ME 451 FINITE ELEMENT METHOD

ESE SUMMER 2020 SYLLABUS

COURSE DESCRIPTION:

Course introduces undergraduate students to Finite Element Analysis and Simulation Technique. The course aims at imparting knowledge of Finite Element Analysis and Simulation Technique.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Mathematics, Mechanics of Material and Machine Drawing.

COURSE OBJECTIVE:

The students should able to

1. introduce the concepts of Mathematical Modelling of Engineering Problems.
2. study the applicability of FEM to a range of Engineering Problems.
3. acquaint with applications of numerical techniques for solving problems.

COURSE OUTCOMES:

On completion of this course, student shall be able to:

1. Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer.
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems.
4. Implement and solve the finite element formulations using MATLAB.

Introduction to FEA

Introductory Concepts: Introduction to FEM , Discretization going from part to whole approach, Physical problem, mathematical models and finite element solution, FEA as an integral part of CAD. FEM Software's - Pre-processing, processing and post processing. Advantages and disadvantages of FEM.

Conventional Numerical Methods- Finite difference method, weighted residual techniques, method of Least squares, Galerkin methods, Rayleigh- Ritz method, and Boundary Value problems, Displacement methods, equilibrium method.

Finite Elements Types: One dimensional element such as two nodded & three nodded Spar or truss element. Two and three dimensional elements, triangular, rectangular quadrilateral.

One-Dimensional Analysis

Discretization. Derivation of Shape functions, interpolation function, Stiffness matrices, global stiffness matrix, application of boundary, and force vectors.

Assembly of Matrices - solution of problems in one dimensional structural analysis, Stepped and Taper Bars, Torsion of circular shaft, thin wall tubes steady state heat conduction& convection, laminar pipe flow.

FEM direct approach elements stiffness, potential energy approach, treatment of boundary conditions, temperature effects.

Analysis of Plane Trusses, Analysis of Beams.

Two-Dimensional Analysis
Introduction. Finite element analysis for two dimensional problems. Natural coordinates and coordinates transformations, Derivation of shape functions for triangular element. Application of heat transfer, analysis of structural vibration. Finite element formation of beams.

Simulation Theory and Application
System models and studies: - concepts of a system, system environment, stochastic activities, continuous and discrete systems, system modelling, types of models, principles used in modelling, types of system studies.
System simulation:-The techniques of simulation, Monte Carlo method, comparison of simulation and analytical methods, analog computers and methods, hybrid computer, simulators, continuous system simulation languages, system dynamics, growth models, logistic curves, multi segments models, probability concepts in simulation, system simulation, events, representation of time, arrival pattern.

Books

Text Book

1. Seshu P, "Textbook of Finite Element Analysis", PHI, Eastern Economy Edition, 2012
2. Reddy, J. N., "Finite Element Method in Engineering", Tata McGraw Hill, 3rd edition 2007.

Reference Books

1. Singiresu S. Rao, "Finite element Method in Engineering", 5th edition 2012
2. Zeincowicz, "The Finite Element Method for Solid and Structural Mechanics", 4th Edition, 2007
3. C. S. Krishnamoorthy., "Finite element analysis", TMH, 2nd edition 2007
4. Klaus-Jurgen Bhate, "Finite element analysis", PHI.
5. Kenneth Lt. Huebner, "The FEM for Engineers", Wiley India Pvt. Ltd. New Delhi, 4th edition, 2001

R. V. Mahajan
Course-Coordinator

ME 452 PROJECT AND FINANCIAL MANAGEMENT

E SUMMER 2020 SYLLABUS

OURSE DESCRIPTION:

This course introduces undergraduate students to imparting knowledge of project & business management. The background required a sound knowledge of network technique, organization structure, Financial and material management.

COURSE OBJECTIVES

Student should be able to

1. Provide about project and its management.
2. Develop knowledge about organization and impart knowledge about functioning of management.
3. Develop knowledge about financial management techniques.

COURSE OUTCOME

On completion of this course student should be able to:

1. Develop knowledge of project management and statistical tools used in its.
2. Helped to understand the various functions of management along with its types.
3. Develop knowledge about Capital cost and cost control.

COURSE CONTENTS

Project Management

Introduction to project management, Concept of project management, Managerial function at different organizational levels, Types of projects, Project identification, scheduling, Monitoring, Control, Basic tool & techniques for projects scheduling Bar chart, Project life cycle curves, Line balancing, Problems on Line balancing.

Project statistic technique

Introduction of Network technique, Fundamental concept and network models, construction of network diagrams, Application of network analysis, definition of PERT and CPM, comparison between CPM and PERT, Critical path method with problem, programme evaluation and review techniques with problem, time cost problem (crash) with PERT.

