NOTE

The Study Scheme and the detailed contents of various courses for 2019 admission batch onwards are based upon the suggestions and corrections incorporated in BOS (Mechanical Engineering) meeting held on 24/10/2019 (Ref. No. ME/36/4833 dated 4-11-2019).

GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA

(An Autonomous College u/s 2 (f) and 12 (B) of UGC Act 1956)

DEPARTMENT OF MECHANICAL ENGINEERING

STUDY SCHEME

M.Tech. (Mechanical Engineering)

2019 Admission Batch onwards

1st Semester (GNDEC)										
Category	**Subject Code**	**Subject Name**	**Subject Type (Theory / Practical)**	**Contact Hours/Week**			**Maximum Marks**			**Credits**
				L	**T**	**P**	**Int.**	**Ext.**	**Total**	
Core Course	MME-101	Finite Element Analysis	**Theory**	3	0	0	50	100	150	3
Core Course	MME-102	Advanced Thermodynamics	**Theory**	3	0	0	50	100	150	3
Core Course	MME-103	Decision Making Methods	**Theory**	3	0	0	50	100	150	3
Core Course	MME-104	Computer Integrated Manufacturing	**Theory**	3	0	0	50	100	150	3
Core Course	LMME-101	Finite Element Analysis Laboratory	**Practical**	0	0	4	50	50	100	2
Core Course	LMME-102	Advanced Thermodynamics Laboratory	**Practical**	0	0	4	50	50	100	2
Core Course	LMME-103	Computer Integrated ManufacturingLaboratory	**Practical**	0	0	4	50	50	100	2
Audit Course	MAC-XXX	Audit Course - 1	**Theory**	2	0	0	50	-	50	S/US
Total				**14**	**0**	**12**	**400**	**550**	**950**	**18**
Total Contact Hours/Week = 26										

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(An Autonomous College u/s 2 (f) and 12 (B) of UGC Act 1956)

DEPARTMENT OF MECHANICAL ENGINEERING

STUDY SCHEME

M.Tech. (Mechanical Engineering)

2019 Admission Batch onwards

2nd Semester (GNDEC)										
Category	**Subject Code**	**Subject Name**	**Subject Type (Theory / Practical)**	**Contact Hours/Week**			**Maximum Marks**			**Credits**
				L	**T**	**P**	**Int.**	**Ext.**	**Total**	
Programme Elective	MME-XXX	Programme Elective– 1	**Theory**	3	0	0	50	100	150	3
Programme Elective	MME-XXX	Programme Elective–2	**Theory**	3	0	0	50	100	150	3
Programme Elective	MME-XXX	Programme Elective– 3	**Theory**	3	0	0	50	100	150	3
Programme Elective	MME-XXX	Programme Elective–4	**Theory**	3	0	0	50	100	150	3
Core Course	MRM-101	Research Methodology and IPR	**Theory**	3	0	0	50	100	150	3
Core Course	LMME-104	Decision Making Methods Laboratory	**Practical**	0	0	4	50	50	100	2
Project	LMPME-105	Project	**Practical**	0	0	4	50	50	100	2
Audit Course	MAC-XXX	Audit Course - 2	**Theory**	2	0	0	50	-	50	S/US
Total				**17**	**0**	**8**	400	600	1000	**19**
Total Contact Hours/Week = 25										

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GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA

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DEPARTMENT OF MECHANICAL ENGINEERING

STUDY SCHEME

M.Tech. (Mechanical Engineering)

2019 Admission Batch onwards

3rd Semester (GNDEC)										
Category	**Subject Code**	**Subject Name**	**Subject Type (Theory / Practical)**	**Contact Hours/Week**			**Maximum Marks**			**Credits**
				L	**T**	**P**	**Int.**	**Ext.**	**Total**	
Programme Elective	MME-XXX	Programme Elective - 5	**Theory**	3	0	0	50	100	150	3
Open Elective	MOZZ-XXX	Open Elective -1	**Theory**	3	0	0	50	100	150	3
Pre-Thesis	MPTME-101	Pre-Thesis	**Practical**	0	0	2#+18*	100	100	200	10
Total				**6**	**0**	**20**	**200**	**300**	**500**	**16**
Total Contact Hours/Week = 26										

