



Scheme of Instruction & Syllabi

Of

Bachelor of Technology

4thYear

(Civil Engineering)

(Effective From 2012-2013)

Invertis Institute of Engineering & Technology

INVERTIS UNIVERSITY

Invertis Village

Bareilly-Lucknow NH-24, Bareilly



INVERTIS UNIVERSITY, BAREILLY

STUDY & EVALUATION SCHEME

B. Tech. Civil Engineering

(Effective from the academic year 2012-2013)

YEAR IV, SEMESTER-VII

S. No.	Course Code	SUBJECT	Evaluation Scheme								SUBJECT TOTAL	Credits
			PERIODS			SESSIONAL EXAM.			E-SEM			
			L	T	P	CT	TA	TOTAL				
THEORY												
1	BCE-701	Steel Structures	3	1	0	20	10	30	70	100	4	
2	BCE-702	Water Resource Engineering I	3	1	0	20	10	30	70	100	4	
3	BCE-703	Environmental Impact Assessment	3	1	0	20	10	30	70	100	4	
4	BCE:704	Pre-stressed Concrete	3	1	0	20	10	30	70	100	4	
5		CE ELECTIVE-III	3	1	0	20	10	30	70	100	4	
PRACTICAL/DESIGN/DRAWING												
6	BCE-751	Industrial Training	0	0	0	-	-	25	-	25	1	
7	BCE-752	Structural Engineering Lab	0	0	2	-	-	10	15	25	1	
8	BCE-753	Project	0	0	4	-	-	15	35	50	2	
9	GP-701	General Proficiency	-	-	-	-	-	25	-	25	1	
Total			15	5	6	100	50	225	400	625	25	

CE ELECTIVE-III

BCE:031 Bridge Engineering

BCE:032 Environmental
Geotechnology
BCE:033 Finite Element
Methods
BCE: 034 Industrial Pollution
Control Env.Audit

STUDY & EVALUATION SCHEME

B. Tech. Civil Engineering

(Effective from the academic year 2012-2013)

YEAR IV, SEMESTER-VIII

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credits
			L	T	P	SESSIONAL EXAM.			E-SEM		
						CT	TA	TOTAL			
THEORY											
1	BCE-801	Construction Planning and Management	3	1	0	20	10	30	70	100	4
2	BCE-802	Water Resource Engineering II	3	1	0	20	10	30	70	100	4
3		CE Elective-IV	3	1	0	20	10	30	70	100	4
4		CE Elective-V	3	1	0	20	10	30	70	100	4
PRACTICAL/DESIGN											
5	BCE-851	Cad Lab	0	0	2	-	-	10	15	25	1
6	BCE-852	Steel Structures Lab	0	0	2	-	-	10	15	25	1
7	BCE-853	Project Lab	0	0	4	-	-	50	100	150	6
8	GP-801	General Proficiency	-	-	-	-	-	25	-	25	1
Total			12	4	8	80	40	215	410	625	25

CE ELECTIVE-IV

BCE-041 Open Channel Flow

BCE-042 River Engineering

BCE-043 Plastic analysis of structure

BCE-044 Tunnel Engineering

CE ELECTIVE-V

BCE-051 Ground Improvement Techniques

BCE-052 Earthquake resistant design of structure

BCE-053 Ground Water Management

BCE-054 Analysis and design of hydraulic structures

MODULE I

Introduction to rolled steel sections, loads, factor of safety, permissible and working stresses.
Riveted and welded connections, strength, efficiency and design of joints.

Compression members- Effective length, Slenderness ratio, Strength of Compression members, Design of Struts, Columns, Built-up Columns, Design of eccentrically loaded columns.

MODULE II

Tension members – Net and Gross sectional areas, Strength of members and their design.
Design of slab and Gusset bases, Design of Grillage footing.

MODULE III

Beams – web crippling and web buckling, design of laterally supported beam, design of laterally unsupported beam, Purlins.

Design of Industrial Buildings – Detailed design of roof trusses.

