:** Lecture: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit 1	**Brief Introduction to Different Modes of Heat Transfer**, Heat Transfer applications, Heat conduction with heat generation Plane wall and cylinder with uniform heat generation, applications. Two-dimensional steady state conduction in semi-finite and finite plates, Combined mechanisms of Heat Transfer. (06 Hrs)
Unit 2	**Heat Transfer through extended surfaces**: Classification of fins, Steady state analysis and optimization, radial fins of rectangular and hyperbolic profiles longitudinal fin of rectangular profile radiating to free space. Design analysis of fin. (06 Hrs)
Unit 3	**Transient heat conduction** Lumped system analysis-1D Transient Heat Conduction – Heisler charts-semi-infinite solid-use of shape factors in conduction. Finite Difference Methods for Conduction: ID & 2D steady state and simple transient heat conduction problems-implicit and explicit methods. Periodic heat flow, Systems with Negligible Surface Resistance. (06 Hrs)
Unit 4	**Radiation heat transfer:** Laws of radiation, Nature of thermal radiation, radiation effect on temperature measurements, radiation properties of a participating medium, emissivity and absorptivity of gases and gases mixtures, heat transfer from the human body, radiative exchange and overall heat transfer in furnaces, Electrical Network Analogy for Thermal Radiation Systems, Radiation Between

	Two Black Isothermal Surfaces**,** Radiation Shape Factor. (06 Hrs)
Unit 5	**Convective Heat Transfer** Concept of velocity, Thermal boundary layer, Laminar and turbulent flow Equations of fluid flow-concepts of continuity, momentum equations-derivation of energy equation-methods to determine heat transfer coefficient: Analytical methods-dimensional analysis and concept of exact solution. Approximate method-integral analysis. External Flows: Flow over a flat plate: integral method for laminar heat transfer coefficient for different velocity and temperature profiles. (06 Hrs)
Unit 6	**Boiling and condensation** Boiling Heat Transfer Phenomena, Simplified Correlations for Boiling with Water, Boiling curve-correlations for different regimes — Condensation: Film and Dropwise condensation – Nusselts theory of film condensation on a vertical plate – assumptions & correlations of film condensation for different geometries. Radiation Heat Transfer: Radiant heat exchange in grey, non-grey bodies, with transmitting. Reflecting and absorbing media, specular surfaces. Flow boiling, turbulent film wise condensation. (06 Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1.	Heat Transfer	S. P. Sukhatme	Universities Press	4th Edition
2.	Fundamentals of Engineering Heat Transfer	R.C. Sachdeva	New age Science	1st Edition
3.	Fundamentals of Heat & Mass Transfer	Sarit K. Das	Alpha Science International Ltd	1st Edition
4.	Basic and Applied Thermodynamics	P.K.Nag	TMH	2nd Edition
6.	Thermodynamics	J P Holman	McGraw Hill	4th Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science and Technology) Syllabus of M. Tech. (Mechanical Engineering) Semester-I	
Course Code:MTM111 Course: Lab-I **Teaching Scheme:** Practical: 2 Hrs /week	Credits: 0-0-1 Credits: 1 Practical/Oral Exam: -NA Term Work: 25 Marks
Lab work consists of two parts as below **Part A:** The candidate will deliver an industrial case study in front of two examiners (one internal and other appointed by the principal) **Part B:** Assignments shall be based on five theory subjects of semester (one on each course). The marks will be awarded by the concerned course teacher.	

