DEVI AHILYA VISHWAVIDYALAYA, INDORE

FACULTY OF ENGINEERING

SCHEME OF EXAMINATION
&
COURSE OF CONTENTS

ME I & II Year Programme (Full Time)
(Design & Thermal Engineering)

INSTITUTE OF ENGINEERING & TECHNOLOGY
(www.iet.dauniv.ac.in)

DEVI AHILYA VISHWAVIDYALAYA, INDORE
INSTITUTE OF ENGINEERING & TECHNOLOGY
ME (Design & Thermal Engineering) (Full Time)

Schemes of Subjects & Examination (Subject to revision)

TH Marks (Max 100, Min 50) shall be based on Theory paper-It shall be an examination in the end of the semester.

CW Marks (Max 50, Min 25) shall be based on Attendance (25), Marks obtained in Test-I & Test-II of 25 marks each. Average of the two tests will be taken for awarding the 25 marks.

SW Marks (Max 50, Min 25) shall be based on Attendance (25), Marks obtained in Two Experiments and Viva Voce (25).

PR Marks (Max 50, Min 25) shall be based on Viva-Voce by External Examiner.
Th- Theory, CW – Class Work, SW – Sessional Work, Pr – Practical.

SEMESTER I						**Maximum Marks**				
No.	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**TH**	**CW**	**SW**	**PR**	**TOTAL**
1	5DT601	Advanced Thermodynamics	3	1	-	100	50	-	-	150
2	5DT602	Design of I. C. Engine components & Sub Systems	3	1	2	100	50	50	50	250
3	5DT603	Tribology	3	1	2	100	50	50	50	250
4	5DT604	Advanced Machine Design	3	1	2	100	50	50	50	250
5		Elective I	3	1	-	100	50	-	-	150
6	5DT610	Comprehensive Viva - I	-	-	-	-	-	-	100	100
	TOTAL		15	5	6	500	250	150	250	1150

SEMESTER II						**Maximum Marks**				
No.	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**TH**	**CW**	**SW**	**PR**	**TOTAL**
1	5DT651	Design of Heat Transfer Equipments	3	1	-	100	50	-	-	150
2	5DT652	Refrigeration Systems & Component Design	3	1	2	100	50	50	50	250
3	5DT653	Machinery Fault Diagnosis &Signal Processing	3	1	2	100	50	50	50	250
4	5DT654	Machine Vibrations Analysis	3	1	2	100	50	50	50	250
5		Elective II	3	1	-	100	50	-	-	150
6	5DT660	Comprehensive Viva - II	-	-	-	-	-	-	100	100
	TOTAL		15	5	6	500	250	150	250	1150

SEMESTER III			Maximum Marks							
No.	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**TH**	**CW**	**SW**	**PR**	**TOTAL**
1	6DT601	Dissertation Phase- I	-	-	8	-	-	100	50	150
	TOTAL		-	-	8	-	-	100	50	150

SEMESTER IV			Maximum Marks							
No.	**Sub. Code**	**Subject Name**	**L**	**T**	**P**	**TH**	**CW**	**SW**	**PR**	**TOTAL**
1	6DT651	Dissertation Phase- II	-	-	8	-	-	250	100	350
	TOTAL		-	-	8	-	-	250	100	350

GRAND TOTAL OF FOUR SEMESTERS	**2800**

List of Electives for Semester I

No.	**Sub. Code**	**Subject Name**
1	5DT605	Fatigue, Creep & Fracture
2	5DT606	Advanced Mechanics of Solids
3	5DT607	Mechanism and Robot Kinematics
4	5DT608	Thermal Systems: Simulation & Design
5	5DT609	Non Conventional Energy Systems

List of Electives for Semester II

No.	**Sub. Code**	**Subject Name**
1	5DT655	Applied Elasticity & Plasticity
2	5DT656	Computer Aided Mechanism Design
3	5DT657	Experimental Stress Analysis
4	5DT658	Automotive System: Analysis & Design
5	5DT659	Cogeneration & Waste Heat Recovery

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design &Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT601 ADVANCED THERMODYNAMICS	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives: The basic objective of the subject is to deal fundamentals of Thermodynamics, Compressible Fluid Flowproperties, Thermodynamics relations & Exergy.

Pre requisites: Basic Engineering Thermodynamics.

COURSE CONTENTS

UNIT-1
Mass and Energy Analysis of Control Volume
Control Volume, Steady Flow Process, Mass Balance and Energy Balance in a Simple Steady Flow Processes, Variable Flow Processes, Comparison of SFEE with Euler and Bernoulli Equations, Discharging and Charging a Tank.

UNIT-2
Compressible Fluid Flow
Velocity of Pressure Pulse, Stagnation Properties, One Dimensional Steady Isentropic flow, Critical Properties, Normal Shocks, Adiabatic Flow with Friction, Diabatic Flow without Friction.

UNIT-3
Thermodynamic Property Relations
Mathematic Theorems, Maxwell,s Relations, TdS Equations, Heat Capacities, Joule Kelvin Effects, Claussius Clapeyron Equation, Gibb's Phase Rule, Local Equilibrium Conditions,

UNIT-4
Exergy
Work Potential of Energy, Reversible work and Irreversibility, Second Law Efficiency, Exergy Change of System, Exergy Transfer, Exergy Principles.

UNIT-5
Gas Turbine Power Plants
General Aspects, Simple Gas Turbine Plant, Constant Pressure Combustion Gas Turbines, Constant Volumes Gas Turbines, Combination Gas Turbine Cycles, Gas Turbine Power Lay out, Relative Thermal Efficiencies of Different Cycles.

