STUDENT HAND BOOK

M. TECH.

Semester- 1st

Study Scheme- 2016 onwards

MRSPTU, Bathinda

DEPARMENT OF MECHANICAL ENGINEERING

ASRA COLLEGE OF ENGINEERING & TECHNOLOGY

BHAWANIGARH (SANGRUR)

ASRA

Department of Mechanical Engineering

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MRSPTU M-TECH MECHANICAL SYLLABUS 2016 BATCH ONWARDS

M. TECH. (MECHANICAL ENGINEERING) (1st Year)

Total Contact Hours = 24 **Total Marks = 800** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
MMEE2-101	Research Methodology & Design of Experiment	4	0	0	50	100	150	4
MMEE2-102	Advanced Heat & Mass Transfer	4	0	0	50	100	150	4
MMEE2-103	Advanced Manufacturing Processes	4	0	0	50	100	150	4
MMEE2-104	Advanced Machine Design	4	0	0	50	100	150	4
MMEE2-105	Lab –I	0	0	4	50	-	50	2
Departmental Elective – I (Select any one)		4	0	0	50	100	150	4
MMEE2-156	Composite Material							
MMEE2-157	Mechatronics							
MMEE2-158	Finite Element Modelling							
Total	Theory = 5 Lab = 1	20	0	4	300	500	800	22

RESEARCH METHODOLOGY

Subject Code: MMEE2-101 L T P C Duration – 45 Hrs.

4 0 0 4

Nature and objectives of research Methods of Research: historical, descriptive and experimental Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses, Feasibility, preparation and presentation of research proposal

UNIT-I (11 Hrs)

Introduction to statistical analysis: Probability and probability distributions; binomial, Poisson, exponential and normal distributions and their applications. Sampling: Primary and secondary data, their collection and validation, methods of sampling: Simple random sampling, stratified random sampling and systematic sampling.

UNIT-II (10 Hrs)

Regression and correlation analysis. Tests of significance based on normal, t and chi-square distributions. Analysis of variance.

UNIT-III (13 Hrs)

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.

UNIT-III (11 Hrs)

Use of software for statistical analysis like SPSS, Mini Tab or MAT Lab, Report writing, preparation of thesis, use of software like MS Office.
The course will include extensive use of software, report writing and seminars in the tutorial class.

Recommended Books

1. C.R. Kothari, Research Methodology, Wishwa Prakashan.
2. P.G. Tripathi, Research Methodology, Sultan Chand & Sons, N. Delhi.
3. Fisher, Design of Experiments, Hafner.
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers.
5. Stoufferetal, Measurement & Prediction, Wiley, N. York.
6. J.W. Barnes, Statistical Analysis for Engineers & Scientists, McGraw Hill, N. York.
7. Donald Cooper. Business Research Methods, Tata McGraw Hill, N. Delhi.

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ADVANCE HEAT AND MASS TRANSFER

Subject Code: MMEE2-102 L T P C Duration – 45 Hrs.
4 0 0 4

Review
Review of the basic laws of conductions, radiation and convection.

UNIT-I (13 Hrs)
Conduction
One dimensional steady state conduction with variable thermal conductivity and with internal distributed heat source, local heat source in non-adiabatic plate. Extended surfaces-review, fins of non-uniform cross section, performance of fins (fin efficiency, thermal resistance of a fin, total surface efficiency), design consideration. Two dimensional steady and unsteady state conduction, semi-infinite and finite flat plates; temperature field in finite cylinders and infinite semi-cylinders, numerical method, graphical method. Unsteady state conduction; sudden changes in the surface temperatures of infinite plate, cylinders and spheres; solutions using Groeber's and Heisler's charts for plates, cylinders and spheres suddenly immersed in fluids.
UNIT-II (11 Hrs)

Radiation
Introduction, properties and definitions, review of radiation principles (Planck's law, Kirchoff''s law, Stefan Boltzman law, Lambert's cosine law). Radiation through non-absorbing media; Hottel's method of successive reflections; Radiation through absorbing media; logarithmic decrement of radiation; apparent absorptivity of simple shaped gas bodies; net heat exchange between surfaces separated by absorbing medium; radiation of luminous gas flames.
UNIT-III (12 Hrs)