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code:MTM112 Course: Lab-II **Teaching Scheme:** Practical: 02 Hr/week	Credits: 0-0-1 Term work: 25 Marks

Course Content:

The lab work consists of the assignments/experiments related to

Introduction to ANSYS Software

1. Modelling of structure using line element
2. Modelling of two and three dimensional machine components.
3. Mesh generation of solid part
4. Static structural analysis of machine component
5. Transient structural analysis of machine components
6. Steady state thermal analysis of machine components
7. Buckling analysis of machine components
8. Modal analysis of machine components

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code:MTM113	Credits: 0-0-1
Course : Lab-III[MATLAB]	Term work: 25 Marks
Teaching Scheme:	
Practical: 02 Hr/week	

Course Content:

The lab work consists of the assignments/experiments related to

Introduction to MATLAB Software

1. MATLAB window: Command window, Workspace, Command history, setting directory, Working with the MATLAB user interface
2. Basic commands, Assigning variables, Operations with variables
3. Data Types: Character and string, Arrays and vectors, Column vectors, Row vectors
4. Basic Mathematics: BODMAS Rules, Arithmetic operations, Operators and special characters, Mathematical and logical operators, Solving arithmetic equations
5. Operations on matrix: Crating rows and columns Matrix, Matrix operations, Finding transpose, determinant and inverse, Solving matrix
6. Other operations: Trigonometric functions, Complex numbers, fractions, Real numbers, Complex numbers
7. Plots: Plotting vector and matrix data, Plot labelling, curve labelling and editing, 2D plots: Basic Plotting Functions, Creating a Plot, Plotting Multiple Data Sets in One Graph, Specifying Line Styles and Colours, Graphing Imaginary and Complex Data, Figure Windows, Displaying Multiple Plots in One Figure, Controlling the Axes

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Syllabus of M. Tech. (Mechanical Engineering) Semester-I

Course Code: MTM114 Course: Seminar **Teaching Scheme:** Practical: 04 Hr/week	Credits: 0-0-2 Pr-Oral : 50 Marks

Seminar 1: It shall be based on the literature survey on any topic, which may lead to dissertation in that area. It will be submitted as a report.

The candidate will have to deliver a seminar presentation before the examiners, one of them will be guide and other will be examiner appointed by Examination Cell.

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Syllabus of M. Tech. (Mechanical Engineering) Semester-II

Course Code:MTM141 Course: Advanced Optimization Techniques **Teaching Scheme:** Lecture: 3 Hrs/week Tutorial: 1 Hr/week	Credits: 3-1-0 (4) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit1	**Introduction** Optimal Problem Formulation, engineering optimizations Problems, Optimization Algorithms Single Variable Optimization Algorithms**:** Optimality criteria, bracketing methods, region elimination methods, point estimation methods, gradient base methods, root finding using optimization techniques. (06Hrs)
Unit 2	**Multivariable optimization Algorithms** Optimality criteria, unidirectional search, direct search methods, gradient based methods. (06Hrs)
Unit 3	**Constrained Optimization Algorithms** Kuhn-Tucker conditions, transformation methods, Sensitivity Analysis, direct search for constrained minimization, linearized search techniques, feasible direction method, generalized reduced gradient method, and gradient projection method. (06Hrs)
Unit 4	**Fuzzy Logic** Introduction to Fuzzy logic: Fuzzy sets and membership functions, operations on fuzzy sets, fuzzy relations, rules, propositions, implications and inferences, defuzzification techniques, fuzzy logic controller design, some applications of fuzzy

	logic. (06Hrs)
Unit 5	**Special Optimization Algorithms** Integer programming, geometric programming, Genetic Algorithm, Simulated annealing, Global optimization, ant colony optimization. (06Hrs)
Unit 6	**Optimization in Operations Research** Linear Programming Problems, simplex method, artificial variable technique, dual phase method, sensitivity analysis. (06Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1.	Optimization for Engineering Design	Deb Kalyanmoy	PHI, New Delhi	2nd Edition
2.	Engineering Optimization	Rao S.S.	John Wiley, New Delhi	3rd Edition
3.	Multi-Objective Algorithms using Evolutionay Algorithms	Deb Kalyanmoy	John Wiley, New Delhi.	1st Edition
4.	Principles of Optimum Design: Modelling and Computation	Paplambross P. Y. and Wilde D. J.	Cambridge University Press, UK	2nd Edition
5.	Optimization concepts and Applications in Engineering	Ashok D Belegundu Tirupathi R. Chandupatla	Cambridge University Press	3rd Edition

