M.Tech in Thermal and Design

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME201	DC	Design of thermal systems	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks

Course Objectives:-

The basic objective of the subject is to have goal of achieving a workable system and of designing an optimum system. The possibility of optimization represents one of the few facets of this subject. Pre requisites: Thermodynamics, Heat & Mass Transfer.

Course Outcomes:-

To learn basic principles underlying piping, pumping, heat exchangers; modeling and optimization in design of thermal systems. To develop representational modes of real processes and systems. To develop thermo economic optimization concerning design of thermal systems.

Syllabus

UNIT- 1

Designing a Workable System and its Economics:

Steps in Arriving at a Workable System, Creativity in Concept Selection, Design of any Thermal Process Plant, Preliminaries to the Study of Optimization

UNIT- 2

Dynamic Behavior of Thermal Systems:

Dynamic Analysis, One Dynamic Element in a Steady State Simulation, Laplace Transformers, Inversion of Laplace Transforms, Feedback Control Loops, Time Constants Blocks, Cascaded Time Constant Blocks, Stability Analysis.

UNIT- 3

Modeling Thermal Equipment:

Using Physical Insight, Selecting vs Simulating a Heat Exchanger, Evaporators and Condensers, Condensation of a Binary Mixture, Overview of Search Methods, Assessment of Single Variable Searches.

UNIT-4

System Simulation:

Description of System Simulation Uses of Simulation, Information Flow Diagrams, Sequential and Simultaneous Calculations, Taylor Series Expansion, Newton Raphson Method with Multiple Equations.

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UNIT- 5 Optimization:
Levels of Optimization, Mathematical Representation of Optimization Problems, Linear Programming, Setting up the Mathematical Statement, Calculus Methods of Optimization, Expansion of Lagrange Multiplier Equations, Unconstrained Optimization.

Reference Books:

1. Cengel YA.,Heat Transfer-A Practical Approach, Tata McGraw Hill, New Delhi 2e,2002.
2. Stoecker, WF. Design of Thermal Systems ,McGraw Hill International Editions, New Delhi, 2007
3. Woodson,TT. Introduction to Engineering Design, McGraw Hill, New York, 1996.
4. Rudd, DF. Strategy of Process Design, McGraw Hill, New York, 1996.

List of Practical's:

1. Compressibility factor measurement of different real gases.
2. Dryness fraction estimation of steam.
3. Flame propagation analysis of gaseous fuels.
4. Performance test and analysis of exhaust gases of an I.C. Engine.
5. Heat Balance sheet, Volumetric Efficiency and air fuel ratio estimation of an I.C. Engine.
6. COP estimation of vapour compression refrigeration test.
7. Performance analysis of Air conditioning unit.
8. Performance analysis of heat pipe.
9. Solar Flat Plate Collector
10. Evacuative tube concentrator

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME202	**DC**	Design of IC Engine and Components	2	0	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:-

The course should enable the students to:

1. Know about various types of materials, properties of materials and various applications of the materials, and computer aided application.
2. Know about the fits, clearance and tolerances concepts, also the design of the helical springs.
3. know about design procedure to design piston and its parts, cylinder and cylinder block,
4. lubrication of piston assembly.

Course Outcomes:-

The students should be able to:

1. Know about the types of materials and material properties, Application of the materials, CAD application in the Automobile industry and Differentiate between the concepts of Fits, Clearance and Tolerance.
2. Design the helical springs and its application. The cylinder block and cylinder parts based on the engine specification of and also based on the engine application and the piston and its parts based on the engine specification of and also based on the engine application.
3. Design the connecting rod and its parts based on the engine specification of and also based on the engine application. The crankshaft and its parts based on the engine specification of and also based on the engine application also with the balancing weight of the crankshaft.
4. Design the valves and its mechanism for both the inlet and exhaust valve based on the engine specification of and also based on the engine application.
5. identify the different types of materials used for the manufacturing of the valve and its components.