BOOKS RECOMMENDED:

[1] Y.A Cengel, *Thermodynamics-An Engineering Approach* , McGraw Hill Companies,2006.
[2] P.K Nag, *Engineering Thermodynamics* , The McGraw Hill Companies, Third Edition.
[3] G.E Myers, *Engineering Thermodynamics* ,Prentice Hall, Third Edition.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				M.E. I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT602 DESIGN OF IC ENGINES COMPONENTS & SUB SYSTEMS	L	T	P		TH	CW	SW	PR	Total
	3	1	2	Max	100	50	50	50	250
Duration of Theory Paper: 3 Hours				Min	50	25	25	25	125

Objectives & Pre requisites: To impart the basics of Internal Combustion Engine design and theory. Fundamentals of thermodynamics, Combustion process, Theory of Internal combustion Engines.

COURSE CONTENTS

UNIT-1
Theory of IC Engines
Introduction to different types of IC engine systems. Engine design and operating parameters. Power plant cycles for stationary and aerospace applications, component behaviours, analysis of ramjet, turbojet and turbo-propeller. Inlets and nozzels. Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

UNIT-2
Fuels and Combustion
Fuels for engines and their characteristics. Fuel-air mixing, gas exchange, Ignition and combustion. Stoichiometry Relations, Theoretical Air Required for Complete Combustion, Calculation of Minimum Amount of Air Required for a Fuel of known Composition, Calculation of Dry Flue Gases if Fuel Composition is Known, Calculation of the composition of Fuel & Excess Air Supplied, from Exhaust Gas Analysis, Dew Point of Products, Flue Gas Analysis (O_2, CO_2, CO, NO_x, SO_x) Ignition, Concept of Ignition, Auto Ignition, Ignition Temperature.

UNIT-3
IC Engines Sub System Design
Fuel injection systems.. Combustion chamber designs for spark ignition and compression ignition engines. Engine cooling and cooling system design. Engine lubrication system. 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. Testing and performance of IC engines .

UNIT-4
Advance IC Engines Subsystems
Emission control and electronic management systems. Design of Supercharged engines, Advances in engine design, Modern trends in IC Engines. Engines for special applications - Mining Defence, Off-highway -Tractor, Bulldozer etc. Submarines, Race car engine systems, Flexible fueled systems.

UNIT- 5
Thermal System Optimisation
Objective function formulation, Constraint equations, Mathematical formulation, Calculas method, Dynamic programming, Geometric programming, Linear programming methods, solution procedures. Steady state simulation, Laplace transformation, Feedback control loops, Stability analysis, Non-linearties.

BOOKS RECOMMENDED:

[1] V. Ganesan, *Internal Combustion Engines*, TataMcGrraw-hill,1990
[2] Gordon P.Blair, *Basic design of Two-stroke Engines*, S.A.E., 1992.
[3] A.Kolchin, *Design of Automotive Engines*, Mir Publishers, Moscow, 1984.
[4] Kapoor J.N., *Mathematical Modelling*, Wiley Eastern Ltd., New York, 1989.
[5] Winterbone D.E., *Design Techniques for Engine Manifolds, Wave action methods for I.C Engines*, Professinal Engineering Publishing Ltd., UK, 2000.

LABORATORY EXPERIMENTS:

1. Study of various IC Engine Components.
2. Performance test on spark ignition engine using Alternate fuels such as ethanol and LPG.
3. Emission measurement in Spark Ignition and Compression Ignition Engines.
4. Heat Transfer through fins.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT603 **TRIBOLOGY**	L	T	P		TH	CW	SW	PR	Total
	3	1	2	Max	100	50	50	50	250
Duration of Theory Paper: **3 Hours**				Min	50	25	25	25	125

COURSE CONTENTS

Objectives & Pre requisites:
The basic objective of the subject is to deal fundamentals of friction, wear and lubrication. The subject is useful in understanding the nature of surfaces of engineering materials. The Pre requisites are Material Science and Machine Design.

UNIT- 1
Fundamentals of Tribology
Introduction to tribology and its historical background, Industrial importance, factors influencing Tribological phenomenon. Engineering surfaces- surface characterization, computation of surface parameters. Surface measurement techniques.

UNIT- 2
Friction
Genesis of friction, friction in contacting rough surfaces, sliding and rolling friction, various laws and theory of friction, friction of elastomers, friction of various materials, friction measurement methods.

UNIT- 3
Wear
Introduction, types of wear, wear mechanism, minor forms of wear, wear debris analysis, wear testing method, wear of metals, ceramics, polymers, system approach for wear reduction.

UNIT-4
Lubrication
Basic principal of lubrication, choice of lubricant type, selection of lubrication oils, oil changing and oil conservation, oil feed system, Greece and anti seizes, gas bearing, lubricating sealing, lubricating testing and specifications, lubrication monitoring.

UNIT- 5
Design for Tribological Elements
An overview of engineering materials having potential for tribological application, characterization and evaluation of ferrous materials for tribological requirements/application, selection of ferrous materials for rolling element bearings, Boundary lubrication, Hydrodynamic lubrication, elastohydrodynamic lubrication, Design of hydrodynamically loaded journal bearing, externally pressurized bearing, rolling element bearing, performance analysis of bearing.

BOOKS RECOMMENDED:

[1] Moore F Desmond , *Principals and application of Tribology*, ,Pergamon press,1975.
[2] Sahoo P., *Engineering Tribology*, Prentice-Hall of India, New Delhi, 2005.
[3] Lansdown A. R., Lubrication, *A practical Guide to Lubricant selection*, Pergamon Press, 1982.
[4] Majumdar B.C., *Introduction to Tribology of Bearings*, Wheeler Publishing, New Delhi, 1999.

LABORATORY EXPERIMENTS:

1. Performance analysis of Journal Bearings.
2. Experimental analysis of Lubricants.
3. Experimental analysis of Friction on different material.
4. Study of method for Wear Debris analysis.
5. Design analysis for Hydrodynamic Journal Bearing and rolling contact bearing

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT604 **ADVANCED MACHINE DESIGN**	L	T	P		TH	CW	SW	PR	Total
	3	1	2	Max	100	50	50	50	250
Duration of Theory Paper: **3 Hours**				Min	50	25	25	25	125

Objectives & Pre requisites: The objective of the subject is to deal with failure analysis and advanced areas of design of machine elements based on reliability, fatigue, creep. Also deals with the fracture mechanics approach to design. Pre requisites are Material science, Machine Design I and Machine Design II.

