Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Branch- Common to All Discipline

ES401	Energy & Environmental Engineering	3L-1T-0P	4 Credits

The objective of this Course is to provide *an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.*

Module 1: Introduction to Energy Science:
Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

Module2: Ecosystems
• Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem   (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3: Biodiversity and its conservation
• Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-sports of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module 4: Environmental Pollution
• Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.

Module 5: Social Issues and the Environment
• From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies

Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Module 6: Field work

- Visit to a local area to document environmental assets- river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai,
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards', Vol I and II, Enviro Media (R)
6. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press.
7. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, IV-Semester

ME402- INSTRUMENTATION & CONTROL

[1] Introduction to instrument systems, classifications, functional elements of a measurement system, standards and calibration, static performance characteristics, measurement errors and uncertainties, analysis, sequential and random test, specifications of instrument static characteristics, data acquisition, reduction, data outliner detection,

[2] Dynamic characteristics of the instruments, formulation of system equations, dynamic response, compensation, periodic input, harmonic signal non harmonic signal, Fourier transform, response to the transient input, response to random signal input, first and second order system compensation,

[3] (a) Temperature measurements, thermometry based on thermal expansion, liquid in glass, bimetallic, electric resistance- thermometry, thermocouples, thermistors, detectors, (b) pressure and velocity measurements, barometer, manometer, dead weight tester, pressure gauges and transducers, dynamic measurements,(c) flow measurements, pressure differential meters, orifice meter, venturi meter, rota-meter,

[4] strain gauges, strain and stress measurements, electrical circuits, compensations, motion force and torque measurements, displacement measurements, potentiometers, linear and rotary variable differential transformers, velocity measurements, electromagnetic technique, stroboscope, load cell, measurement of torque on rotating shaft, power estimation from rotating shaft.

[5] Control systems, open loop and close loop control, mathematical modeling of dynamic systems – mechanical systems, electrical systems, fluid systems, thermal systems, transfer function, impulse response function, block diagrams of close loop systems, system modeling using software.

BOOKS:

[1] Nakra B.C.Chaudhary K.K, Instrumentation measurement and analysisTata McGraw Hill, ISBN 0 07 451791 0

[2] Richard S, Figiola & Donal E. Beasley, John Wiley, Theory and design of mechanical measurements.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, IV-Semester

ME403 -THEORY OF MACHINES

[1] Introduction, kinematics and kinetics, mechanisms and machines, degree of freedom, types of motions, kinematic concept of links, basic terminology and definitions, joints and kinematic chains, inversions, absolute and relative motions, displacement, velocity and acceleration diagrams, different mechanisms and applications,

[2]   kinematic synthesis of linkages, dynamic motion analysis of mechanisms and machines, D'Alembert's principle, number synthesis, free body diagrams, kinematic and dynamic quantities and their relationships, analytical method and graphical method

[3] Cams, introduction, classifications of cams and followers, nomenclature, analysis of cam and follower motion, analytical cam design with specific contours, pressure angle, radius and undercutting, motion constrains and program, critical path motion, torque on cam shaft

[4] Power transmission, kinematics of belt- pulley, flat and v –belt, rope, condition of maximum power transmission, efficiency, friction, friction devices, pivot and collars, power screw, plate and cone clutch, brakes, classifications, bock, band, internal and external, friction circle, friction axis,

[5]   Gears, laws of gearing, classification and basic terminology, tooth profiles, kinematic considerations, types of gears, spur, bevel, worm, helical, hypoid etc, gear trains, epicyclic, compound,, balancing- static and dynamic, in same/ different planes, Introduction to vibration, single degree of freedom.

BOOKS:
 [1] R.L.Norton,kinematics& dynamics of machinery,Tata McGraw Hill, ISBN13 978 0 07 014480 4
 [2] A.Ghosh & A.Malik, Theory of Mechanisms and Machines,EWP Pvt Ltd,ISB 81 85095 72 8

 Tutorials:
   1.Displacement diagrams of slider crank and other linkages, analytical and graphical
   2 Velocity diagrams and acceleration diagrams
   3 Diagrams of cam and followers for different applications
   4 Gears and gear trains transmission diagrams, analytical and graphical applications
   5 Solutions to problems of industrial application using software

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, IV-Semester

ME404- FLUID MECHANICS

[1] Introduction, fluid and the continuum, fluid properties, surface tension, bulk modulus and thermodynamic properties, Newton's laws of viscosity and it's coefficients, Newtonian and non Newtonian fluids, hydrostatics and buoyancy, meta center and metacentric height, stability of floating bodies.

[2] Fluid kinematics, Langragian and Eularian mrthod, description of fluid flow, stream line, path line and streak line, types of flow and types of motion, local and connective acceleration, continuity equation, potential flow, circulation, velocity potential, stream function, laplace equation, flow nets.

[3]   Fluid dynamics, system and control volume, Reynold transport theorem, Euler's equation, Bernoulli's equation, momentum and moment of momentum equation, their applications, forces on immersed bodies, lift and drag, streamlined and bluff bodies, flow around circular cylinder and aerofoils.

[4] Flow through pipes, Reynold number, laminar and turbulent flow, viscous flow through parallel plates and pipes, Navier Stoke's equation, pressure gradient, head loss in turbulent flow (Darcey's equation), friction factor, minor losses, hydraulic and energy gradient, pipe networks

[5]   Introduction to boundary layer theory, description of boundary layer, boundary layer parameters, Von Karman momentum equation, laminar and turbulent boundary conditions, boundary layer separation, compressible flow, Mach number, isentropic flow, stagnation properties, normal and oblique shocks, Fanno and Reyleigh lines, flow through nozzles,

BOOKS:
 1. Massy B.S., Mechanics of fluid, Routledge Publication
 2.Shames, Fluid Mechanics, Tata McGraw Hills

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, IV-Semester

ME405- MANUFACTURING TECHNOLOGY

[1] Analysis of Machining processes, introduction, tool geometry, tool materials, wear characteristics, cutting forces, , cutting fluids, failure of cutting tools, broaching operation, types of broaching machines, design of broaching tools, centre less grinding, thread chaser, thread grinding boring, super finishing processes like honing, lapping, electro polishing and buffing

[2] Gear machining, types of gears, elements of gears, different methods of gear production, gear cutting on milling machine, gear machining by generation method, principles of generation of surfaces – hobbing, shaping and basic rack cutting, gear finishing by shaving and gear grinding, tooth profile grinding, suitable gear treatments

[3 Plastics, composition of plastic materials, moulding method- injection moulding, compression moulding, transfer moulding, extrusion moulding, calendaring, blow moulding, laminating and reinforcing, welding of plastics.

