

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, Clarendon Press Oxford (TB).
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
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

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, IV-Semester

CE402 Construction Technology

Unit-I Design features and construction of Foundations Introduction and essential requirements of foundations, footing types and depth of footings, contact pressure below footings such as strip footings, isolated footings, eccentrically loaded footings, Grillage foundations, , design features and construction detail of combined footing, strap footing, problem of frost heave, its causes and prevention, effect of ground water on footings.

Purpose of pile foundation, classification based on different criterion and types, advantages and disadvantages, selection of pile type, pile action, behavior of pile and pile group under load, definition of load failure.

Unit-II Formwork and Temporary structures Design and construction features of different types of temporary structures, stationary and slip form work techniques, special features of in-situ construction, stripping and removal of formworks, formworks for special structures, e. g. shells bridges towers etc.

Unit-III Masonry and walls Brick masonry, Bonds, Jointing, Stone masonry, casting and laying, masonry construction, brick cavity walls, code provisions regarding load bearing and non load bearing walls, common defect in construction and their effect on strength and performance of walls, Design of brick masonry, precast stone masonry, hollow concrete block and hollow block masonry walls, plastering and pointing, white and colour washing, distempering, dampness and its protection.

Doors windows and ventilators: types based on materials etc. size location fittings, construction sunshades, Sills and jambs, RCC doors/windows frames, Stair types, rules of proportionality, etc., Repair Techniques for masonry, walls, doors and windows.

Unit- IV Construction of Floors Ground floor-introduction, Components of a floor, Materials for construction, Selection of flooring material, Construction of Various types of floorings such as Mud, Brick, Cement, Terrazzo, Mosaic, Tiled, Marble, Rubber, Glass and plastic floorings etc., Upper floor- Introduction, construction of Slab floors, Jack arch floors, RCC floors, Ribbed or Hollow tiled flooring, Filler Joist floors, Pre-cast concrete floors, Timber floors etc. Repair Techniques for floors.

Construction of Roofs Introduction and types of roofs, Construction of Pitched roofs, single roofs, double or purlin roofs, trussed roofs, steel roof trusses etc. roof coverings for pitched roofs and flat terraced roof etc. Repair Techniques for roofs.

Unit- V Construction of Earthquake Resistant Building Planning of earthquake resistant building, Construction of walls – provision of corner reinforcement, construction of beams and columns, Base isolation.

Reference:-

1. Mohan Rai & M. P. Jai Singh, Advances in Building materials and Constructions.
2. S. P. Arora and S. P. Bindra, A text Book of Building Construction-Dhanpat Rai and Sons, New Delhi.
3. S. K. Sarkar and Saraswati, Construction Technology- Oxford University Press, New Delhi.
4. Sushil Kumar, Building Construction.
5. B. C. Punmia , Building Construction.
6. Metchell , Building Construction.
7. Chudley R., Construction Technology.
8. Dr. K.R. Arora Soil Mechanics & Foundation Engg - Std. Publishers Delhi
9. B.C. Punmia, Soil Mechanics & Foundation Engg. - Laxmi Publications Delhi

List of Experiments:

1. Tests on Bricks
2. Tests on Aggregates (fine and Coarse)
- 3 Tests on Cements and concrete
4. Tests on tiles

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Civil Engineering, IV-Semester

CE403 Structural Analysis-I

UNIT I Virtual work and Energy Principles: Principles of Virtual work applied to deformable bodies, Strain energy and complementary energy, Energy theorems, Maxwell's Reciprocal theorem, Analysis of Pin-Jointed frames for static loads.

UNIT II Indeterminate Structures-I: Static and Kinematics indeterminacy, Analysis of Fixed and Continuous beams by theorem of three moments, Effect of sinking and rotation of supports, Moment distribution method (without sway)

UNIT III Indeterminate Structures - II: Analysis of beams and frames by slope Deflection method, Column Analogy method.

UNIT IV Arches and Suspension Cables: Three hinged arches of different shapes, Eddy's Theorem, Suspension cable, stiffening girders, Two Hinged and Fixed Arches - Rib shortening and Temperature effects.

UNIT V Rolling loads and Influence Lines: Maximum SF and BM curves for various types of Rolling Loads, focal length, EUDL, Influence Lines for Determinate Structures- Beams, Three Hinged Arches.

References:

1. Rammamurtham, Theory of Structures, Dhanpat Rai .
2. Bhavikatti S.S. Analysis of Structures (I&II) Vikas Publication
3. B C Punmia, Theory of Structures, Firewall Media.
4. A Kassimali, Structural Analysis, Cengage Learning.
5. A Ghali, A Neville, T G Brown, Structural Analysis: CRC Press.
6. Hibbler, Structure Analysis -1, Pearson Education India
7. C S Reddy, Basic Structural Analysis, Tata McGraw Hill Publishing Company.
8. Pandit and Gupta, Theory of Structures – I, McGraw Hills
9. West HH, Fundamental of Structural Analysis, Wiley India
10. Das MM, Structural Analysis, PHI
11. Thandavamurthy TS, Structural Analysis, Oxford
12. Muthuku, Azmi I, Basic Structural Analysis, IK International Publisher
13. C KWang, Intermediate Structural Analysis, McGraw Hill
14. J Kinney Sterling, Indeterminate structural Analysis, Addison-Wesley
15. RR Mamuther S Theoty of Structures Dhanpat Rai
16. Jain O.P.-Jain B.K. Theory& Analysis of Structures (I&II) Nem Chand

Structure Analysis Lab - I

1. To verify Maxwell- Bett's Law.
2. To determine the flexural rigidity of the beam verify it theoretically
3. To determine the deflection of a pin jointed truss and to verify the results theoretically and graphically
4. To verify strain in an externally loaded beam with the help of a strain gauge indicator and to verify theoretically
5. To study behaviour of different types of columns and find Euler's buckling load for each case
6. To study two hinged arch for the horizontal displacement of the roller end for a given system of loading and to compare the same with those obtained analytically
7. To study the behaviour of a portal frame under different end conditions.