Max.hours for Teacher

*Independent study hours

4th Semester (GNDEC)										
Category	**Subject Code**	**Subject Name**	**Subject Type (Theory / Practical)**	**Contact Hours/Week**			**Maximum Marks**			**Credits**
				L	**T**	**P**	**Int.**	**Ext.**	**Total**	
Thesis	MTME-101	Thesis	**Practical**	0	0	4#+28*	100	200	300	16
Total				**0**	**0**	**32**	**100**	**200**	**300**	**16**
Total Contact Hours/Week = 32										

Max.hours for Teacher

*Independent study hours

Total Credits for the Programme: 69

Note:

A. Student can opt for any five Programme Elective Subjects 1, 2, 3, 4 & 5 respectively from the entire list of Programme Elective Subjects.

B. If a student selects all the fivProgramme Elective Subjects from the same specialization group of Programme Elective Subjects and also completes his / her project and dissertation in the same field of specialization, then he /she may be **awarded a separate / additional certificate indicating the more concentration in a that particular field of specialization e.g. Manufacturing, Industrial, Design or Thermal Engineering.**

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GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA
(An Autonomous College u/s 2 (f) and 12 (B) of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

STUDY SCHEME
M.Tech. (Mechanical Engineering)
2019 Admission Batch onwards

LIST OF AUDIT SUBJECTS

MAC-101	English for Research Paper Writing
MAC-102	Disaster Management
MAC-103	Sanskrit for Technical Knowledge
MAC-104	Value Education
MAC-105	Constitution of India
MAC-106	Pedagogy Studies
MAC-107	Stress Management by Yoga
MAC-108	Personality Development through Life Enlightenment Skills.

LIST OF PROGRAMME ELECTIVE SUBJECTS

SPECIALIZATION GROUP

(I) DESIGN ENGINEERING

MME-111	Engineering Design Optimization
MME-112	Advanced Vibration Engineering
MME-113	Mechatronics
MME-114	Dynamics of Rotating Machines
MME-115	Experiential Stress Analysis
MME-116	Sustainable Design and Manufacturing
MME-117	Vibration and Noise Control
MME-118	Composite Materials
MME-119	Instrumentation and Control Engineering

(II) THERMAL ENGINEERING

MME-121	Advanced Internal Combustion Engines
MME-122	Design of Steam Turbine
MME-123	Convective Heat Transfer
MME-124	Combustion Engineering
MME-125	Conductive &Radiative Heat Transfer
MME-126	Solar Energy Utilization
MME-127	Design of HVAC systems
MME-128	Design and Optimization of Thermal Systems
MME-129	Advanced Heats and Mass Transfer
MME-130	Computational Fluid Dynamics

(III) MANUFACTURINGENGINEERING

MME-131	Advanced Welding Technology
MME-132	Automation and Robotics
MME-133	Advanced Material Characterization Techniques
MME-134	Rapid Prototyping
MME-135	Advanced Metal Cutting
MME-136	Advanced Casting Processes

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MME-137	Maintenance and Reliability Engineering
MME-138	Jig, Fixtures and Die Design
MME-139	Machine Tool Design

(IV) INDUSTRIAL ENGINEERING

MME-141	Supply Chain Management
MME-142	Product Design and Development
MME-143	Project Appraisal and Management
MME-144	Entrepreneurship
MME-145	Safety Engineering
MME-146	Quality Assurance
MME-147	Materials Management
MME-148	Organization Theory and Behavior
MME-149	Business Policy and Strategies

LIST OF OPEN ELECTIVE SUBJECTS(*for other branches*)

MME-151	Business Analytics
MME-152	Industrial Safety
MME-153	Operations Research
MME-154	Cost Management of Engineering Projects
MME-155	Composite Materials
MME-156	Waste to Energy

Subject Code: MME-101 **Subject Name:Finite Element Analysis**

Programme: M.Tech. (ME)	**L:** 3 **T:** 0 **P:** 0
Semester: 1	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits: 3**
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 50%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 150	**Course Status:** Core

Prerequisites: Knowledge of Basic concepts of Mechanics and Engineering Mathematics
Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Interpret the philosophy behind principles, design and modeling considerations in using finite element analysis.
2	Describe the concept of direct equilibrium method and potential energy method for structural mechanics problems
3	Develop stiffness matrices for spring, truss, beam, plane stress problems and three dimensional problems.
4	Derive the shape function for elements having different nodes.
5	Use mathematical tools to calculate stresses, forces, temperature etc.for given problem.
6	Apply the concepts of FEM in Dynamic problems.