Business management

Introduction to management, Concept of management, The function of management, importance of management Forms of business organisation, Concept of Ownership Organization, Types of ownership, Individual Ownership, Partnership organization, joint stock companies, types of stock companies,Co-operative Organisations, various types of co-operative societies, Public sector organization, State ownership, public cooperation, choice of form of organisation, comparative evaluation of different forms of business ownership.

Financial Management

Introduction, Definition of financial management, functions of financial management, Sources of Funds, Capital, classification of capital, working capital, need for working capital, assessment of working capital, Factors affecting working capital, Sources of finance (Shares, debentures, loans from banks, trade credit public deposits financial institutions). Cost and cost control: Elements of cost, direct cost, indirect cost, variable and fixed cost, cost control technique, marginal costing, break even analysis.

Text Books

1. Production(Operation)Management, L. C. Jhamb , Everest publishing house
2. Theory And Problems in Production and Operations Management, Chary, 2nd Reprint, Tata

McGraw Hill Publishing Co. New Delhi., 1996.
3. Production & Operations Management, Nair, N.G., Tata McGraw Hill Publishing Co. N
1997.

References Books

1. Fundamentals of Financial Management, Chadra Presanna, Tata McGraw Hill New Delhi,1994.
2. Marketing Management, Kolter Philip, Prentice-hall of India,1988.
3. Fundamental of Financial Management, Vyuptakesh Sharan.,Pearson Education
4. Industrial engineering and production management, Martand telsang,1st Edition reprint 2013-S.chand & company ltd. New Delhi, 2013
5. Financial Management, M.K.Khan & P.K.Jain, Tata McGraw Hill Publishing Co. New Delhi.
6. Business Management, J.P.Bose, S.Talukdar, New Central Agencies (P) Ltd.

for 9/9/2020

ME 453 (A) Elective-II
POWERPLANT ENFINEERING

UMMER 2020 SYLLABUS

COURSE DESCRIPTION:
To understand the various components, operations and applications of different types of power plants.

COURSE OBJECTIVES :
Student should be able to

1. Define terms and factors associated with power plant economics.
2. Calculate present worth, depreciation cost of different types of power plants.
3. List types, principles of operations, components and applications of steam turbine power plants, steam generators.
4. Describe basic working principles of gas turbine and diesel engine power plants.
5. Define the performance characteristics and components of such power plants.
6. List the principal components and types of nuclear reactors.
7. Understand the basics of pollution from power plants, thermal pollution, air pollution, and its environmental effects.
8. Understand the various devices for energy storage.

COURSE OUTCOMES:
On completion of this course student should be able to:

1. Analyze the economics of power generation.
2. Understand basics of steam turbine power plants.
3. knowledge of power generation systems like thermal power, hydraulic power, nuclear power
4. knowledge of environmental impact of power plant and their remedies
5. Knowledge of various energy storage devices.

COURSE CONTENTS:

Thermal Power Plants
Thermal power stations. Main components and working of power stations, thermodynamics cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup water. Choice of pressure of steam generation and steam temperature, selection of appropriate vacuum economizer, air pre-heater, feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant, heat balance and efficiency. Boilers and steam generation, general classification, fire tube and water tube boilers, natural circulation and forced circulation boilers, high pressure, high temperature boilers, supercritical pressure boilers, boiler mounting and accessories, feed pumps, economizers, super heaters, air pre-heaters; boiler furnaces, heat generation rates, water walls.

Diesel and Gas turbine Power Plant
Diesel power plants: Diesel engine performance and operation, plant layout, log sheets, selections of engine size. b Gas turbine plants: Plant layout, methods of improving output and performance fuel and fuel systems, methods of testing, open and closed cycle plants, operating characteristics.

Renewable Energy Power Plant
Basic bio-conversion mechanism; source of waste; simple digester; composition and calorific values of bio-gas. Wind energy generation; Special characteristics; Turbine parameters and optimum operation; Electrical power generation from wind/tidal energy. c Ocean thermal energy conversion; Geothermal energy-hot springs and steam injection; Power plant based on OTEC and geothermal springs.