[4] Unconventional machining processes, introduction, abrasive jet machining, ultrasonic machining, electrochemical machining, electro discharge machining, electron beam machining, laser beam machining, plasma arc machining, non destructive testing of machined surfaces and tools,

[5] Extrusion, principles, hot and cold extrusion processes, tube extrusion, sawing, power hacksaw, band saw, circular saw, Introduction to numerical control machining, NC Machine tools, NC tooling ,part programming, functions, coordinate systems

BOOKS:
[1] Ghosh A., Mallik A.K.,Manufacturing science,EWP Pvt Ltd, ISBN 81 85095 85 X
[2] R.K.Jain, Production Technology, Khanna Publishes, ISBN 81 7409 099 1
[3] Campbell J.S., Principles of Manufacturing Materials and Processes.
[4] CMTI Handbook
[5] Rao P.N., Manufacturing Technology, Tata McGraw Hill

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, IV-Semester

ME406- SOFTWARE LAB

[1]   . Role of computers in design and manufacture. Drawing soft ware, configuration, function and facilities, parametric representation, examples of drawings and systems

[2] Surface modeling, curves and surface representation – composite surfaces, case studies in CAD, parametric representation analytic and synthetic curves, surface manipulation, design and engineering applications,

[3] Current developments in CAD, feature based modeling,, design by feature,

[4] Solid modeling, boundary representation, analytic solid modeling, constructive solid geometry, sweep representation, design and engineering applications,

[5] Strategic plan of CAD system design and development, graphic exchange, features recovery, etc.

BOOKS:

1. Donald H, Paulin M, Computer graphics, Prentice Hall,

2. Ibrahim z., CAD/CAM, Theory and Practice, McGraw Hill,

3. Mc mohan C, Browne , CAD/ CAM Principles- practice and manufacturing management, Pearson Education AsiaLtd,

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

ME- 601 Thermal Engineering and Gas Dynamics

Unit 1: Steam generators and boilers
Steam generators: classification, conventional boilers, high-pressure boilers-Lamont, Benson, Loeffler and Velox steam generators, performance and rating of boilers, equivalent evaporation, boiler efficiency, heat balance sheet, combustion in boilers, super critical boilers, fuel and ash handling, boiler draught, overview of boiler codes.

Unit 2 : Vapour Cycles
Phase Change Cycles: Vapor Carnot cycle and its limitation, Rankin cycle, effect of boiler and Condenser pressure and superheat on end moisture and efficiency of ranking cycle, modified Rankin cycle, reheat cycle, perfect regenerative cycle, Ideal and actual regenerative cycle with single and multiple heaters, open and closed type of feed water heaters, regenerative-reheat cycle, supercritical pressure and binary-vapor cycle, work done and efficiency calculations.

Unit 3: Gas Dynamics
Gas dynamics: speed of sound, in a fluid mach number, mach cone, stagnation properties, one dimensional isentropic flow of ideal gases through variable area duct-mach number variation, area ratio as a function of mach number, mass flow rate and critical pressure ratio, effect of friction, velocity coefficient, coefficient of discharge, diffusers, normal shock.

Unit 4: Air Compressors
Air compressors: working of reciprocating compressor, work input for single stage compression different, compression processes, effect of clearance, volumetric efficiency real indicator diagram, isentropic & isothermal and mechanical efficiency, multi stage compression, inter - cooling, condition for minimum work done, classification and working of rotary compressors.

Unit 5: Nozzles and Condensers
Steam nozzles: isentropic flow of vapors, flow of steam through nozzles, condition for maximum discharge, effect of friction, super-saturated flow. Steam condensers, cooling towers: introduction, types of condensers, back pressure and its effect on plant performance air leakage and its effect on performance of condensers, various types of cooling towers.

References:
1. Arasu Valan A; Thermal Engineering; TMH
2. Nag PK; Basic and applied Thermo-dynamics; TMH
3. Nag PK; Power plant Engineering; TMH
4. Rathakrishnan E; Gas Dynamics; PHI Learning
5. Balachandran P; Gas Dynamics for Engineers; PHI Learning
6. Yahya SM; Fundamentals of Compressible flow; New Age
7. Gordon J. Van Wylen; Thermodynamics
8. R.Yadav Thermal Engg.
9. Kadambi & Manohar; An Introduction to Energy Conversion – Vol II. Energy conversion cycles

List of Experiments (Please Expand it) (Thermal Engg and gas dynamics):
1. Study of working of some of the high pressure boilers like Lamont or Benson
2. Study of Induced draft/forced and balanced draft by chimney
3. Determination of Calorific value of a fuel
4. Study of different types of steam turbines

5. Determination of efficiencies of condenser
6. Boiler trail to chalk out heat balance sheet
7. Determination of thermal efficiency of steam power plant
8. Determination of Airflow in ducts and pipes.
9. To find out efficiencies of a reciprocating air compressor and study of multistage Compressors
10. Find Out heat transfer area of a parallel flow/counter flow heat exchanger

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

ME- 602 Machine Component and Design

Unit 1: **Introduction to stress in machine component:**

Stress concentration and fatigue: causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage factor.

Unit 2: Shafts:

Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; Design of shaft subjected to dynamic load; Design of keys and shaft couplings.

Unit 3: **Springs:**

Design of helical compression and tension springs, consideration of dimensional and functional constraints, leaf springs and torsion springs; fatigue loading of springs, surge in spring; special springs, Power Screws: design of power screw and power nut, differential and compound screw, design of simple screw jack.