Text Books

1. IS : 800 – 1984.
2. *Design of Steel Structures* by A. S. Arya & J. L. Ajmani, Nem Chand & Bros., Roorkee.

References

1. *Design of Steel Structures* by S. K. Duggal, Tata Mc-Graw-Hill Publishing Company.
2. *Design of Steel Structures* by Gaylord & Gaylord.

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MODULE I

Precipitation its Measurement, analysis and losses: Hydrologic cycle, catchment area and watershed, Rainfall and its characteristics, Rain gauges, Non-Recording and Recording type, average rainfall over a catchments, Evapo-transpiration, Pan evaporation, pan coefficient

Infiltration W -Index and ϕ - Index;

MODULE II

Hydrographs: Discharge formulae, characteristics of a Run off hydrograph, Unit hydrograph, S-hydrograph, Instantaneous hydrograph, synthetic Unit hydrograph, Duration Curve, Mass Flow hydrograph, Stream gauging, Flow rating curve, use of current meters for velocity measurement, Dye-dilution method of discharge measurement

MODULE III

Flood Control: Flood flows, Frequency studies, Statistical analysis for flood prediction, Method of flood control, Flood routing, Reservoir routing and Channel routing, River training work

Dock and Harbours: Natural and artificial Harbours, Selection of site, study of winds, tides and wave actions, Accretion and denudation, Principle of construction of Breakwaters, Quays and jetties, Wet and Floating Docks.

Text Books

1. *K. C. Patra, Hydrology & Water Resources Engg., Narosa Publishing House, New Delhi, 2nd Edition.*
2. *K. Subramanya, Engineering Hydrology, Tata McGraw Hill, 2nd Edition.*

References:

1. *R. Srinivasan, Harbour, Dock and Tunnel Engineering.*
2. *V. T. Chow, Hand book of Applied Hydrology, McGraw-Hill Publishing Company, New York.*
3. *R. K. Linsely, M. A. Kohlar, J. L. H. Pauluhus, Hydrology for Engineers, Tata McGraw Hill, New Delhi.*
4. *R. S. Varshany, Engineering Hydrology, Nem Chand and Brothers, Roorkee.*

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5. *E. M. Wilson, Engineering Hydrology, Macmillan, ELBS, London.*
 6. *Water resources Engg. By Wurbs and James, John wiley India*
 7. *Water Resources Engg. By R. K. Linsley, McGraw Hill*
 8. *Irrigation and water Resources Engg. By G L Asawa, New age International*

BCE:703 ENVIRONMENTAL IMPACT ASSESSMENT
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MODULE I

Evolution of EIA : EIA at project; Regional and policy levels; Strategic EIA; EIA process; Screening and scoping criteria; Rapid and comprehensive EIA; Specialized areas like environmental health impact assessment

MODULE II

Environmental risk analysis; Economic valuation methods; Cost-benefit analysis; Expert system and GIS applications; Uncertainties; Practical applications of EIA; EI methodologies; Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment

MODULE III

Environmental management plan; Post project monitoring, EIA report and EIS; Review process. Case studies on project, regional and sectoral EIA; Legislative and environmental clearance procedures in India and other countries, Siting criteria; CRZ; Public participation; Resettlement and rehabilitation.

Text Books::

1. *B. M. Noble, Introduction to Environmental Impact Assessment: A Guide to Principles and Practice. Oxford University Press, USA, 2005.*
2. *J. Glasson, Introduction to Environmental Impact Assesment: Principles, and Procedures, Process, Practice and Prospects (The Natural and Built Environment Series), Routledge; 3rd edition, 2005.*

References:

1. P. Morris, *Methods of Environmental Impact Assessment (The Natural and Built Environment Series)*, Spon Press, USA, 2nd edition, 2001.
2. R. K. Jain, L. V. Urban, G. S., Stacey, Harold, E. Balbach, *Environmental Assessment*, McGraw-Hill Professional; 2 edition, 2001.
3. B. B. Marriott, *Environmental Impact Assessment: A Practical Guide*, McGraw-Hill Professional, 1 edition, 1997.
4. D. P. Lawrence, *Environmental Impact Assessment: Practical Solutions to Recurrent Problems*, Wiley-Interscience; 1st edition, 2003.