Solar Energy Power Plant
Energy from the sun: Techniques of collection; Storage and utilisation; Types of solar collectors; Selective surfaces; Solar thermal processes; Heating; Cooling; Drying; Power generation, etc.
Direct energy conversion methods: Photoelectric, thermoelectric, thermionic, MHD (magneto-hydrodynamics) and electro-chemical devices; Solar cells, Solar Concentrators

Text Book

1. P K Nag, "Power Plant Engineering", Tata McGraw Hill
2. R K Rajput, "Power Plant Engineering", Laxmi Publications (P) Ltd.
3. Arora and Domkundwar,"A Course in Power Plant Engineering", Dhanpat Rai & Co., De
4. R. Yadav - Steam and Gas turbines, central publishing house, Allahabad

Reference Books

1. M. M. El Wakil, " Power plant technology", Tata McGraw Hill
2. M Khopkar, " Environmental Pollution : Monitoring and Control", New Age International Publishers
3. Dr B B Parulekar, " Energy Technology", Khanna Publishers, Delhi
4. A K Raja, "Power Plant Engineering", New Age International Publishers, Delhi

S & Learning
Course - Coordinator

ESE SUMMER

ME 454 (C) Elective-III TRIBOLOGY

ESE SUMMER 2020 SYLLABUS

COURSE DESCRIPTION:

The course aim of imparting the knowledge of Tribology. The background required includes knowledge of mathematics, chemistry, engineering materials, and fluid mechanics. The objective of the course is to understand the tribological concept, bearing design and its application, lubrication practices

DESIRABLE AWARENESS/SKILLS:

Fundamental Knowledge of Physics, Chemistry, Engineering Math, Fluid Mechanics, Machine Design and Engineering materials.

COURSE OBJECTIVE:

The students should able to

1. To know about properties of lubricants, modes of lubrication, additives etc.
2. To Select suitable/proper grade lubricant for specific application.
3. To Apply the basic theories of friction, wear and lubrications about frictional behaviour commonly encountered sliding surfaces.
4. To suggest an explanation to the cause of tribological failures.
5. To design bearing, friction, wear test rig for laboratory purposes.

COURSE OUTCOMES:

On completion of this course student should be able to:

1. Have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces.
2. Have a mastery of the friction/lubrication mechanisms and know how to apply them to the practical engineering problem.
3. To enhance students awareness of tribological issues in the design of machine components, such as rolling element bearings, journal bearings, thrust bearings, seals and braking systems

COURSE CONTENT:

Introduction to Tribology, tribology in design, tribology in industry, Lubricants Properties-physical and chemical, Types of additives, extreme pressure lubricants, Lubrication-introduction, basic modes of lubrication, Tribology of sliding contact bearings and Rolling contact bearings.

Wear, Friction and Lubrication Wear- Mechanism of wear, types of wear, measurement of wear (wear testing and wear debris analysis). Theory of wear, factor affecting on wear rate. Friction: Sources of friction, Influence of roughness of friction, coefficient of friction, Friction of metals, kinds and measurements of frictions, stick slip oscillation (Vibration) and its elimination surfaces, static and kinematics coefficient of friction, Lubrication: Types of lubricants, lubricant coating, lubrication mechanism, squeeze film, hydrodynamic, elasto-hydrodynamic lubrication

Hydrodynamic Bearings: Mechanism of pressure development in oil film in hydrodynamic lubrication, Solution of Generalized Reynold's equation, Infinitely long journal bearing, Infinitely short journal bearing, thrust bearing, Sommerfeld number, Raimondi and Boyd method, Temperature rise, Parameters of bearing design-Length to diameter ratio, Unit bearing pressure, Optimal Radial clearance and minimum oil film thickness.

Gas Lubrication: Introduction, Reynolds equation for gas lubrication, self-acting gas bearing, Merits and demerits of gas lubrication, Applications, Lubrication in metal working: Rolling, Forging, Drawing and extrusion Bearing Materials and bearing constructions. Oil seals and shields, Gaskets.

Text Book

1. A Text Book of "Tribology" by Hg Phakatkar, Rr Ghorpade, Second Revised Edition, Nirali Prakashan, Pune, Aug 2011.
2. A Text Book of "Tribology" by R.B.Patil, First Edition, Tech-Max Publications, Pune, Aug 2009
3. A Text Book of "Introduction to Tribology" by Bharat Bhushan, Second Edition, John Wiley and Sons Publication, NY, 2013.
4. A Text book of "Design of Machine Elements by V.B.Bhandari, Fourth Edition, Tata-McGraw Hill Publication Co. Ltd., Aug 2016

Reference Books

1. "Theory and Practice of Lubrication for Engineers", by Fuller D. D., Vol.1, Issue 4, by John Wiley and Sons Publication. 1984.
2. "The Tribology Hand Book" by Neale M. J, Second Edition, Butterworth-Heinemann, 1996.
3. "Handbook of Tribology" by Bharat Bhushan. First Edition, Krieger Publishing Company,1997

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Course - Coordinator