Unit 4 : Brakes & Clutches:

Materials for friction surface, uniform pressure and uniform wear theories, Design of friction clutches: Disk, plate clutches, cone & centrifugal clutches. Design of brakes: Rope, band & block brake, Internal expending brakes, Disk brakes.

Unit 5: Journal Bearing:

Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations, Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, Rolling-element Bearings: Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

References:

1. Shingley J.E; Machine Design; TMH
2. Sharma and Purohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agrawal; Machine Design; Kataria & sons
7. Maleev; Machnine Design;

List of Experiment (Pl. expand it):
1. Design considerations for fatigue.
2. Design criteria and procedure for springs.
3. Design of shaft.

4. Design of keys.
5. Design of couplings.
6. Design of leaf spring for a given load.
7. Design of power screw and nut.
8. Design of Centrifugal clutch.
9. Design of disc brake.
10. Design considerations for roller bearings.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

Departmental Elective ME- 603 (A) Turbomachinery

Unit 1: **Energy transfer in turbo machines**:

Application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only.

Unit 2: **Steam turbines**:
Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. Reactions staging: Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.

Unit 3: Water turbines:

Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines. Centrifugal Pumps: classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done. Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitations.

Unit 4 : Rotary Fans, Blowers and Compressors:

Classification based on pressure rise, centrifugal and axial flow machines. Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics. Centrifugal Compressor – Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. Axial flow Compressors- Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis, Characteristics, surging, Polytrophic and isentropic efficiencies.

Unit 5: Power transmitting turbo machines:

Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics, Positive displacement machines and turbo machines, their distinction. Positive displacement pumps with fixed and variable displacements, Hydrostatic systems hydraulic intensifier, accumulator, press and crane.

References:
1. Venkanna BK; turbomachinery; PHI
2. Shepherd DG; Turbo machinery
3. Csanady; Turbo machines
4. Bansal R. K; Fluid Mechanics & Fluid Machines;
5. Rogers Cohen & Sarvan Multo Gas Turbine Theory
6. Kearton W. J; Steam Turbine: Theory & Practice

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

Departmental elective ME- 603 (B) Computer Aided Engineering

Unit 1: Introduction to Computer Engineering

Methods to solve engineering problems- analytical, numerical, experimental, their merits and comparison, discretization into smaller elements and effect of size/ shape on accuracy, importance of meshing, boundary conditions, Computer Aided Engineering (CAE) and design, chain-bumping-stages v/s concurrent-collaborative design cycles, computer as enabler for concurrent design and Finite Element Method (FEM), degree of freedom (DOF), mechanical systems with mass, damper and spring, stiffness constant K for tensile, bending and torsion; Practical applications of FEA in new design, optimization/ cost-cutting and failure analysis,

Unit 2: Types of Analysis

Types of analysis in CAE, static (linear/ non linear), dynamic, buckling, thermal, fatigue, crash NVH and CFD, review of normal, shear, torsion, stress-strain; types of forces and moments, tri-axial stresses, moment of inertia, how to do meshing, 1-2-3-d elements and length of elements; force stiffness and displacement matrix, Rayleigh-Ritz and Galerkin FEM; analytical and FEM solution for single rod element and two rod assembly.

Unit 3: 2 D- Meshing

Two-dimension meshing and elements for sheet work and thin shells, effect of mesh density and biasing in critical region, comparison between tria and quad elements, quality checks, jacobian, distortion, stretch, free edge, duplicate node and shell normal.

Unit 4: 3 D-Meshing

Three-dimension meshing and elements, only 3 DOF, algorithm for tria to tetra conversion, floating and fixed trias, quality checks for tetra meshing, brick meshing and quality checks, special elements and techniques, introduction to weld, bolt, bearing and shrink fit simulations, CAE and test data correlations, post processing techniques

Unit 5: Optimization

Review of linear optimization, process and product optimization, design for manufacturing (DFM) aspects in product development, use of morphing technique in FEA, classical design for infinite life and design for warranty life, warranty yard meetings and functional roles, climatic conditions and design abuses, case studies.

References:
1. Gokhle Nitin; et al; Practical Finite Element Analysis; Finite to Infinite, 686 Budhwar Peth, Pune.
2. Krishnamoorthy; Finite Element Analysis, theory and programming; TMH
3. Buchanan; Finite Element Analysis; Schaum series; TMH
4. Seshu P; Textbook of Finite Element Analysis; PHI.
5. Desai Chandrakant S et al; Introduction to finite element Method ,

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

Departmental elective ME- 603 (C) Product Design

Unit 1: Introduction to product design

Product life-cycle, product policy of an organization. Selection of a profitable product, Product design process, Product analysis.

Unit 2: Value engineering in product design

Advantages, applications in product design, problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, functional analysis: Functional Analysis System Technique (FAST), Case studies.

Unit 3: Introduction to Product design tools

QFD, Computer Aided Design, Robust design, DFX, DFM. DFA, Ergonomics in product design.

Unit 4: DFMA guidelines
Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc.,

Unit-5: Rapid Prototyping

Needs of rapid prototyping, needs, advantages, working principles of SLA, LOM and SLS.

References:
1. Value Engineering: Concepts, Techniques and Applications by A.K. Mukhopadhaya
2. Rapid Prototyping: Principles and Applications by C.K. Chua
3. Engineering Design by Linda D. Schmidt

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

Open Elective ME- 604 (A) Robotics

Unit 1 Introduction:
Need and importance, basic concepts, structure and classification of industrial robots, terminology of robot motion, motion characteristics, resolution, accuracy, repeatability, robot applications.

Unit 2 End Effectors and Drive systems:
Drive systems for robots, salient features and comparison, different types of end effectors, design, applications.

Unit 3 Sensors:
Sensor evaluation and selection, Piezoelectric sensors , linear position and displacement sensing, revolvers, encoders, velocity measurement, proximity, tactile, compliance and range sensing. Image Processing and object recognition.

Unit IV Robot Programming:
Teaching of robots, manual, walk through, teach pendant, off line programming concepts and languages, applications.