BCE:704 PRE-STRESSED CONCRETE

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MODULE I

Historical developments, Basic concepts, types, different systems, Materials-Steel, concrete and their properties; losses of pre-stress, design of simply supported beams basic assumptions, **Stress in concrete and steel** due to load and pre-stress, pressure line and internal resisting couple, kern distance, cracking moment, general approach for service load design, graphical methods, Lin's method, limit state design as per IS code, partial pre-stressing; Shear and principal stresses in homogenous elastic beams,

MODULE II

Design of reinforcements for shear and torsion Stress distribution in end block—Magnel's method, Guyen's method, Rowe's method, IS code method; Design of pipes and tanks, railway sleepers, electric posts, composite construction.

MODULE III

Beam deflection- short term and long term deflections; Design of continuous beam-Principles of design of prismatic continuous beams of two and three equal, unequal spans, with variable moments of inertia. Cap cables. Jaques Muller's theorem.

Text Books:

1. Y. Guyen, *Prestressed concrete Vol-I and II*, John Wiley & Sons, New York, 1960.
2. T. Y. Lin and H. Burns, *Design of pre-stressed concrete structures*, Ned- John Wiley & Sons, New York, 1982.

References:

1. E. W. Bennet, *Prestressed concrete: Theory and design*, Chapman and Hall, London, 1962.
2. N. Krishnaraju, *Prestressed concrete*, Tata McGraw Hill, New Delhi, 2004.
3. S. K. Mallik & A. P. Gupta, *Prestressed concrete*, Oxford and IBH, New Delhi, 1982

DEPARTMENTAL ELECTIVE

BCE 031 BRIDGE ENGINEERING

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MODULE I

Site selection, various types of bridges and their suitability, loads, forces and IRC bridge loading and permissible stresses, Design of RC bridges under concentrated loads using effective width and Pigeauds Method,

MODULE II

Courbon's method of load distribution. Detail design of slab culvert T-beam bridge, box culverts,

MODULE III

Design and detailing of plate girder and steel Truss type bridges, Design of piers and pier caps. Abutments and bearings

Text Books :

1. *Essentials of Bridge Engineering* by D J Victor
2. *Limit State Design of Steel Structures* by S K Duggal
3. *Design of steel Structures* by Ramchandra

BCE 032 FINITE ELEMENT METHODS

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MODULE I

Calculus of variation, Introduction to calculus of variations, Introduction to equilibrium equations in elasticity, Euler's Lagrange's equations, Principal of virtual work, virtual displacements, Principles of minimum potential energy, boundary value, initial value problems, Flexibility approach, Displacement approach, Different problems in structural analysis.

MODULE II

FEM Procedure, Derivation of FEM equations by variation principle polynomials, Concept of shape functions, Derivation for linear simplex element, Need for integral forms, Interpolation polynomials in global and local coordinates. Weighted residual Methods: Concept of weighted residual method, Higher order Elements: Concept of iso-parametric elements, Concept of sub-parametric and super - parametric elements, Concept of Jacobin matrix.

MODULE III

Numerical Integration: Numerical Integration, one point formula and two point formula for 2D formula, Different problems of numerical integration evaluation of element stiffness matrix, Automatic mesh generation schemes.

Analysis of structures: Truss elements, Analysis of truss problems by direct stiffness method. Analysis of frames and different problems, Different axi-symmetric truss problems.