Detailed Contents:

Part-A

1. **Introduction:**Introduction of the FEM and its historical background, Brief overview of the steps used in FEM and various approaches to formulate elemental equations, Review of the concept of stresses, strains, equilibriums, boundary conditions, temperature effect and there relations, Concept and application of Minimum Potential energy method, Rayleigh Ritz method, Galerkin Method and Principle of Virtual Work applied to elasticity problems. **08 Hrs**
2. **Matrix Algebra & Gauss Elimination Method:**Matrix algebra and its different operations, Eigen values and Eigen vectors, Positive definite matrix, Gauss elimination method to solve a large linear equations. **04 Hrs**
3. **1- Dimensional Problem:** Introduction, finite element modeling using bar element, shape functions, Iso, super and sub parametric types of FEM formulation, Potential energy approach and Galerkin method to solve 1-D problems, assembly of elemental equations, types and applications of boundary conditions, higher order 1-D element and their shape functions, its application to 1-D problem, Accounting of temperature effect in 1-D problems. **07 Hrs**
4. **Trusses:**Introduction, 2-D, concept of local and global coordinate system and its transformation matrix, solution of 2-D by the FEM, stress calculations, Accounting of the temperature effect,

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computer programming concepts and its implementation to FEM, sample source code of processing, pre and post processing of the FEM. **07 Hrs**

Part-B

5. **2-D Problem Using Constant Strain Triangles (CST):**Introduction, finite element modeling using CST elements, its shape function, Potential energy approach, solution of the 2-D problem, Accounting of temperature effect, Problem modeling and boundary conditions for symmetrical problems. **05 Hrs**
6. **2-D Isoparamatric Elements and Numerical Integration:** Introduction, Four noded quadrilateral element based FE Modeling and its solution, Numerical integration, concept of weights and gauss points, its values for one point, two point etc. formulae, 2-D & 3-D numerical integration and its application in FEM, Higher order quadrilateral and triangular elements and it's numerical integration. **05 Hrs**

Reference Books

1. Robert D. Cook , David S. Malkus , Michael E. Plesha , Robert J. Witt , *"Concept & Application of Finite Element Analysis"*, John Wiley, 4th Edition , 2001
2. Chandrupatala & Belegundu, *" Introduction to Finite Elements in Engineering"*, PHI, 3rd Edition
3. C S Krisnamoorthy, *"Finite Element Analysis (Theory & programming)"*, TMH, 2nd Edition,2004
4. J N Reddy , *"Finite Element Method"*, McGraw Hill, 3nd Edition .2005

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/112104116/
2. https://nptel.ac.in/courses/112104115/
3. https://nptel.ac.in/courses/105/105/105105041/

Subject Code: MME-102 **Subject Name: Advanced Thermodynamics**

Programme: M.Tech.(ME)	**L:** 3 **T:** 0 **P:** 0
Semester: 1	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 60%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 150	**Course Status:** Core

Prerequisites: Engineering Thermodynamics, Engineering Mathematics
Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course the student will have the ability to:

CO #	Course Outcomes (CO)
1.	Analyze thermodynamic systems using advance concepts of First Law of thermodynamics.
2.	Examine and conceptualize the thermodynamic systems using with knowledge of Second law of thermodynamics.
3.	Identify and quantify irreversibility or exergy destruction or entropy generation within various processes and components of thermodynamic cycles and systems.
4.	Comprehend the advanced concepts in thermodynamics with emphasis on thermodynamic relations, properties of single phase systems.
5.	Use thermodynamic relations, properties and phase diagrams for equilibrium and stability of multi-phase multi component systems.
6.	Understand and apply the molecular basis of thermodynamics to determine the thermodynamic properties of thermal systems.