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Syllabus of M. Tech. (Mechanical Engineering) Semester-II

Course Code: MTM142 Course: Advanced Machine Design **Teaching Scheme:** Lecture: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs

Unit 1	**Fundamentals of Design Considerations:** Principal Planes and Principal Stresses, tri-axial state of stresses, Mohr's circle for tri-axial state of stresses and strains, volumetric strains, Principal stresses computed from Principal strains, Principal strains due to perpendicular stresses and shear stresses. (08 Hrs)
Unit 2	**Mechanical Springs:** Design of square or rectangular bar helical springs, Belleville springs, ring springs, torsion bar springs, theory of square or rectangular bars helical springs under axial loading, cone, or flat disc spring theory. (06 Hrs)
Unit 3	**Shafts and Axles:** Introduction, Causes of failure in Shafts and Axles and Stresses in Shafts, Materials for Shafts and Axles, Methods of Manufacturing of Shafts, Designing of Straight Shafts, Pure Torsional Load, Designing for Rigidity and Stiffness, Design of Axles, Flexible Shafts**.** (06 Hrs)
Unit 4	**Cams:** Basic curves, cam size determination, calculating cam profiles, advance curves, polydyne cams, dynamics of high speed cam systems, surface materials, stresses, and accuracy, ramps. (06 Hrs)
Unit 5	**Fracture and Creep:** Fracture Mechanics approach to design, Causes and Interpretation of failures, Creep behavior; rupture theory; creep in high temperature low cycle fatigue; designing against creep. (06 Hrs)

Unit 6	**Computer Aided Machine Design:** Philosophy of Computer Aided Machine Design, Interactive design software, Basic advantage of analysis Software, Design of machine components (springs, gears, temporary fasteners, permanent fasteners, belts and ropes) through Interactive programming. (04 Hrs)				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Advanced Solid Mechanics	L S Srinath	Tata McGraw-Hill	3rd Edition
	2.	Computer Aided Machine Design and Analysis	V Ramamurti	Tata McGraw-Hill	3rd Edition
	3.	Advanced Mechanics of Materials	Sidebottom Borosi	John wily and sons	7th Edition
	4.	Mechanical Design Analysis	Spotts M.F	PHI Publications	3rd Edition

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Syllabus of M. Tech (Mechanical Engineering), Semester-II

Course Code:MTM143	Credits: 3-0-0 (3)
Course Title: Advanced Manufacturing Processes	Mid Semester Examination-I: 15 Marks
	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 20 Marks
Theory: 3 Hrs./week	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 02 Hrs

Unit 1	**Advanced Casting Processes** Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting, Counter-gravity flow - pressure casting, Semisolid metal casting, Rheocasting. (06 Hrs)
Unit 2	**Advanced Metal Forming Processes** Details of high energy rate forming (HERF) process, Electro-magnetic forming, explosive forming, electro-hydraulic forming, stretch forming, contour roll forming. (06 Hrs)
Unit 3	**Advanced Welding Process** EBW, LBW, USW, Explosion welding, ESW and EGW, Cold pressure welding, FSW, UWW: wet and dry. Automation in welding, Remote welding, Robotic welding, Gravity welding and Fire cracker welding, selecting welding system. (06 Hrs)
Unit 4	**Surface Treatment** Scope, Cleaners, Methods of cleaning, Surface coating types, Economics of coating, CVD, PVD, Thermal spray coating, Ion implantation, Diffusion coating, Diamond coating and cladding. (06 Hrs)
Unit 5	**Non-conventional Machining Processes** Introduction, Need, Process capabilities, Parametric analysis, Advantages and Disadvantages, Applications of: AJM, WJM, USM, EDM, WEDM, LBM, ECM,

