

STUDY & EVALUATION SCHEME

B. Tech. Mechanical Engineering

4th year

8th Semester

Sl. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total
						Sessional			End Sem. Exam.	
			L	T	P	CT	TA	Total		
Theory Subjects										
1.	IME - 801	Power Plant Engineering	03	01	-	30	20	50	100	150
2.	IME - 802	Mechanical Systems Design	03	01	-	30	20	50	100	150
3.	IME - 803	Project Management	03	01	-	30	20	50	100	150
4.	IEME – 05-	Elective -5	03	01	-	30	20	50	100	150
5.	IEME – 06-	Elective -6	03	01	-	30	20	50	100	150
6.	IME-804	Non-destructive Testing	02	01	-	15	10	25	75	100
Practicals/ Training/ Project										
7.	IME -856	Project	-	-	12	-	50	50	150	200
8.	GP - 801	General Proficiency	-	-	-	-	-	50	-	50
Total			17	06	12	165	160	375	725	1100

Project should be complied by the end of 8th Semester with good report and presentation out of 12 project-periods 3 period per week should be allotted for a group and 9 periods per week should be allotted for the self study, lab and project work.

L – Lecture T – Tutorial P – Practical CT – Class Test TA – Teacher Assessment

Sessional Total = Class Test + Teacher Assessment

Subject Total = Sessional Total + End Semester Examination

LIST OF ELECTIVE SUBJECTS

B.Tech. Mechanical Engineering

Elective –4 (Seventh Semester)

IEME-041	Drilling Technology for Water, Oils and Mineral Exploration
IEME-042	Engineering Materials
IEME-043	Unconventional Manufacturing processes
IEME-044	Total Quality Management (TQM)
IEME-045	Environmental Protection and Management
IEME-046	Product Development and Design
IEME-047	Operations Management Models and Concepts

Elective –5 (Eighth Semester)

IEME-051	Mechanical Vibrations
IEME-052	Advanced Fluid Mechanics
IEME-053	Non-conventional Energy Resources and Utilization *
IEME-054	Concurrent Engineering
IEME-055	Management Information System
IEME-056	Automatic Controls
IEME-057	Concepts of Modern Physics

Elective –6 (Eighth Semester)

IEME-061	Experimental Stress Analysis
IEME-062	Optimization Techniques in Engineering
IEME-063	Industrial Ergonomics
IEME-064	Advanced Dynamics of Machines
IEME-065	Introduction to Nuclear Engineering
IEME-066	Energy Management
IEME-067	Advanced Synthesis of Mechanism
IEME-068	Automation and Robotics

Open Elective Subjects (Seventh Semester) offered by Mechanical Engg. Deptt. for other Branches.

IOE-007	Quality System and Management
IOE-008	Condition Monitoring and Diagnostics
IOE-009	Value Engineering
IOE-018	Nanotechnology
IOE-019	Solar Energy
IOE-020	Human Resource Management

* This subject (IEME-053) will not be available to those students who have already studied similar paper as main subject in their curriculum, with the name Non-Conventional Energy.

POWER PLANT ENGINEERING

IME-801

w.e.f. Session 2015-2016

L T P
3 1 0

UNIT –I

Introduction :

Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, steam generators steam prime movers, steam condensers, water turbines. 3

Energy audit concepts, Energy audit based on 1st law and 2nd law of thermodynamics, Mass & energy balances, Availability Analysis, Evaluation of Energy conserving opoportUNITies, Economic Analysis & life cycle costing 3

Variable Load Problem:

Industrial production and power generation compared, ideal and realized load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem. 2

Power Plant Economics and Selection :

Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit, depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection. 3

UNIT-II

Steam Power Plant :

Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizers and coal burners, combustion system, draft, ash handling system, feed water treatment and condensers and cooling system, turbine, auxiliary systems such as governing, feed water heating, reheating, flange heating and gland leakage. Trouble shooting and remedies. 8

UNIT-III

Diesel Power Plant :

General layout. Performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, cooling system, diesel plant operation and efficiency, heat balance, trouble shooting and remedies. 2

Gas Turbine Power Plant :

Elements of gas turbine power plants, regeneration and reheating cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, performance and trouble shooting and their remedies. Combined cycle power plants. 6

UNIT-IV

Nuclear Power Plant :

Principal of nuclear energy, basic components of nuclear reactos, nuclear power station, trouble shooting and remedies.