Apparatus

8. To find the value of flexural rigidity (EI) for a given beam and compare it with theoretical value
9. To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally
10. To verify the Muller Breslau theorem by using Begg's deformatior set

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Civil Engineering, IV-Semester

CE404 TRANSPORTATION ENGINEERING –I

Unit–I: Introduction, Tractive resistances & Permanent way : Principles of Transportation, transportation by Roads, railways, Airways, Waterways, their importance and limitations. Route Surveys and alignment, railway track, development and gauges. Hauling capacity and tractive effort.

1. Rails: types, welding of rails, wear and tear of rails, rail creep.
2. Sleepers: types and comparison, requirement of a good sleeper, sleeper density.
3. Rail fastenings: types, Fish plates, fish bolts, spikes, bearing plates, chain keys, check and guard rails.
4. Ballast: Requirement of good ballast, various materials used as ballast, quantity of ballast. Different methods of plate laying, material trains, and calculation of materials required, relaying of track

Unit –II : Geometric Design ; Station & Yards; Points and Crossings & Signaling and interlocking : Formation, cross sections, Super elevation, Equilibrium, Cant and cant deficiency, various curves, speed on curves. Types locations, general equipments, layouts, marshalling yards. Definition, layout details, design of simple turnouts. Types of signals in stations and yards, principles of signaling and inter-locking.

Unit – III : Bridge Site Investigation and Planning ; Loading Standards & Component parts: Selection of site, alignment, collection of bridge design data : essential surveys, hydraulic design, scour depth of bridge foundation, Economical span, clearance, afflux, type of road & railway bridges : Design loads and forces, Impact factor, Indian loading standards for Railways Bridges and Highway Bridges. Bridge super structure and sub-structures, abutments, piers, wing walls, return walls, approaches, floors & flooring system, choice of super structure.

Unit – IV: Bridge Foundations, Construction, Testing and Strengthening of Bridges: Different types of foundation: piles and wells, sinking of wells, coffer-dams. Choice of bridges and choice of materials, details of construction underwater and above water, sheet piles coffer dams, Erection of bridges, girders, equipments and plants, inspection and data collection, strengthening of bridges, Bridge failure.

Unit – V: Tunnels:

1. Selection of route, Engineering surveys, alignment, shape and size of tunnel, bridge action, pressure relief phenomenon, Tunnel approaches, Shafts, pilot shafts.
2. Construction of tunnels in soft soil, hard soil and rock. Different types of lining, methods of lining. Mucking operation, Drainage and ventilation. Examples of existing important tunnels in India and abroad.

References:-

- 1.Chakraborty and Das; Principles of transportation engineering; PHI
- 2.Rangwala SC; Railway Engineering; Charotar Publication House, Anand
- 3.Rangwala SC; Bridge Engineering; Charotar Publication House, Anand
- 4.Ponnuswamy; Bridge Engineering; TMH
- 5.Railway Engineering by Arora & Saxena - Dhanpat Rai & Sons
- 6.Railway Track by K.F. Antia
- 7.Principles and Practice of Bridge Engineering S.P. Bindra - Dhanpat Rai & Sons
- 8.Bridge Engineering - J.S. Alagia - Charotar Publication House, Anand
- 9.Railway, Bridges & Tunnels by Dr. S.C. Saxena
- 10.Harbour, Docks & Tunnel Engineering - R. Srinivasan
- 11.Essentials of Bridge Engg. By I.J. Victor; Relevant IS & IRS codes

Transportation Engineering Lab - I

1. Collection of different types of photographs showing
 - a. Various bridge types
 - b. Rail tracks
 - c. Tunnels
2. Hydraulic design of bridges.
3. Various modern large span bridges: Pre stressed bridges and launching process.
4. Visit of Railway bridges for rehabilitation.
5. Visit of Railway Over Bridges and Under Bridges.

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Civil Engineering, IV-Semester

CE405 ENGINEERING GEOLOGY & REMOTE SENSING

Unit 1: Introduction and physical geology: branches application and scope of geology, age and parts of the earth, weathering of rocks, geological action of river, ground water, sea and oceans, Concept and causes of earthquakes and volcanoes.

Unit 2: Mineralogy and crystallography: fundamentals of mineralogy, physical properties, study of common rock forming minerals and ore minerals, importance to civil engineering, and element of crystals and introduction to crystal systems.

Unit 3: Petrology: rock cycle, composition, classification and structures of igneous, sedimentary and metamorphic rocks of civil engineering importance, study of common rock types, brief geological history of India.

Unit 4: Structural geology: dip, strike, outcrops, classification and detailed studies of geological structures i.e. Folds, Faults, Joints, Unconformity and their importance in civil engineering.

Unit 5: Applied geology and remote sensing, engineering properties of rocks, selection of sites for Dam, Tunnel, Reservoirs and Canals, uses of remote sensing technique. Types, components and elements of remote sensing, EMS and MSS, Visual interpretation technique, application of GIS in civil engineering and resource mapping (site selection, water resources, rocks and soil)

List of Experiment's (Expandable)

1. Identification of simple rock forming minerals and important ores.
2. Identification of rocks
3. Simple map Exercises.
4. Field Visit/Geological Excursion

Reference:

1. Prabin Singh - "Engineering and General Geology"
2. P. K. Mukherjee - "A text Book of Geology"
3. S. K. Garg --"A text Book of Physical and Engineering Geology"

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Civil Engineering, IV-Semester

CE406 SOFTWARE LAB (AutoCAD)

List Of Experiments:

1. Introduction to CAD, Introduction to AutoCAD, Software and hardware requirements, various input and output devices. Getting started with AutoCAD, Setting drawing limits, Units etc.
2. Learning and practice of Draw commands, Modify commands, utility and other commands.
3. Drawing basic Geometric Shapes, Basic Plotting and Editing Tools, Architectural Views & Drafting Views.
4. 3D modelling with AutoCAD
5. Dimensioning, Annotating in AutoCAD with Text & Hatching, Blocks, drafting symbols and Attributes, Layers, Templates & Design Center, Advanced plotting (Layouts, Viewports)
6. Drawing plan, section and elevation of 1 BHK house.