COURSE CONTENTS

UNIT-1

Introduction to Advanced Mechanical Engineering Design

Review of materials and processes for machine elements. Case studies of mechanical engineering design failures. Review of static strength failure analysis – theories of failure.

UNIT -2

Reliability and Optimum based Design

Introduction to optimum design, analysis of simple machine members based on optimum design. Fundamentals of reliability ,System concepts in Reliability engineering. Failure distributions, Statistical analysis of failure data, Weibull analysis, dimensioning.

UNIT -3

Design for Dynamic Loading

High cycle and low cycle fatigue, Fatigue strength. Design of Mechanical Equipment Elements. Exercises of fatigue design of shafting and gears. Exercises of surface fatigue design of rolling contact bearings including linear bearings.

UNIT -4

Design for Creep

Introduction to Design for creep. Combined creep and fatigue failure prevention. Design for low temperature (Brittle failure). Design for corrosion, wear, hydrogen embrittlement, fretting fatigue and other combined modes of mechanical failure.

UNIT -5

Fracture mechanics

Introduction: Fracture mechanics approach to design, the energy criterion, the stress intensity approach, effect of material properties on fracture, dimensional analysis in fracture mechanics.

Fundamental concepts: Stress concentration effect of flaws, the Grifith energy balance, the energy release rate, instability and the R curve, stress analysis of cracks, K as a failure criterion. Fracture toughness testing of metals

Note: Only Mechanical Engineer's Handbook, Data-books and certified notes are allowed in the examination hall.

BOOKS RECOMMENDED:

[1] Shingley J.E., *Mechanical Engineering Design*, McGraw-Hill 2003.
[2] Dieter G.E., *Engineering Design*, McGraw-Hill 2000.
[3] Spotts M.F.,Shoup T.E., Hrnberger L.E., *Design of Machine Elements*, Pearson Education ,8e, 2006.
[4] Shariff A.,*Design of Machine, Elements*,Dhanpat Rai Publications(P) Ltd.,3e,1995.
[5] Mubeen., Machin*e Design*, Khanna Publications(P) Ltd., 2004.

LABORATORY EXPERIMENTS:

1. Problem based on theories of failures.
2. Problem based on Reliability Criterion.
3. Problem based on Optimum Criterion.
4. Problem on Design of parts subjected to Fatigue Loading.
5. Problem on Design of parts subjected to Creep.
6. Experimental analysis of fracture mechanism for different materials.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT605 FATIGUE, CREEP & FRACTURE	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives:
The objectives of this course will be achieved by learning the phenomenon of fatigue creep & fracture Mechanism inside the metallic bodies also the behavior of the material can be understand under these states.

Prerequisites:
Strength of Material, Machine Design & Material Science.

COURSE CONTENTS

UNIT-1
Introduction
Introduction & types of fatigue creep & Fracture phenomenon. Stress Analysis under fatigue, creep & Fracture. Material selection under the given conditions.

UNIT -2
Fatigue
Types of fatigue leading and failure, Fatigue test, endurance limit, S-N diagram; Various failure relations, Viz., Soderberg, Modified Goodman-, Gerber parabolic-, Elliptical-relations; Factors influencing fatigue strength; Influence of stress concentration on fatigue test; Fretting corrosion; Effect of environment-corrosion fatigue; Increased fatigue life due to surface protection.

UNIT -3
Creep
Mechanics of creep, inter-granular, trans-granular creep, Creep test, Creep strain rate-time curves, Deformation mechanism map; High temperature properties of materials; Long time creep-stress-time relations; Creep contribution to the fracture mechanism; Creep contribution to the fracture mechanism; DVM, DVL German-standard, Hatifield time yield test.

UNIT -4
Fracture
Damage tolerance analysis, residual strength in presence of cracks; Mechanisms of crack growth and fracture; Basic modes of fracture; Stress Concentration factor, state of stress at a stress concentration, load-flow-times; Measurement of Collapse strength; Griffith's theory of brittle fracture; Irwin's theory of fracture in elastic-plastic materials; Theories of linear elastic plastic fracture mechanics (LEFM); Stress intensity fracture, toughness, stress distribution at crack tip: plane stress, plane strain cases; Theories of elastic plastic fracture mechanics (EPFM); Crack opening displacement (COD) Criterion, COD tests, crack tip opening displacement (CTOD) measurement; Crack arresters; Implementation of fracture control.

UNIT -5
Design against Creep
Types of creep, Introduction to Design against creep. Combined creep and fatigue failure prevention.Shearby Dorn Parameter, Larson Miller Parameter, Menson- Haferd Parameter.

BOOKS RECOMMENDED:

[1] Norman E. Dowling, *Mechanical Behavior of Materials: Engineering Methods for Deformation, Fracture and Fatigue*, 3rd edition, *Pearson Prentice Hall*, 2007.
[2] Shigley J.E. *Mechanical Engineering Design*, McGraw Hill 2003.
[3] Mubeen A. "*Machine Design* ", Khanna Publications (P) Ltd.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT606 ADVANCE MECHANICS OF SOLIDS	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objective: The basic objective of the course is to deal with advances in mechanics of materials, stresses in materials, load & deflection relationship and bending properties of material.

Pre requsites: Basic Mechanics of Solids, Material Science.

COURSE CONTENTS

UNIT-1
Stress and strain
Review: Tensile, Compressive and Shear Stresses, Modulus of Elasticity. Modulus of Rigidity, Bulk Modulus, Poisson's ratio, Relations between the three Moduli, Compound Stresses, Principle Stresses & Strain. Elastic Strain Energy, Different types of loading, Resilience, Proof Resilience, Strain Energy in Tensile, Static, Sudden falling, gradually applied and Impact loading. Strain Energy due to Shear Stresses.