Convection
Heat transfer in laminar flow; free convection between parallel plates; forced internal flow through circular tubes; fully developed flow; velocity and thermal entry lengths; solutions with constant wall temperature and with constant heat flux; forced external flow over a flat plate; the two dimensional velocity and temperature boundary layer equations; Karman Pohlhousen approximate integral method. Heat transfer in turbulent flow; eddy heat diffusivity; Reynold's analogy between skin friction and heat transfer; Von Karman integral equations, analogy between momentum and heat transfer, flow across cylinders, spheres and other bluff shapes and packed beds.

UNIT-IV (9 Hrs)
Mass Transfer
Introduction, concentration, velocities and fluxes, Fick's law of diffusion, steady state diffusion in common geometries, equimolal counter-diffusion in gases, steady state diffusion in liquids, transient mass diffusion in common geometries, mass transfer coefficient, convective mass transfer

Recommended Books
1. Eckert and Drake, Analysis of Heat and Mass Transfer, McGraw Hill.
2. Erk and Grigul Fundamentals of Heat Transfer Grober, McGraw Hill.
3. J.P. Holman, Heat Transfer, McGraw Hill

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4. Schneider Addison Wesley, Conduction Heat Transfer.

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ADVANCE MANUFACTURING PROCESSES

Subject Code: MMEE2-103 L T P C Duration - 42
4 0 0 4

UNIT-I (5 Hrs.)
Introduction: Overview of general trends in Manufacturing, concept and significance of important properties related to manufacturing processes; Machinability index, Formability, weldabilty, Fluidity, dimensional accuracy, surface integrity, residual stresses, limitations of conventional manufacturing processes need and evolution of advanced manufacturing, selection and economics of manufacturing processes.

UNIT-II (16 Hrs)
Advanced Machining Processes: Classification, Review of conventional machining processes , Principles, process parameters, capabilities and mechanism of material removal of Electro discharge machining, Electrochemical Machining, Laser Beam Machining, and Abrasive Flow machining, concept and need of Hybrid machining Processes, Advanced Welding Processes Classification, Review of conventional welding processes, Principles, process parameters, capabilities and theoretical considerations for Ultrasonic Welding, friction Welding, Explosion Welding, Underwater Welding, Adhesive Bonding

UNIT-III (11 Hrs)
Advanced Forming Processes: Classification, Review of conventional Forming processes (2hours), concept of High Energy Rate Forming, Principles, process parameters, capabilities and theoretical considerations for Explosive Forming, Electro hydraulic Forming, Electromagnetic Forming, Super plastic forming

UNIT-IV (10 Hrs)
Advanced Casting processes: Classification, Review of conventional casting processes brief review regarding Casting of Ferrous and Non-ferrous metals, Principles, process parameters, capabilities and theoretical considerations for Shell Mould Casting, Vacuum Casting, Lost Foam Casting, Investment Casting, Centrifugal Casting, concept of rapid solidification.

Recommended books
1. Shan and Pandey, Modern Machining Processes, Tata Mc Hill, N. Delhi.
2. ASTME High Velocity Forming of Metals, PHI, N. Delhi.
3. Serope Kalpakjian and Steven R. Schmid, Manufacturing Processes for Engg. Materials, Pearson Education.
4. G.F. Benedict, Non Traditional manufacturing, Marcel Dekker.
5. P.K. Mishra, Non-Conventional Machining, Narosa Publishing House, N. Delhi.

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ADVANCE MACHINE DESIGN

Subject Code: MMEE2-104 L T P C Duration – 35 Hrs.
4 0 0 4

UNIT-I (5 Hrs)
Machine Design Review
Review of failure theories; designing against fatigue; cumulative damage theories; design of machine members (bolts, shafts, springs) under fatigue loading.