Text Books:

1. *The Finite Element method* -ZIENKIEWICZ.O.C.Tata McGraw Hill Pub. New Delhi, 2000
2. *Finite Element Methods* by C R Alaval , PHI

3. *Finite Elements in Engineering:- Chandrupatta, et. Al. Prentice Hall of India Pvt. Ltd.,*

Reference Books:

1. *Concepts and Applications of Finite Element Analysis: COOK. D. Robert. Malus.S.David, Plesha E.*

Michel, John wiley & sons 3rd Edn. New York, 2000

2. *Finite Element Analysis -C.S. Krishnanmoorthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi,*

3. *Introduction to the Finite Element method -Desai/ ABEL-C.B.S. Publishers & Distributors, New*

BCE 033 ENVIRONMENTAL GEOTECHNOLOGY
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MODULE I

Introduction, Development of Environmental Geotechnology, Aims, Environmental Cycle and their interaction with geotechnology. Natural environment, cycles of nature, environmental geotechnical problems, Identification and characteristics of contaminated soil, classification, Characteristics of dust, dust in environment, ionexchange reaction and ion exchange capacity, ion exchange reaction in contaminated .soil-water system, Site Investigation for detection of sub-surface contamination

MODULE II

Environment factor design criteria, soil structure vs. structure soil interaction, load and environmental loads, bearing capacity based on load footing interaction lateral earth pressure, pile foundations environmental factors affecting pile capacity, under-water foundation problems. Ash Pond and Mine Tailing Impoundments, Geotechnical reuse of waste materials and fills, Grouting and injection process, Grout used for controlling hazardous wastes, Sinkhole: interaction with environment , remedial action

MODULE III

Sanitary landfills: Selection of waste disposal sites, Landfills for Municipal and Hazardous wastes, Design of liners: clay and synthetic clay liners, Bearing capacity of foundation on sanitary landfills

Text Books:

1. Fang, H. – *Introduction to Environmental Geotechnology*.
2. Sharma, H. D. and Sangeeta, P.L. - *waste containment systems, waste stabilization and landfill s: design and evaluation*.

References:

3. Koerner, R. M. - *Designing with geosynthetics*

BCE – 034 INDUSTRIAL POLLUTION CONTROL & ENVIRONMENTAL AUDIT

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MODULE I

Industrial wastes & their sources: various industrial processes, sources and types of wastes- solid, liquid, gaseous, noise & radiation emissions. Sources for industrial water usages and various industrial processes requiring water use and water quality. processes responsible for deterioration in water quality, various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease

MODULE II

Control of gaseous emissions: hood and ducts, tall stacks, particulate and gaseous pollutant control; Solid waste generation and disposal management; Hazardous wastes: definitions, concepts and management aspects; Noise & radiation: generation, control and management.

Recent trends in industrial waste management, cradle to grave concept, life cycle analysis, clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.

MODULE III

Environmental audit: definitions and concepts, environmental audit versus accounts audit, compliance audit, relevant methodologies, various pollution regulations, Introduction to ISO and ISO 14000.

Text books:

1. *Wastewater Engineering: Treatment & Re-use.* Metcalf & Eddy, Tata Mc Graw-Hill.
2. *Industrial Pollution Prevention Handbook.* Shen, T.T., Springer-Verlag, Berlin.

References:

1. *Industrial Wastewater Management Handbook*, Azad, Hardom Singh, Editor-in-Chief, McGraw Hill, New York.
2. *Wastewater Reuse and Recycling Technology-Pollution Technology Review-72*, Culp, Gordan, George Wasner, Robert Williams and Mark , V.Hughes Jr., Noyes Data Corporation, New Jersey
3. *The Treatment of Industrial wastes.* Edmund, B. Besselieve P.E., McGraw Hill, New York.
4. *Industrial Pollution Control \Issues and Techniques.* Nancy, J. Sell, Van Nostrand Reinhold Co , NY.
5. *Environmental Engineering.* Pandey, G.N. and Corney, G.C., Tata McGraw Hill, New Delhi
6. *Environment (protection) Act- 1986.* Any authorized & recent publication on Government Acts.

