

BTCE 801 Design of Steel Structures – II

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
4 1 0

Note: Use of relevant Indian Standards is allowed.

- 1) Elements of a plate girder, design of a plate girder, curtailment of flanges, various type of stiffeners.
- 2) Design of steel foot bridge with parallel booms and carrying wooden decking, using welded joints.
- 3) Complete design of an industrial shed including:
 - i) Gantry girder
 - ii) Column bracket
 - iii) Mill bent with constant moment of inertia
 - iv) Lateral and longitudinal bracing for column bent
- 4) Design of single track railway bridge with lattice girders having parallel chords (for B.G.)
 - i) Stringer
 - ii) Cross girder
 - iii) Main girders with welded joints
 - iv) Portal sway bracings
 - v) Bearing rocker and rollers

BOOKS & CODES RECOMMENDED:

- 1) Limit state design of steel structures: **S K Duggal**
 - 2) Design of steel structures: **N Subramanian**
 - 3) Design of steel structures (Vol. 2): **Ram Chandra**
 - 4) Design of steel structures: **L S Negi**
 - 5) Design of steel structures (by limit state method as per IS: 800-2007): **S S Bhavikatti**
 - 6) IS 800: 2007 (General construction in steel-Code of practice)*
 - 7) SP: 6(1) (Handbook for structural engineers-Structural steel sections)*
- * permitted in Examination

BTCE 802 DISASTER MANAGEMENT

Internal marks: 40
External marks: 60
Total marks: 100

L T P
4 0 0

Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.

Disaster Mitigation and Preparedness: *Natural Hazards:* causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. *Man-made hazards:* causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.

Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.

Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.

Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines..

Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.

Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.

Books/References:

1. Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
2. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester
3. Disaster Management, R.B. Singh (Ed), Rawat Publications
4. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction.
5. [www.http//ndma.gov.in](http://ndma.gov.in)
6. Disaster Management –Future Challenges & Opportunities by Jagbir Singh, I.K. International Publishing House.

BTCE-803 IRRIGATION ENGINEERING-II

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 1 0

1. **Head Works:**Types of head works, Functions and investigations of a diversion head work : component parts of a diversion head work and their design considerations, silt control devices.
2. **Theories of Seepage:** Seepage force and exit gradient, assumptions and salient features of Bligh's Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness.
3. **Design of Weirs:** Weirs versus barrage, types of weirs, main components of weir, causes of failure of weir and design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.
4. **Energy Dissipation Devices:** Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipators and their hydraulic design.
5. **Canal Regulators:** Offtake alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape.
6. **Canal Falls:** Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.
7. **Cross-Drainage works :** Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types and design considerations, super passages, canal siphons and level crossing.
8. **Canal Out-lets :** Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality, sensitivity, sensitiveness, etc. Details and design of nonmodular, semi-modular and modular outlets.

Books

1. Irrigation Engg. & Hydraulic Structure by Santosh Kumar Garg, Khanna Publishers
2. Design of Irrigation Structures by R.K. Sharma, Oxford IBH Pub
3. Irrigation Engg. and Hydraulics Structures by S.R. Sahasrabudhe, . Katson Publishing
4. Irrigation Practice and Design Vol. I to VII by K.B. Khushlani. Oxford IBH Pub
5. P.N. Modi; Irrigation with Resources and with Power Engineering, Standard Book House
6. Irrigation Engg. Vol. I & II by Ivan E. Houk, John Wiley and sons

BTCE-804 Transportation Engineering – II

Internal Marks: 40
External Marks: 60
Total Marks: 100

L T P
3 1 0

Railway Engineering

- 1) Introduction to Railway Engineering:** History of Railways, Development of Indian Railway, Organisation of Indian Railway, Important Statistics of Indian Railways. Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.
- 2) Railway Track:** Requirements of a Good Track, Track Specifications on Indian Railways, Detailed Cross-Section of Single/Double Track on Indian Railways. Components of Railway Track: Rails, Sleepers, Ballast, Subgrade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.
- 3) Geometric Design of Railway Track:** Alignment, Gradients, Horizontal Curve, Super-elevation, Equilibrium Cant, Cant Deficiency, Transition Curves.
- 4) Points and Crossings:** Functions, Working of Turnout, Various types of Track Junctions and their layouts, Level-crossing.
- 5) Railway Stations & Yards:** Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations & Yards
- 6) Signalling and Interlocking:** Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signalling, Principal of Interlocking.
- 7) Modernization of Railway Tracks:** High Speed Tracks, Improvement in existing track for high speed, Ballastless Track, MAGLEV, TACV Track.