Unit V Safety and Economy of Robots:
Work cycle time analysis, economics and effectiveness of robots, safety systems and devices, concepts of testing methods and acceptance rule for industrial robots.

References:
1. Mittal RK, Nagrath IJ; Robotics and Control; TMH
2. Groover M.P,Weiss M, Nagel,OdreyNG; Industrial Robotics-The Appl□; TMH
3. Groover M.P; CAM and Automation; PHI Learning
4. Spong Mark and Vidyasagar; Robot Modelling and control; Wiley India
5. Yoshikava ; Foundations of Robotics- analysis and Control; PHI Learning;
6. Murphy ; Introduction to AI Robotics; PHI Learning
7. FU KS, Gonzalez RC, Lee CSG; Robotics □Control, sensing□; TMH
8. Shimon, K; Handbook of Industrial Robots; John Wiley & Sons,.
9. Ghosal Ashitava; Robotics Fundamental concepts and analysis; Oxford
10. Saha S; Introduction to Robotics; TMH
11. Yu Kozyhev; Industrial Robots Handbook; MIR Pub.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

Open Elective ME- 604 (B) Optimization Techniques

Unit 1 Introduction to Optimization:

Engineering application of Optimization – Statement of an Optimization problem - Optimal Problem formulation - Classification of Optimization problem. Optimum design concepts, Definition of Global and Local optima – Optimality criteria - Review of basic calculus concepts – Global optimality

Unit 2 Linear programming methods for optimum design:

Review of Linear programming methods for optimum design – Post optimality analysis - Application of LPP models in design and manufacturing.

Unit 3 Optimization algorithms for solving unconstrained optimization problems:

Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method.

Unit-4 Optimization algorithms for solving constrained optimization problems:

Direct methods – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Unit 5 Modern methods of Optimization:

Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications. Use of Matlab to solve optimization problems.

References:

1. Rao S. S. - 'Engineering Optimization, Theory and Practice' - New Age International Publishers - 2012 - 4th Edition.
2. Deb K. - 'Optimization for Engineering Design Algorithms and Examples' – PHI - 2000
3. Arora J. - 'Introduction to Optimization Design' - Elsevier Academic Press, New Delhi - 2004
4. . Saravanan R. - 'Manufacturing Optimization through Intelligent Techniques' - Taylor & Francis (CRC Press) - 2006
5. Hardley G. -'Linear Programming' - Narosa Book Distributors Private Ltd. - 2002

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

Open Elective ME- 604 (C) Renewable Energy Technology

UNIT-I Solar Radiation:

Extra-terrestrial and terrestrial, radiation measuring instrument, radiation measurement and predictions. Solar thermal conversion: Basics, Flat plate collectors-liquid and air type. Theory of flat plate collectors, selective coating, advanced collectors, Concentrators: optical design of concentrators, solar water heater, solar dryers, solar stills, solar cooling and refrigeration.
Solar photovoltaic: Principle of photovoltaic conversion of solar energy; Technology for fabrication of photovoltaic devices; Applications of solar cells in PV generation systems; Organic PV cells.

UNIT-II Wind Energy:

Characteristics and measurement: Metrology of wind speed distribution, wind speed statistics, Weibull, Rayleigh and Normal distribution, Measurement of wind data, Energy estimation of wind regimes; **Wind Energy Conversion**: Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics; power curve of wind turbine, capacity factor, matching wind turbine with wind regimes; Application of wind energy.

UNIT-III Production of biomass:

Photosynthesis-C3 & C4 plants on biomass production; Biomass resources assessment; Co2 fixation potential of biomass; Classification of biomass; Physicochemical characteristics of biomass as fuel Biomass conversion routes: biochemical, chemical and thermo chemical Biochemical conversion of biomass to energy: anaerobic digestion, biogas production mechanism, technology, types of digesters, design of biogas plants, installation, operation and maintenance of biogas plants, biogas plant manure-utilization and manure values. Biomass Gasification: Different types, power generation from gasification, cost benefit analysis of power generation by gasification.

UNIT-IV Small Hydropower Systems:

Overview of micro, mini and small hydro system; hydrology; Elements of turbine; Assessment of hydro power; selection and design criteria of turbines; site selection and civil works; speed and voltage regulation; Investment issue load management and tariff collection; Distribution and marketing issues. Ocean Energy: Ocean energy resources, ocean energy routs; Principle of ocean thermal energy conversion system, ocean thermal power plants. Principles of ocean wave energy and Tidal energy conversion.

UNIT-V Geothermal Energy:

Origin of geothermal resources, type of geothermal energy deposits, site selection geothermal power plants; Hydrogen Energy: Hydrogen as a source of energy, Hydrogen production and storage. Fuel Cells: Types of fuel cell, fuel cell system and sub-system, Principle of working, basic thermodynamics

References:

1. Kothari, Singal & Rajan; Renewable Energy Sources and Emerging Technologies, PHI Learn
2. Khan, B H, Non Conventional Energy, TMH.
3. Sukhatme and Nayak, Solar Energy, Principles of Thermal Collection and Storage, TMH.
4. Tiwari and Ghosal, Renewable Energy Resources: basic principle & application, Narosa Publ

5. Koteswara Rao, Energy Resources, Conventional & Non-Conventional, BSP Publication.
6. Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and Application,PHI L
7. Abbasi Tanseem and Abbasi SA; Renewable Energy Sources; PHI Learning
8. Ravindranath NH and Hall DO, Biomass, Energy and Environment, Oxford University Press.
9. Duffie and Beckman, Solar Engineering of Thermal Process, Wiley
10. Nikolai, Khartchenko; Green Power; Tech Book International
11. Tester, Sustainable Energy-Choosing Among Options, PHI Learning.
12. Godfrey Boyle, Renewable Energy: Power for a sustainable future, Oxford OUP.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Mechanical Engineering, VI-Semester

Departmental Lab ME-605 CAD Lab

List of Experiments:

