

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Civil Engineering, VI-Semester

## CE- 6001 Design of Hydraulic Structures

### Unit - I

**Gravity dams:** Design Criteria, forces acting on gravity dams, elementary profile, low and high gravity dams, stability analysis, evaluation of profile by method of zoning, practical profile, foundation treatment, construction joints, galleries in gravity dams.

### Unit - II

Earth and Rock fill dams :

**Earth Dams:** Types, causes of failure and design criteria, soils suitable for earth dam construction, construction methods, foundation requirements, typical earth dam sections, estimation of seepage through and below the dam, seepage control, stability of slopes by slip circle method of analysis, pore pressures, sudden draw down, steady seepage and construction pore pressure condition.

**Rock fill dams:** Types, merits and demerits, conditions favourable for their adoption.

### Unit - III

**Spillways :** Ogee spillway and its design, details of syphon, shaft, chute and side channel spillways, emergency spillways.

### Unit - IV

**Energy dissipations and gates :** Principles of energy dissipation Energy dissipators based on tail water rating curve and jump height curves Spillway crest gates - vertical lift and radial gates, their design principles and details. Design of canal regulating structures, Detailed design of Sarda Falls, design of cross drainage works, sphypon aquaduct.

### Unit - V

**Hydropower Plants:** Introduction of Hydropower development, assessment of power potential, types of hydropower plants, general features of hydro-electric schemes, selection of turbines, draft tubes, surge tanks, penstocks, power house dimensions, development of micro hydel stations, tidal plants, pumped storage plants and their details.

### Reference Books: -

1. Engineering for Dams (Volumes I, II & III) by Creager, Justin & Hinds
2. Hydroelectric Hand Book by Creager
3. Hydraulic Structures by Varshney
4. Irrigation & Water Power Engg. by Punmia & Pandey
5. Water Power Engineering by Dandekar

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Civil Engineering, VI-Semester

CE- 6002 Structural Design-I (RCC)

## 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)

## Suggested 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.
9. Design of Concrete Structure, Ramchandra & V.Gehlot, Scientific Publisher, Jodhpur

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Civil Engineering, VI-Semester

CE- 6003 Geotechnical Engineering – I

## Unit - I

**Basic Definitions & Index Properties:** Definition and scope of soil mechanics, Historical development. Formation of soils. Soil composition. Minerals, Influence of clay minerals on engineering behaviour. Soil structure. Three phase system. Index properties and their determination. Consistency limits. Classification systems based on particle size and consistency limits.

## Unit - II

**Soil Water and Consolidation:** Soil water, Permeability Determination of permeability in laboratory and in field. Seepage and seepage pressure. Flownets, uses of a flownet, Effective, neutral and total stresses.

Compressibility and consolidation, Relationship between pressure and void ratio, Theory of one dimensional consolidation. Consolidation test, Fitting Time curves. Normally and over consolidated clays. Determination of preconsolidation pressure, settlement analysis. Calculation of total settlement.

## Unit - III

**Stress Distribution in Soils and Shear Strength of Soils:** Stress distribution beneath loaded areas by Boussinesq and water gaud's analysis. Newmark's influence chart. Contact pressure distribution.

Mohr - Coulomb's theory of shear failure of soils, Mohr's stress circle, Measurement of shear strength, Shear box test, Triaxial compression test, unconfined compression test, Value shear test, Measurement of pore pressure, pore pressure parameters, critical void ratio, Liquefaction.

## Unit - IV

**Stability of Slopes:** Infinite and finite slopes. Types of slope failures, Rotational slips. Stability number. Effect of ground water. Selection of shear strength parameters in slope stability analysis. Analytical and graphical methods of stability analysis. Stability of Earth dams.

## Unit - V

**Lateral Earth Pressure:** Active, passive and earth pressure at rest. Rankine, Coulomb, Terzaghi and Culmann's theories. Analytical and graphical methods of determination of earth pressures on cohesionless and cohesive soils. Effect of surcharge, water table and wall friction. Arching in soils. Reinforced earth retaining walls.

**LABORATORY WORK :** Laboratory work will be based on the above course as required for soil investigators of engineering projects.

## List of Experiments:

1. Determination of Hygroscopic water content
2. Particle - size analysis
3. Determination of Specific gravity of soil particles
4. Determination of plastic limit

5. Determination of liquid limit
6. Determination of shrinkage limit
7. Permeability tests
8. Direct shear test
9. Consolidation test

**Suggested Books: -**

1. Soil Mech. & Found. Engg. by Dr. K.R. Arora - Std. Publishers Delhi.
2. Soil Mech. & Found. by Dr. B.C.Punmia- Laxmi Publications, Delhi.
3. Modern Geotech Engg. by Dr.I Aram Singh - IBT Publishers, Delhi.
4. Geotech Engg. by C. Venkatramaiah - New Age International Publishers, Delhi
5. Soil Mech. & Found. Engg. by S.K. Garg- Khanna Publishers, Delhi.
6. Soil Testing for Engg. by T.W. Lambe - John Wiley & Soms. Inc.
7. Relevant I.S. Codes

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Civil Engineering, VI-Semester

CE- 6004 Highway Engineering

## Unit - I

**High way planning, Alignment & Geometric Design: Principles of highway planning,** road planning in India and financing of roads, classification patterns. Requirements, Engg. Surveys for highway location.