BCE:751 INDUSTRIAL TRAINING

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BCE:752 STRUCTURAL ENGINEERING LAB

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1. Basic tests for cement and concrete
2. Mix design of concrete of different grades
3. Tensile strength of different types of steel bars
4. Tensile and Flexural strength of concrete of different grades.
5. Testing of simply supported RCC beams for flexural failure
6. Testing of simply supported RCC beams for shear failure
7. Testing of RCC column
8. Non-destructive test of concrete

BCE:753 PROJECT LAB

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BCE:801 CONSTRUCTION PLANNING & MANAGEMENT

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MODULE I

Elements of Management: Project cycle, Organisation, planning, scheduling monitoring updating and management system in construction.

Network Techniques: Bar charts, milestone charts, work break down structure and preparation of networks. Application of network Techniques like PERT, GERT, CPM AON and AOA in construction management.

MODULE II

Engineering Economics : Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison present worth method Equivalent annual cost method, discounted cash flow method, analytical criteria for postponing of investment retirement and replacement of asset. Depreciation and break even cost analysis.

Contract Management: Legal aspects of contraction, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items, settlements of disputes, arbitration and commissioning of project.

MODULE III

Equipment Management : Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction equipments for earth moving, Hauling equipments, hoisting equipments, conveying equipments , Concrete Production equipments

Text Books:

1. “Construction Planning”, *Equipment and Methods.* : R.L. Peurify. T.M.H., International Book Company.
2. “PERT & CPM Principles and Applications” L.S. Srinath, E.W.P. Ltd., New Delhi.

References:

1. “Network Analysis Techniques” S.K. Bhatnagar, Willey Eastern Ltd.
2. *Construction Technology* by Sarkar , Oxford

MODULE I

Hydrologic cycle Water balance, Occurrence of ground water: Origin, geological formations as aquifers, type of aquifers, groundwater basins, springs. Darcy's Law, validity of Darcy's Law permeability, laboratory and field measurement of permeability, groundwater Flow lines. Steady flow to a well, steady radial flow to a well in confined aquifer and unconfined aquifer, Unsteady radial flow into a confined aquifer, Non equilibrium Theis equation, Theis method of solution, multiple well system;

MODULE II

Effect of irrigation, stream flow, rainfall on groundwater fluctuations, seasonal and secular variations, fluctuation due to miscellaneous causes; Surface and Subsurface investigations of groundwater: Geophysical exploration, Electrical resistivity method, aerial photo interpretation, remote sensing applications to ground water exploration, test drilling, Artificial recharge by water spreading, through pits and shaft, recharge through other methods; Ground water pollution: Municipal sources, liquid wastes from domestic uses, solid wastes, Industrial sources, tank and pipeline leakage, Mining activity, agricultural sources, septic tank and cesspools, saline water intrusion in coastal aquifers, methods to control saline water intrusion

MODULE III

Groundwater management: Concepts of Basin management, Equation of hydrologic equilibrium, groundwater basin investigations, conjunctive use of surface and groundwater.

Text Books:

1. K. C. Patra, *Hydrology and Water Resources Engg.*, Narosa Publishing house, New Delhi.
2. D. K. Todd, *Groundwater Hydrology*, John Wiley and Sons.

References:

1. H. M. Raghunath, *Ground Water*.
2. S. P. Garg, *Groundwater and Tube Wells*, Oxford and IBH Publishing Co., New Delhi.
3. V. T. Chow, *Hand book of Applied Hydrology*, McGraw-Hill Publishing Company, New York.

DEPARTMENTAL ELECTIVE

MODULE I

Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections, energy-depth relations: Concept of specific energy, specific force, critical flow, critical depth, hydraulic exponents, and channel transitions.

Gradually Varied Flow (GVF): Equation of gradually varied flow and its limitations, flow classification and surface profiles, Control sections, Computation methods and analysis Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curved channels.