	ECG, CHM, PAM. (06 Hrs)				
Unit 6	**High-end Manufacturing Processes** E-manufacturing, Nano-technology, Etching techniques: wet etch and dry etch, Lithography, Micromachining, HSM, Additive Manufacturing, 3-D Printing. (06 Hrs)				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Manufacturing Processes for Engineering Materials	Serope Kalpakjian and Steven R. Schmid	Pearson Education India	6th Edition
	2.	Manufacturing Processes and Systems	Philip F. Ostwald and Jairo Munoz	Wiley Student Edition.	9th Edition
	3.	Manufacturing Technology: Foundry, Forming and Welding	P N Rao	McGraw Hill Education.	4th Edition
	4.	The 3D Printing Handbook: Technologies, Design and Applications	Ben Redwood. Fielmon	3D Hubs	1st Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M. Tech (Mechanical Engineering), Semester-II	
Course Code:MTM144 Course: Computational Fluid Dynamics **Teaching Scheme:** Lecture: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Unit 1	**Introduction:** Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description. Classification and Overview of Numerical Methods: Classification into various types of equation; parabolic elliptic. (06 Hrs)
Unit 2	**Classification of Physical Behaviour:** Classification of fluid flow equations, auxiliary conditions for viscous fluid flow equations. Implementation of boundary condition **Turbulence and its Modelling:** Transition from laminar to turbulent flow, effect of turbulence on time averaged Navier Stoke equation, Characteristics of simple turbulent flow, Free turbulent flows, Flat plate boundary layer, pipe flow, Turbulence model Mixing length model, k-omega, and k-epsilon model. (06 Hrs)
Unit 3	**Numerical Grid Generation:** General principles of grid generation Numerical grid generation and types; basic ideas of transformation and mapping. Elliptic grid generation, algorithm, Grid clustering, Grid refinement, Adaptive grids, Moving grids. (06 Hrs)
Unit 4	**Finite difference discretization** Elementary finite difference coefficients, basic aspects of finite difference equations, consistency, explicit and implicit methods,

	errors and stability analysis. Fundamentals of fluid flow modeling-conservative property, upwind scheme, transporting property. Finite difference applications in heat transfer – conduction, convection. (06 Hrs)
Unit 5	**Finite Volume Method Introduction**, Application of FVM in diffusion and convection problems, NS equations – staggered grid, collocated grid, SIMPLE algorithm. Finite volume methods for unsteady problems – explicit schemes, implicit schemes. (06 Hrs)
Unit 6	**Errors** and its types, Validation of CFD Code, Application of CFD in Automobile, Aviation, biomedical engineering, combustion, food industry etc. and basic governing equations, Introduction to various commercial softwares ANSYS, COMSOL Multiphysics, Autodesk CFD. (06 Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1.	Computational Methods for fluid Dynamics	Ferziger J. H., Milovan Peric	Springer	3rd Edition
2.	Computational fluid Dynamics	Anderson J. D. JR	Springer	3rd Edition
3.	Computational Fluid Dynamics: A Practical Approach	Jiyuan Tu,	Butterworth-Heinemann	3rd Edition
4.	Fluid Dynamics: Part 1: Classical Fluid Dynamics	Anatoly I Ruban and Jitesh S B Gajjar.	Oxford University Press	1st Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

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Syllabus of M. Tech (Mechanical Engineering), Semester- II

Course Code:MTM161 Course Title: Finite Element Method (Professional Elective-II) **Teaching Scheme:** Theory: 3 Hrs./week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 03 Hrs