Hydro Electric Station :

Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run-off size of plant and choice of UNIT, operation and maintenance, hydro systems, interconnected systems, trouble shooting and remedies. 3

Introduction to non conventional power plants (Solar, wind, geothermal, tidal) 4

UNIT-V

Electrical System :

Generators and generator cooling, transformers and their cooling, bus bar, etc. 2

Instrumentation :

Purpose, classification, selection and application, recorders and their use, 2

Listing of various control rooms. 2

Pollution due to power generation 2

Books:

1. Power Plant Engineering : F.T. Morse, Affiliated East West press Pvt. Ltd.
2. Power Plant Engineering : Verma Mahesh, Metropolitan Book Co.
3. Modern Power Station Practice : Central Electricity Generating Board (UK)
4. Power Plant Technology : El-Vakil, McGraw Hill.

MECHANICAL SYSTEMS DESIGN

IME-802

w.e.f. Session 2015-2016

L T P
3 1 0

UNIT –I

Engineering Process and Systems Approach :

Application of systems concepts in engineering, identification of engineering functions, systems approach, Engineering Activities Matrix, Defining the proposed effort, Role of engineer, Engineering problem solving. Concurrent engineering. A case study: e.g. viscous lubrication system in wire drawing.

6

Problem Formulation :

Nature of engineering problems, Needs statement, Hierarchical nature of systems, Hierarchical nature of problem environment, problem scope and constraints. A case study: e.g. heating duct insulation-system, High-speed belt drive system.

3

UNIT-II

System Theories :

System analysis view-points, Black box approach, State theory approach, component integration approach, Decision process approach. A case study; e.g. Automobile instrumentation panel system.

3

System Modelling :

Need for modelling, Modelling types and purposes, Linear graph modelling concepts, Mathematical modelling Concepts; A case study; e.g. A compound bar system.

4

UNIT-III

Linear Graph Analysis :

Graph modelling analysis process, Path problem, Network flow problem, A case study: e.g. Material handling system.

4

Optimization Concepts :

Optimization concepts, Motivation and freedom of choice, Goals and objectives-Criteria, Methods of optimization-Analytical, Combinatorial, Subjective. A case study: e.g. Aluminium extrusion system.

3

UNIT-IV

System Evaluation :

Feasibility assessment, Planning horizon, Time value of money, Financial analysis. A case study: e.g. Manufacture of a Maize –Starch system.

4

Calculus Methods for Optimization :

Model with one decision variable, Model with two decision inequality constraint. A case study e.g. Optimization of an insulation-system.

4

UNIT-V

Decision Analysis :

Elements of a decision problem, Decision model probability a dignity function, Expected monetary value, Utility value, Baye's theorem: A case study : e.g. Installation of machinery.

4

System Simulation :

Simulation concepts, simulation models, Iconic, Analog, Analytical, Waiting line simulation, Simulation process problem definition, Input model construction, Solution process, Limitation of simulation approach: A case study: e.g. An inventory control in a production-plant.

5

Books:

1. Design and Planning of Engineering System: D.D. Meredith, K.V.Wong, R.W. Woodhead, R.R. Worthman, prentice-Hall Inc. Englewood Clifts, New Jersey.
2. Design Engineering: J.R. Dixon, Tata McGraw Hill.
3. An Introduction to Engineering Design Method: V.Gupta and P.N. Murthy, Tata McGraw Hill.
4. Engineering Design : Robot Matousck, Blackie and son.
5. Optimization Techniques: S.S. Rao.
6. System Analysis and Project Management : Devid I, Cleland, William R. King, Mc. Graw Hill.