Airport Engineering

- 8) Introduction to Airport Engineering:** Air Transport Scenario in India and Stages of Development, National and International Organizations.
- 9) Airport Planning:** Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport. Obstructions and Zoning Laws, Imaginary Surfaces, Approach Zones and Turning Zones.
- 10) Runway Orientation and Design:** Head Wind, Cross Wind, Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration.
- 11) Taxiway and Aircraft Parking:** Aircraft Parking System. Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.
- 12) Visual Aids:** Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

Books Recommended:

1. Chandra S., and Aggarwal, "Railway Engineering", M.M. Oxford University Press, New Delhi, 2007.
2. Saxena, S.C., and Arora, S.P., "A Text Book of Railway Engineering", Dhanpat Rai and Sons, Delhi, 1997.
3. J. S. Mundrey, "Railway Track Engineering", McGraw Hill Publishing Co., 2009
4. Khanna, S.K., Arora, M.G., and Jain, S.S., "Airport Planning and Design", Nem Chand & Bros. Roorkee, 1999.
5. Horenjeff, R. and McKelvey, F., "Planning and Design of Airports", McGraw Hill Company, New York, 1994.
6. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, "Airport Engineering: Planning, Design and Development of 21st Century", Wiley Publishers, 2011

BTCE-805 PROJECT

Internal Marks: 100
External Marks: 50
Total Marks: 150

L T P
- - 6

Students are required to work on project in any of the areas related to Civil Engineering. The students will work 6 hrs per week with his / her supervisor(s).

BTCE-806 DYNAMICS OF STRUCTURES

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Overview of structural dynamics: Fundamental objective of structural dynamic analysis - types of prescribed loadings - essential characteristics of a dynamic problem - method of discretization: lumped-mass procedure - generalized displacements - the finite-element concept

Single degree of freedom systems: Components of the basic dynamic system formulation of the equations of motion - direct equilibration using D'Alembert's principle - principle of virtual displacements - *generalized SDOF systems* - rigid body assemblage

Free vibration response: Solution of the equation of motion - undamped free vibrations - damped free vibrations - critical damping - underdamped systems - overdamped systems - negative damping

Response to harmonic loading: Undamped system complementary solution - particular solution - general solution - response ratio - damped system - resonant response

Response to periodic loading: Fourier series expression of the loading - response to the fourier series loading - exponential form of fourier series solution

Response to impulsive loads: General nature of impulsive loads - sine-wave impulse - rectangular impulse - triangular impulse - shock load.

Response to general dynamic loading: Duhamel integral for an undamped system - numerical evaluation of the duhamel integral for an undamped system - response of damped systems - response analysis through the frequency domain

Multi degree of freedom systems: Formulation of the MDOF equations of motion - selection of the degrees of freedom - orthogonality conditions - normal co-ordinates - uncoupled equations of motion - undamped & damped - mode superposition procedure

Continuous parameter systems: Vibration analysis by Rayleigh's method - basis of the method - approximate analysis of a general system - selection of the vibration shape - improved Rayleigh method

Practical vibration analysis: Preliminary comments - stodola method - fundamental mode analysis – proof of convergence - analysis of second mode - analysis of third and higher modes – analysis of highest mode - Rayleigh's method in discrete co-ordinate systems.