Unit 1	Introduction to Finite Difference Method and Finite Element Method, Advantages and disadvantages, Mathematical formulation of FEM, Variational (Rayleigh-Ritz) Method, Potential Energy Method, Weighted Residual (Galerkin) Approach, Weighted Residual (Least Squares) Approach. (06 Hrs)
Unit 2	Shape functions, Natural co-ordinate system, Element and global stiffness matrix, Boundary conditions Errors, Convergence and patch test, Higher order elements. (06 Hrs)
Unit 3	Applications: problems of structural mechanics and solid mechanics, Plane stress and plane strain problem, 3-D problems. Torsion, bending of plates and shells. (06 Hrs)
Unit 4	FE formulation for vibration, heat transfer, and fluid flow problems. (06 Hrs)
Unit 5	Application of the method to materially non-linear bending of straight beams and elastic plates problems, associated flowcharts and computer programming, Data preparation and mesh generation through computer graphics, Numerical techniques, 3D problems. (06 Hrs)
Unit 6	FEM an essential components of CAD, Use of commercial FEM packages, ANSYS Software and MATLAB Programs for Finite Element Analysis,

	Comparison with conventional analysis. (06 Hrs)				
References	**Sr. No.**	**Title**	**Author**	**Publication**	**Edition**
	1.	Introduction to Finite Elements in Engineering	T. R. Chandrupatla & A.D. Belegundu	Prentice Hall India.	3rd Edition
	2.	An Introduction to the Finite Element Method	Reddy J.N	McGraw-Hill	4th Edition
	3.	Introduction to the Finite Element Method: A Numerical Method for Engineering Analysis	Desai.C.S and Abel.J.F	CBS Publisher	1st Edition

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Syllabus of M. Tech (Mechanical Engineering), Semester- II

Course Code:MTM162 Course: Reliability and Maintenance Engineering (Professional Elective-II) **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs

Unit 1	**Introduction:** Reliability concepts and patterns of failure, reliability Management, reliability, for system effectiveness. **Reliability and hazard rates:** Failure data, reliability function, failure rate and hazard rate, common distributions in failure mechanisms - exponential, Weibull, gamma, Normal, log normal. (06 Hrs)
Unit 2	**System Reliability:** Series, parallel and mixed configurations. High level vs low level redundancy, k-out-of-n-structure, complex configurations. Economics of introducing a standby or redundancy into a production system, optimum design configuration of a series/parallel system: maximizing reliability subject to budgetary constraint optimum level of active parallel redundancy for an equipment with components subject to failure. (06 Hrs)
Unit 3	**Design for Reliability:** Reliability Specifications and System Measurements, reliability allocation, failure analysis, reliability improvement, selection of components to improve system reliability **Reliability Testing:** Product Testing, Reliability Life Testing, Burn –In Testing, Accelerated Life testing. (06 Hrs)

Unit 4	**Maintenance Engineering**: Fundamentals of Maintenance Engineering, importance of Maintenance, types of maintenance policies: corrective maintenance, preventive maintenance, condition monitoring and its techniques. (06 Hrs)
Unit 5	**Emerging trends in maintenance**-Proactive Maintenance, Total Productive Maintenance (TPM). Reliability Centered Maintenance (RCM), RCM approach, RCM methodology, Application of RCM: examples and computers implementation. (06 Hrs)
Unit 6	**Replacement Decisions**: Economic models, block replacement policy, age replacement policy, replacement policies to minimize downtime, economics of preventive maintenance. (06 Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1.	An Introduction to Reliability and Maintainability Engineering	Charles E. Ebeling	TMH Publication	2nd Edition
2.	Reliability in Engineering	L. S. Srinath,	Affiliated East West Press	4th Edition
3.	Terotechnology: Reliability Engineering & Maintenance Management	K. Basu and B. Bhadury -	Asian Books Private Limited	1st Edition
4.	Maintenance, Replacement and Reliability- Theory and Applications	A.K.S. Jardine and A.H.C. Tsang	CRC Press, Taylor and Francis	2nd Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of M. Tech (Mechanical Engineering), Semester- II	
Course Code:MTM163 Course: Refrigeration and Cryogenics (Professional Elective-II) **Teaching Scheme:** Theory: 3 Hrs/week	Credits: 3-0-0 (3) Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Teacher Assessment: 20 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02Hrs
Unit 1	**Refrigeration cycles** – analysis: Development of Vapor Compression Refrigeration Cycle from Reverse Carnot Cycle- conditions for high COP-deviations from ideal vapor compression cycle, Multi-pressure Systems, Cascade Systems-Analysis. (06Hrs)
Unit 2	**Main system components:** Compressor- Types , performance , Characteristics of Reciprocating Compressors , Capacity Control , Types of Evaporators & Condensers and their functional aspects, Expansion Devices and their Behavior with fluctuating load. (06Hrs)
Unit 3	**Refrigerants:** Classification of Refrigerants, Refrigerant properties, Oil Compatibility, Environmental Impact-Montreal/ Kyoto protocols-Eco Friendly Refrigerants. Different Types of Refrigeration Tools, Evacuation and Charging Unit, Recovery and Recycling Unit, Vacuum Pumps. (06Hrs)
Unit 4	**Other refrigeration cycles:** Vapor Absorption Systems-Aqua Ammonia & Li-Br Systems, Steam Jet Refrigeration Thermo Electric Refrigeration, Air Refrigeration cycles. (06Hrs)
Unit 5	**Principle and Methods** of production of low temperature and their analysis: Joule