**Cross sectional elements- width, camber, super-elevation, sight distances, extra** widening at curves, horizontal and vertical curves, numerical problems.

## Unit – II

**Bituminous & Cement Concrete Pavements: Design of flexible pavements, design of** mixes and stability, WBM, WMM, BM, IBM, surface dressing, interfacial treatment- seal coat, tack coat, prime coat, wearing coats, grouted macadam, bituminous concrete specification, construction and maintenance. Advantages and disadvantages of rigid pavements, general principles of design, types, construction, maintenance and joints, dowel bars, tie bars. Brief study of recent developments in cement concrete pavement design, fatigue and reliability.

## Unit – III

**Low Cost Roads, Drainage of Roads, Traffic Engg. & Transportation Planning:**

Principles of stabilization, mechanical stabilization, requirements, advantages, disadvantages and uses, quality control, macadam roads-types, specifications, construction, maintenance and causes of failures.

**Surface and sub-surface drainage, highway materials: properties and testing etc.**

Channelised and unchannelised intersections, at grade & grade separated intersections, description, rotary-design elements, advantages and disadvantages, marking, signs and signals, street lighting. Principles of planning, inventories, trip generation, trip distribution, model split, traffic assignment, plan preparation.

## Unit - IV

**Airport Planning, Runway & Taxiway: Airport site selection. air craft characteristic**

and their effects on runway alignments, windrose diagrams, basic runway length and corrections, classification of airports.

**Geometrical elements: taxi ways and runways, pattern of runway capacity.**

## Unit - V

**Airport, Obstructions, Lightning & Traffic control: Zoning regulations, approach**

area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental landing system, precision approach radar, VOR enroute traffic control.

### List of Experiments:

1. Aggregate Crushing Value Test
2. Determination of aggregate impact value
3. Determination of Los Angeles Abrasion value
4. Determination of California Bearing Ratio values
5. Determination of penetration value of Bitumen

6. Determination of Viscosity of Bituminous Material
7. Determination of softening point of bituminous material
8. Determination of ductility of the bitumen
9. Determination of flash point and fire point of bituminous material
10. Determination of Bitumen content by centrifuge extractor
11. Determination of stripping value of road aggregate
12. Determination of Marshall stability value for Bituminous mix
13. Determination of shape tests on aggregate

**Reference Books & Study Materials:**

1. Highway Engineering by Gurucharan Singh
2. Principles of Pavement Design by E.J. Yoder & M.W. Witzech
3. Highway Engineering by O'Fleherty
4. Highway Engineering by S.K. Khanna & C.E.G. Justo
5. Airport Planning & Design by S.K. Khanna & M. G. arora
6. Foresch, Charles "Airport Planning"
7. Horonjeff Robert "The Planning & Design of Airports"
8. Sharma & Sharma, Principles and Practice of Highway Engg.
9. Haung, Analysis and Design of Pavements
10. Relevant IRC & IS codes
11. Laboratory Mannual by Dr. S.K. Khanna
12. Highway Engg. By Hews & Oglesby
13. Highway Material by Walker

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VI-Semester**

**Elective – II CE- 6005 (1) Advanced Water Resources Engineering**

**Unit - 1**

Optimal Raingauge Network Design, Adjustment of Precipitation Data, Depth Area-Duration Analysis, Design Storm, Probable Maximum Precipitation, Probable Maximum Flood, Flood Frequency Analysis, Risk Analysis,

**Unit - 2**

Flood Management, Flood Routing through Reservoirs, Channels Routing Muskingum Method, Introduction to Stochastic Models in Hydrology like AR, ARMA, ARIMA etc. Concept of Correlogram.

**Unit - 3**

System Analysis: Need, Water Resources Systems, Optimisation Techniques, Linear Programming, Feasible Solutions, Graphical Method, Simplex Method, Use of LP in Water Resources, Introduction to Reservoir Operation, Rule curves, Linear Decision Rule

**Unit - 4**

Dynamic Programming, its utility in Resource Allocation and other Decision Making Problems, Optimal Operating Policies, Use of D. P. in Reservoir, Operation.

**Unit-5**

Network Methods, Project Optimality Analysis. Updating of Network, Utility in Decision Making.

**Book Recommended:**

**Test Books**

1. Subramany K., *Engg. Hydrology*.
2. Philipps & Ravindran: *Operations Research*
3. Hire D.S. & Gupta: *Operation Research*

*Reference Books*

1. Loucks D.P., Stedinger I.R. & Haith D.A : *Water Resources Systems Engg.*
2. Kottegoda N. T., *Stochastic Water Resources Technology*.
3. Singh V.P. : *Elementary Hydrology*

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

Credit Based Grading System

**Civil Engineering, VI-Semester**

## **Elective – II CE- 6005 (2) Computational Methods in Structural Engineering**

### **Unit - I.**

Matrix formulation for the principle of virtual work and energy principles, principle of contragradience, stiffness and flexibility matrices, Degree of Freedom. Axial, bending, shear and torsional deformations.