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Civil Engineering, VI-Semester

CE601- Structural Design & Drawing (RCC-I)

Structural Design & Drawing (RCC-I)

Unit - I

Basic Principles of Structural Design: Assumptions, Mechanism of load transfer, Various properties of concrete and reinforcing steel, Introduction to working stress method and limit state methods of design, partial safety factor for load and material. Calculation of various loads for structural design of singly reinforced beam, Partial load factors.

Unit - II

Design of Beams: Doubly reinforced rectangular & Flanged Beams, Lintel, Cantilever, simply supported and continuous beams, Beams with compression reinforcement: Redistribution of moments in continuous beams, Circular girders: Deep beams. Design of beam for shear and bond.

Unit-III

Design of Slabs: Slabs spanning in one direction. Cantilever, Simply supported and Continuous slabs, Slabs spanning in two directions, Circular slabs, Waffle slabs, Flat slabs, Yield line theory.

Unit -IV

Columns & Footings: Effective length of columns, Short and long columns- Square, Rectangular and Circular columns, Isolated and combined footings, Strap footing, Columns subjected to axial loads and bending moments (sections with no tension), Raft foundation.

Unit -V

Staircases: Staircases with waist slab having equal and unequal flights with different support conditions, Slabless tread-riser staircase.

NOTE :- All the designs for strength and serviceability should strictly be as per the latest version of IS:456. Use of SP-16 (Design aids)

Laboratory Work: Laboratory work will be based on the above course as required for engineering projects.

Reference Books: -

1. Plain & Reinforced Concrete Vol. I & II – O.P. Jain & Jay Krishna
2. Limit State Design by P.C.Varghese ; Prentice Hall of India, New Delhi
3. Design of Reinforced Concrete Elements by Purushothman; Tata McGraw Hill, New Delhi
4. Reinforced Cement Concrete by Gupta & Mallick, Oxford and IBH

5. Reinforced Cement Concrete by P. Dayaratnam, Oxford and IBH
6. Plain & reinforced concrete - Rammuttham
7. Plain & reinforced concrete – B.C. Punnia
8. Structural Design & Drawing by N.K.Raju.

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Civil Engineering, VI-Semester

CE602- Environmental Engineering-I

Environmental Engineering-I

Unit – I

Estimation of ground and surface water resources. quality of water from different sources, demand & quantity of water, fire demand, water requirement for various uses, fluctuations in demand, forecast of population.

Unit – II

Impurities of water and their significance, water-borne diseases, physical, chemical and bacteriological analysis of water, water standards for different uses. Intake structure, conveyance of water, pipe materials, pumps - operation & pumping stations.

Unit – III

Water Treatment methods-theory and design of sedimentation, coagulation, filtration, disinfection, aeration & water softening, modern trends in sedimentation & filtration, miscellaneous methods of treatment.

Unit – IV

Sewerage schemes and their importance, collection & conveyance of sewage, storm water quantity, fluctuation in sewage flow, flow through sewer, design of sewer, construction & maintenance of sewer, sewer appurtenances, pumps & pumping stations.

Unit – V

Characteristics and analysis of waste water, recycles of decomposition, physical, chemical & biological parameters. Oxygen demand i.e. BOD & COD, TOC, TOD, Th OD, Relative Stability, population equivalent, instrumentation involved in analysis, natural methods of waste water disposal i.e. by land treatment & by dilution, self purification capacity of stream, Oxygen sag analysis.

Reference Books: -

1. Water Supply Engineering by B.C. Punmia - Laxmi Publications (P) Ltd. New Delhi
2. Water Supply & Sanitary Engg. by G.S. Birdi - Laxmi Publications (P) Ltd. New Delhi
3. Water & Waste Water Technology by Mark J.Hammer - Prentice - Hall of India, New Delhi
4. Environmental Engineering - H.S. Peavy & D.R.Rowe-Mc Graw Hill Book Company,New Delhi
5. Water Supply & Sanitary Engg. by S.K. Husain
6. Water & Waste Water Technology - G.M. Fair & J.C. Geyer
7. Relevant IS

List of Experiments:

1. To study the various standards for water
2. To study of sampling techniques for water
3. Measurement of turbidity
4. To determine the coagulant dose required to treat the given turbid water sample
5. To determine the conc. of chlorides in a given water samples
6. Determination of hardness of the given sample
7. Determination of residual chlorine by “Chloroscope”
8. Determination of Alkalinity in a water samples
9. Determination of Acidity in a water samples
10. Determination of Dissolved Oxygen (DO) in the water sample.

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Civil Engineering, VI-Semester

Departmental Elective CE 603(A) Water Resource Engineering

Unit - I

Irrigation water requirement and Soil-Water-Crop relationship: Irrigation, definition, necessity, advantages and disadvantages, types and methods. Irrigation development. Soils - types and their occurrence, suitability for irrigation purposes, wilting coefficient and field capacity, optimum water supply, consumptive use and its determination. Irrigation methods surface and subsurface, sprinkler and drip irrigation. Duty of water, factors affecting duty and methods to improve duty, suitability of water for irrigation, crops and crop seasons, principal crops and their water requirement, crop ratio and crop rotation, intensity of irrigation.

Unit - II

Ground Water and Well irrigation:

Confined and unconfined aquifers, aquifer properties, hydraulics of wells under steady flow conditions, infiltration galleries. Ground water recharge-necessity and methods of improving ground water storage. Water logging-causes, effects and its prevention. Salt efflorescence causes and effects. Reclamation of water logged and salt affected lands. Types of wells, well construction, yield tests, specific capacity and specific yield, advantages and disadvantages of well irrigation.

Unit-III

Hydrology: Hydrological cycle, precipitation and its measurement, recording and non recording rain gauges, estimating missing rainfall data, rain gauge net works, mean depth of precipitation over a drainage area, mass rainfall curves, intensity-duration curves, depth-area duration curves, Infiltration and infiltration indices, evaporation stream gauging, run off and its estimation, hydrograph analysis, unit hydrograph and its derivation from isolated and complex storms, S-curve hydrograph, synthetic unit hydrograph.