Detailed Contents:

1. **The First Law:** Review ofbasic terms of thermodynamics; Closed Systems: Work Transfer, Heat Transfer; Energy Change: Open Systems. **04 Hrs**

2. **The Second Law:** Closed Systems: Cycle in Contact with One Temperature Reservoir, Cycle in Contact with Two Temperature Reservoirs, Cycle in Contact with Any Number of Temperature Reservoirs, Process in Contact with Any Number of Temperature Reservoirs; Open Systems; Local Equilibrium; Entropy Maximum and Energy Minimum. **07 Hrs**

3. **Entropy Generation, Or Exergy Destruction:** Lost Available Work; Exergy; Irreversibility; Cycles: Heat Engine Cycles, Refrigeration Cycles, Heat Pump Cycles; Non-flow Processes; Steady-Flow Processes; Mechanisms of Entropy Generation: Heat Transfer across a Temperature Difference, Flow with Friction, Mixing; Entropy Generation Minimization: Method, Tree-Shaped Fluid Flow, Entropy Generation Number. **08 Hrs**

4. **Single-Phase Systems:** Simple System; Equilibrium Conditions; Fundamental Relation: Energy Representation, Entropy Representation, Extensive Properties versus Intensive Properties, Euler Equation, Gibbs–Duhem Relation; Legendre Transforms; Relations between Thermodynamic Properties: Maxwell's Relations. **08 Hrs**

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5. **Multiphase Systems:** Energy Minimum Principle: Energy Minimum, Enthalpy Minimum, Helmholtz Free-Energy Minimum, Gibbs Free-Energy Minimum, Star Diagram; Stability of a Simple System: Thermal Stability, Mechanical Stability, Chemical Stability.

06 Hrs

6. **Statistical Thermodynamics:** Introduction: Statistical Foundation of Classical Thermodynamics; Classification Scheme for Statistical Thermodynamics; Why Statistical Thermodynamics; Statistics of Independent Particles:Essential Concepts from Quantum Mechanics.

03 Hrs

Reference Books:

1. A. Bejan, *"Advanced Engineering Thermodynamics"*, John Wiley and sons, 4th Edition, 2016.
2. I. K. Puri and K. Annamalai, *"Advanced Engineering Thermodynamics"*, CRC Press, 2001.
3. Yunus A. CengelAnd Michael A. Boles, *"Thermodynamics- An Engineering Approach"*, 8th Edition, McGraw Hill Education, 2015.
4. Gordon J. Van Wylen and Richard E. Sonntag, *"Fundamentals of Classical Thermodynamics"*, 3rd Edition, John Wiley, 1986.
5. Normand M. Laurendeau, *"Statistical Thermodynamics: Fundamentals and Applications"*, Cambridge University Press, 2005.
6. Chang L. Tien and John H. Linhard, "Statistical Thermodynamics", Hemisphere Publishing Corporation, Revised Edition, 1985.

Subject Code: MME-103 **Subject Name: Decision Making Methods**

Programme: M.Tech. (ME)	**L:** 3 **T:** 0 **P:** 0
Semester: 1	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 60%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 150	**Course Status:** Core

Prerequisites: Knowledge of Probability and Basic Mathematics
Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

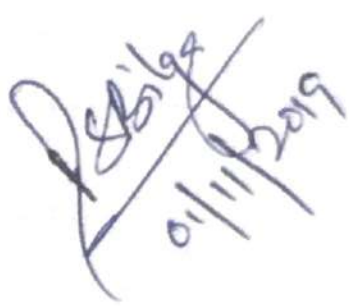
CO#	Course Outcomes (CO)
1	Understand different types of decision making tools.
2	Solve a variety of business issues using appropriate decision tools and frameworks.
3	Application of different case studies in real environment.
4	Analyse organizational systems to identify opportunities to improve decision making.
5	Evaluate various approaches in decision making in taking the better decision.
6	Synthesis the decision making on basis of individual and group decision making.

Detailed Contents:

1. **Introduction:** Problem Solving and Decision Making, Types of decisions: Insight, innovation and creativity in decision making, Decision Making Tools and Models, Individual and Group Decision Making, Quantitative and Qualitative Methods in Practice. **05 Hrs**
2. **Probability:**Experiments and the Sample Space, Assigning Probabilities to Experimental Outcomes, Probability Distributions, Random Variables, Discrete Probability Distributions, Uniform Probability Distribution, Normal Probability Distribution, Decision Making with/without Probabilities. **05 Hrs**
3. **Linear Programming:**Linear Programming Problem: Problem Formulation, Graphical, Simplex, Big M Method, Duality, Duality Theorem, Sensitivity Analysis and Interpretation of Solution. **08 Hrs**
4. **Distribution and Sequencing Methods:**Transportation Problem, Assignment Problem, Sequencing Problem, Processing n jobs through one machine, two machine and m machines. **06 Hrs**
5. **Multi-Criteria Decision Methods:**Concept of MCDM, Difference between MCDM and MADM, AHP, TOPSIS, DEA. **08Hrs**
6. **Big Data:**The future of big data and decision making, Case discussion **04 Hrs**

