

Mechanical Engineering

Semester VII

Teaching Scheme

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
HS 4001	Infrastructure Planning and Management	3	0	0	4
ME 4001	Industrial Hydraulics and Automation	3	1	3	6
ME 4501	B. Tech Project I	0	0	3	4
ME 400X	Open Elective - I	3	0	0	4
ME 400X	Open Elective - II	3	0	0	4
	Total	12	1	6	22

Open Electives

Course Code	Course Name	Lecture hours	Tutorial hours	Practical hours	Credit
ME 4002	Computational Heat Transfer	3	0	0	4
ME 4003	Power Plant Engineering	3	0	0	4

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I	Course Code	HS 4001			
II	Course Title	Infrastructure Planning and Management			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite(If any for the student)	Completed introductory course in Economics			
V	Course Content	<p>Basics of Infrastructure Understanding of Infrastructure, Types of Infrastructure, Role of Infrastructure, Infrastructure scenarios in India and problems of Infrastructure Development in India Urban Infrastructure in India An overview of Urban Infrastructure in India, Models of Urban Governance, Municipal Finances, Major municipal reforms, Framework for Urban Infrastructure Delivery, Quality of water supply and services, Models of Urban governance, Municipal governance, Urban renewal projects Rural Infrastructure in India Road development scenario in India, The state of rural infrastructure in India, Infrastructure and rural growth, Characteristics of rural India, Strategies to improve infrastructure in rural areas, Government initiatives for rural infrastructure improvement, Role of private sector in infrastructure development. Key Issues of provision of Infrastructure system Leadership and strategy issues in the funding, financing, development and delivery of new infrastructure in the country Issues regarding the design and technology to be used, priority of location of infrastructure development, cost and level of risks that we have to tolerate Infrastructure Investment and Finance Background behind investment and funding required for the financial planning of the infrastructure Various forms of funding available for infrastructure (public, private and combined) Privatization in Infrastructure Projects Overview of history of privatization, The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Privatization of road Transportation Infrastructure in India Supply and Demand for Infrastructure Issues of demand and supply management Evaluation of Infrastructure Investments Cost- benefit analysis Stages of an infrastructure project Lifecycle Risk and Risk management framework for infrastructure project implementation</p> <ul style="list-style-type: none"> • Legal contractual Issues in Infrastructure Projects • Environmental issues in infrastructure development • Challenges in Construction and Maintenance of Infrastructure <p>Infrastructure Asset Management Management of infrastructure both at individual as well as network/system level Concepts, theory and methods for infrastructure asset management and asset performance requirements Smart Infrastructure The will be done via the case studies on smart cities. These case studies will include both Indian and international cases, with emphasis on Indian cases.</p>			

VI	Text/References	<ol style="list-style-type: none"> 1. Goodman AS, Hastak M (2006). Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw Hill ASCE Press. Chapter 1 2. World Bank (2012). Transformation through Infrastructure. Selected pages handed out in class. 3. World Bank (2006). Infrastructure at the Crossroads: Lessons from 20 Years of World Bank Experience. 4. ULI and Ernst & Young (2013) Infrastructure 2013: Global Priorities, Global Insights, The Urban Land Institute, Washington DC. Available free: initiative/infrastructure-2013-explores-global-infrastructure-priorities/ 5. Lee (2009) New Delhi Water and Power. Harvard Kennedy School of Government Case Program #1891
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I	Course Code	ME 4001			
II	Course Title	Industrial Hydraulics and Automation			
III	Credit Structure	L	T	P	C
		3	1	3	6
IV	Prerequisite(If any for the student)	Fluid Mechanics			
V	Course Content	<p>Introduction to Industrial Hydraulic Systems. Comparison with Pneumatics. Fields of applications. Advantages & limitations.</p> <p>Review of basic fluid mechanics.Pumps-types of positive displacement pumps. Relief & safety Valve. Power Pack. Hydraulic oils. Pipes.</p> <p>Valves-Pressure, flow & direction Control valves. Types & applications.</p> <p>Actuators- Linear, rotary & oscillating. Types, Construction. Single-acting & double-acting. Speed control- of actuators. Selection of actuator size. Auxiliary devices accumulators, Intensifiers .Developing simple hydraulic circuits. Electro-hydraulic systems. Basics of automation. Sequencing through the ladder diagrams. Truth table & Boolean Algebra. PLCs.</p> <p>Proportional Valves & their applications. Introduction to servo Control.Hydraulic & Electro-hydraulic Servo Systems</p>			
VI	Text/References	<ol style="list-style-type: none"> 1. Oil Hydraulic Systems-Principles & Maintenance. S.R. Majumdar, Tata McGraw Hill, New Delhi. 2. Industrial Hydraulic Technology. Parker Hannifin Corporation Training Modules. 3. Industrial Hydraulics - Phippenjer Industrial press 4. Fluid Power and Control Systems. Fitch E C McGraw Hill Book Co. 			