PROJECT MANAGEMENT

IME-803

w.e.f. Session 2015-2016

L T P
3 1 0

UNIT –I

Project Management Concepts :

Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals. Nature and context of project management; phases of PM, A framework for PM issues, PM as a conversion process, project environment and complexity. Organizing human resources, organizing systems and procedures for implementation. Project direction. **8**

UNIT-II

Project Organization and Project Contracts :

Introduction, functional organization, project organization, matrix organization, modified matrix organization, pure, project organization, selection of project organization structure, project break down structures, project contracts, types of contracts, types of payments to contractors. **8**

UNIT-III

Project Appraisal and Cost Estimation :

Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social cost/benefit analysis, project risk analysis. Cost analysis of the project, components of capital cost of a project, modern approach to project performance analysis. **8**

UNIT-IV

Project Planning and Scheduling :

Introduction to PERT and CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks and floats, PERT model, expected time for activities, expected length of critical path, calculating the project length and variance, PERT and CPM. cost accounting systems, lowest cost schedule, crashing of networks, linear programming formulation of event oriented networks, updating of networks. LOB technique. **8**

UNIT-V

Modification and Extensions of Network Models :

Complexity of project scheduling with limited resources, resource leveling of project schedules, resource allocation in project scheduling-heuristic solution. precedence networking-examples with algorithm, decision networks, probabilistic networks, computer aided project management-essential requirements of PM, software packages for CPM. Enterprise-wide PM, using spread sheets for financial projections. **8**

Books:

1. Project Management: Kerzner KBS.
2. Essentials of Project Management : Denis Lock, Grover.
3. Projects –Planning, Analysis, Selection, Implementation and Review: P. Chandra, TMH.
4. Project Management Basics: R.L. Kimmons, Dekker.
5. Practical Project Management : R.G. Ghattas and Sandra L.Mckec, Pearson Education Asia.
6. A Management Guide to PERT/CAM : Wiest and Levy, Prentice Hall.
7. Project Management : Harvky Maylor.
8. Planning Performance and Controlling Projects: Angus Gundrson and Cullinanre.

NON DESTRUCTIVE TESTING

IME-804

w.e.f. Session 2015-2016

L T P
2 1 0

UNIT –I

Scope and advantages of N.D.T. some common NDT methods used since ages-visual inspection, Ringing test, and chalk-test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects. Modern NDT methods. Dye-penetrant test-principle, scope, equipment and techniques. Zygló testing. **8**

UNIT-II

X-ray radiography – principle, equipment, and methodology. Interpretation of radiographs, limitations. Gamma ray radiography. Principle, equipment, source of radioactive material and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods. **7**

UNIT-III

Magnetic Particle Inspection. Scope of test, Principle equipment and technique. DC and AC magnetization, use of dry and wet powders magnaglow testing. Interpretation of results. **7**

UNIT-IV

Introduction Principle of Operation-piezoelectricity and ultrasonic probes, Cathode ray oscilloscope techniques, Advantages and limitations. Application of NDT method in the inspection of castings, forging and welded structures with illustrative examples. **8**

(To be offered where NDT lab facilities are available)

MECHANICAL VIBRATION
IEME-051
w.e.f. Session 2015-2016

L T P
3 1 0

UNIT - I

Introduction

Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis **3**

Single Degree Freedom System

Free vibration, Natural frequency, Equivalent systems, Energy method for determining natural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement **5**

UNIT - II

Single Degree Freedom: Forced Vibration

Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments **8**

UNIT- III

Two Degree Freedom systems

Introduction, Principal modes, Double pendulum, Torsional system with damping, coupled system, undamped dynamic vibration absorbers, Centrifugal pendulum absorbers, Dry friction damper **8**

UNIT- IV

Multi Degree Freedom system: Exact Analysis

Undamped free and forced vibrations of multi-degree freedom systems, influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts **8**

UNIT- V

Multi Degree Freedom system: Numerical Analysis

Rayleigh's, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method **5**

CRITICAL SPEED OF SHAFTS

Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed. **3**

Books and References:

1. Mechanical Vibrations – P. Srinivasan, TMH
2. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee
3. Mechanical Vibrations – W. T. Thomson
4. Mechanical Vibrations – JS Rao & K Gupta, New Age
5. Mechanical Vibrations – Tse, Morse & Hinkle
6. Mechanical Vibrations – V. Rama Murthy, Narosa Publications

ADVANCED FLUID MECHANICS
IEME-052
w.e.f. Session 2015-2016

L T P
3 1 0

UNIT-I

Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress. **7**

UNIT-II

Non-viscous incompressible flow- Equation of continuity, Euler's equation of motion, Bernoulli's equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of source-sink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoils. **9**

UNIT-III

Boundary layer Concept-Introduction to boundary layer formation, Navier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication. **8**

UNIT-IV

Compressible flow- Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables. **8**