Reference Books

1. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, James J. Cochran, *"Quantitative Methods for Business"*, 13th Edition, South Western Cengage Learning, Mason, OH, 2015.
2. Prem Kumar Gupta, D S Hira, *" Operations Research"*,6th Edition, S. Chand, New Delhi 2011.
3. R V Rao, *"Decision Making in the Manufacturing Environment Using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods"*, 1st Edition, Springer-Verlag London,2007.
4. Christian Albright, Wayne L. Winston, *"Business Analytics: Data Analysis and Decision Making"*, 5th Edition, Cengage Learning, 2015.



Subject Code: MME-104 **Subject Name:Computer Integrated Manufacturing**

Programme: M.Tech. (ME)	**L:** 3 **T:** 0 **P:** 0
Semester: 1	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 100	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 150	**Course Status:** Core

Prerequisites: Computers, manufacturing and automation

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Describe various manufacturing aspects of the machining.
2	Compare NC, CNC and DNC machines
3	Construct part programmes for given sample components
4	Develop an FMS (Flexible Manufacturing System) layout for sample part family, using group technology concepts.
5	Apply computer aided process planning, MRP, CNC part programming.
6	Recognize use of robotics in the field of manufacturing and explain the various robot configurations, robot motions.

Detailed Contents:

1. **Introduction to CAD and CAM**: Brief introduction to CAD and CAM, Manufacturing Planning, Manufacturing control, Concurrent Engineering, CIM concepts; Computerized elements of CIM system, Manufacturing models, Manufacturing Control, Basic Elements of an Automated system, Automation principles and strategies , Lean Production and Just-In Time Production. **06 Hrs**
2. **Computer Aided Process Planning**: Process planning ,Computer Aided Process Planning (CAPP), Logical steps in Computer Aided Process Planning ,Approaches to CAPP,Implementation techniques,the Master Production Schedule ,Material Requirement planning, Capacity Planning, Control Systems, Shop Floor Control Inventory Control, Brief on Manufacturing Resource Planning & Enterprise Resource Planning (ERP). **06 Hrs**
3. **NC and CNC Machines**:Fundamentals of NC Technology; Basic Components of an NC System, NC Coordinate Systems- Motion, Applications of NC,Machine Tool Applications, Computer Numerical Control Features of CNC, The Machine Control Unit for CNC- CAM Software, CNC Applications- Advantages and Disadvantages of CNC, Direct Numerical Control of machine tools. **06 Hrs**

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4. **CNC Part Programming**:Basic terms of part programming , coordinate system, tool functions, basic codes, Description of codes- G codes, M codes, Other codes , Turning centre programming, Machining centre programming, computer aided part programming. **08 Hrs**
5. **Group Technology and FMS**:Group technology-Definition-Advantages and limitations of GT-Part family formation, Classification and coding-, Applications & benefits of GT, Flexible manufacturing system (FMS) -Scope of FMS-FMS compared to other types of manufacturing approaches- Major elements of FMS-Benefits of FMS. **06 Hrs**
6. **Industrial Robotics**:Introduction; configuration of robot, the manipulator, controller power supply, Programming robots –online programming, offline programming, programming languages- robot sensors- robots and computer aided design, Programming robots-Programming methods, Applications of industrial robot. **04Hrs**

Reference Books

1. Mikell.P.Groover *"Automation, Production Systems and Computer Integrated Manufacturing"*, Pearson; 5th Edition, 2018.
2. P. Radhakrishnan S. Subramanyan and V. Raju, *"CAD/CAM/CIM"*, New Age International (P) Ltd, New Delhi, 2nd Edition, 2000.
3. P N Rao, *"CAD/CAM Principles and Applications"*, McGraw Hill India; 3rd Edition,2010.
4. Quesada Robert, *"Computer Numerical Control-Turning and Machining centers"* Prentice Hall, 2014.
5. Farid Amirouche, *"Principles of computer aided design and manufacturing"*, Pearson, 2nd Edition, 2004.
6. M. Groover, *"CAD/ CAM"*, Pearson Education; 1st Edition, 2003.