UNIT-II (6 Hrs)
Contact Stresses
Hertzian contact stresses (cylindrical and spherical surfaces) and their effect on design; theory of limit design; Machinery construction principles.

UNIT-III (9 Hrs)
Fracture and Creep
Fracture Mechanics approach to design. Causes and interpretation of failures; Creep behaviour; rupture theory; creep in high temperature low cycle fatigue; designing against creep.

UNIT-III (5 Hrs)
Reliability
Probabilistic approach to design; reliability prediction; design for reliability.

UNIT-IV (10 Hrs)
Computer Aided Machine Design
Philosophy of Computer Aided Machine Design, Interactive design software, Basic advantages of analysis Software, Design of machine components (springs, gears, temporary fasteners, permanent fasteners, belts and ropes) through interactive programming, Introduction to FEM.

Recommended Books
1. Sharma & Aggarwal, Machine Design.
2. B'ack, Machine. Design.
3. Shigle ,Machine Design .
4. Pandya & Shah, Machine Design.
5. Sadhu Singh, Strength of Materials.

LAB-I
Subject Code: MMEE2-105
Max. Marks: 100
Time Allowed: 2hrs
One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 1st semester.

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MECHATRONICS

Subject Code: MMEE2-157 L T P C Duration - 40 Hrs

4 0 0 4

UNIT-I (6 Hrs)

Control Engineering: Open loop and closed loop control system, system components, hydraulic, thermal, pneumatic processes and their electrical analogies.

UNIT-II (15 Hrs)

Process Control: Concept of measurement of electrical and non-electrical parameters, displacement, force, temperature, pressure etc. and related signal conditioning techniques. Valves, drives and actuators, PID controllers, multivariable and multi-loop processes, basic circuits using pneumatic and PLC's.

UNIT-III (6 Hrs)

Sensors and Signal Conditioners: Transducers for Industrial processes, signal conditioning, output devices and displays.

UNIT-IV (13 Hrs)

Microprocessors and Interfacing: Microprocessors/ Microcontroller architecture and programming memory, Input/output operations and interfacing, peripherals, typical applications of Microprocessors, system design concept through case studies.

Recommended Book

1. Koren Computer Control of Manufacturing System, McGraw Hill.
2. Groover, Production Systems and CIM, PHI.
3. Maleki, Flexible Manufacturing Systems, Prentice Hall.
4. B.C. Kuo, Feedback Control Systems, PHI.
5. E.O. Doeblin, Measurement Systems, McGraw Hill.

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Subject- Research Methodology

Assignment No.-1

1 Briefly describe the different steps involved in a research process.

2. What do you mean by research? Explain its significance in modern times.

3. Distinguish between Research methods and Research methodology.

4. Describe the different types of research, clearly pointing out the difference between an experiment and a survey.

5. Write short notes on:

(1) Design of the research project; (2) Ex post facto research;

(3) Motivation in research; (4) Objectives of research;

(5) Criteria of good research; (6) Research and scientific method

Assignment No.-2

1 Describe fully the techniques of defining a research problem.

2 Write a short note on 'Experience Survey' explaining fully its utility in exploratory research studies

3 What do you mean by 'Sample Design'? What points should be taken into consideration by a researcher in developing a sample design for this research project.

4 Discuss the relative merits and demerits of:

(a) Rating vs. Ranking scales. (b) Summated vs. Cumulative scales.

Assignment No.-3

1 Distinguish between: (i) Field editing and central editing;

(ii) Statistics of attributes and statistics of variables;

(iii) Exclusive type and inclusive type class intervals;

(iv) Simple and complex tabulation; (v) Mechanical tabulation and cross tabulation

2 Describe briefly the commonly used sampling distributions

3 Distinguish between the following: (i) Simple hypothesis and composite hypothesis; (ii) Null hypothesis and alternative hypothesis

4 What is Chi-square text? Explain its significance in statistical analysis.

5 Narrate the various advantages of using non-parametric tests. Also point out their limitations

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Advanced Heat and Mass Transfer

Assignment No. 01

1. Define Critical Radius of Insulation.
2. What is Heat Transfer? How it occurs? Define about Conduction and Convection.
3. What is Thermal Conductivity? Explain about Thermal Conductivity of Liquids and Solids.
4. Explain about 3-D General Differential Equation of Heat Conduction.
5. What is Convection? Write the difference between Free and Forced Convection.
6. What is the difference between Plain and Laminar Flow? Explain with diagram.