1. Layout and sketching of different geometries
2. Drawing environment in AUTOCAD
3. Elements of drawing and draw commands
4. 3D functions in AUTOCAD
5. 2D: Figures for practice using AutoCAD
6. ISOMETRIC drawing for practice using AutoCAD
7. 3-D solid figures using AUTOCAD
8. Introduction to CREO 3.0
9. Learning different Operations like Threading, Sweep, Swept-blend.
10. Modeling & Assembling

References:

1. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishers.
2. Beginning AutoCAD 2019 Exercise Workbook by Cheryl R. Shrock, Steve Heather.
3. CAD Exercises by Sachidanand Jha.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

O/E Lab ME- 606 RDBMS Lab

List of Experiments :(Pls. expand it)

1. What do you mean by normalization and explain its forms with suitable example.
2. Case study on normalization.
3. Introduction of query processing and query optimization.
4. Study and usage of query optimization techniques.
5. Study and usage of backup recovery features of database.
6. Study and usage of any object or object oriented relational database management software.
7. Study and usage of open source data mining tool: WEKA.
8. Creating and use web database in PHP.
9. Display project using database.

References:
A Silberschatz, H.F. Korth, Sudersan "Database System Concept"=, MGH Publication.
2. C.J. Date "An introduction to Database System"=6th ed.
3. Elmasri & Navathe "Foundamentals of Database system"- III ed.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

ME 801- Refrigeration & Air Conditioning

Course Objectives

After studying this course,students will be able to:

1. Learn the basic concepts and principles of refrigeration and air conditioning.

2. Learn the fundamental analysis methodology of refrigeration.

3. Learn the basic process and systems of air conditioning.

4. Will apply the course knowledge to do a design project of HVAC system.

Course Content

Unit-I Introduction: Principles and methods of refrigeration, freezing; mixture cooling by gas reversibleexpansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Unit-II Vapour compression system: Vapor compression cycle, p-h and t-s diagrams, deviations fromtheoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

Unit-III (a) **Vapour absorption system**: Theoretical and practical systems such as aqua-ammonia, Electrolux & other systems;

(b) **Steam jet refrigeration**: Principles and working, simple cycle ofoperation, description and working of simple system,

(c)**Refrigerants:** nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

Unit-IV Psychometric: Calculation of psychrometric properties of air by table and charts;psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards,

infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,

Unit-V Air conditioning : Calculation of summer & winter air conditioning load, bypass factor ofcoil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

Evaluation:

Evaluation will be continuous and integral part of the class as well as through external assessment.

References:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI
6. Pita ; Air conditioning Principles and systems: an energy approach; PHI
7. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
8. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA

List of Experiments:

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant
3. General Study and working of cold storage
4. General Study Trane Air Condition (Package Type).
5. General Study of Electrolux Refrigeration
6. General Study One tone Thermax refrigeration unit.
7. General Study of Water cooler
8. General Study of Psychrometers (Absorption type)
9. General Study of Leak Detectors (Halide Torch).
10. General Study and working of Gas charging Rig.
11. General Study of window Air Conditioner.
12. General Study and working of Vapor compression Air conditioning Test rig.
13. Experimentation on Cold Storage of Calculate COP & Heat Loss.
14. Experimentation on Vapor compression Air Conditioning test rig.
15. Changing of Refrigerant by using Gas Charging Kit.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Departmental Elective ME 802(A) Automobile Engineering

COURSE OBJECTIVES

The students will be made to learn.
- The anatomy of the automobile in general.
- The location and importance of each part of automobile.
- The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels, suspension, frame, springs and other connections.
- The effect of automobile emissions on environment and how to control pollution.

Course Contents:

Unit-I: Chassis & Body Engg: Types, Technical details of commercial vehicles, types of chassis, layout, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body andtheir construction, driver's visibility and methods for improvement, safety aspects of vehicles, vehicleaerodynamics, optimization of body shape, driver's cab design, body materials, location of engine, frontwheel and rear wheel drive, four wheel drive.

Unit-II: Steering System: front axle beam, stub axle, front wheel assembly, principles of types of wheelalignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe-out, conditionfor true rolling motion, centre point steering, directional stability of vehicles, steering gear, powersteering, slip angle, cornering power, over steer & under steer, gyroscopic effect on steering gears.

Unit-III: Transmission System: Function and types of clutches, single plate, multi-plate clutch, roller &spring clutch, clutch lining and bonding, double declutching, types of gear boxes, synchroniser, gearmaterials, determination of gear ratio for vehicles, gear box performance at different vehicle speed,automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft,constant velocity universal joints, differential gear box, rear axle construction.

Unit-IV: Suspension system : Basic suspension movements, Independent front & rear suspension,shock absorber, type of springs: leaf spring, coil spring, air spring, torsion bar, location of shackles,power calculations, resistance to vehicle motion during acceleration and breaking, power & torquecurve, torque & mechanical efficiency at different vehicle speeds, weight transfer, braking systems, disctheory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energisation, air-bleedingof hydraulic brakes, types of wheels and tyres, tyre specifications, construction and materialproperties of tyres& tubes.

Unit-V: Electrical and Control Systems: Storage battery, construction and operation of lead acid battery,testing of battery, principle of operation of starting mechanism, different drive systems, starter relayswitch, regulator electric fuel gauge, fuel pump, horn, wiper, lighting system, head light dazzling,signaling devices, battery operated vehicles, choppers, importance of maintenance, scheduled andunscheduled maintenance, wheel alignment, trouble Shooting probable causes & remedies of varioussystems, microprocessor based control system for automobile, intelligent automobile control systems.

Unit-VI: Emission standards and pollution control: Indian standards for automotive vehicles-Bharat I, II, III, IV, Euro I to Euro VI norms, fuel quality standards, environmental management systems forautomotive vehicles, catalytic converters, fuel additives, and modern trends in automotive engineefficiency and emission control.