	Thomson Expansion, Cascade processes, Linde -Hampson cycles, Claude and cascaded systems, magnetic cooling, Stirling Cycle Cryocoolers, Philips refrigerators, Pulse tube refrigerators (06Hrs)
Unit 6	**Applications of refrigeration** and cryogenics: Introduction, Food preservation, Factors contributing to food spoilage, Methods of food preservation, Method of food freezing, Food processing/preservation by refrigeration, Cold storage, Refrigeration methods for transport, Domestic refrigerators, Water coolers Cryogenic Systems: Medical applications, Space applications, Production engineering applications, superconductivity, Magnetic levitation (descriptive treatment). (06Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1	Refrigeration and Air Conditioning	C. P. Arora	Tata McGraw Hill	3rd Edition
2	Refrigeration and Air Conditioning	Manohar Prasad	Prentice-Hall India	2nd Edition
3	Refrigeration and Air Conditioning	P.L.Ballaney	Khanna Publisher	1st Edition
4	Fundamentals of Cryogenic Engineering	Manta Mukhopadhyay	PHB learning Private limited	1st Edition

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Syllabus of M. Tech (Mechanical Engineering), Semester- II

Course Code:MTM151 Course: Lab IV (Optimization Programming or software) **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 (1) Term-work: 25 Marks

The lab work consists of the assignments/experiments related to

- Part-A: Selection of a case study on design of experiment
- Part-B: Optimization of the experiment using any DOE software such as Minitab, SPSS etc.

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Syllabus of M. Tech (Mechanical Engineering), Semester- II

Course Code:MTM152 Course: Lab V (CFDSoftware) **Teaching Scheme:** Practical: 2 Hrs/week	Credits: 0-0-1 (1) Term-work: 25 Marks

The set of tutorials designed to provide the student with the necessary tools for using sophisticated commercial Ansys fluent CFD software. A set of laboratory tasks will take the student through a series of increasingly complex flow and heat transfer simulations, requiring an understanding of the basic theory of computational fluid dynamics (CFD). At the end of the course each student will have to complete a mini project.

1. Perform numerical analysis on flow through pipe with varying Reynolds Number.
2. Calculate hydrodynamic length and boundary layer thickness for pipe flow numerically
3. Calculate lift and drag co-efficient for a cylinder by using numerical analysis.
4. Calculate variation of lift and drag co-efficient for an airfoil with varying angle.
5. Understand the behavior of Creeping flow by numerical simulation.
6. Case study based on course of CFD

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Syllabus of M. Tech. (Mechanical Engineering), Semester-II

Course Code:MTM153 Course: Lab-VI [Advanced MATLAB Programming] **Teaching Scheme:** Practical: 02 Hr/week	Credits: 0-0-1 Term work: 25 Marks

Course Content:

The lab work consists of the assignments/experiments related to

Programming in MATLAB Software.

