

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Branch- Common to All Discipline

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

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 outlier 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 constraints 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, block, 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, ISBN 13 978 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

ME404 FLUID MECHANICS

- [1] Introduction, fluid and the continuum, fluid properties, surface tension, bulk modulus and thermodynamic properties, Newton's laws of viscosity and its coefficients, Newtonian and non Newtonian fluids, hydrostatics and buoyancy, meta center and metacentric height, stability of floating bodies.
- [2] Fluid kinematics, Lagrangian and Eulerian method, description of fluid flow, stream line, path line and streak line, types of flow and types of motion, local and convective 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 (Darcy'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 Rayleigh lines, flow through nozzles,

BOOKS:

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

ME405 MANUFACTURING TECHNOLOGY

- [1] Casting processes, introduction, materials for casting and for processes, pattern and mould, melting, pouring, cooling and solidification, defects in casting, dry sand mould casting, shell mould casting, investment casting, gravity die casting, die casting, centrifugal casting, slush casting, co₂ process. Market nomenclature and different standards
- [2] Forming processes, introduction, plastic deformation and yield criteria, mechanics and operations of forming processes like rolling, forging, drawing, deep drawing, bending, extrusion, punching and blanking, Various designs of presses and their characteristics, high energy rate forming processes, other processes, Forces and energy analysis.
- [3] Joining processes, introduction, solid phase welding, liquid phase welding(fusion welding), heat affected zone (HAZ), heat and mass transfer, strength of the joint, aftereffects and residual stresses, solid/ liquid joint like soldering and brazing, adhesive bonding, materials' characteristics, arc welding, resistance welding, gas welding, thermit welding, ultrasonic welding, electron beam welding, laser beam welding, explosive welding, inspection and defects
- [4] Machining processes, introduction, tool geometry, tool materials, wear characteristics, cutting forces, orthogonal/ oblique cutting, machinability, hardness and other mechanical properties of tool and job and their comparison, cutting fluids, failure of cutting tools, machining processes like turning, shaping, planning, drilling, milling, cylindrical, surface and centre less grinding, boring, broaching, multipoint machining, surface finish and accuracy checks,
- [5] 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,

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 F.C., Manufacturing processes.