References:
1. Crouse , Automotive Mechanics TMH.
2. Srinivasan S; Automotive engines; TMH
3. Gupta HN; Internal Combustion Engines; PHI;
4. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
5. Kripal Singh, Automotive Engineering Khanna Pub.
6. Newton &Steeds , Automotive Engineering
7. Emission standards from BIS and Euro –I to Euro-VI

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Departmental Elective ME 802(B) Tribology And Maintenance Engineering

Course Objectives
After studying this course, students will be able to learn;
- The basic principles governing the tribology and apply them to reduce friction and wear in mechanical machines and structures.
- About lubrication,lubricants, mechanism of lubrication
- About Nano tribology, Instrumental tests, Bearings,Clutches and Brakes

Chapter 1: Introduction, history of tribology, early scientific studies of - friction, wearand lubrication. Tribo-Surface preparations and characteristics. Surface contacts, Hertz contact stresses, residual stress, surface fatigue, creep, stress relaxation, fracture mechanics, elastic, viscoelastic and plastic behavior of materials. Choice of materials.

Chapter 2: Friction, laws of friction, rolling/sliding friction, theory of adhesion and abrasion, different mechanisms of friction , stick slip characteristics, interface temperature, thermal analysis, Molecular mechanical theory of friction, operating conditions and system parameters, calculations of coefficient of friction, design of friction devices.

Chapter 3: Wear, different types of wear mechanisms, adhesive, abrasive impact,percussion erosion, fretting wear calculations of wear rate, two body/ three body wear, wear prevention, wear of metal cutting and metal forming tools, wear mapping of materials, cavitation, surface fatigue, corrosion, performance levels classifications and specifications of lubricants

Chapter 4: Lubrication, lubricants and additives, composition and properties of lubricants, maintenance of oil and emulsions, industrial hygiene aspects, technical regulations for lubricants. boundary/ mixed and fluid film lubrication, industrial methods of lubrications, SAE,BIS, ASTM, IP, DIN Standards, oil testing's, wear and chemistry of lubricants.

Chapter 5: Nano tribology, Instrumental tests,. Bearings, clutches and brakes, slide units, dynamic seals, Automobile applications, machine tools/ press machines applications. Other applications and case studies.

Evaluation:

Evaluation will be continuous an integral part of the class as well through external assessment.

References:

1. Principles and applications of tribology, Bharat Bhushan, John Wiley& sons, ISBN 0471
594075.
2. Tribology,, - lubrication ,friction and wear, I V Kragelsky and V VAlisin, Mir publication,
ISBN 1860582885.
3. Applied Tribology,MMKhonsari and E. R. Booser, John Wiley, ISBN 04712830

Tutorial topics:

1. Testing equipments of tribology.
2. Various industrial applications of tribology.
3. NEMS and MEMS applications
4. Solid, liquid and mist/ gas lubricants.
5. Surface coatings.
6. Chemical analysis of materials
7. Various simulations
8. AFM/ FFM , SFA, STM, studies.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Departmental Elective ME 802(C) Machine Tool Design

Course Objectives

After studying this course, students will be able to :

- Understand the Kinematics of Machine Tools.
- Work with different drive systems
- Design Concepts of Metal working Tools.
- Do Design of Jigs, Fixtures and Gauges

Unit I Basic Features and Kinematics of Machine Tools: Features of basic machine tools; constructionand operation, types 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, kinematic-features of gear shapers and gear hobbing machine.

Unit II Regulation of Speed: Design of gear boxes- need for variation of speed, selection of speedrange, laws of stepped regulation, standardization of speeds, speed diagram, analysis of productivity loss, kinematic advantage of GP, structural diagrams, ray diagram and speed chart.

Gear Drives: Belt and cone pulley, slip gear type, north gear drive, draw key gear drive, clutch type, mechanical step less drives, electrical drives; hydraulic drive.

Unit III Design of Metal working Tools: Design of press working tools, shearing, piercing, blanking,dies, compound die design principles for forging dies, bending, forming drawing dies, tooling for forging design principles for forging dies, drop forging, upset forging, design principles and practice for rolling, roll press design.

Unit IV Design of Jigs and Fixtures: Principles of location, locating method and devices, principles ofclamping, clamping devices, drilling jigs, types, drill bushes, fixture and economics, types of fixture, milling, grinding, broaching, assembly fixtures indexing jig and fixtures, indexing devices.

Unit V Design of Gauges and Inspection Features: Design of gauges for tolerance for dimensions andform inspection; dies and mould design for plastics& rubber parts: compression molding, transfer molding, blow molding.

References:

1. Mehta N.K.; Machine Tool Design and Numerical Control; TMH
2. Sen G.C, Bhattacharya A; Principles of Machine Tools; New Central Book Agency.
3. Donaldson; Tool Design T.M.H.
4. Jain KC and Chitale AK; Text Book Of Production Engineering; PHI Learning
5. Juneja, Sekhon and Seth; Fundamentals of Metal Cutting and Machine Tools; New Age.
6. Krar SF, Gill AR, Smid P; Technology of Machine Tools;TMH
7. Sharma P.C; Production Engineering; Chand S
8. Wilson; Fundamentals of Tool Design; ASTME
9. Paqwin J.R; Die Design Handbook; The Industrial Press-NY
10. ASTME; Die Design Hand Book; McGraw Hill
11. Archinov; Metal Cutting & Cutting Tool Design; MIR Publishers
12. Moscow Kempster M.H.A; Introduction to Jig and Tool Design; FLBS

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Departmental Elective ME 802(D) Production Planning and Control

OBJECTIVES

After studying this course, students will be able to;

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.

- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP)

- To learn work study,time study, work measurement

Unit-I
Introduction: Types and characteristics of production systems Objective and functions of Production, Planning & Control, Place of production, Planning in Engineering, manufactures organization. Preplanning: Forecasting & Market Analysis. Factory Location & Layout, Equipment policy and replacement. Preplanning production, capacity planning.

Unit II

Work Study : Method study, basic procedure-Selection-Recording of process – Critical analysis, Development – Implementation – Micro motion and memo motion study – work measurement – Techniques of work measurement – Time study – Production study – Work sampling – Synthesis from standard data – Predetermined motion time standards.

Unit-III
Production Planning: Aggregate Planning, MPS, Material Resource Planning, Selection of material methods, machines & manpower. Routing, Scheduling and Dispatching and its sheets & charts, ProductionLineBalancing.