Unit - IV

Canals and Structures: Types of canals, alignment, design of unlined and lined canals, Kennedy's and Lacey's silt theories, typical canal sections, canal losses, lining-objectives, materials used, economics. Introductions to Hydraulic Structures viz.Dams,Spillways,Weirs ,Barrages,Canal Regulation Structures.

Unit-V

Floods: Types of floods and their estimation by different methods, probability and frequency analysis, flood routing through reservoirs and channels, flood control measures, economics of flood control.

Reference Books: -

1. Irrigation & Water Power Engg. by Punmia & Pandey B.B.Lal
2. Engg. Hydrology by K. Subhramanya - Tata Mc Graw Hills Publ. Co.
3. Engg. Hydrology - J.NEMEC - Prentice Hall
4. Hydrology for Engineers Linsley, Kohler, Paulnus - Tata Mc.Graw Hill.
5. Hydrology & Flood Control by Santosh Kumar - Khanna Publishers
6. Engg. Hydrology by H.M. Raghunath

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Civil Engineering, VI-Semester

Departmental Elective CE 603(B) Precast & Modular Construction

Precast & Modular Construction

Unit – I

Introduction-Need for prefabrication – Principles – Materials – Modular coordination – Standardization –Systems – Production – Transportation – Erection.

Unit – II

Prefabricated components-Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

Unit – III

DESIGN PRINCIPLES Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

Unit – IV

Joints in Structural Members-Joints for different structural connections – Dimensions and detailing – Design of expansion joints

Unit – V

Design of abnormal load: Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., – Importance of avoidance of progressive collapse.

Reference Books: -

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., “Knowledge based process planning for construction and manufacturing”, Academic Press Inc., 1994

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Civil Engineering, VI-Semester

Departmental Elective CE 603(C) Advance Pavement Design

Advance Pavement Design

Unit -I

Equivalent Single Wheels Load concepts and applications, Relationship between wheel arrangements and loading effects, tyre contact area, Effect of load repetition, Effect of transient loads, Impact of moving loading, Factors to be considered in Design of pavements, Design wheel load, soil, climatic factors, pavement component materials, Environmental factors, Special factors such as frost, Freezing and thawing.

Unit -II

Flexible Pavements : Component parts of the pavement structures and their functions, stresses in flexible pavements, Stress distribution through various layers, Boussinesque's theory , Burmister's two layered theory, methods of design, group index method, CBR method, Burmister's method and North Dakota cone method.

Unit -III

Rigid Pavements: Evaluation of subgrade, Modulus-K by plate bearing test and the test details, Westergaard's stress theory stresses in rigid pavements, Temperature stresses, warping stresses, frictional stresses, critical combination of stresses, critical loading positions.

Unit -IV

Rigid pavement design: IRC method, Fatigue analysis, PCA chart method. AASHTO Method, Reliability analysis. PAVEMENT JOINTS: Types of joints, contraction and warping joints, dowel bars and tie bars, Temperature reinforcements, filling and sealing of joints.

Unit -V

Evaluation and Strengthening of Existing Pavements: Benkleman beam method, Serviceability Index Method. Rigid and flexible overlays and their design procedures.

Reference Books:--

1. Principles of pavement design by E.J.Yoder & M.W. Witzczak
2. AASHTO, "AASHTO Interim Guide for Design of Pavement Structures", Washington, D.C.
3. Portland Cement Association, Guidelines for Design of Rigid Pavements, Washington
4. DSIR, Conc. Roads Design & Construction
5. Srinivasan M. "Modern Permanent Way"

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Departmental Elective CE 603(D) Cost Effective & ECO-Friendly Structures

Cost Effective & ECO-Friendly Structures

Unit -I

Concepts of energy efficient & environment friendly materials and techniques. Cost effective materials :- Soil, Fly ash, Ferrocement, Lime, Fibres, Stone Dust, Red mud, Gypsum, Alternate Wood, Polymer.

Energy Efficient & Environment friendly building material products:- Walls - Stabilised and sun dried, soil blocks & bricks, Solid & Hollow concrete blocks, stone masonry blocks, Ferrocement partitions.

Roofs - Precast R.C. Plank & Joists roof, Precast channel roof, Precast L-panel roof, Precast Funicular shells, Ferrocement shells, Filler Slab, Seasal Fibre roof, Improved country tiles, Thatch roof, M.C.R. tile.

Unit -II

Cost effective construction techniques and equipments :-

(a) Techniques :- Rat trap bond construction, Energy Efficient roofings, Ferrocement technique, Mud Technology.

(b) Equipments :- Brick moulding machine, Stabilised soil block making machine and plants for the manufacturing of concrete blocks, M.C.R. tile making machine, Ferrocement wall panel & Roofing channel making machine, R.C.C. Chaukhat making m/c.

Unit -III

Cost effective sanitation :-

- (a) Waste water disposal system
- (b) Cost effective sanitation for rural and urban areas
- (c) Ferrocement Drains

Unit -IV

Low Cost Road Construction:-

Cost effective road materials, stabilization, construction techniques tests, equipment used for construction, drainage, maintenance.

UNIT-V

Cost analysis and comparison :-

- (a) All experimental materials
 - (b) All experimental techniques
- Green Building rating systems

Reference books:-

1. Alternative Building Materials and Technologies – K S Jagadeesh, B V Venkatta Rama Reddy & K S NanjundaRao – New Age International Publishers
2. Integrated Life Cycle Design of Structures – AskoSarja –CRC Press
3. Non-conventional Energy Resources –D S Chauhan and S K Sreevasthava – New Age International Publishers
4. Buildings How to Reduce Cost – Laurie Backer - Cost Ford
5. Lynne Elizabeth, Cassandra Adams Alternative Construction : Contemporary Natural BuildingMethods ”, Softcover, Wiley & Sons Australia, Limited, John,2005
6. Givoni, “Man, Climate, Architecture, Van Nostrand, New York, 1976.
7. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery,John Wiley & Sons,2005.
8. Eugene Eccli- Low Cost, Energy efficient shelter for owner & builder, Rodale Press, 1976

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Civil Engineering, VI-Semester

Open Elective CE 604(A) Fluid Mech. – II

Fluid Mech. – II

Unit-I

Turbulent flow : Laminar and turbulent boundary layers and laminar sublayer, hydrodynamically smooth and rough boundaries, velocity distribution in turbulent flow, resistance of smooth and artificially roughened pipes, commercial pipes, aging of pipes. Pipe flow problems : Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel, branching of pipes. Pipe Network : *Water Hammer (only quick closure case). transmission of power. *Hardy Cross Method

Unit-II

Uniform flow in open channels : Channel geometry and elements of channel section, velocity distribution, energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, Chezy's and Manning's formulae, determination of normal depth and velocity, Normal and critical slopes, Economical sections, Saint Venet equation.