UNIT-V

Flow with normal shock waves- Development of shock wave, rarefaction wave, governing equations, Prandtle-Meyer relation. Thermodynamic properties across shock. Wind tunnels. **3**

Flow in constant area duct with friction-Fanno curves, Fanno flow equations, Solution of fanno flow equations. Variation of flow properties. Tables & charts for Fanno flow. **3**

Flow in constant area duct with heat transfer- Rayleigh line, Fundamental equations, Rayleigh flow relation, Variation of flow properties. Tables & Charts for Rayleigh flow. **2**

Books/ References:

1. Fluid Mechanics by White.
2. Fluid Mechanics by Streeter
3. Fluid Mechanics by Som & Biswas
4. Fluid Mechanics by K.L. Kumar
5. Fluid Mechanics by A.K. Jain
6. Fluid Mechanics by Robert W. Fox & Alan T. Mc Donald, Wiley Students Edition
7. Fundamentals of Compressible flow by S.M. Yahya
8. Gas Dynamics by Z. Hussain
9. Viscous fluid flow by White
10. Computational Fluid Dynamics by Anderson
11. Gas Dynamics by E. Radhakrishnan
12. Fluid Mechanics by Kundu & Cohen, Academic Press, Elsevier

NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION

IEME-053

w.e.f. Session 2015-2016

L T P
3 1 0

UNIT-I

Energy resources and their utilization :

Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. 4

Solar radiations:

Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India. 4

UNIT-II

Solar energy:

Solar thermal power and its conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. 2

Solar thermal energy storage, Different systems, Solar pond. 2

Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants. 2

Solar photovoltaic system:

Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system. 2

UNIT-III

Biogas:

Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India. 5

Wind energy:

Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development. 3

UNIT-IV

Electrochemical effects and fuel cells:

Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells,

Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells. 3

Tidal power:

Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. 2

Hydrogen Energy:

Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.. 3

UNIT-V

Thermoelectric systems:

Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. **2**

Geothermal energy:

Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants.

Advanced concepts, Problems associated with geothermal conversion. **2**

Ocean energy;

Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics . **2**

Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy. **2**

Books / Reference:

Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata Mc Graw Hill.

Kothari D.P., "Renewable energy resources and emerging technologies", Prentice Hall of India Pvt. Ltd.

Rai G.D, "Non-Conventional energy Sources", Khanna Publishers.

Ashok V. Desai, "Nonconventional Energy", New Age International Publishers Ltd.

CONCURRENT ENGINEERING
IEME-054
w.e.f. Session 2015-2016

L T P
3 1 0

Unit-I

Introduction:

Background and challenges faced by modern production environment, sequential engineering process, Concurrent engineering definition and requirement, meaning of concurrent objectives of CE, benefits of CE, Life cycle design of products, life cyclecosts. **4**

Support for CE

Classes of support for CE activity, CE organizational, structure CE, team composition and duties, Computer based Support, CE Implementation Process. **4**

Unit-II

Design Product for Customer

Industrial Design, Quality Function Deployment, house of quality, Translation process of quality function deployment (QFD). **4**

Modeling of Concurrent Engineering Design

Compatibility approach, Compatibility index, implementation of the Compatibility model, integrating the compatibility Concerns. **4**

Unit-III

Design for Manufacture (DFM)

Introduction, role of DFM in CE, DFM methods, e.g. value engineering, DFM guidelines, design for assembly, creative design methods, product family themes, design axioms, Taguchi design methods, Computer based approach to DFM. Evaluation of manufacturability and assemblability. **8**

Unit-IV

Quality by Design

Quality engineering & methodology for robust product design, parameter and Tolerance design, Quality loss function and signal to noise ratio for designing the quality, experimental approach. **8**

Unit-V

Design for X-ability

Design for reliability, life cycle serviceability design, design for maintainability, design for economics, decomposition in concurrent design, concurrent design case studies. **8**

Books

1. Concurrent Engineering Kusiak John Wiley
2. Concurrent Engineering Menon Chapman & hall

MANAGEMENT INFORMATION SYSTEM
IEME-055
w.e.f. Session 2015-2016

L T P
3 1 0

Unit-I

Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, Various channels of information & MIS. **6**

Unit-II

Foundation of Information System : Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc. **10**

Unit-III

Business application of information technology, electronic commerce, Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage. **8**

Unit-IV

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools. **6**

Unit-V

Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, Procurement Management System Object Oriented modeling case studies. **10**

Books

1. O.Brian, "Introduction to Information System", Mc-Graw Hill.
2. O.Brian, "Management Information System", TMH.
3. Alter, "Information Systems : A Management Perspective", Addison Wesley.
4. Arora & Bhatia, "Information Systems for Managers", Excel
5. Bansal, "Information System Analysis & Design", TMH.
6. Jawadegar, "Management Information System", TMH.
7. Murdick, "Information System for Modern Management", PHI.
8. Alexis Leon, "Enterprise Resource Planning", TMH.