Unit-IV
Production and Inventory Control: Progress control through records and charts. Types of inventories, Inventory Classification. Inventory Control under constraints Economic lot (batch) size. Trends in purchasing and store keeping, JIT production MRP II, comparison of Push & Pull systems, ERP, CAPPC.

Unit-V
Productivity: Importance, Productivity patterns, productivity measurements & ratios, improvement-maintenance process. 3 Human Factors & Ergonomics: Human abilities, Training & motivation safety programs,workplacedesign&workingconditions.

Reference Books :

1. Elements of Production Planning & Control –Eilon

2. Production Planning & Control – Jain and Agarwal

3. Operations Management – Buffa and Sarin.

4. Project Management, S.C. Sharma, Khanna Publishing House

5. Production System – J.L. Riggs.

6. Industrial Engineering and Production Management : Martand Telsang, First edition, S. Chand and Company, 2000.

7. Theory and Problems in Production & Operations Management: Chary. S.N, Tata McGraw Hill, 1995

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Open Elective ME 803(A) Data Analytics

Course Objectives:

Data Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better, and in many contexts enable us to make better decisions. While this is broad and grand objective, the last 20 years has seen steeply decreasing costs to gather, store, and process data, creating an even stronger motivation for the use of empirical approaches to problem solving.

This course will enable you with a wide range of data analytic techniques and is structured around the broad contours of the different types of data analytics, namely, descriptive, inferential, predictive, and prescriptive analytics.

Pre-requisites:

This course requires that you are familiar with high-school level linear algebra, and calculus.Knowledge of probability theory, statistics, and programming is desirable

UNIT-I

DESCRIPTIVE STATISTICS :Probability Distributions, Inferential Statistics ,Inferential Statistics through hypothesis tests Regression & ANOVA ,Regression ANOVA(Analysis of Variance).

UNIT-II

INTRODUCTION TO BIG DATA: Big Data and its Importance, Four V's of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications.

BIG DATA TECHNOLOGIES: Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics, Information Management.

UNIT-III

PROCESSING BIG DATA: Integrating disparate data stores, Mapping data to the programming framework, Connecting and extracting data from storage, Transforming data for processing, subdividing data in preparation for Hadoop Map Reduce.

UNIT-IV

HADOOP MAPREDUCE: Employing Hadoop Map Reduce, Creating the components of Hadoop Map Reduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs, monitoring the progress of job flows, The Building Blocks of Hadoop Map Reduce Distinguishing Hadoop daemons, Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT-V

BIG DATA TOOLS AND TECHNIQUES: Installing and Running Pig, Comparison with Databases, Pig Latin, User- Define Functions, Data Processing Operators, Installing and Running Hive, Hive QL, Querying Data, User-Defined Functions, Oracle Big Data.

Reference Books and Study Materials:

1.   Hastie, Trevor, et al.�The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.

2.   Montgomery, Douglas C., and George C. Runger.�Applied statistics and probability for engineers. John Wiley & Sons, 2010

3.   NPTEL Video Course :Introduction to Data Analytics by Dr. Balaraman Ravindran Department of Computer Science and Engineering IIT Madras and Dr. Nandan Sudarsanam Department of Management Studies IIT Madras.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Open Elective ME 803(B) Energy Conservation, Management & Audit

Course Objectives

After studying this course, students will be able to;

- Understand the concepts of energy management and conservation.
- Able to conduct energy audit and report.
- Concepts of Energy policy its purpose and formation.
- Able to do Electrical Energy Management in different electrical systems

UNIT-I

Energy Management: Concept of energy management, energy demand and supply, economic analysis; Duties and responsibilities of energy managers. Energy Conservation: Basic concept, energy conservation in Household, Transportation, Agricultural, service and Industrial sectors, Lighting, HAVC.

UNIT-II

Energy Audit: Definition, need and types of energy audit; Energy management (Audit) approach: Understanding energy cost, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirement; Fuel & energy substitution; Energy audit instruments; Energy conservation Act; Duties and responsibilities of energy manager and auditors.

UNIT-III

Material energy balance: Facility as an energy system; Method for preparing process flow; material and energy balance diagrams. Energy Action Planning: Key elements, force field analysis; Energy policy purpose, perspective, content, formulation, rectification

UNIT-IV

Monitoring and Targeting: Definition monitoring & targeting; Data and information analysis. Electrical Energy Management: energy conservation in motors, pumps and fan systems; energy efficient motors.

UNIT-V

Thermal energy management: Energy conservation in boilers, steam turbine and industrial heating system; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pump; Building Energy Management.

References:

1. Murphy & Mckay, Energy Management, BSP Books Pvt. Ltd.

2. Smith CB; Energy Management Principle, Pergamon Press, New York.

3. Rajan GG, Optimising Energy Efficiency in Industry, TMH.

4. Callaghan P O, Energy Management, McGraw-Hill Book Company.

5. Amit Kumar Tyagi, Handbook on Energy Audit and Management, Tata Energy Research Institute. 6. Bureau of Energy Efficiency, Study material for energy Managers and Auditors: Paper I to V.

7. Hamies; Energy Auditing and Conservation: Method, Measurement, Hemisphere, Washington.

8. Witty, Larry C, Industrial Enegy Management Utilisation, Hemisphere Publishers, Washington 9.Kreith & Goswami, Energy Management and Conservation Handbook, CRC Press

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Open Elective ME 803(C) Entrepreneurship and Management Concepts

Course Objective:

To familiarize the students with the concepts and applications of Management, Marketing, Productivity & Entrepreneurship in competitive world.

Unit-I

System Concepts: Types, definition & characteristics; supra & subsystems, key component; boundary & interface complexity; feedback (pull) & feed forward (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alter's nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

Unit-II

Management: Importance, definition and functions; schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps in decision making, structured and unstructured decision; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, spam and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task force, business process reengineering and process of change management, HR planning placement and training, MIS; attitudes and personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

Unit-III

Marketing: Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research. Finance: Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

Unit-IV

Productivity and Operations: Productivity, standard of living and happiness, types of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility,

predetermined motion and time method, product and process specification, TQM, cost of quality, introduction to lean manufacturing (JIT), QFD, TPM & six sigma quality.