UNIT -2
Stresses in Beams
Bending Stresses: Pure Bending, Moment of inertia of section, Graphical Determination of Moment of Inertia, Bending Stresses, Stress Concentration in Bending, Combined Bending and Direct Stresses, Composite Beams.
Shear Stresses: variation of Shear Stresses, Rectangular Section, I-Section, Shear Centre, Location of shear centre for various sections -shear flows.

UNIT -3
Deflection of Beams
Stresses and deflections in beams subjected to symmetrical/unsymmetrical loading-kern of a section, Strain Energy due to Bending, Applications to Impact, Deflection by Calculus, Macauly's Method, Moment – Area Method, Method of Deflection Coefficients, Deflection due to Shear, Deflection by Graphical Method.

UNIT -4
Built - In and Continuous Beams
Moment Area Method for Built-Beams, Macaulay Method, Continuous Beams.

UNIT -5
Bending of Curved Beams and Rigid Frames
Stresses in Bars of Small Initial Curvature, Stresses in Bars of Large Initial Curvature, Deflection of Curved Bars (Direct Method), and Deflection from Strain Energy (Castigliano's Theorem).

BOOKS RECOMMENDED:

[1] Warnock Ramamurtham, *Strength of Materials,*Dhanpat Rai Publications,1998.
[2] Bansal R K, *Strength of Materials*,4/e,Laxmi Publications(P) Ltd,2007.
[3] Popov *Mechanics of Solids*,2/e, Prentice-Hall (India), 1999.
[4] Timoshenko, *Elements of Strength of Materials,* 5/e**,**Wadsworth Publishing;1968.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instruction Hours per Week			Marks					
5DT607 MECHANISMS AND ROBOT KINEMATICS	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objective and Pre requisites: The objective of the subject is to introduce the students about the basic analytical techniques and fundamental principles of Robot Kinematics. The Pre requisites are knowledge of the basic course in theory of machines, matrix theory, probability, computer programming and mathematical analysis.

COURSE CONTENT

UNIT-1
Introduction to Robotics & Mechanisms
Introduction, Automation and Robotics, Robot anatomy and Robot configurations, Links and joints notations, End effectors, Work volume and Obstacles, Overview of Robot drive systems and Control systems, Robot sensing, Dynamic performance and Precision of movement, Applications in Robotics.

UNIT-2
Robot Arm Kinematics
Introduction, Forward or direct Kinematics Problem, Matrix Representations, Robot arm coordinates and Transformation matrix, Composite homogeneous transformation matrix, Denavit-Hartenberg representation, Kinematic equations, Location of end effector, Inverse kinematic problem, Geometric approach for solution of inverse kinematic problem.

UNIT-3
Trajectory Planning
Introduction, Constraints and Path specifications, Basic algorithm for generation of joint trajectory, joint interpolated trajectories, Cartesian path trajectory planning.

UNIT-4
Robot Arm Control.
Fundamentals of control system theory, Joint motion controls: Servo mechanism, Computed torque technique, Minimum time control, Variable structure control. Adaptive control modes.

UNIT-5
Robot Programming and Task Planning
Introduction, Characteristics of robotic programming languages, position and motion specification, development and debugging facilities, task-level programming and robot program synthesis, Robot intelligence and task planning.

BOOKS RECOMMENDED:

[1] Mikell P.Groover, *Industrial Robotics,* McGraw Hill Pvt. Ltd., New Delhi.
[2] K. S. Fu, R. C. Gonzalez, C. S.G. Lee, *Robotics: Control, Sensing, Vision and Intelligence*, McGraw Hill Book Company, Singapore, International Edition 1987.
[3] Robert J. Schilling, *Fundamentals of Robotics: Analysis & Control*, Prentice-Hall of India Private Limited, New Delhi, 5th Reprint, 2003.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT608 THERMAL SYSTEMS: SIMULATION & DESIGN	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

COURSE CONTENTS

Objective of the Subject:
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 requsites: Thermodynamics, Heat & Mass Transfer.

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 Behaviour 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
Modelling 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 .

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

BOOKS RECOMMENDED:

[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.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instruction Hours per Week			Marks					
5DT609 NON CONVENTIONAL ENERGY SYSTEMS	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives: The objective of the subject to acquaint the students the renewable energy technological systems, its principle ,working, system design and analysis of present systems, to analysis the environmental and cost economics of using renewable energy sources compared to fossil fuels.

Pre requisites: Thermal Engineering, Heat and Mass transfer, fluid mechanics, steam engineering, combustion technology.

COURSE CONTENT

UNIT-1

Solar Energy

Solar radiation its measurements and prediction - solar thermal flat plate collectors concentrating collectors – applications - heating, cooling, desalination, power generation, drying, cooking etc - principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. Design and Thermal analysis.

UNIT-2

Wind Energy

Atmospheric circulations – classification - factors influencing wind - wind shear – turbulence - wind speed monitoring - Betz limit - Aerodynamics of wind turbine rotor- site selection - wind resource assessment - wind energy conversion devices - classification, characteristics, and applications. Hybrid systems - safety and environmental aspects.

UNIT-3

Bio-Energy

Biomass resources and their classification - chemical constituents and physicochemical characteristics of biomass - Biomass conversion processes - Thermo chemical conversion: direct combustion, gasification, pyrolysis and liquefaction - biochemical conversion: anaerobic digestion, alcohol production from biomass - chemical conversion process: hydrolysis and hydrogenation. Biogas - generation - types of biogas Plants- applications Design of bio gas digesters, landfill gas systems and gasifiers.

UNIT-4

Hydrogen and Fuel Cells

Thermodynamics and electrochemical principles - basic design, types, and applications - production methods - Bio photolysis: Hydrogen generation from algae biological pathways - Storage gaseous, cryogenic and metal hydride and transportation. Fuel cell – performance characteristics ,principle of working- various types - construction and applications.