Unit-III

Non uniform flow in open channels : Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow hydraulic jump in rectangular channels and its basic characteristics, surges in open channels & channel flow routing, venturi flume.

Unit-IV

Forces on immersed bodies: Types of drag, drag on a sphere, a flat plate, a cylinder and an aerofoil development of lift, lifting vanes, magnus effect.

Unit-V

Fluid Machines: Turbines : Classifications, definitions, similarity laws, specific speed and unit quantities, Pelton turbine-their construction and settings, speed regulation, dimensions of various elements, Action of jet, torque, power and efficiency for ideal case, characteristic curves.

Reaction turbines: construction & settings, draft tube theory, runaway speed, simple theory of design and characteristic curves, cavitation. Pumps: Centrifugal pumps : Various types and their

important components, manometric head, total head, net positive suction head, specific speed, shut off head, energy losses, cavitation, principle of working and characteristic curves.

Reciprocating pumps: Principle of working, Coefficient of discharge, slip, single acting and double acting pump, Manometric head, Acceleration head.

Reference books:-

1. Fluid Mechanics - Modi & Seth - Standard Book house, Delhi
2. Open Channel Flow by Rangaraju - Tata Mc Graw - Hill Publishing Comp. Ltd., New Delhi
3. Fluid Mechanics - A.K. Jain - Khanna Publishers, Delhi
4. Fluid Mechanics, Hydraulics & Hydraulic Machanics - K.R. Arora - Standard Publishers Distributors 1705- B, Nai Sarak, Delhi-6
5. Hyd. of open channels By Bakhmetiff B.A. (McGraw Hill, New York)
6. Open Channel Hyd. By Chow V.T. (McGraw Hill, New York)
7. Engineering Hydraulics By H. Rouse
8. Centrifugal & Axial Flow Pump By Stempanoff A.J. New York
9. Relevant IS codes.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(B) Intellectual Property Rights

Course Objective

Acquaint the students with the basic concepts of Intellectual Property Rights; and sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT I Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- *Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property.*

Major international documents relating to the protection of IP - *Berne Convention, Paris Convention, TRIPS.* The World Intellectual Property Organization (WIPO).

UNIT II Copyright

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, *Civil, Criminal, Administrative*, Registration Procedure.

UNIT III Patents

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

Course Outcome:

1. Students will be able to understand Primary forms of IPR
2. Students will be able to asses and critique some basic theoretical justification for major forms of IP Protection
3. Students will be able to compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Students will be able understand the registration procedures related to IPR.
5. Students will be exposed to contemporary issues and enforcement policies in IPR.

References:

1. **P. Narayanan, Intellectual Property Law, Eastern Law House**
2. . **Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014**
3. **N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.**
4. **Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.**
5. **Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.**
6. **Prabuddha Ganguli, “ Intellectual Property Rights” Mcgraw Hill Education, 2016.**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(C) Environmental Impact Assessment

Environmental Impact Assessment

UNIT-I

Concept of EIA : Introduction of EIA, Utility and scope of EIA, Significant Environmental Impacts, Stage of EIA, Environmental Inventory, Environmental Impact Statement (EIS)

UNIT-II

Methods of Impact Identification : Environmental Indices and indicators for describing the affected environment, matrix methodologies, network, checklist, and other method.

UNIT-III

Impact analysis : Framework, statement predication and assessment of impact of air, water, noise and socio-economic environment.

UNIT-IV

Preparation of written documentation : Initial planning phase, detailed planning phase, writing phase, organizing relevant information, co-ordination of team writing effort.

UNIT-V

Public Participation in Environmental Decision making : Basic definitions, Regulatory requirements, Advantages & disadvantages of Public Participation, Selection of Public participation techniques, Practical considerations for implementation.

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(D) Operation Research

Operation Research

Unit I

Linear Models: The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

Unit II

Transportation Models And Network Models: Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

Unit III

Inventory Models: Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

Unit IV

Queueing Models: Queueing models – Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

Unit V

Decision Models: Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

Reference books:-

Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

CE605- Advance surveying lab

List of Experiments

1. Measurement of Distance by Chaining and Ranging.
2. Locating Various Objects by Chain or Cross-Staff Surveying.
3. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
4. Determination of elevation of various points with dumpy level by collimation plane method and rise & fall method.
5. Fixing bench mark with respect to temporary bench mark with dumpy level by fly levelling and check levelling.
6. Measurement of vertical angles with theodolite.
7. Determination of horizontal distance between two inaccessible points with theodolite.
8. Locating given building by theodolite traversing
9. To perform complete survey with Total Station.

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

CE606- Non- Destructive Testing Lab

Non- Destructive Testing Lab

List of experiment:

1. To study of Rebound Hammer Test.
2. To study of UPV Test.

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

CE801- Design of Steel Structures

UNIT I: Basis of Structural Design and Connection Design

Introduction; Metallurgy of steel; Structural properties of steel; Design philosophies; Limit state method; Partial load factors; Loading and load combination on structures; Local buckling and section classification.

Types of connections; Welded connections; Types of joints and welds; Connection design; Concentric connection; Eccentric connections; Truss connections; Bolted connections; Force transfer mechanism; Failure mechanism; Analysis of bolt groups; Beam column connections, shear connection; Moment connection.