Unit V

Entrepreneurship : Definition and concepts, characteristics, comparison with manager, classification, theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors, sources of funds, entrepreneur development program.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination .

References:

1. Daft R; The new era of management; Cengage.
2. Bhat Anil, Arya kumar; Management: Principles,Processes and Practices; Oxford higheredu.
3. Mukharji R.S.,Agrawal N.K.; Entrepreneurship and Management Concepts,Technocrats Publication
4. Davis & Olson; Management Information System; TMH.
5. Steven Alter; Information systems, Pearson, www.stevenalter.com
6. Kotler P; Marketing management; 6- Khan, Jain; Financial Management; 7- ILO; Work study;ILO.
7. Mohanty SK; Fundamental of Entrepreneurship; PHI.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

Open Elective ME 803(D) Management Information System

Course Objectives

After studying the course, students will be able to;

- Know about MIS, MIS Theory, Systems Approach

- Understand the concept of decision making and MIS

- Learn about conceptual system design, detailed system design

- Understand implementation,evaluation and maintenance of MIS

Unit-I

Introduction of MIS

What is MIS, Decision support systems, systems approach, The systems view of business, MIS organization within the Company. Management organizational theory and the systems approach:

Development of organizational theory, Management and organizational behavior, Management information and the systems approach.

Unit-II

Information systems for decision-making:

Evolution of an information system, Basic information systems, Decision making and MIS, MIS as technique for making programmed decisions, design assisting information systems.

Strategic and project planning for MIS

General business planning, appropriate MIS response, MIS planning-general, MIS planning-details

Unit-III

Conceptual System Design

Define the problems, Systems objectives, Establish system constraints, Determine information needs, Determine information sources, Develop alternative conceptual designs and select one, Document the system concept, Prepare the conceptual design report.

Detailed System Design

Information and involve the organization, arm of detailed design, Project management of MIS detailed design. Identify dominant and trade off criteria define the subsystems, Sketch the detailed operating MIS systems and information flows, Determine the degree of automation of each operation, inform and involve the organization again, Inputs, Outputs and processing, early system testing, Software, Hardware and tools, propose an organization to operate the system, Document the detailed design., Revisit the manager user.

Unit-IV

Implementation, Evaluation and Maintenance of the MIS

Plan the implementation, Acquire floor space and plan space layouts organized for implementation, Develop procedures for implementation, Train the operating personnel, Computer related acquisitions, Develop forms for data collection and information dissemination, Develop the files, Test the system, Cut over, Document the system, Evaluate the MIS, Control and maintain the system.

Unit-V

Pitfalls in MIS Development

Fundamental weaknesses, Soft spots in planning, Design problem, Implementation the TAR PITF.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination

References

1.Murdick R.G., Russ J.B., Clagget J.R., Information Systems for modem management

2.Effy OZ, Management Information Systems, 3rd edition, Thomson.

3. Jawadekar W.S., Management Information System.

4. Brien J.A.O., Irwin, Management Information Systems, McGraw Hill

5. Dour's G.B., Olson M.H., Management Information Systems, 2nd edition, McGraw Hill

6. Thireramp R.J., Decision Support Systems for Effective Planning and Control, PHI.

7. Sadagopan S., Management Information Systems, 4thedition, Prentice-Hall of India

8. Kanter J., Managing with Information, 4th edition, Prentice-Hall of India.

9. Ladon K.C., Landon, J.P., Management Information Systems, 4th edition, Prentice-Hall of India.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

ME 804- Simulation And Modeling

Course Contents:

Introduction to ModelingSoftware Packages like Solid Works, CATIA, ANSYS, Assembly of Sleeve and Cotter joint, Gib and Cotter joint/ Knuckle Joint/ Flanged Coupling, Assembly of Connecting Rod.

Introduction to Simulation software Packages like ANSYS, Fluent, and etc. Various types of analysis. Structure analysis, Thermal analysis, Stress analysis, CFD analysis, FEM analysis, and their problem solving in actual situations.

List of Experiments (Expandable)

1. Introduction to CATIA software.
2. Introduction to ANSYS software.
3. Assembly of Sleeve and Cotter joint/ Gib and Cotter joint/ Knuckle Joint/ Flanged Coupling using CATIA.
4. Assembly of Connecting Rod using CATIA.
5. Stress analysis using ANSYS (examples: plate with a circular hole, rectangular L bracket, Axis-symmetric components, various types of beams, etc.)
6. Thermal stress analysis of a 2D component.
7. Conductive and convective heat transfer analysis of a 2D component.
8. CFD Simulation of various situations (example: Laminar pipe flow, Flat plate boundary layer, steady flow past a cylinder, Compressible flow in a Nozzle, Flow over an airfoil.)

Evaluation will be continuous an integral part of the laboratory class followed by the final external viva/voce examination

References:

1. User manual of CATIA software.
2. User manual of ANSYS and Fluent software.
3. Chandrupatla, T.R. and Belegundu, A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Pvt. Ltd.
4. Zienkiewicz O C, The Finite Element Method, 3rd ed, Tata McGraw Hill.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Mechanical Engineering, VIII-Semester

ME 805- MAJOR PROJECT- II

COURSE GUIDELINES

The objectives of the course 'Major Project -II' are

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.

- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.

- To give students an opportunity to do some thing creative and to assimilate real life work situation in institution.

- To adapt students for latest developments and to handle independently new situations.

- To develop good expressions power and presentation abilities in students.

The focus of the Major Project-II is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write-up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis, market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan.Student may carry his /her topic of major project –I for major project –II provided that supervisor of the student is agree for the same on the basis of feasibilitity and scope of work of the selected topic. Each student is required to prepare a project report and present the same at the time of final examination with a demonstration of the working system (if any).

The faculty and student should work according to following schedule:

i) Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff.

ii) The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

iii) At all the steps of the project, students must submit a written report of the same.

Evaluation

Evaluation will be continuous an integral part of the project work done by student on regular basis by the supervisor followed by the final external viva/voce examination.