Syllabus

Unit-I

General Considerations in Engine Design

Principle of similitude, Choice of cycle, Speed, Fuel, Bore and Stroke, Cylinder arrangement, choice of material, Stress and Fatigue considerations, Design for manufacture, Factors for NHV and Control.

Unit-II

Design of Major Components

Piston system, Connecting rod assembly, Crankshaft system, Valve gearing, Stress analyses.

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Unit-III

Design Of Other Components

Inlet and exhaust manifolds, Cylinder block, Cylinder liner, Cylinder head, Crankcase, Engine foundations and mountings, Gaskets, Bearings, Flywheel. Turbocharger, Supercharger, computer controlled fuel injection system.

Unit-IV

Design Of Two-Stroke Engines

Arrangement and sizing of ports, Piston assembly, Intake and exhaust system, Scavenging, application to automotive gasoline and marine diesel engines.

Unit-V

Concepts Of Computer Aided Design

Preparation of working drawings of designed components using CAD system.

Reference Books:

1. Gordon P.Blair, Basic design of Two-stroke Engines, S.A.E., 1992.
2. Gordon P.Blair, Advanced Concepts of Two-stroke Engines, S.A.E., 1990.
3. Pounder, C.C., Marine Diesel Engines, Butterworths, 1981.
4. A.Kolchin and V.Demidov, Internal Combustion Engine Design, MIR Publishers, Moscow, 1984.
5. Gordon P.Blair, Design and Simulation of Four-Stroke Engines, Society of Automotive Engineers, Inc., USA, 1999.
6. D.E.Winterbone and R.J.Pearson, Design Techniques for Engine Manifolds, Wave action methods for I.C.Engines, Professional Engineering Publishing Ltd., UK, 2000.
7. John Fenton (Editor), Gasoline Engine Analysis for Computer Aided Design, Mechanical Engineering Publishing Ltd., UK, 1986.
8. Rodica Baranescu and Bernard Challen (Editors), Diesel Engine Reference Book, Second Edition, Society of Automotive Engineers, Inc., USA, 1999.
9. SAE Special Publication SP-700, Adiabatic Engines and Systems, Society of Automotive Engineers, Inc., USA, 1987.

List of Practical's:

Design of automobile components:

1. Cylinder
2. Piston
3. Connecting rod.
4. Valves
5. Crank shaft
6. Cam shaft
7. Analysis of compression and expansion processes.
8. Modeling of combustion in S.I. and C.I. engines

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME203	DC	Dynamics of mechanisms design	2	0	2	3	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:-

The course should enable the students to:

1. To understand the method of static force analysis and dynamic force analysis of mechanisms
2. To study the undesirable effects of unbalances in rotors and engines.
3. To understand the concept of vibratory systems and their analysis
4. To understand the principles of governors and gyroscopes.

Course Outcomes:-

The students should be able to:

1. Students will demonstrate the ability to synthesis, both graphically and analytically, multilink mechanisms.
2. Students will demonstrate the ability to perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms.
3. Students will demonstrate the ability analyze gear trains.

Syllabus

UNIT - I:

Angular Motion: Gyroscopes - effect of precession - motion on the stability of moving vehicles such as motorcycle - motorcar - aero planes and ships. Static and Dynamic Force Analysis of planar mechanisms.

UNIT - II:

Friction: Inclined plane - Friction of screw and nuts - Pivots and collars - uniform pressure, uniform wear - friction circle and friction axis: lubricated surfaces - boundary friction - film lubrication, Clutches, Single plate, multi plate, cone clutch, centrifugal clutches.

Brakes And Dynamometers: Simple block brake - Internal expanding brake band brake of vehicle. Dynamometers - absorption and transmission types, General description and methods of operation.

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UNIT - III:

Turning Moment Diagram and Flywheels: Turning moment- Interia torque- connecting rod angular velocity and acceleration-crank effort and torque diagrams-fluctuation of energy - flywheels and their

Governors: Watt, Porter and Proell governors- Spring loaded governors - Hartnell and Hartung with auxiliary springs- Sensitiveness, isochronisms and hunting- effort and power of the governors.