AUTOMATIC CONTROLS

IEME-056

w.e.f. Session 2015-2016

L T P
3 1 0

Unit –I

Introduction:

Concept of automatic controls, Open and closed-loop systems, Block diagrams, Transfer functions. Application of Laplace Transform in control system. 4

Representation of Control Components and System:

Translational and rotational mechanical components, Electrical components, Series and parallel combinations, Cascade systems, Analogous system. 4

Unit-II

System Response :

First systems response to impulse, Ramp and sinusoidal inputs, Unit step response of second order system. 4

Modes of Controls :

Basic control action. On-off control, Proportional control. 4

Unit-III

Controller Mechanisms :

Pneumatic, Hydraulic and electric controllers, General principles for generating proportional control actions. Concept of control valve. 4

Control System Analysis :

Stability of control system, Rough's criterion, Root locus Plot for simple system. 4

Unit-IV

Frequency Response Analysis :

Polar plot, Bode plots Niquisth stability criteria, Gain and phase margins. 4

Root Locus Plots :

Simple Transfer functions, transient response from foot locus plots. 4

Unit-V

Industrial Applications :

Industrial applications such as: Temperature controls in furnace, oven etc; Flow controls in fluid flow and fluid machines e.g. Turbines; Industrial environment controls. 5

Case Studies :

Illustration of use and importance of Controls with a few case-studies. 3

Books:

1. Automatic Control Theory: Raven, McGraw Hill.
2. Industrial Automatic Control: Lajoy, Longmans Green.
3. Automatic Control System: B.C. Kuo, Prentice-Hall.
4. Modern Control Engineering: K. Ogata, PHI
5. Introduction to Control Engineering and Linear Control Systems: W.Leonhard, Allid Publishers.
6. Control System Engineering: I.J. Nagrath and M. Gopal New Age.
7. Automatic Process Control: DP Eckman, Wiley Eastern.

CONCEPTS OF MODERN PHYSICS

IEME-057

w.e.f. Session 2015-2016

L T P

3 1 0

Unit-I

Atomic & Quantum Physics: Wave-Particle Duality. Atomic-models. Quantum Physics- Planck, Bohr, de-Broglie, Schrödinger, Heisenberg, Born. Quantum and Wave Mechanics. X-ray, Laser etc. **8**

Unit-II

Particle Physics & Dynamics: Molecule, Atom and Nucleus. Elementary Particles (& antiparticles) and its characteristics & historical development. Conservation laws. Quarks and quarkmodel. Simple particle interaction /dynamics. Feynman Diagrams & rules. **8**

Unit-III

Relativistic Mechanics : Special-Relativity. Relativity as a bridge of electricity and magnetism. Minkowskian space-time. Introduction to General-Relativity (almost without Tensors), concept of curved space-time and gravity as curvature. Tests of Special & General Relativity. **9**

Unit-IV

Astro-physics and Cosmo-Dynamics: Brief review of universe big-bang to black-hole including nucleo-synthesis, solar-system and galaxy. Hubble's law. Critical density, space- from closed, flat, open. Recent studies on Dark-matter and Dark-energy and its possible candidates. **8**

Unit-V

Unification of forces: Fundamental forces- gravitational, electrical, magnetic, strongnuclear & weak nuclear. Maxwell (& Faraday) unification of electric & magnetic field as electromagnetic. Brief introduction (with Feynman diagram) to GSW Electro-weak unification, and Standardmodel. Brief mention of GUT, and String/M-theory. **7**

Books

1. Stephen Hawking- Brief History of Time
2. Besier- Concept of Modern Physics
3. Krane- Modern Physics
4. Kaku- Beyond Einstein
5. Griffith- Quantum Electrodynamics
6. Griffith- Elementy Particles
7. Hartle- Gravity
8. Bryan Greene- Elegant Universe