Subject Code: LMME-101 **Subject Name: Finite Element Analysis Laboratory**

Programme: M.TECH. (ME)	**L:** 0 **T:** 0 **P:**4
Semester: 1	**Teaching Hours:** 48
Theory/Practical: Practical	**Credits:** 2
Internal Marks:50	**Percentage of Numerical/Design/Programming Problems:** N.A.
External Marks: 50	**Duration of End Semester Exam(ESE):** 2hr
Total Marks: 100	**Course Status:** Core

Prerequisites: Fundamental of Strength of materials, CADD

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the general steps used in the finite element analysis to model problems in engineering.
2.	Create and design engineering structures using finite element methods.
3.	Develop the finite element formulations for heat transfer problems
4.	Explore the issues in convergence of solutions using finite element analysis.
5.	Predict the safe design limits for engineering structures.
6.	Communicate effectively through a written report the creation of optimized design of engineering structures.

Detailed Contents:

Each student can use any FEA software to perform the different analysis such as mechanical/ thermal deformation, strain, stresses etc. on various structural elements like bars, trusses, beams, etc as well as various complex mechanical components and assemblies using different shape functions. The various practices can be done by changing boundary conditions for the given application. **48 Hrs**

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Subject Code: LMME-102 **Subject Name: Advanced Thermodynamics Laboratory**

Programme:M.Tech.(ME)	**L:** 0 **T:** 0 **P:** 4
Semester: 1	**Teaching Hours:** 48
Theory/Practical: Practical	**Credits:** 2
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** N.A.
External Marks: 50	**Duration of End Semester Exam(ESE):** 2hr
Total Marks: 100	**Course Status:** Core

Prerequisites: Physics, chemistry, Engineering Thermodynamics, Engineering Mathematics
Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course the student will have the ability to:

CO #	Course Outcomes (CO)
1.	Perform theoretical and experimental parametric studies of thermodynamic systems.
2.	Visualize the effect of different parameters on the thermodynamic phenomenon.
3.	Analyze thermodynamic systems using advance concepts of First Law and Second Law of thermodynamics.
4.	Identify and quantify irreversibility or exergy destruction or entropy generation within various processes and components of thermodynamic cycles and systems.
5.	Plan the experimentation using methods of design of experiments using available software.
6.	Do single objective optimization of thermodynamic systems using available software

Detailed Contents:

Each student is required to independently work on at least three experimental setups available within the laboratory related to the subject matter of the theory course in this regard in the curriculum. Each student shall do the detailed theoretical and experimental parametric studies and analyze the thermodynamic system using advance concepts of first law and second law of thermodynamics. The thermodynamic system may be related with power producing system such as I.C. engine etc., power consuming system such as vortex tube refrigeration or heating etc. and thermal energy storage such as waste heat recovery using waxes etc. Each student will be able to plan the experimentation using some method of design of experiments and may do single objective optimization using available software. **48 Hrs**

Subject Code: LMME-103 Subject Name: Computer Integrated Manufacturing Laboratory

Programme: M.TECH. (ME)	**L: 0 T: 0 P: 4**
Semester: 1	**Teaching Hours:** 48
Theory/Practical: Practical	**Credits:** 2
Internal Marks:50	**Percentage of Numerical/Design/Programming Problems:** N.A.
External Marks: 50	**Duration of End Semester Exam(ESE):** 2hr
Total Marks: 100	**Course Status:** Core

Prerequisites: Nil

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the concepts of CNC machine tools and CAPP.
2.	Apply JIT and Lean production concept in industry.
3.	Generate part programs using CNC programming.
4.	Evaluate the performance of drilling by CNC drill machine.
5.	Understand and apply the concept of additive manufacturing.
6.	Identify the need for FMS and GT concept in a manufacturing system.

Detailed Contents:

Each student is required to work independently on the non-conventional and CNC machines available in the mechanical laboratory and workshop. Each student shall do the detailed theoretical and experimental studies of machining parameters on any three available machines like electrochemical machine, electro discharge machine, CNC drill machine, CNC milling etc. Each student will plan the experiment using some method of design of experiments. Demonstration and use of 3D printing machine will be done for understanding the concept of additive manufacturing. Each student shall make the program for pick and place of objects.

48Hrs

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