UNIT - IV:

Static and dynamic balancing – Balancing of rotating masses-Balancing a single cylinder engine– Balancing of Multicylinder inline, V-engines-Partial balancing in engines Balancing of linkages-Blancing machines Field balancing of discs & rotors

UNIT - V:

Response of one degree freedom systems to periodic forcing- Harmonic disturbances- Disturbance caused by unbalance- Support motion-transmissibility- Vibration isolation vibration measurement.

Reference Books:

1. Theory of Machines / Shigley / Mc Graw Hill Publishers.
2. Theory of Machines / Thomas Bevan / Pearson.
3. Theory of Machines / R. K. Bansal / Lakshmi Publications / 5th Edition
4. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age.
5. Theory of Machines / Sadhu Singh / Pearson / 3rd Edition.
6. Mechanism and Machine Theory / Ashok G. Ambekar / PHI / Eastern Economy Edition.

TEXT BOOKS:

1. Theory of Machines / S. S. Rattan / Mc Graw Hill.
2. Theory of Mechanism and Machines / Jagdish Lal / Metropolitan Book Company.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME214	DES	Incompressible and Compressible Flows	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives:-

To impart knowledge of various basic principles and equations of fluid flow, exact and approximate solutions of Navier-Stokes equations under various flow conditions and introducing concepts in compressible flow normal shock, oblique shock and Fanno flow and Reyleigh Flow

Course Outcomes:-

The student will be able to

1. Ascertain basic concepts in the fluid flow.
2. Analyze both incompressible and compressible flow conditions.
3. Analyze practical problem in fluid flow.
4. Apply the concepts in the analysis of the fluid flow problems.
5. Capable of using the theories in the real life situation and take appropriate decisions with regards to design of various fluid handling devices.
6. Understand the performance of fluid flow devices in laminar and turbulent flow.
7. Design compressible flow components used in Turbo Machines and Air-Conditioning.

SYLLABUS-

Unit-I

Introduction: Introduction to Fluid Mechanics, Properties of Fluids

Fluid Statics: Fluid Statics, Fundamental Equations-Applications of Fundamental Equations, Relative Motion of Liquids Kinematics of Fluids,

Kinematics of Fluids- Review of basics, Velocity potential, Stream function and Vorticity. **Theory of Stress and Rate of Strain:** General theory of Stress and Rate of Strain Fundamental Equations, Integral form Fundamental Equations, Reynolds Transport Theorem, Applications of the Integral Form of Equations-Numerical.

Unit-II

Fundamental Equations in Differential Form: Equations in Differential Form, One-dimensional Inviscid Incompressible Flow, Euler's Equation and Bernoulli's Equation, Applications of the Bernoulli's Equations-Numerical.

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Two and Three – dimensional Inviscid Incompressible Flow: Two and Three – dimensional Inviscid Incompressible Flow, Laminar Flow, Flow between Parallel Flat plates, Steady Flows in Pipes, Applications of Laminar Flow-Numericals.

Unit-III

The Laminar Boundary layer: The Laminar Boundary layer, Prandtl's Boundary Layer Equations, The Boundary layer along a Flat Plate, Solution to the Boundary Layer Equations, Momentum Integral Equation, Separation of Boundary Layer and Control-Numericals

Turbulent Flow: Introduction to Turbulent Flow, Modified N-S Equations-Semi, empirical Theories, Turbulent Boundary Layer,Numericals

Dimensional Analysis: Flow over a bluff body, Lift and Drag, Dimensional Analysis and Similitude.