UNIT-5

Other Types of Energy

Ocean energy resources - principles of ocean thermal energy conversion systems - ocean thermal power plants - principles of ocean wave energy conversion and tidal energy conversion – hydropower – site selection, construction, environmental issues - geothermal energy - types of geothermal energy sites, site selection, and geothermal power plants, MHD, Thermal analysis

Note: HMT Data-books and certified notes are allowed in the examination hall.

BOOKS RECOMMENDED:

[1] Sukhatme, S.P., *Solar Energy*, Tata McGraw Hill, 1984**.**

[2] Twidell, J.W. and Weir, A., *Renewable Energy Sources*, EFN Spon Ltd., 1986.

[3] Kreith, F and Kreider, J. F., *Principles of Solar Engineering*, McGraw-Hill, 1978.

[4] Duffie and Beckman, *Solar Thermal Engineering Process*, John Wiley @Sons, New York.

[5] Veziroglu, T.N., *Alternative Energy Sources*, Vol 5 and 6, McGraw-Hill, 1990.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT651 DESIGN OF HEAT TRANSFER EQUIPMENTS	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives & Pre requisites:
The basic objective of the subject is to have in-depth knowledge about the generalized modes of heat transfer and their applications in the designing of thermodynamic systems. Pre requisites are Heat & Mass Transfer & Machine Design.

COURSE CONTENTS

UNIT- 1
Steady State Heat Conduction
One Dimensional Heat Conduction Equation, General Heat Conduction Equation, Heat generation in a Solid, Variable Thermal Conductivity, Thermal Contact Resistance, Heat Conduction in Cylinders and Spheres, Critical Radius of Insulation Heat Transfer from Finned Surfaces.

UNIT- 2
Transient Heat Conduction
Lumped System Analysis, Transient Heat Conduction in Large Plane Walls and Long Cylinders, Transient Heat Conduction in Semi-Infinite Solids, Transient Heat Conduction in Multidimensional Systems, Two Dimensional Transient Heat Conduction.

UNIT- 3
Fundamentals of Convection
Physical Mechanism on Convection, Velocity Boundary Layer and Thermal Boundary Layer , Derivation of Differential Convection Equation, Natural Convection over Surfaces, Natural Convection from Finned Surfaces and PCBs, Forced Convection across Cylinders, Spheres and Tube Banks, Combined Natural and Forced Convection.

UNIT-4
Fundamentals of Thermal Radiation
Introduction, Radiative Properties, View Factor Relations, Radiation Heat Transfer, Radiation Shields and the Radiation Effects.

UNIT- 5
Heat Exchangers
Types, overall heat Transfer Coefficient, Effectiveness-NTU method, Cooling of Electronic Equipments, Cooling Load of Electronic Equipment, Conduction and Air Cooling.

BOOKS RECOMMENDED:

[1] Cengel Y.A., *Heat Transfer-A Practical Approach*, Tata McGraw Hill, New Delhi 2e, 2002.
[2] Rudramoorthy R., *Heat Transfer-Theory and Problems, Pearson* Education, New Delhi, 2006.
[3] Christopher A., *Essential Heat Transfer*, Pearson Education, New Delhi, 2001.
[4] Nag P.K., *Heat Transfer*, Tata McGraw Hill, New Delhi, 1e, 2006.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	**Instructions Hours per Week**			**Marks**					
5TD652 REFRIGERATION SYSTEMS & COMPONENT DESIGN	**L**	**T**	**P**		**TH**	**CW**	**SW**	**PR**	**Total**
	3	1	2	**Max**	100	50	50	50	250
Duration of Theory Paper: 3 Hours				**Min**	50	25	25	25	125

Objectives & Pre requisites:

The basic objective of the subject is to impart the basics of refrigeration and Air conditioning equipment design and theory. Fundamentals of thermodynamics, refrigeration cycles Psychrometry. Pre requisites are Refrigeration & Air Conditioning.

COURSE CONTENTS

UNIT-1

Refrigeration Cycles

Vapor Compression Cycle, Multi-pressure Systems, Air Refrigeration Cycles, Systems Equilibrium and Cycling Controls, Classification of Refrigerants, Refrigerant Properties, Oil Compatibility, Blends, Eco Friendly Refrigerants. Vapor Absorption Systems, Steam Jet Refrigeration, Thermo Electric Refrigeration.

UNIT -2

Compressors and Expanders

Refrigeration Compressors, Compressors types and Control, Expansion Devices. Valves, Receivers, Oil Trap, Oil Regenerators, Driers and Strainers, Accumulator. Functional Aspects of the above components & accessories.

UNIT -3

Optimum Cooling Water Rate and Velocity Heat Exchange Devices

Types of heat exchangers, Condensers: Condensers Types Design, estimation of heat transfer coefficient, Optimum Cooling Water Rate and Velocity Fouling factor, Friction factor. Wilson plots, BIS Standards, Optimization studies. Evaporators: types of evaporators, Cooling towers: Types, Air Washer, Selection of pumps and fans, Energy conservation.

UNIT -4

Design of Air-conditioning Systems

Moist Air, Psychrometric Chart and Processes, Cooling Load Estimation, Controls of Temperature, Humidity and Airflow. Flow through Ducts, Losses, Duct Design – Equal Friction Methods. Indoor Air Quality, Thermal Insulation, Water Piping in Chilled Water Systems, Construction Details of Room Air Conditioner – Window Type, Package Type, Split Type Central Units – Air Distribution Devices – Air Circuits – Air Supply System.

UNIT -5

Fans, Blowers and Compressors

Turbo machines, Performance characteristics, fan laws, Dimensionless parameters, Specific speed, centrifugal, axial, mixed flow, Axial flow machines. Centrifugal Blowers: characteristic curves, velocity triangles, losses and efficiency, flow through impellers, casing, diffusers, cross-flow fans. Axial flow fans: Rotor design, airfoil theory, vortex theory, cascade effects, degree of reaction, surge and stall, stator and casing, mixed flow impellers.