Local and Global Element stiffness matrices for bar, beam, shaft, grid, shear wall, beamcolumn,

beam with rigid ends, beam on elastic foundation and elements with special boundary conditions. nonprismatic and curved elements, forces and displacements in general coordinate axes, structure stiffness matrix.

### **Unit - II.**

Basics of the Direct Stiffness method - Analysis of pinjointed frames, rigid jointed structures, plane grids and composite structures for different loads including temperature, shrinkage, prestressing forces. Elastic stability analysis of 2-D rigid jointed frames, (Sway & Nonsway)

### **Unit - III.**

Concepts of Bandwidth, various storage schemes & equation solvers; Reduction in order of stiffness matrix - use of substructures, static condensation method, Exploiting symmetry, skew symmetry and cyclic symmetry in structures, Imposition of Constraints – Lagrange Multiplier and Penalty Methods.

### **Unit - IV.**

Analysis of continuum structures - Fundamental equations of theory of elasticity (2D), basic concepts of Finite Element Analysis, derivation of generalised element stiffness matrix and load vectors, convergence requirements, stiffness matrices for various elements using shape functions, Triangular and Rectangular elements. (PSPS)

### **Unit - V.**

Two Dimensional Iso parametric elements, shape functions for Simplex. Lagrangian and Serendipity family elements in natural coordinates, computation of stiffness matrix for isoparametric elements, degrading of elements, plate bending elements.

### **Reference Books :-**

1. Ghali A & Neville M., Structural Analysis - A Unified Classical and Matrix Approach, Chapman and Hall, New York.
2. Weaver William & Gere James M., Matrix Analysis of Framed structures, CBS Publishers and Distributors, New Delhi.
3. Cook R.D., Concepts and Applications of Finite Element Analysis, Wiley, New York.
4. Gallagher R., Finite Element Analysis Fundamentals, Prentice-Hall, Englewood Cliffs, NJ.
5. Rubenstein M.F., Matrix Computer Analysis of structures, Prentice Hall, Englewood Cliffs, N.J.
6. Zeinkiewicz O.C & Taylor R.L., The Finite Element Method, McGraw Hill, London

W.E.F. July 2017

Academic Session 2017-18



**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

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**Civil Engineering, VI-Semester**

**Elective – II CE- 6005 (3) 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.

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Civil Engineering, VI-Semester

## Elective – II CE- 6005 (4) IPR (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

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**Course Outcome:**

1. Students will be able to understand Primary forms of IPR
2. Students will be able to assess 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 to 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.

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**Civil Engineering, VI-Semester**

**CE- 6006 Design of Hydraulic Structures (Lab)**

**List of Experiments :-**

1. To study the characteristics of hydraulic jump development in the laboratory Flume.
2. Potential estimation of a particular dam site.
3. Estimation of live storage of a reservoir and hydropower potential for the site.
4. Estimation of suspended load, bed load and total load, and life of reservoir.
5. Study of various existing barrages and canals.
6. Hydraulic models- all types of dams, spillways, weir & barrages, hydel power plant.

# **RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

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**Civil Engineering, VI-Semester**

## **CE-6007 Creativity and Entrepreneurship Development**

### **Course Objective:**

- Understand and use tools for generating entrepreneurial ideas and problem solving.
- Understand and use tools for the selection of ideas.
- Understand and gain the skills that are needed to implement ideas in today's society
- Understand Entrepreneurship's part in process that includes idea generation and implementation.
- Understand the concept of Entrepreneurship and its place in today's society

### **Course Outcomes:**

- Recognize an opportunity for a user group and frame an appropriate design challenge that addresses the need for the user.
- Practice observation, interview and empathy skills to evolve a thorough understanding of the needs of the user.
- Share and integrate team leanings.
- Generate, develop and describe creative ideas that address the design challenge.

### **Syllabus:**

1. The concept of Entrepreneurship, its history and its place in society.
2. The concept of Entrepreneurship and its relation to concept of innovation.
3. Creative processes for idea generation and problem solving.
4. Business plan.
5. Role of creativity, innovation and business research.
6. Entrepreneurship opportunities in contemporary business environment.

### **Reference Books :**

1. Dollinger M.J. "Entrepreneurship strategies and resources," 3<sup>rd</sup> edition Pearson Education New Delhi.
2. Panda, Shiba charan "Entrepreneurship development", Anmol publication New Delhi.
3. Richard Blundel & Nigel locket, "Exploring Entrepreneurship : practices & perspectives Oxford.
4. Charles E. Banford & Garry D. Bruton, "Entrepreneurship – A small business Approach, McGrawhill Education.
5. P. Narayana Reddy, "Entrepreneurship" : Text and cases, Cengage learning
6. Rajeev Roy, "Entrepreneurship" Oxford.