Unit-IV

Introduction to Compressible Flow: Review of Fundamentals Stagnation Properties, Relations and Tables, Numericals

Wave Motion: Propagation of Motion in Compressible Fluids, Mach number and Mach Cone, Numericals, Isentropic Flow

Isentropic Flow: Relations, Flow through Nozzles and Diffusers, Isentropic Flow Relations and Tables, Numericals

Unit-V

Flow across Normal Shock and Oblique Shock: Basic Equations, Normal Shock, Prandtl-Meyer Equation, Oblique shock-Property variation, Relations and Tables, Numericals.

Flow through a constant area duct with Friction: Flow through a constant area duct with Friction Fanno, Line Fanno Flow, Variation of Properties, Relations and Tables, Numericals. Flow through a constant area duct with Heat Transfer, Flow through a constant area duct with Heat Transfer Rayleigh Line, Rayleigh Flow.

Reference Books:

1. S.W. Yuan ., Foundations of Fluid Mechanics, Prentice Hall of India, 2000
2. 2. S.M. Yahya , Fundamentals of Compressible Flow, with Aircraft and Rocket Propulsion, 4th edition, New Age techno, 2010
3. Schlichting, H., Boundary Layer Theory, 8th edition, Springer, 2004.
4. White F.M., Viscous Fluid Flow, 3rd edition, Tata McGraw Hill Book Company, 2011.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME224	**DES**	**Measurement in thermal engineering**	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:-
The objective of the course is to make the students:

- Introduce to analyze experimental error, static and dynamic characteristics of instruments
- Learn the working of various measuring instruments used in the field of thermal engineering
- Learn the measurement of properties like thermal conductivity of solids, liquids and gases
- Learn the measurement of transport properties like diffusion, convective heat transfer
- Introduce to electronic control systems associated with automatically controlling the measuring parameters.
- Introduce to applications and important features of various measuring instruments

Course Outcomes (COs):-
After completion of this course the students will be able to:

CO1: Use appropriate instrument for measurement of specific parameter.
CO2: Analyze experimental error, Static and Dynamic characteristics of instruments.
CO3: Use appropriate instrument measurement of transport properties.
CO4: Practically apply the principles of measurement to engineering applications / projects.

UNIT-I
Instrument classification, static and dynamic characteristics of instruments, experimental error analysis, systematic and random errors, statistical analysis, uncertainty, reliability of instruments,
Variable resistance transducers, capacitive transducers, piezoelectric transducers, photoconductive transducers, photovoltaic cells, ionization transducers, Hall effect transducers.

UNIT-II
Dynamic response considerations, Bridgman gauge, McLeod gauge, Pirani thermal conductivity gauge, Knudsen gauge, Alphatron.

UNIT-III
Flow measurement by drag effects; hot-wire anemometers, magnetic flow meters, flow visualization

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methods, interferometer, Laser Doppler anemometer.
Temperature measurement by mechanical effect, temperature measurement by radiation, transient response of thermal systems, thermocouple compensation, temperature measurements in high- speed flow.

UNIT-IV

Thermal conductivity measurement of solids, liquids, and gases, measurement of gas diffusion, convection heat transfer measurements, humidity measurements, heat-flux meters.
Detection of thermal radiation, measurement of emissivity, reflectivity and transmissivity, solar radiation measurement.

UNIT-V

Review of open and closed loop control systems and servo mechanisms, Transfer functions of Mechanical Systems, input and output systems.

Reference Books:

1. *Holman, J.P., "Experimental methods for engineers", Tata McGraw-Hill, 7th Edition, 2007.*
2. *Prebrashensky. V., "Measurement and Instrumentation in Heat Engineering", Vol.1, MIR Publishers, 1980.*
3. *Raman, C.S. Sharma, G.R., Mani, V.S.V., "Instrumentation Devices and Systems", 2nd Edition, Tata McGraw-Hill., 2001.*
4. *Morris. A.S, "Principles of Measurements and Instrumentation",3rd Edition, Butterworth-Heinemann, 2001.*
5. *Beckwith & Buck : Mechanical Measurements*
6. *Control Systems, Principles & Design, 2nd Edition – M. Gopal – TMH.*

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME215	DES	Advanced Heat and Mass Transfer	2	1	0	3	60	20	20	0	0

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:- The basic objective of the subject is to have goal of achieving a workable system and of designing an optimum system. The possibility of optimization represents one of the few facets of this subject. Pre requisites: Thermodynamics, Heat & Mass Transfer.