BOOKS RECOMMENDED:

[1] Ozisik, M.N., *Design of Heat exchangers, condensers and evaporators*, John Wiley, New York, 1e, 1985.
[2] Nicholas Cheremisioff, *Cooling tower*, Ann Arbor Science pub., 1e, 1981.
[3] W.F. Stoecker, *Refrigeration and Air conditioning*, McGraw-Hill Book Company, 1e, 1985.
[4] Austin H. Church, *Centrifugal pumps and blowers*, John Wiley and Sons, 1e, 1980.
[5] *Carrier Air conditioning Co., Handbook of Air conditioning systems design*, McGraw-Hill, 1e, 1985.
[6] C.P. Arora, *Refrigeration and Air conditioning*, Tata McGraw-Hill Pub. Company, New Delhi, 4e, 2006.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT653 MACHINERY FAULT DIAGNOSIS &SIGNAL PROCESSING	L	T	P		TH	CW	SW	PR	Total
	3	1	2	Max	100	50	50	50	250
Duration of Theory Paper: **3 Hours**				Min	50	25	25	25	125

Objectives & Pre requisites:
The basic objective of the subject is to deal with the analysis of faults generated inside the machine during the operations. The subject provides the basic knowledge of the methods used for the prevention of the faults and also the approach for analyzing the signals generated during the faulty condition of the machine. The Pre requisites are Tribology and Vibration.

COURSE CONTENTS

UNIT- 1
Introduction to Diagnostic Maintenance and Condition Monitoring
Introduction to condition based maintenance, applications and economic benefits, signature analysis-online & offline technique, various condition monitoring techniques, levels condition monitoring, fault detection and diagnosis.

UNIT- 2
Fault Diagnosis using Vibration Monitoring
Vibration monitoring and analysis, shock pulse methods, noise monitoring, envelope detection technique, types of vibration test, field balancing, case studies on vibration based condition monitoring.

UNIT- 3
Noise Monitoring & Control
Introduction to noise, properties of noise, loudness and weighting networks, octave and FFT analysis, impulsive noise, instrumentation for noise measurement and analysis, sound power, sound intensity, noise source location, noise diagnostics, noise monitoring of machines with example, cepstrum analysis, noise control methods, maintenance and noise reduction, vehicle and machinery noise, noise standards, case studies.

UNIT-4
Advanced Methods of Condition Monitoring
Oil analysis including wear debris and contaminant monitoring, performance monitoring, non-destructive techniques, IR-Thermography, ultrasonic monitoring, reliability centred maintenance, higher order spectrum/advanced signal processing.

UNIT- 5
Computer Aided Monitoring
Application and choice of the methods, computer aided monitoring including experts system like artificial neural network, fuzzy logic and other optimizing techniques, practical applications and case studies on computer based condition monitoring.

BOOKS RECOMMENDED:

[1] Ramamurthy V.,*Mechanical Vibration Practice with Basic Theory* ,Narosa Publication House, New Delhi 1e,2002.
[2] Rao J S & Gupta K. *Introductory Course on Theory and Practice of Mechanical Vibration* ,New Age Publisher, New Delhi, 2e, 2002.
[3] Rao J S, *Vibratory Condition Monitoring of Machine*, Narosa Publishing House, New Delhi, 1e,2002.
[4] Mishra R C & Pathak K., *Maintenance Engineering & Management*, Printice Hall of India, New Delhi, 1e , 2002.
[5] Gopalkrishnan P. & Banerji AB, *Maintenance & Spare Part Management*, Printice Hall of India, New Delhi, 3e,2002.
[6] Hand Book of Condition Monitoring by BKN Rao, UK.

LABORATORY EXPERIMENTS:

1. Case studies based on vibration based condition monitoring.
2. Experimental analysis of Noise based condition monitoring.
3. Experimental analysis of faults using IR-Thermography .
4. Experimental analysis of faults using Non- Destructive methods.
5. Case studies on computer aided fault diagnosis.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT654 MACHINE VIBRATIONS ANALYSIS	L	T	P		TH	CW	SW	PR	Total
	3	1	2	Max	100	50	50	50	250
Duration of Theory Paper: **3 Hours**				Min	50	25	25	25	125

Objectives & Pre requisites: The objective of the subject is to deal with machine vibration analysis techniques and advanced areas of vibrations of machine elements based on Undamped and Damped Free Vibrations for single degree of freedom systems, Multi-degree of Freedom and Continuous Systems . Pre requisites are Theory of vibrations , Machine Design I and Machine Design II.

COURSE CONTENTS

UNIT-1

Review: Fundamentals of Vibration

Main causes, Advantages and Disadvantages. Vector method of representing Harmonic motion. Characteristics of vibration. Harmonic analysis. Beats Phenomenon. Work done by harmonic forces on harmonic motion. Periodic, non-harmonic functions: Fourier Series analysis, Evaluation of coefficients of Fourier series. Elements of vibratory system. Lumped and distributed parameter systems.

UNIT -2

Systems with single and two Degrees of Freedom

Forced harmonic vibration: vector representation of forces. Excitation due to Rotating and Reciprocating unbalance. Vibration isolation, Force transmissibility. Motion transmissibility: absolute motion of mass and relative motion of mass. Undamped free vibrations and Principal Modes of vibration. Torsional vibrations. Forced Undamped vibrations with harmonic excitation.

UNIT -3

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.

UNIT -4

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 -5

Numerical Integration methods in Vibration Analysis

Introduction, Finite Difference Method, Runge-Kutta Method for single degrees of freedom systems, Houbolt method , Finite Difference method for continuous systems.

BOOKS RECOMMENDED:

[1] Thomson W.T., *Theory of Vibration with Applications*, CBS Pub. And Distributors.
[2] Morse T., and Hinkle, *Mechanical Vibration*, Prentice Hall of India Pvt. Ltd.
[3] Singiresu S. Rao, *Mechanical Vibrations*, Pearson Education.,2005
[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.