UNIT II: Design of Compression and Tension Members

Types of tension member; Behaviour of tension members; Factors affecting the strength of tension members; Design of tension member; for yielding; Net section rupture; Block shear; Tension splices; Lug angles; Concept of shear lag.

Types of compression members; Basis of current codal provision for compression member design; Slenderness ratio; Elastic buckling; Strength curves; Design of compression members.

UNIT III: Design of Flexural Members

Beam types; Lateral stability of beams; Lateral torsional buckling of symmetric beams; Design strength of Laterally supported and Unsupported beams in bending; Shear strength of steel beams; Web buckling and crippling; Design of beams; Built-up beams; Design of plate girders; Types of stiffeners; Flange and web splices; Design of beam-columns subjected to combined tension and bending.

UNIT IV: Design of Columns and Column Bases

Design of single section and compound section ; Design of laced and battened type columns; Design of column bases; Slab base; Gusseted base; Grillage foundation

UNIT V: Design of Industrial Buildings

Introduction, Frames; Multistory frames; Various types of trusses and their selection; Design of purlin and elements of truss; Effect of wind loads on purlin and truss; Bracing systems ,Design of Gantry Girder ,

References:

1. Gambhir M. L., Fundamentals of Structural Steel Design, McGraw Hill Education., First edition, 2017.
2. Dayaratnam P., Design of Steel Structures, A. H. Wheeler & Co. Ltd., Allahabad, 2008
3. Arya and Ajmani, Design of Steel Structures, NemChand Brothers, Roorkee, 2007
4. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, Design of Steel Structures, Arihant Publications, Bombay, 2008

5. Shiyekar M. R., Limit State Design in Structural Steel, Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.
6. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2013.
7. Narayanan R.et.al., Teaching Resource on Structural Steel Design, INSDAG, Ministry of Steel Publications, 2002
8. Duggal S. K., Limit State Design of Steel Structures, Tata McGraw Hill Publishing Company, Third edition, 2019.
9. Bhavikatti S. S, Design of Steel Structures by Limit State Method as per IS:800-2007, IK International Publishing House Pvt. Ltd., 2009
10. IS 800: latest version, General Construction in Steel - Code of Practice, Bureau of Indian Standards, New Delhi.
11. IS 875 (Part 1): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 1 Dead Loads - Unit Weights of Building Materials and Stored Materials, Bureau of Indian Standards, New Delhi.
12. IS 875 (Part 2): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 2 Imposed Loads, Bureau of Indian Standards, New Delhi.
13. IS 875 (Part 3): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 3 Wind Loads, Bureau of Indian Standards, New Delhi.
14. IS 875 (Part 4): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 4 Snow Loads, Bureau of Indian Standards, New Delhi.
15. IS 875 (Part 5): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 5 Special Loads and Combinations, Bureau of Indian Standards, New Delhi.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

Departmental Elective CE 802(A) Engineering Hydrology

UNIT I

Hydrological cycle, water budget, Practical applications of Hydrology, Hydrometeorology, airmasses. Formation of precipitation, types of precipitation, meteorological observations, probability & random variables, regression analysis, catchment its type and importance, measurement of precipitation, Raingauges, location of raingauges, interpretations & analysis of rainfall data, calculation of average rainfall, Hyetograph, Intensity-duration, Frequency curves , Mass curve.

UNIT II

Stream flow measurement and various methods, stage-discharge relations. Rating curve and its extension, stream gauge Networking, stage & discharge hydrographs, evaporation & evapotranspiration-calculation, factors affecting measurement, Reducing evaporation.

UNIT III

Infiltration, Factors affecting it, measurement of Infiltration, Infiltration equation and Indices. Occurance of ground water, Darcey's law, flow in wells (steady & unsteady). Ground water exploration. Yield of well, determination of yield.

UNIT IV

Runoff and its components, factors affecting runoff, Basin yield, Rainfall-Runoff relationships, flow-duration curve, flow mass curve, Hydrograph, separation of hydrograph, unit hydrograph - theory & application, derivation of unit hydrograph convolution equation, unit hydrograph from complex storms unit hydrograph for various durations, synthetic unit hydrograph, S-curve hydrograph, distribution graph, use & applications of unit hydrograph, Dimensionless unit Hydrograph.

UNIT V

Instantaneous unit Hydrograph, Derivation of IUH, flood routing, reservoir routing, different methods, storage discharge relationship, ISD method, puls method, channel routing –muskingham method, design flood –Empirical & rational formula, frequency analysis, Gumbel's distribution, Reservoir sedimentation-causes, factors affecting & control.

Books:

1. Engineering Hydrology by Subramanyam
2. Introduction to hydrology By: Viessman & Lewis
3. Applied Hydrology By: CW Fetter
4. A text Book of Hydrology By: Reddy
- 5.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

Departmental Elective CE 802(B) Foundation Engineering

UNIT 1. Selection of foundation and Sub-soil exploration/investigation: Types of foundation, Factors affecting the selection of type of foundations, Steps in choosing types of foundation based on soil condition. Objectives and planning of exploration program, methods of exploration-wash boring and rotary drilling-depth of boring, Soil samples and soil samplers-representative and undisturbed sampling, Field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log, report writing.

UNIT 2. Shallow Foundation: Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton, Meyerhof), Bearing capacity determination using IS Code. Settlement, components of settlement & its estimation, permissible settlement, Proportioning of footing for equal settlement, allowable bearing pressure. Bearing capacity from in-situ tests (SPT, SCPT, PLATE LOAD), Factors affecting bearing capacity, Contact pressure under rigid and flexible footings. Floating foundation.

UNIT 3. Pile foundations: Introduction, Load transfer mechanism, Types of piles and their function, Factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, Piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), Pile load test, Pile group: carrying capacity, efficiency and settlement. Negative skin friction.

UNIT 4. Foundations on problematic soil & Introduction to Geosynthetics: Significant characteristics of expansive and collapsible soils, footing on such soils, Problems and preventive measures. Under-reamed pile foundation-its concept, design & field installation. Introduction to geosynthetics-materials, types, functions and uses.