MODULE II

Rapidly Varied Flow (RVF): Characteristics of rapidly varied flow, Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater, **Flow measurement:** by sharp crested and broad crested weirs, critical depth flumes, sluice gate, free overfall. Rapidly varied unsteady flow: Equation of motion for unsteady flow, “Celerity” of the gravity wave, deep and shallow water waves, open channel positive and negative surge

MODULE III

Spatially Varied Flow (SVF): Basic principles, Differential SVF equations for Increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, Flow over side-weir and Bottom-rack. Flow in channel of non-linear alignment and non-

prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert.

Text Books:

1. Chow, V.T., *Open channel Hydraulics*, McGraw Hill International
2. Henderson, F.M., *Open Channel Flow*, McGraw Hill International
3. Subramanya, K., *Flow in Open Channels*, Tata McGraw Hill

References:

1. Ranga Raju, K.G., *Flow through open channels*, T.M.H.
- 2 M. Hanif Chaudhry, *Open Channel Flow*, PHI
3. French, R.H., *Open channel Hydraulics*, McGraw Hill International

BCE 042 RIVER ENGINEERING

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MODULE I

Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes.

MODULE II

Behaviour of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control. Mechanics of Alluvial Rivers, Rivers and restoration structures, sociocultural influences and ethics of stream restoration.

MODULE III

Bioengineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data. River Training and Protection Works:

Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works.

Textbook:

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.

References:

1. Irrigation & Water Power Engineering - B. C. Punmia and Pande B. B. Lal.

BCE – 043 PLASTIC ANALYSIS OF STRUCTURE
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MODULE I

Introduction, Historical review, plastic failure, plastic moment, capacity of a cross-section, shape factor, concept of load factor. Plastic hinge and collapse Mechanisms. Analysis of beams and frames.

MODULE II

Semi Graphical method and Mechanism method. Plastic moment distribution for multi-storey and multi-bay frames.

MODULE III

Analysis for deflections at collapse. Effect of axial force and shear.

Text Books :

- 1. Plastic Analysis of Structures by P G Hodge, McGraw Hill*
- 2. Plastic Analysis and Design of steel structures by M Bill Wong*

References:

1 Inelastic Analysis of Structures by M Jirasek & Z P Bazant , John Wiley

BCE 044 – TUNNEL ENGINEERING

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MODULE I

Site investigations, Geotechnical Considerations of tunnelling

Design of Tunnels

MODULE II

Construction & Excavation methods, soft ground tunnels , Rock tunnels

Micro tunnelling techniques, Tunnel support design

MODULE III

Ventilation of tunnels , tunnel utilities , safety aspects

Text Books :

1. Tunnel Engineering Handbook by J O Bickel & T R Kuesel

References:

1. Rock Mechanics Design in Mining & Tunneling by Z T Bieniawski

BCE 051 GROUND IMPROVEMENT TECHNIQUES
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MODULE I

Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes. In situ densification methods in granular soils, Deep compaction Introduction, terraprobe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement

MODULE II

In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test

MODULE III

Underpinning of foundations: importance and situations for underpinning, methodology, typical examples. Geotextiles: types, functions, specifications, precautions in transportation and storage.

Recommended Books:

1. *S. K. Garg – Soil Mechanics & Foundation Engineering.*
2. *Purshotham Raju – Ground Improvement.*
3. *Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics*
4. *J. N. Mandal – Geosynthetics World*
5. *Bergado et. al. – Soft Ground Improvement*
6. *Koerner, R. M. - Designing with geosynthetics*

BCE – 052 EARTQUAKE RESISTANT DESIGN OF STRUCTURE
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MODULE I

Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes, Response of Structure to Earthquake motion, Modelling of structures, Dynamics of single degree of freedom system,

MODULE II

Dynamics of multi degree of freedom system, Idealization of structures, Dynamics of soils and seismic response, Conceptual design, Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Design of Masonry buildings,

MODULE III

Reinforced Concrete buildings, Steel Buildings, Material Properties, Code provisions. Introduction to machine foundation. Degrees of freedom of a block foundation. I.S. code provisions for design and construction of machine foundations.