Course Outcomes:-
To learn basic principles and mode of transfer of heat energy by convection, conduction and radiation.
To learn basic Application of empirical relations to variation geometries for laminar and turbulent flows.
Each student understands the physical mechanisms involved in radiation heat and mass transfer

Syllabus

UNIT- 1

Introduction To Different Modes Of Heat Transfer

Conduction: General heat Conduction equation-initial and boundary conditions. Transient heat conduction: Lumped system analysis- Heisler charts-semi infinite solid-use of shape factors in conduction-2D transient heat conduction-product solutions.

UNIT- 2

Finite Difference Methods For Conduction

ID & 2D steady state and simple transient heat conduction problems-implicit and explicit methods. Forced Convection: 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..

UNIT- 3

External Flows

Flow over a flat plate: integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometries for laminar and turbulent flows. Internal flows: Fully developed flow: integral analysis for laminar heat transfer coefficient-types of flow-constant wall temperature and constant heat flux boundary conditions-hydrodynamic & thermal entry lengths; use of empirical correlations.

UNIT-4

Convection

Thermal boundary layers - Momentum and energy equations -Internal and external flows- Forced convection over cylinders, spheres and bank of tubes.

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UNIT- 5

Radiation

Radiation ; Recapitulation of fundamentals of radiative heat transfer, radiative properties of surfaces, methods of estimating configuration factors, heat exchange between diffusively emitting and diffusively reflecting surfaces. Radiant energy transfer through absorbing, emitting and scattering media. Combined conduction and radiation systems: fins, Introduction to solar radiation in earth's atmosphere.

Reference Books:

1. V.S Arpaci – Conduction Heat Transfer E.M Sparrow,
2. R.D Cess – Radiation Heat Transfer
3. Engg. Heat & Mass Transfer/ Sarit K. Das/Dhanpat Rai
4. Heat Transfer/ P.K.Nag /TMH
5. Heat Transfer/RK Rajput/S.Chand
6. Introduction to Heat Transfer/SK Som/PHI
7. Engineering Heat & Mass Transfer/Mahesh Rathore/Lakshmi Publications
8. Heat Transfer / Necati Ozisik / TMH
9. Heat Transfer / Nellis & Klein / Cambridge University Press / 2012.
10. Heat Transfer/ P.S. Ghoshdastidar/ Oxford Press

List of Practical's:

1. To determine following parameters for composite wall structure. (a) Total thermal resistance,(b)Thermal conductivity (c)To plot temperature gradient along the composite wall structure
2. To determine the value of Nusselt number and convective heat transfer coefficient for ice plate loosing heat by natural convection experimentally and by using empirical correlation.
3. To determine surface heat transfer coefficient for vertical cylinder / tube in natural convention mode
4. To determination of Emissivity of non black surface. And study of variation of Emissivity of test plate with respect to absolute temperature.
5. To study the unsteady state of heat transfer.
6. To study of temperature distribution along the length of simple pin fin in both natural & forced convection. Comparison of theoretical temperature distribution with experimentally obtained distribution. Comparison of performance of fins of various materials supplied.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME225	DES	Gas Turbines And Jet Propulsion	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To understand the basic concepts and importance of gas dynamics.
2. To understand the phenomena of various flows such as Shock, Fanno and Rayleigh flow.
3. To understand the type of flow takes place in flow and non-flow system.
4. To understand various terms such as mach no., Subsonic, Sonic and Supersonic flow.
5. To understand the thrust equation and its application in aircraft and rocket propulsion.