UNIT 5. LATERAL EARTH PRESSURE: Active, Passive and Earth pressure at rest. Rankine's theory of earth pressure, Earth pressures in layered soils, Coulomb's earth pressure theory, Culmann's graphical method.

RETAINING WALLS: Types of retaining walls- stability of retaining walls against overturning, sliding, bearing capacity and drainage from backfill. Reinforced earth retaining walls.

Reference Book:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi, 2014.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition 2017.
4. Joseph E bowles, "Foundation Analysis and design", McGraw Hill Education, 5th Edition, 28th August 2015.

5. Shamsheer Prakash et al, "Analysis, Design of foundations and Retaining Structures" Sarita Prakashan.
6. Murthy, V.N.S., "Advanced Foundation Engineering", CBS Publishers and Distributors
7. Coduto D.P., Foundation design; principles and practices, Pearson Publication

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

Departmental Elective CE 802(C) Bridge Engineering

UNIT 1: Types of Bridge Super Structures

Introduction and types, temporary bridge superstructures, military bridges, other temporary bridges, permanent bridges, R.C.C. bridges, Pre-stressed concrete bridges, steel bridges, movable steel bridge.

Consideration of loads and stresses in road bridges: Introduction, loads, forces and stress, dead loads, bridge loading as per relevant IRC and IRS specifications traffic lanes, foot way, kerbs, railing and parapet loading, impact, wind load, longitudinal forces, Temperature effect of live load on back fill and on the abutment.

UNIT 2: Design of R.C. Bridge

Slab culvert, pipe culvert, T-beam, box culvert bridge super structure, Courbon's theory for load distribution, balanced cantilever bridges, design examples.

UNIT 3: Design of Steel Bridges

Types of steel superstructure, plate girder bridge, truss bridge, wind forces of lattice girder bridge, bracings, arch and bowstring girder bridge, design example.

UNIT 4: Pier, Abutment and Wing Walls

Types of piers and abutments, stability analysis of piers and abutments, design of piers, Forces on piers, stability, abutment, bridge code provision for abutments, wing walls, design examples.

UNIT 5: Foundations and Bearings

Types of bridge foundations and general design criteria, shallow foundations, deep foundations, piles, wells and pneumatic caissons, river training works.

Bearings: functions and types of bearings, necessity of bearings, design of elastomeric bearings, expansion joints, necessity and types of expansion joints, design considerations.

References Books:

1. Victor, D.J., Essential of Bridge Engineering , Oxford & IBH Publishing Co., New Delhi.
2. Rowe, R.E., Concrete Bridge Design , C.R. Books Ltd., London
3. Krishna Raju N, Design of Bridges, Oxford & IBH Publishing Co., New Delhi.
4. Bakht. B and Jaeger, L.C., Bridge Analysis Simplified, McGraw Hill Book Co. Inc.
5. Ponnuswamy, S., Bridge Engineering, Tata McGraw Hill, New Delhi.
6. Bakht, B. and Jaeger, L.G., Bridge Deck Analysis Simplified, McGraw Hill International Edition, Singapore
7. Aswani M.G., Vazirani V.N. and Ratwani M.M., Design of Concrete Bridges, Khanna publishers, New Delhi.
8. Hambly E.C., Bridge Deck Behaviour.
9. Sastry V.V., Design of Bridges, Dhanpat Rai & Co
10. Raina V.K., Concrete Bridge Design and Practice, Tata McGraw Hill, New Delhi.

11. Jagadeesh .T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013
12. Indian Standard Codes and IRC codes related to bridges.

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

Departmental Elective CE 802(D) Earthquake Resistant Design of Structures

Unit I

Engineering Seismology: Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, Earthquake measurement parameters, Characteristics of earthquake and its quantification- Magnitude and Intensity scales, Seismic instruments. Seismic zoning map of India.

Unit II

Response Spectrum: Response history and strong motion characteristics. Response Spectrum- elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design .Computation of seismic forces in multi-storeyed buildings - using procedures as per codal provisions.

Unit III

Aseismic Structural Modelling: Structural configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls,

Unit IV

Design of structure for earthquake resistance: Seismic design philosophy, Load combinations, Ductility and energy absorption in buildings. confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS-1893. Lateral load resisting structural systems.

Unit V

Seismic control of structures: Introduction, concept and types of seismic control systems as active, passive and semi-active systems. Requirements of efficient earthquake resistant structural system, damping devices, base isolation systems. Retrofitting of structures.

Reference Books:

1. Chopra Anil Kumar, Dynamics of Structures - Theory and Application to Earthquake Engineering, Pearson Education.

2. Hosur Vinod, Earthquake Resistant Design of Building Structures, Wiley (India).
3. Duggal S. K., Earthquake Resistant Design of Structures, Oxford University Press.
4. Agarwal Pankaj, Shrikande Manish, Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi India.
5. Pauley & Priestly, Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons.
6. Stratta J. L, Manual of Seismic Design, Prentice-Hall India Pvt Ltd.
7. Kramer S. L., Geotechnical Earthquake Engineering, Prentice-Hall India Pvt Ltd.
8. All relevant IS codes:
 - IS 1893: Criteria for earthquake resistant design of structures, Bureau of Indian Standards, New Delhi.
 - IS 4326: Code of practice for earthquake resistant design and construction of buildings, Bureau of Indian Standards, New Delhi.
 - IS 13920: Ductility detailing of reinforced concrete structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

Open Elective CE 803(A) Artificial Intelligence

Course Objectives

After studying this course, students will be able to

1. learn about importance of AI techniques. Adoption of Artificial Intelligence (AI) technologies is widely expanding in our society. Applications of AI include: self-driving cars, personal assistants, surveillance systems, robotic manufacturing, machine translation, financial services, cyber security, web search, video games, code analysis and product recommendations.
2. Know the exact application of AI Techniques. Such applications use AI techniques to interpret information from a wide variety of sources and use it to enable intelligent, goal-directed behavior.
3. understand the working of Modern AI based systems. It often involves self-learning systems that are trained on massive amounts of data, and/or interacting intelligent agents that perform distributed reasoning and computation.
4. Know about sensors used in AI based systems. AI connects sensors with algorithms and human-computer interfaces, and extends itself into large networks of smart devices.
5. know the opportunities after having knowledge of AI techniques. The knowledge of Artificial Intelligence opens career opportunities in companies that are building the next generation of intelligence and language understanding for their products: for example intelligent personal assistants, opinion mining systems, customer support system, biomedical applications, computer games, smart adaptive devices, robots, smart planning systems.