References:

1. *Introduction to Structural Dynamics - J.M. Biggs*
2. *Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran*
3. *IS: 1983 - 1984 Criterion for Earthquake Resistant Design.*
4. *Structural Dynamics - Theory & computation - Mario Paz.*
5. *Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra.*
6. *Earthquake Resistant of Design of structures, Agarwal and Srihande.*
7. *Earthquake Resistant of Design of structures, S.K.Duggal*

BCE-053: GROUND WATER MANAGEMENT

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MODULE I

Introduction, hydrological cycle & definitions, Occurrence of ground water, hydro-geology & aquifers, Ground water movement, Darcy's law, flow-nets in isotropic medium. steady and unsteady flow through confined and unconfined aquifers, Dupuits theory, Observation wells, Well Hydraulics: Single & Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity, Inverse problem i.e. pumping tests for aquifer parameters

MODULE II

Water Wells: Design of water wells, Well construction, Well completion, Development of wells Pumping equipment for water wells, maintenance of wells, ground water irrigation. Ground Water quality, Contamination of groundwater and its Control, Ground Water Modeling

Techniques, Ground water exploration, Surface and Subsurface Investigations of Ground water, Artificial discharge and Recharge of Ground Water, Groundwater drainage

MODULE III

Ground Water Management Techniques: Groundwater budgeting, groundwater modeling & stimulation, application of GIS and remote sensing in groundwater management. roof-top rainwater harvesting and recharge.

Text Books:

1. 'Groundwater Hydrology' by Todd D. K.
2. 'Groundwater Resource Evaluation' by Walton W. C.
3. 'Groundwater' by Raghunath H. M.

References:

1. 'Handbook of Applied Hydrology' by Chow V. T.
2. 'Irrigation: Theory & Practice' by Michael A. M.

BCE – 054 ANALYSES AND DESIGN OF HYDRAULIC STRUCTURES
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MODULE I

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, **Blighs.theory**, Khosla's theory for determination pressure, exit gradient. Regulation Works: Falls, Classification, Introduction to design principle of falls, Design of Sarda type and straight glacis fall. Principle and design of Distributary head regulator and cross regulator, canal escape, Bed bars.

MODULE II

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir. Cross drainage works: Necessity and types. Aqueduct,

Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works.

Flood routing: Types, methods of reservoir routing, channel routing by Muskingham Method. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. Dams: classification and selection criteria. Earth Dams: Classification, causes of failure phreatic line, and its determination, Introduction to stability analysis.

MODULE III

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates. Hydro-Electric Power: assessment of potential specially in reference to India, classification of power plants, important terms, types of turbines and their suitability. Power House layout and important structures of a powerhouse.

Text Books :

- 1. Water Resources Engg. By Larry W Mays, John Wiley India*
- 2. Water resources Engg. By Wurbs and James, John wiley India*
- 3. Water Resources Engg. By R.K. Linsley, McGraw Hill*
- 4. Irrigation and Water Resources Engg. By G L Asawa, New age International Publishers*

References:

- 1. Irrigation Engg. And Hydraulic Structures by S. K. Garg, Khanna Publishers*
- 2. Irrigation and Water Power Engineering by B. C. Punimia & Pande B.B. Lal*

L T P C

0 0 2 1

1. WORKING ON DESIGN SOFTWARE LIKE STAAD PRO / STRUDS / SAP / ETAB / STRAP

2. WORKING ON GEOTECHNICAL SOFTWARES like GEO-5 / Plaxis

BCE:852 STEEL STRUCTURES LAB

L T P C

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1. Detailing of column and footing connection
2. Detailing of beam and column connection
3. Grillage foundation detailing
4. Plate girder detailing
5. Gantry girder detailing
6. Detailing of trusses
 - a) Using Angle sections, Tee sections, Channel sections and I-sections
 - b) Using tubular sections
7. Detailing of purlins
8. Overhead tank detailing

BCE:853: PROJECT LAB

L T P C

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