

# Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

**Branch- Common to All Discipline**

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| <b>ES401</b> | <b>Energy &amp; Environmental Engineering</b> | <b>3L-1T-0P</b> | <b>4 Credits</b> |
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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, Gaiam

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**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. Ramamurtham, 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 deformer set

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

## **New Scheme Based On AICTE Flexible Curricula**

### **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.



# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

## **New Scheme Based On AICTE Flexible Curricula**

### **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.