EXPERIMENTAL STRESS ANALYSIS

IEME-061

w.e.f. Session 2015-2016

L T P
3 1 0

UNIT I

Elementary Elasticity:

Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Coordinate System, Special States of Stress. 4

Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress. 4

UNIT II

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid- Method of Strain Analysis. 4

Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data. 4

UNIT III

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor. 4

Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges. 3

Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage. 2

UNIT IV

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors. 8

UNIT V

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photoelasticity. 7

Text Books:

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student Edition, McGraw-Hill Book Company.
2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.

OPTIMISATION TECHNIQUES IN ENGINEERING
IEME-062
w.e.f. Session 2015-2016

L T P
3 1 0

Unit-I

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions. **4**

Unit-II

Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn – Tucker Sufficient Conditions. **8**

Unit-III

Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg-Marquardt, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Linear Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue. **10**

Unit-IV

Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Method and the Runge-Kutta Method for Ordinary Differential Equations, Gaussian Quadrature Trapezoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method. **10**

Unit-V

Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods. **8**

Books.

1. Winston W L: Operations Research: Applications and Algorithms
2. Rao S.S., Optimization: Theory and Applications.
3. Walsh G R: M methods of Optimization.
4. Williams H.P.: Model Building in Mathematics Programming.
5. Williams H.P.: Model Solving in Mathematics Programming
6. G.L. Nemhauser and L.A. Wolsey: Integer and Combinational Optimization.
7. R.G. Parker and R.L. Rardin: Discrete Optimization.

INDUSTRIAL ERGONOMICS
IEME-063
w.e.f. Session 2015-2016

L T P
3 1 0

Unit-I

Introduction: Importance applications and principles of occupational ergonomics. 2

Physiological Principles: Muscular work, Nervous control of movements, Improving working efficiency. Optimal use of muscle strength. /Guidelines for work layout. 4

Skilled work: Acquiring skill, control of skilled movements. Design of tools and equipments for skilled work. 3

Unit-II

Heavy work: Energy consumption, Efficiency, Heart rate as a measure of workload. 2

Work-station Design: Anthropometric data, Reach and clearance dimensions. Percentiles to be accommodated. 5

Unit-III

Working Heights: Comfortable working postures. Room to grasp or move things, and operate controls. Sedentary work. Its advantages, disadvantages and limitation. Sedentary workplace design. Design of VDT workstations, Design of Key board. 5

Handling Lads: The Human spine, back troubles associated with industrial work, Intervertebral disc, disc pressure, slip of disc, Bio-mechanical models of lower back. Recommendations for handling loads. 3

Man-Machine System: Display equipment, Controls, Relation between control and display instruments, Mental activity, Fatigue, Occupational stress, Job design in monotonous task. 3

Unit-IV

Human Visual System: Accommodation, Aperture of the pupil, Adaptation of reline, eye movements Visual capacity, Visual strain, Physiology of reading. 3

Ergonomic Principles of Lighting: Light sources, measurement, physiological requirements of artificial lighting, arrangement of light. Light for fine work and for VDT offices. 3

Unit-V

Noise and Violation: Sound perception, Noise load, damage to hearing, physiological and psychological effects of noise. Protection against noise, Vibrations and their effect on performance. 3

Working Environment: Thermo-regulation in human body, comfort indoors, Air quality and its dryness, Air pollution and ventilation. Heat in industry Recommendations for comfort indoors. Daylight, colours and music for pleasant work environment. 4

Books

1. Fitting the task to the Man, E. Gandjean, Taylor and Francis.
2. A guide to Ergonomics of Manufacturing, Helander, M., East-West Press.
3. Human Factor in Engineering and Design, Sanders, M.S., and Mc Cormik, E.J., McGraw.Hill

ADVANCED DYNAMICS OF MACHINES

IEME-064

w.e.f. Session 2015-2016

L T P

3 1 0

UNIT I

Dynamic Analysis of Mechanisms and Machines: Introduction, Motion of Rigid Body under a System of Forces, Principle of Virtual Work, D'Alembert's Principle and Dynamic Equilibrium, Dynamic Force Analysis, Stresses in Moving Members, Motion Analysis, Equivalent Force and Mass Method. **8**