LABORATORY EXPERIMENTS:

1. Performance Analysis of single degree of systems.
2. Performance Analysis of two degree of systems.
3. Performance Analysis of multi degree of systems.
4. Study of vibration signature analysis methods.
5. Study of vibration measuring instruments.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT655 APPLIED ELASTICITY AND PLASTICITY	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives:
With this subject, the students get knowledge of the various Mechanical engineering materials property as well as behavior of material under Elastic & Plastic zone with different plane of surface.

Prerequisite: Strength of Material, Material Science**.**

COURSE CONTENTS

UNIT - 1
Elasticity
Analysis of stress and strain relationship – Generalized Hook's law, Plane stress and plane strain problems, The state of strain at a point, Basic equations of elasticity, Methods of solution of elasticity problems.

UNIT- 2
Two-Dimensional Problems in Cartesian Co-Ordinates
Two dimensional problems in Cartesian and polar co-ordinates for simple problems, Airy's stress function, Bi harmonic equation, Saint Venant's Principle, Thick cylinder, Bending of curve bars , Simply supported rectangular beam under a triangular load, Fourier series, Complex potentials, Cauchy integral method , Fourier Transform Method, Real potential methods.

UNIT-3
Torsion of Non Circular Section
Methods of analysis, Membrane analogy, Torsion of thin rectangular section and hollow thin walled section, St. Venant's theory, Torsion of hollow cross-sections, Torsion of thin – walled tubes, Torsion of hollow bars, Analogous methods, Torsion of bars of variable diameter.

UNIT-4
Numerical and Energy Methods
Principle of Virtual Work-Energy theorem, Rayleigh Ritz method, Deflection of beams problems, Finite difference method, Rayleigh's method, Finite element method.

UNIT-5
Plasticity
Physical assumption , Mechanical models, Kelvin and Maxwell model, Viscous elasticity, Friction and Coulomb models, Parallel and Hybrid models, Applications, Criterion of Yielding, Yield surface, Flow rule, Elastic – Plastic problem in bending, Torsion and Thick cylinders, Introduction to Fracture mechanics, Wave propagation in plastic materials. Theory and application of slip line field, Bound theorem, Plastic anisotropic large deformation.

BOOKS RECOMMENDED:

[1] Timoshenko S., *Theory of Elasticity*, Mc Graw Hill Book Co., Newyork1988.
[2]. Singh S, *Theory of Elasticity*, Khanna Publishers, New Delhi.1988.
[3] Singh S., *Theory of Plasticity*, Khanna Publishers, New Delhi.1988.
[4] Chakrabarty J., *"Applied Plasticity",* Springer New Yark, 1st ed. 2000.
[5] Hoffman, *"Theory of Plasticity",* Mc Graw Hill, 2nd ed. 1985.
[6] Johnson, *"Engineering plasticity",* Van Nostrand, 1st ed. 1983.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT656 COMPUTER AIDED MECHANISM DESIGN	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives: To understand the application of Computers in Mechanism Analysis and Design of Machine Elements.

Pre requisites: Engineering Drawing, Programming with C++ / Visual Basic / Java.

COURSE CONTENTS

UNIT 1

Introduction

Fundamentals of CAD: Introduction: Design Process: Application of computers in design: Creating manufacturing database: benefits of CAD. Computer Hardware: Graphic input devices; display devices; Graphic output devices; Central processing unit (CPU), Workstations.

UNIT 2

Computer Graphics

CAD software and Database: Software configuration of a graphics system, Output primitives frame buffer – Bresenham's Algorithm – Line – Circle – function of graphics software - 2D & 3D transformation – Translation – scaling – Rotation – Homogeneous coordinate – Concatenation clipping algorithm.

UNIT 3

Techniques For Geometric Modeling

Geometric modelling: curves and surfaces- Representation, Wire Frame models, Intrinsic and parametric representations, analytic and parametric curves and surfaces, Manipulations of curves and surfaces.

Geometric Modeling: Solids

Solid models, Fundamentals of Solid Modeling, Half -spaces, Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Sweep Representation, Analytic Solid Modeling, Solid Manipulations.

UNIT 4

DATA EXCHANGE STANDARDS

Graphics standards – GKS, Data exchanger standards – IGES – STEP - DXF – Concept of data storage for solid models. Mechanisms And Machines - Review of various types of mechanisms and machine linkages, Conventional methods of velocity and acceleration analysis.

UNIT 5

INDRODUCTION TO PARAMETRIC MODELING

Computer Aided Analysis and Synthesis of Mechanisms, Writing of interactive computer program for design of simple machine elements and parametric drawing / model creation using C / C++ / Visual Basic / Java etc.

BOOKS RECOMMENDED:

[1] Rogers D.F., *Mathematical Elements in Computer Graphics*, McGraw – Hill Book Company, NewYork, 1976.
[2] Zeid I., *Mastering CAD / CAM*, TataMcGraw Hill Edition, New Delhi, 2005.
[3] Rooney J., *Computer Aided Design*, Pitman/Open University, London.
[4] Krishnamoorathy C.S., *Computer Aided Design (Software and Analysis Tools)*, Narosa Pub House, New Delhi.
[5] S. S. Rattan, *Theory of Machines*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) Full Time					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT657 EXPERIMENTAL STRESS ANALYSIS	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives & Pre requisites:
The basic objective of the subject is to deal fundamentals of stress analysis techniques. The subject is useful in understanding the behavior of material under the load and distribution of stress inside the material. The Pre requisites are material science, machine design and measurement and control.

COURSE CONTENTS

UNIT- 1
Introduction
Introduction to theory of elasticity. General principles governing the approach to experimental stress analysis technique. Principal of measurements. Accuracy, Sensitivity and range of measurement.

UNIT- 2
Polariscope & Extensometer
Plain polariscope, circular polariscope, white light illumination, analysis of photoelastic data, Moira Method, Mechanism of formation of Moira fringe-geometrical approach to Moire fringe analysis-displacement field approach to Moire fringe analysis., Mechanical , Optical , Acoustical and Electrical extensometer and their uses, advantages and disadvantages.