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I	Course Code	ME 4501			
II	Course Title	B.Tech Project - I			
III	Credit Structure	L	T	P	C
		0	0	3	4
IV	Prerequisite(If any for the student)	Nil			
V	Course Content	Students are required to carry out project under the supervision of faculty members for the defined objectives. The project includes the thesis submission and viva-voice.			
VI	Text/References				

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I	Course Code	ME 4002			
II	Course Title	Open Elective I Computational Heat Transfer			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite(If any for the student)	Fluid Mechanics and Heat Transfer Fortran, Matlab or C Programming			
V	Course Content	<p>Mathematical Description of the Physical Phenomena</p> <p>-Governing equations mass, momentum, energy, species, General form of the scalar transport equation, Elliptic, parabolic and hyperbolic equations, Behavior of the scalar transport equation with respect to these equation type Discretization Methods</p> <p>- Methods for deriving discretization equations-finite difference, finite volume and finite element method,</p> <p>Method for solving discretization equations, Consistency, stability and convergence</p> <p>Diffusion Equation</p> <p>- 1D-2D steady diffusion, Source terms, non-linearity, Boundary conditions, interface diffusion coefficient, Under- relaxation, Solution of linear equations (preliminary), Unsteady diffusion, Explicit, Implicit and Crank-Nicolson scheme, Two dimensional conduction, Accuracy, stability and convergence revisited</p> <p>Convection and Diffusion</p> <p>- Steady one-dimensional convection and diffusion, Upwind, exponential, hybrid, power, QUICK scheme, Two-dimensional convection-diffusion, Accuracy of Upwind scheme; false diffusion and dispersion, Boundary conditions Flow Field Calculation</p> <p>- Incompressibility issues and pressure-velocity coupling, Primitive variable versus other methods, Vorticity-stream function formulation, Staggered grid, SIMPLE family of algorithms</p> <p>Multiphase problems</p> <p>Modelling of multiphase problems: enthalpy method, volume of fluid (VOF) and Level Set Methods.</p> <p>Introduction to turbulence modeling</p> <p>Projects/Exercises</p> <p>Solving simplified problems: formulation, discretization with coarse grids, applying appropriate boundary and initial conditions. Solving practical problems through software: writing user sub-routines; post-processing and interpretation of results.</p>			
VI	Text/References	<ol style="list-style-type: none"> 1. S. V. Patankar, "Numerical Heat Transfer and Fluid Flow," Hemisphere Publishing Corporation, 1980. 2. D. A. Anderson, J. C. Tannehill, and R. H. Pletcher, "Computational Fluid Mechanics and Heat Transfer," Hemisphere Publishing Corporation, 1984. 3. J. H. Ferziger and M. Peric, "Computational Methods for Fluid Dynamics", Second Edition, Springer, Berlin, 1999. 4. H. K. Versteeg and W. Malalasekera, "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", 			

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I	Course Code	ME 4003			
II	Course Title	Open Elective II Power Plant Engineering			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite(If any for the student)	Basic thermodynamics, Fluid Mechanics			
V	Course Content	<p>Basics of Turbo-machines, Analysis of Steam Turbines, Gas Turbines, Hydraulic Turbine, Pumps. Elements of Power Plant: General Sources of power, Importance of Central Power Stations, types of power stations steam, nuclear, diesel and hydro Elements of modern power stations.</p> <p>Steam Power Plant: Steam power plants, selection of working medium, Heat Balance in steam cycles, Heat rates, comparison of efficiencies gas loop, fuels and combustion. Boilers and their analysis, Supercritical boilers, mounting and accessories, Condenser-Cooling tower.</p> <p>Hydro Electric power station Classification of Hydro-electric power plants and their applications-Selection of prime movers-Potential power with reference to rainfall and catchments area, Water storage, equipment used in hydroelectric power stations. Characteristics of hydraulic Turbines. Comparison of the factors governing the cost of hydro steam and diesel power stations.</p> <p>Diesel power station Suitability of diesel engines for bulk power, advantages and limitations of diesel, power stations, efficiency and heat balance.</p> <p>Nuclear Power Plant: Evolution of nuclear energy from atoms by fission and fusion. Chain reactions, fission materials, types of reactors, gas cooled, boiling water liquid, metal cooled and fast reactor, arrangements of various elements in a nuclear power station.</p> <p>Gas turbine power plant: Open and closed cycles, Inter-cooling, Reheating and Regenerating-Combined cycle power plant.</p> <p>Idealized and realized load curves, effect of variable load on plant design and Operation variable load operation and load dispatch. Combustion and Firing Methods. Coal handling and preparation-Combustion equipment and firing methods. Power Plant Economics, Indian Energy Scenario, Elements of Electric power systems primary and secondary distribution substations.</p>			
VI	Text/References	<ol style="list-style-type: none"> 1. Nag P.K. 2014. Power Plant Engineering 4 edition Tata McGraw-Hill Pub. Com., New Delhi. (Text Book). 2. R. Yadav, 2000, Steam and Gas Turbines and Power Plant Engineering, 7th Edition, Central Publishing House. (Text Book). <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Arora S.C., Domkundwar S. A Course in Power Plant Engineering, Dhanpat Rai & Co. New Delhi. 			