Assignment No. 02

1. What is thermal radiation? How does it differ from other forms of electromagnetic radiation?
2. What is a black body? Does a black body actually exist?
3. Define the total and spectral black body emissive powers. How are they related to each other?
4. What does the view factor represent? When is the view factor form a surface to itself not zero?

Assignment No. 03

1. Explain about Boiling Heat Transfer.
2. What is the difference between Free Convection and Nucleate Boiling?
3. What is the difference between Filmwise Condensation and Dropwise Condensation?
4. Explain about Bubble Growth and Collapse with neat sketch.

Assignment No. 04

1. How does mass transfer differ from bulk flow? Can mass transfer occur in a homogeneous medium?
2. Give examples for (a) liquid-to-gas (b) solid-to-liquid, (c) solid-to-gas, and (d) gas-to-liquid mass transfer.
3. What is the driving force for (a) heat transfer (b) electric current (c) fluid flow and (d) mass transfer?
4. What is an impermeable surface in mass transfer? How is it expressed mathematically? To what does it correspond in heat transfer?
5. What is concentration boundary layer? How is it defined for flow over flat plate?
6. What is the physical significance of the Schmidt number? What is the heat transfer equivalent of this number?
7. What is the physical significance of the Lewis number? What is the heat transfer equivalent of this number?
8. What is the physical significance of the Sherwood number? What is the heat transfer equivalent of this number?

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Subject: Advance Manufacturing Processes

Assignment No. 01

1. Explain about selection and economics of manufacturing processes.

2. Classification and review of conventional machining processes.

3. Explain the mechanism of material removal of,

a. Electro Discharge Machining

b. Laser Beam Machining

c. Abrasive Flow Machining

4. Give classification of Advanced Welding Processes.

Assignment No. 02

1. What is the Principle and Process Parameters in Welding Process.

2. Explain about followings:

a. Ultrasonic Welding

b. Friction Welding

c. Underwater Welding

3. Give Classification of Forming Processes.

4. Explain the concept of High Energy Rate Forming

Assignment No. 03

1. Explain the following processes,

a. Explosive Forming

b. Electro-hydraulic Forming

c. Electro-magnetic Forming

2. Explain about Principle and Parameters used in Super Plastic Forming.

3. Give classification of Casting Processes.

4. Explain the concept of Rapid Solidification with sketches.

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Subject: Advance Machine Design

Assignment No. 01

1. Design the springs under fatigue loading.
2. Explain the philosophy of computer aided machine design.
3. Explain interactive design software.
4. Design the cylindrical surface by hertzian contact stresses

Assignment No. 02

1. Explain the basic advantages of analysis software.
2. Design the spring through interactive programming.
3. Design the spherical surfaces by theory of limit design.
4. Design the bolts under fatigue loading.

Assignment No. 03

1. Design the shafts under fatigue loading.
2. Explain the FEM in cad /cam.
3. Design the gears through interactive programming.
4. Explain probabilistic approach to design.

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Subject- Mechatronics

Assignment No.-1

1 What is Mechatronics? Explain key elements of Mechatronics.

2. Explain Programmable Logic Controllers.

3. Write short notes on- Wheatstone bridge, Digital Signals, and Pulse Modulation.

Assignment No.-2

1 What is an actuation system? Explain Electro- Hydraulic actuation system.

2. What is a Bipolar Transistor Circuits?

3. Explain Wheatstone bridge circuits with diagram.

Assignment No.-3

1 Explain Key Elements of Controlled Mechatronics Systems.

2. Explain fundamentals of Signal Processing.

3. Write Laplace Transformation & its applications.

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