Unit-I

Basic Concepts of Gas Dynamics: Terms related to gas dynamics, Energy Equation for flow process, Various flow regions, stagnation state, velocity of sound, Mach number ,,Subsonic, Sonic and Supersonic Flow, Critical mach number, Crocco Number, Mach cone, effect of mach number on compressibility, T-S and h-s diagram for diffuser and nozzle process.

Unit-II

Oblique Shock Waves: Relations and reflections of oblique shock waves, interaction of oblique shock waves, conical shock waves, Expansion waves, Prandtl-Meyer flow, reflection of expansion waves, flow over bodies involving shock and expansion waves, Variable area flow and its equations, characteristitics of Nozzle operation, Supersonic diffusers-Convergent and Divergent. Flow in constant area duct. The fanno line.

Unit-III

Flow with Heat addition or removal:1-D flow in constant area duct, variable area flow with addition of heat, Generalized Quasi 1-D flow, one-dimensional constant area flow with friction and heat exchange, Governing equations for 1-D flow, Two-Dimensional Compressible Flow: Governing equations, velocity potential, linearized subsonic flow, linearized supersonic flow.

Unit-IV

Propulsion: Air craft propulsion, jet engine and its types, flow of energy through jet engines, thrust, power and propulsive efficiency of jet engines. Turbojet components such as diffuser, compressor, combustion chamber, turbines, exhaust systems. Jet Engine-Performance, turbo prop engines, ram jet and pulse jet engines.

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Unit-V

Rocket propulsion: Principle of rocket propulsion, Thrust equations, effective jet velocity, performance of rocket engines, specific impulse, thrust application, solid and liquid propellant rockets.

Reference Books:

1. Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997.
2. Rathakrishnan. E., "Gas Dynamics", Prentice Hall of India, New Delhi, 2001
3. Anderson, D. John Jr., 'Introduction to Flights', Mc Graw Hill, ISE, 2004
4. Dr. Somasundaram S.L., 'Gas Dynamics and Jet Propulsion', Newnes – Butterworths & Co Publishers Ltd 1999
5. Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997

Text Book:

1. Yahya. S.M., Fundamental of compressible flow with Aircraft and Rocket propulsion", New Age International (p) Ltd., New Delhi, 2005.
2. Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTME206	DC	Material Behaviour and Vibration	0	0	2	1	0	0	0	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:-

1. Summarize significance of material science and its role in manufacturing.
2. To provide methods of calculating safe rotating speed range to avoid whirling.

Course Outcomes:-

1. Classify different engineering material (plastics, composites, smart materials and nanomaterials).
2. Ability to analyze the various properties and manufacturing techniques of plastics materials.
3. Ability of estimation of factor of safety of different designing materials.
4. Ability to use nanomaterials for linear and nanotechnology vibratory systems.
5. General notion on frequency and time response of vibratory systems.

Syllabus

Unit-I

Introduction:

Modern materials in design- plastics, composites, smart materials and nanomaterials, Weight reduction using plastics and composites, Properties and uses of plastics, composites, smart materials and nanomaterials in the design of mechanical equipments. Estimation of factor of safety in design

Unit-II

Design Of Plastic Components:

Analysis of various properties for plastic components, manufacturing techniques of plastics, Various design considerations for plastic components, Applications of plastics in design of mechanical equipments, Mechanical properties of glass filled –polyphenylene, glass filled -polyethylene and glass filled-polyurethane.

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Unit-III

Nanomaterials:

Nanotechnology, Nanoscale, Design applicaions, Nanotubes, Nano-sized particles in composites, Fabrication of nano-sized particles, nanodevices.

Unit-IV

Determination of Natural Frequencies Approximate methods of determining fundamental frequencies: Dunkerleys lower bound approximation and Rayleighs Method. Stodolas Method. The Holzers Method. The Method of Matrix Iteration, Envelop Analysis.