UNIT II

Dynamics of Direct Acting Engine Mechanisms: Introduction, Piston Motion, Turning Moment on Crank-Shaft, Dynamically Equivalent Link, Approximate Expression for Turning Moment, Correction to the Approximate Expression, Turning Moment Diagram, Fluctuation of Crank-Shaft Speed, Flywheel Analysis. **8**

UNIT III

Balancing of Inertia Force and Moments in Machines: Introduction, Balancing of Rotating Masses, Two-Plane Balancing, Determination of Balancing Masses, Balancing of Internal Combustion Engines. **8**

UNIT IV

Gyroscopic action in Machines: Introduction, Motion of a Rigid Body in Three-Dimensions, Principal Axes, Angular Velocity and Momentum about Principal Axes, Euler's Equation of Motion, Euler's Modified Equation, Simple Precession of a Symmetrical Gyroscope in Angular Precession, Gyroscopic Effects in Machines, Gyroscopic Stabilization. **8**

UNIT V

Dynamics of Rotating Shafts: Introduction, Critical Speed, Shaft with an Unbalanced Disc at Mid-Span, Generalized Forces, Lagrange's Equation of Motion, Gyroscopic Effect on Critical Speed. **8**

Text Book:

1. Theory of Mechanisms and Machines by Amitabh Ghosh and Ashok Kumar Malik, Affiliated East- West Press Pvt. Ltd, New Delhi.
2. Theory of Machines and Mechanisms by Joseph Edward Shigley and John Joseph Uicker, J.R. International Student Edition, Mc-Graw Hill International Company.

INTRODUCTION TO NUCLEAR ENGINEERING

IEME-065

w.e.f. Session 2015-2016

L T P
3 1 0

Unit –I

Nuclear forces and binding energy of the nucleus, Nuclear stability and radioactivity, Law or radioactive decay. 4
Binary nuclear reactions, Energy release in fission and fusion reactions, concepts of microscopic and macroscopic cross sections. 4

Unit-II

Nuclear fuels in fission and fusion reactors, Types of nuclear reactors, Fissile and fertile materials, neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, Moderators, Control and structural materials. 8

Unit-III

Heat generations and steady state temperature distribution in fuel elements, Heat removal, single and two phase heat transfer and fluid flow correlations. 8

Unit-IV

Neutron lifetime, Delayed neutrons, Concept of reactivity and point reactor kinetics, Qualitative discussion of safety and radioisotopes in industry, Agriculture and medicine. 6
Brief discussion of safety and radioactive waste disposal. 2

Unit-V

Introduction of nuclear radiation with matter, Shielding, Radiation exposure and dose, Applications of nuclear radiation and radioisotopes in industry, Agriculture and medicine. 8

Books:

1. Nuclear Reactor Engineering: S. Glasstone and A. Sesonske.
2. Basic Nuclear Engineering : K.S. Ram
3. Introduction to Nuclear Engineering : J.R. Lamarsh.
4. nuclear Electricity : Ian Hore-Lacy.

ENERGY MANAGEMENT
IEME-066
w.e.f. Session 2015-2016

L T P
3 1 0

UNIT-1

Introduction to energy, Sources of energy, Forms of energy, Energy reserves, renewable energy sources, Unites of energy and the laws of thermodynamics,, Energy consumption and GDP, energy database , Energy demand analysis, Costs of exploration and utilization of depletable resources, energy pricing, National energy plan. **8**

UNIT-2

Energy audit concepts, Energy audit based on 1st law and 2nd law of thermodynamics, Mass and Energy balances, Availability analysis, Evaluation of energy conserving opportunities, Economic analysis and life cycle costing. **8**

UNIT-3

Energy conservation areas, Energy transmission and storage, Plant wide energy optimization Models, Data base for energy management , Energy conservation through controls, Computer aided energy management, Program organization and methodology. **8**

UNIT-4

Electrical energy conservation in building lighting, heating, ventilating and air conditioning, Energy efficient motor, power factor improvement in power systems, Energy audit of Combustion process, Boilers, Turbines, compressors, Pumps, Heatexchangers, Condensers, Use of industrial, wastes. **9**

UNIT-5

Energy environment interaction, Environmental issues, Global warning, Carbon dioxide emissions, Depletion of ozone layer, Government's regulations, Energy economy interaction. **7**