UNIT- 3
Electrical Resistance Strain Gauge
Principal of operation and requirement, types and their uses, Material of strain gauge, Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators, strain gauge adhesive and mounting methods.

UNIT-4
Photoelasticity
Two dimensional photoelasticity. Concepts of light-photo-elastic effects, stress optic law, Interpretation of fringe pattern, compensation and separation technique, photoelastic material, Introduction to three dimensional photoelasticity, digital photoelasticity, Effects of stressed model in a plane polariscope.

UNIT- 5
Non Destructive Testing
Fundamentals of NDT, Radiography, Ultrasonic, Magnetic particle inspection, Fluorescent penetrate technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Holography, Ultrasonic, C-Scan, Thermography, Fibre optic Sensors.

BOOKS RECOMMENDED:

[1] Dally J.W., *Experimental Stress Anaysis*, Mc Graw Hill Inc., New York, 1978
[2] Hetyenyi M., *Hand Book of Experimental Stress Analysis*, John Wiley and Sons Inc., New York, 1972.
[3] Srinath L.S., *Experimental Stress Analysis*, Tata Mc Graw Hill, New Delhi, 1984.
[4] Singh S., *Experimental Stress Analysis*, Khanna Publication, 2001.
[5] Mubeen A., *Machine Design*, , Khanna Publications(P) Ltd.,2004.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT658 AUTOMOTIVE SYSTEM ANALYSIS & DESIGN	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: 3 Hours				Min	50	25	-	-	75

Objectives: The objective is to understand the principles and working of different systems of Automobiles & design principal & its applications.

Pre requisites: Machine Design and Strength of Material**.**

COURSE CONTENT

UNIT-1

Design for Tool Drive

Design of machine tools, machine tools motions, transmission-rotation in to rotation, rotation in to translation, kinematic-structures of machine tools: elementary, complex and compound structure elementary, complex and compound structure, kinematic-features of gear shapers and gear hobbing machine.

UNIT-2

Transmission System

Requirements Clutches, Toque converters, Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber, Steering geometry, Ackerman mechanism.

UNIT-3

Electrical and Control Systems

Types of storage battery, Construction and operation of lead acid battery, Testing of battery, Principle & operation of starting mechanism, Electric fuel gauge, Fuel pump, Horn, Wiper, Lighting system, Head light dazzling, Signaling devices and circuit, Battery operated vehicles. Microprocessor based control system for automobiles, Car air conditioning systems and components, Indian standards for automotive vehicles exhaust emission Bharat and Euro norms, Indian Motor vehicle act- preliminary information.

UNIT-4

Chassis and Body Engineering

Chassis classification, Types of frames, Vehicle body types & construction, Body materials, Driver's visibility and methods for improvement, Safety aspects of vehicles, Location of engine, Front wheel and rear wheel drive, Performance of Vehicle.

UNIT-5

Suspension System

Vehicle Dynamics and requirement of suspension , Suspension types & construction, Shock absorber, Types of leaf springs coil spring, Air spring, Torsion bar, Location of shackles, Brakes-classification & construction, Mechanical, Hydraulic & Pneumatic power brake systems, Air-bleeding of Hydraulic brakes, ABS, Performance- Braking efforts, Efficiency, Stopping Distance & time, tendency of overturning.

BOOKS RECOMMENDED:

[1] Singh Kirpal, *Automobile Engineering*, Vol.1, Standard Pub, 9e, 2003.
[2] Giri N.K., *Automotive Technology*, Khanna Pub, 4e, 2009.
[3] Newton & Steeds, *Automobile Engineering*, Butterworth Int, 1999.
[4] Heitner Joseph, *Automotive Mechanics*, Principles and Practices, East-West Pub., 2001.
[5] Crouse W.H., *Automotive series Part-I to VI*, Tata Mc Graw hill, 9e, 2004.

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year (Design & Thermal Engg.) (Full Time)					
Subject Code & Name	Instructions Hours per Week			Marks					
5DT659 COGENERATION AND WASTE HEAT RECOVERY	L	T	P		TH	CW	SW	PR	Total
	3	1	-	Max	100	50	-	-	150
Duration of Theory Paper: **3 Hours**				Min	50	25	-	-	75

Objectives & Pre requisites:
The objective of the subject is to provide an understanding of energy conservation in various thermal engineering applications. The Pre requisites are Thermodynamics, Fluid Mechanics and Heat Transfer.

COURSE CONTENT

UNIT- 1
Energy Usage and Conservation
Energy: forms and Conversion; Patterns of energy use; potential for energy conservation; optimum use of energy resources; total energy approach.

UNIT- 2
Thermodynamic Cycles and Cogeneration
Review of Various Thermodynamic cycles; Coupled cycles; Systems approach to a thermal engineering application based plants; combined plants and cogeneration systems.

UNIT- 3
Energy Storage
Energy Storage Systems: thermal electrical, magnetic and chemical energy storage systems, Need for energy storage; Utilization of industrial waste heat: gas-to-gas, gas-to-liquid and liquid-to-liquid heat recovery systems.

UNIT-4
Waste Heat Recovery
Heat Recovery systems; Recuperators and regenerators; heat pipes; waste heat boilers; fluidized bed heat recovery; shell and tube heat exchangers

UNIT- 5
Heat Recovery Sources
Sources of heat recovery; Prime mover exhausts; incineration plants; heat pump systems; thermoelectric devices. Utilization of low grade rejected heat from power plants.

BOOKS RECOMMENDED:

[1] Reay, D. A., *Heat Recovery Systems*, London, 1979.
[2] Boyce, M, P,. *Handbook for Cogeneration and Combined Cycle Power Plants*, ASME 2002
[3] Fin David, Cogeneration: A Users Guide, IET
[4] Daiment, *Energy Systems*, Longman, UK