1. GUI Design: Introduction of Graphical User Interface, GUI Function Property, GUI Component Design, GUI Container, Writing the code of GUI Call back.
2. MATLAB Programming: Automating commands with scripts, Writing programs with logic and flow control, Writing functions, Control statement Programming, Conditional Statement Programming, Examples.
3. Loops and Conditional Statements: Control Flow Conditional Control if, else, switch
   Loop Control for, while, continue, break Program Termination return
4. Functions: Writing user defined functions, Built in Function, Function calling, Return Value, Types of Functions, Global Variables
5. MATLAB Toolbox: Optimization Toolbox, Fuzzy logic Toolbox, Global Optimization Toolbox, Neural Network Toolbox, Statistics and Machine Learning Tool Box.
6. Introduction to Simulink

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Syllabus of M. Tech. (Mechanical Engineering), Semester-II

Course Code: MTM 154 Course: Mini Project **Teaching Scheme:** Practical: 4 Hr./week	Credits: 0-0-2 Practical /Oral : 50 Marks

Course Content:

A group of students or individual students are required to choose a topic of interest. To train students in identification, analysis, finding solutions and execution of live engineering and managerial problems. The course content of the mini project shall be from emerging / thrust areas, topics of current relevance having research aspects or shall be based on industrial visits.

Students can also choose live problems from manufacturing organizations as their mini project.

At the end of the semester, the students should submit a report and appear for End Semester Examination.

End Semester Examination will be assessed by Examiner appointed by Examination Cell and internal guide. Mini Project will have end Semester examination of 50 marks.

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Syllabus of M. Tech.(Mechanical Engineering), Semester-III

Course Code: MTM 201 Course: MOOC Course **Teaching Scheme:** Online Course (Minimum12Weeks)	Credits:3-0-0 End Semester Exam:100Marks

It is mandatory for the student to complete one MOOC course related to the program of study. The student will have to complete the MOOC course which will be available on the SWAYAM portal (Free online education portal). Registered MOOC courses should not have similar or overlapping content to that of the regular courses in the curriculum of the program. The credits can be given to the students after successful completion of the MOOC course of 12 weeks or more.

The credits will be transferred by the evaluation in terms of assignments or examinations or viva-voce. In case the student is unable to clear MOOC Course examination, the student will have to appear for an Institute-level examination for the respective MOOC course.

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Syllabus of M. Tech.(Mechanical Engineering), Semester-III

CourseCode:MTM211 Course: Dissertation-I **Teaching Scheme:** Practical: 18Hr/week	Credits:0-0-9 Term-work:50Marks Vivavoce:100Marks

The dissertation shall consist of a report on any research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and /or development work that the candidate has executed. The report must include comprehensive literature work on the topic selected for dissertation.

Term-work: The dissertation part-I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be a senior faculty member from the department.

Viva Voce: The dissertation part-I will be in the form of seminar report on the project work being carried out by the candidate and will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be an external examiner.

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Syllabus of M. Tech.(Mechanical Engineering), Semester-IV

Course Code: MTM 251 Course: Dissertation-II **Teaching Scheme:** Practical: 24Hr/week	Credits:0-0-12 Term-work:100 Marks Vivavoce:100 Marks

The dissertation part-II will be in continuation of dissertation part-I and shall consists of a report on the research work done by the candidate or a comprehensive and critical review of any recent development in the subject or detailed report of the project work consisting of a design and /or development work that the candidate has executed. The examinee shall submit the dissertation in triplicate to the head of the institution duly certified by the guide and the concerned head of the department and the Principal that the work has been satisfactorily completed.

Term-work:

The dissertation will be assessed by two examiners appointed by the university, one of whom will be the guide and other will be a senior faculty member from the department.

Viva-Voce:

It shall be consists of a defense presented by the examinee on his research work in the presence of the examiners appointed by the examination cell, one of whom will be the guide and other will be an external examiner.