Books:

1. Energy Management and condevtion, by Clive Beggs, Butterwoth- Heinemann Elsevier Science.
2. Optimising Energy Efficiency in the Industry, By Rajan, Tata Mc Graw Hill Publishers.
3. Guide to energy Management , By C.L Capehart, Fairmont Press.
4. Renewable Energy Sources and their Environment Impact, by Abbasi & Abbasi, Prentice Hall of India.
5. Environmental Risks and Hazards by Cutter, Prentice Hall of India.
6. Energy and Power Risk Management: New Developments in Modeling, Pricing and Hedging, buy Alexander Eydeland, John Wiley & Sons.
7. Energy Management Handbook by, Wayne C. Turner.
8. Thermodynamics, By Kenneth Wark, Tata Mc Graw Hill Publishers.
9. Exergy Analysis of Thermal, Chemical and Metallurgical Process, By Jan Szargut, David R. Morris, Frank R. Steward, Hemisphere Pub, Springer Verlag Publisher

ADVANCED SYNTHESIS OF MECHANISM

IEME-067

w.e.f. Session 2015-2016

L T P
3 1 0

UNIT-I

Introduction:

Mechanisms, Classifications, Relative & absolute motion, degree of freedom, 4-bar mechanisms-planar & spatial mechanisms, Inversion and equivalent linkage, Transmission deviation and pressure angles 4

Kinematic analysis of Planer motion

Relative velocity and velocity difference, Instantaneous centre, Poles and centrodes, Relative acceleration, acceleration difference 4

UNIT-II

Kinematic Synthesis Type, number and dimensional synthesis, spacing of accuracy points, Chebyshev polynomials 4

Four bar coupler point curves:

Four bar linkage, Equation of coupler curves, Double points and symmetry, Robert Chebyshev theorem, Approximate and exact straight line mechanisms 4

UNIT-III

Geometrical Method of Synthesis:

Poles and relative poles of four bar linkage, Poles and relative poles of slider crank mechanism, Synthesis with three accuracy points, Pole triangle, Four position synthesis, Examples 8

UNIT-IV

Algebraic Methods of Synthesis-I:

Displacement equation of four bar linkage, Crank and follower synthesis with three accuracy points, Four bar function generator with three accuracy points, Crank and follower synthesis: angular velocities and accelerations 8

UNIT-V

Algebraic Methods of Synthesis-II:

Synthesis of slider crank mechanism with three accuracy points, Synthesis of slider crank mechanism with four accuracy points, Five accuracy points synthesis of crank and follower mechanism, Analysis of mechanical errors in linkage, Mechanical error in four bar linkage 8

Books & References:

1. Kinematic Synthesis of Linkages RS Hartenberg and J Denavit McGraw Hill, New York
2. Kinematic and Linkage Design AS Hall Jr Prentice Hall India Ltd.
3. Mechanism and Machine Theory Amitabh Ghosh and AK Mallick
4. Mechanism Design: Analysis & Synthesis Erdman & Sandor Prentice Hall of India

AUTOMATION AND ROBOTICS
IEME-068
w.e.f. Session 2015-2016

L T P
3 1 0

UNIT-I

Introduction: Definition, Classification of Robots, geometric classification and control classification.

Robot Elements: Drive system, control system, sensors, end effectors, gripper actuators and gripper design. **8**

UNIT-II

Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world. Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators. **8**

UNIT-III

Robot Control: Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Seroo system for robot control, and introduction to robot vision. **8**

UNIT-IV

Robot Programming: Level of robot programming, language based programming, task level programming, robot programming synthesis, robot programming for welding, machine tools, material handling, assembly operations, collision free motion planning. **8**

UNIT-V

Applications: Application of robot in welding, machine tools, material handling, assembly operations parts sorting and parts inspection. **8**

Text/Reference Books:

1. Coifet Chirroza, "An Introduction to Robot Technology" Kogan Page.
2. Y. Koren "Robotics for Engineers" Mcgraw Hill.
3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, "Robotics" McGraw Hill.
4. J.J. Craig, "Robotics" Addison-Wesley.
5. Grover, Mitchell Weiss, Nagel Octrey, "Industrial Robots" Mcgraw Hill.
6. Asfahl, "Robots & Manufacturing Automation" Wily Eastern.