Syllabus

Unit 1: Introduction to Artificial Intelligence

Main components and characteristics of AI (Feature Engineering, ANN, Deep Learning), Applications of AI, Advantages and disadvantages of AI, Goals of AI, Comparison of Programming of a System with AI and without AI, Challenges in AI, Programming languages preferably used in AI, Techniques/Algorithms used in AI, AI Software platforms, Future of AI

Unit 2: Various types of production systems and search techniques: Types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. A* algorithm, AO* algorithms etc, and various types of control strategies.

Unit 3: Knowledge Representation and Probabilistic Reasoning: Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving, inferencing, monotonic and nonmonotonic reasoning. Probabilistic reasoning, Baye's theorem, semantic networks, scripts, schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Unit 4: Game playing techniques: Minimax procedure, alpha-beta cut-offs etc, planning, Study of the block world problem in robotics, Introduction to understanding and natural languages processing.

Unit 5: Introduction to learning ,ANN: Various techniques used in learning, introduction to Artificial neural networks, common sense, reasoning, Convolution Neural Network, Feedforward Neural Network, Recurrent Neural Network, Multilayer perceptron, Architecture / Three Layers in Artificial Neural Networks, Implementation of ANN, Applications of ANN in images, signals and languages some example of expert systems.

References:-

1. Rich E and Knight K, "Artificial Intelligence", TMH, New Delhi.
2. Nilsson N.J., "Principles of Artificial Intelligence", Springer Verlag, Berlin.
3. Stuart Russell , Artificial Intelligence: A Modern Approach , 3rd Edition), Peter Norvig, PHI, ISBN-13: 978-0136042594, ISBN-10: 0136042597
4. B. Yegnanarayana , Artificial Neural Networks , PHI
5. Schalkoff, Artificial Neural Networks . Mc Graw HILL Education

Evaluation:

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

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VIII-Semester

Open Elective CE 803(B) 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

Civil Engineering, VIII-Semester

Open Elective CE 803(C) Retrofitting and Rehabilitation of Structures

Unit – I

Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

Durability of concrete: Factors affecting durability of concrete, Corrosion of reinforcements in concrete, Carbonation, Chloride ingress, Alkali-silica reaction, Freeze-thaw effects, Chemical attack, Abrasion, erosion and cavitation, Weathering and efflorescence

Unit II

Damage Assessment:

Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

Unit - III

Influence on Serviceability and Durability:

Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

Unit – IV

Maintenance and Retrofitting Techniques:

Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

Unit - V

Materials for Repair and Retrofitting:

Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements

for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Suggested Books: -

Properties of Concrete A. M. Neville Pearson Education

Materials for construction - Lai, James, S.

Structural Condition Assessment Robert T. Ratay

Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"

Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Course Objectives

1. To study the paradigm shift in water management with global and national perspectives of water crisis. It also aims to understand the concepts of 'blue water', 'green water' and 'virtual water' and their roles in water management.
2. To study the sustainable water resources management and to plan and develop framework for future.
3. To study the modern principles of water management and planning.
4. To develop surface and subsurface water systems along with water balance equation.
5. To study the conventional and non-conventional techniques for water security.

UNIT I: Paradigm Shift in Water Management

Global and national perspectives of water crisis, water scarcity, water functions in the life-support systems, water availability and requirements for humans and nature, concepts of 'blue water', 'green water' and 'virtual water' and their roles in water management, human-landscape interventions, and salient water management issues and challenges.-landscape interventions, and salient water management issues and challenges.

UNIT II: Sustainable Water Resources Management

Concept of sustainable development, sustainability principles for water management, goals for guiding sustainable water resource management, important preconditioning in water policy approaches, framework for planning a sustainable water future.

UNIT III: Integrated Water Resources Management (IWRM) Approach

IWRM Principles: Modern principles for water management and planning, definition, components, and critique of IWRM. *IWRM Implementation:* Socio-scientific, economic, political and ecological factors affecting the implementation of IWRM principles Salient examples of river basin management, lessons from best practices in river-basin management.

UNIT IV: Surface and Subsurface Water Systems

Impacts of development activities on the water cycle, precipitation, evapotranspiration, infiltration, runoff, streamflow, erosion and sedimentation, types of aquifer systems and their hydraulic characteristics, environmental impacts on groundwater systems, estimation of groundwater recharge and discharge, assessment of groundwater potential, surface water-groundwater interaction, concept of sustainable groundwater development and management, water balance, balance of water resources and needs, minimum water table and minimum discharges.

UNIT V: Conventional and Non-conventional Techniques for Water Security

Rainwater harvesting, groundwater mining and artificial recharge, conjunctive use of surface water and groundwater resources, long-distance water conveyance and transport, conservation of 'green water', desalination, treatment of poor-quality waters.

Course Outcomes:

After studying this course, students will be able to:

1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.
4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

Text Books:

2. K. Subramanya, Engineering Hydrology, Tata McGraw Hill Publishers, New Delhi.
3. H.M. Raghunath, Ground Water, Wiley Eastern Publication, New Delhi.
4. Daniel P. Loucks and Eelco van Beek, Water Resources Systems. Planning and Management, UNESCO Publication.
5. Mollinga, P. et al, Integrated Water Resources Management, Water in South Asia Volume I, Sage Publications, 2006.
6. Singh, Chhatrapati Water Rights in India, Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi, 1992.
7. Dhruva Narayana, G. Sastry, V. S. Patnaik, Watershed Management, CSWCTRI, Dehradun, ICAR Publications, 1997.

Reference Books:

1. Lal, Ruttan. Integrated Watershed Management in the Global Ecosystem. CRC Press, New York.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.