Unit-V

Systems with Multi-degree of Freedom and Continuous Systems. Equations of motion.The Matrix method : Eigen values and eigen vectors. Vibration of Strings. Longitudinal vibrations of bars. Torsional vibrations of Circular Members. Transverse Vibrations of Beams.

Reference Books

1.Composite manufacturing technology by A.G. Bratukhin and V.S. Bogolyubov, Chapman &Hall publication.

2.Smart Materials and Structures, M.V. Gandhi and B.S. Thomson, Chapman &Hall.

3. Introduction to Nanotechnology, Charles P Poole and Frank J.Owens, Wiley-Inderscience,2003

4. Ambekar A. G., Mechanical Vibrations and Noise Engineering , Prentice Hall of India Pvt. Ltd.,2006.

5. G. K. Grover, Mechanical Vibrations, Nem Chand and Bros., Roorkee.

List of Practical's:

1. Experiments using strain gauges.
2. Measurement of strain, temperature effects,
3. Fixing of gauges on surfaces.
4. Experiments using photoelastic bench.
5. Setting of polariscope and calibration of disc, beam and tension model.
6. Design of power transmission systems – complete design of belt drive and gear reducer and

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drafting.

7. Determination of natural frequency oin single degree of freedom.
8. Determination of fundamental frequency in single degree of freedom
9. Study of torsional vibrations of circular members.
10. Study of transverse vibrations beam.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTIE107	DC	Intellectual property rights	0	0	4	2	0	0	0	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Overview of Intellectual Property, (B) Patents, copyright, Trademarks, (C) Enforcement of Intellectual Property Rights and Intellectual Property.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student would be able to understand the fundamental aspect of intellectual property rights.
2. Student would be able to understand the patent system of India.
3. Students will be able to understand the basics of copyright and protect copyright.
4. Student would be able to demonstrate the related rights.
5. Students would be able to demonstrate various case studies based on patent, copyrights and related rights.

Syllabus

Unit - I

Overview of Intellectual Property:

Introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad some important examples of IPR

Unit - II

Patents:

Macro economic impact of the patent system Patent and kind of inventions protected by a patent Patent document How to protect your inventions? Granting of patent Rights of a patent How extensive is patent protection? Why protect inventions by patents? Searching a patent Drafting of a patent Filing of a patent The different layers of the international patent system.

Copyright

What is copyright? What is covered by copyright? How long does copyright last? Why protect copyright?

Related rights

What are related rights? Distinction between related rights and copyright? Rights covered by

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copyright?

Unit - III

Trademarks

What is a trademark? Rights of trademark? What kind of signs can be used as trademarks? types of trademark function does a trademark perform How is a trademark protected? How is a trademark registered? How long is a registered trademark protected for? How extensive is trademark protection? What are well-known marks and how are they protected? Domain name and how does it relate to trademarks?

Geographical indications

What is a geographical indication? How is a geographical indication protected? Why protect geographical indications?

Unit - IV

Industrial designs:

What is an industrial design? How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

New plant varieties

Why protect new varieties of plants? How can new plants be protected? What protection does the breeder get? How long do the breeder's rights last? How extensive is plant variety protection?

Unfair competition

What is unfair competition? relationship between unfair competition and intellectual property laws?

Unit-V

Enforcement of Intellectual Property Rights:

Infringement of intellectual property rights Enforcement Measures

Intellectual Property

Overview of Biotechnology and Intellectual Property Biotechnology Research and Intellectual Property Rights Management Licensing and Enforcing Intellectual Property Commercializing Biotechnology Invention.

References Books:

1. "Biotechnology Applications and Research", P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew, Technomic Publishing Co., Inc. USA, 1985
2. "Concepts in Biotechnology", D. Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, University Press (Orient Longman Ltd.), 2002
3. "Biotechnology: Demystifying the Concepts", Bourgagaize, Jewell and Buiser, Wesley Longman, USA, 2000.
4. Indian Patents Law Legal & Business, Ajit Parulekar and Sarita D' Souza, Implications; Macmillan India ltd , 2006

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