Books:

1. Clough R.W. & Penzien J., Dynamics of Structures, McGraw Hill
2. Weaver W., Jr. Timoshenko S.P., Young D.H, Vibration Problem in Engineering, John Wiley
3. Meivovitch L., Elements of Vibration Analysis, McGraw Hill
4. Seto W.W., Mechanical Vibrations, Schaum's Outline Series, McGraw Hill
5. Srinivasan P., Mechanical Vibration Analysis, Tata McGraw Hill
6. A K Chopra; Dymanics of Structures; Prentice-Hall
7. Earthquake Resistant Design of Structures; Pankaj Agrawal, Manish Shrikhande; Prentice Hall of India

BTCE-807 FINITE ELEMENT METHODS

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction: the finite element method - the element characteristic matrix - element assembly and solution for unknowns - summary of finite element history - basic equations of elasticity – strain displacement relations - theory of stress and deformation - stress-strain-temperature relations

The direct stiffness method: structure stiffness equations - properties of $[K]$ - solution of unknowns - element stiffness equations - assembly of elements - node numbering to exploit matrix sparsity - displacement boundary conditions - gauss elimination solution of equations - conservation of computer storage - computational efficiency - stress computation - support reactions - summary of the finite element procedure

Stationary principles, Rayleigh-Ritz and interpolation: principle of stationary potential energy - problems having many d.o.f - potential energy of an elastic body - the Rayleigh-Ritz method - piecewise polynomial field - finite element form of Rayleigh-Ritz method - finite element formulations derived from a functional - interpolation - shape functions for C^0 and C^1 elements - lagrangian interpolation functions for two and three dimensional elements

Displacement based elements for structural mechanics: formulae for element stiffness matrix and load vector - overview of element stiffness matrices - consistent element nodal vector - equilibrium and compatibility in the solution - convergence requirements - patch test - stress calculation - other formulation methods

Straight sided triangles and tetrahedral: natural coordinates for lines - triangles and tetrahedral - interpolation fields for plane triangles - linear and quadratic triangle - quadratic tetrahedron

The isoparametric formulation: introduction - an isoparametric bar element - plane bilinear element - summary of gauss quadrature - quadratic plane elements - direct construction of shape functions for transition elements - hexahedral (solid) isoparametric elements - triangular isoparametric elements - consistent element nodal loads - validity of isoparametric elements - appropriate order of quadrature - element and mesh instabilities - remarks on stress computation

Coordinate transformation: transformation of vectors - transformation of stress, strain and material properties - transformation of stiffness matrices - transformation of flexibility to stiffness - inclined support - joining dissimilar elements to one another- rigid links - rigid elements

Bending flat plates: plate bending theory - finite elements for plates - triangular discrete Kirchoff element - boundary conditions

Introduction to weighted residual method: some weighted residual methods - galerkin finite element method - integration by parts - axially loaded bar - beam - plane elasticity

Reference books

1. Desai C.S., *Elementary Finite Element Method*, Prentice Hall of India
2. Chandrupatla T.R. & Belegundu A.D., *Introduction to Finite Elements in Engineering*, Prentice Hall of India
3. Bathe K.J., *Finite Element Procedures in Engineering Analysis*, Prentice Hall of India

4. Gallagher R.H., *Finite Element Analysis: Fundamentals*, Prentice Hall Inc.
5. Rajasekaran S., *Finite Element Analysis in Engineering Design*, Wheeler Pub.
6. Krishnamoorthy C. S., *Finite Element Analysis - Theory and Programming*, Tata McGraw Hill
7. Zienkiewics O.C. & Taylor R.L., *The Finite Element Method*, Vol I & II, McGraw Hill

BTCE-808 ADVANCED REINFORCED CONCRETE DESIGN

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Note: No Indian Codes of Practice and Design handbooks are permitted, so paper setter is expected to provide required data from relevant IS codes, for any numerical or design part.

Large span concrete roofs – Classification- Behaviour of Flat slabs- Direct design and equivalent frame method- Codal provisions

Forms of Shells and Folded plates- Structural behaviour of cylindrical shell and folded plate- Method of analysis-beam action, arch action and membrane analysis- Codal provisions- Design of simply supported circular cylindrical long shells and folded plates.

Yield line analysis of slabs- virtual work and equilibrium method of analysis- simply supported rectangular slabs with corners held down- uniform and concentrated loads- design of simply supported rectangular and circular slabs

Analysis of deep beams- Design as per IS 456-2000

Analysis of stresses in concrete chimneys- uncracked and cracked sections- Codal provisions- Design of chimney

Retaining walls -Analysis and Design of cantilever and counterfort retaining walls with horizontal and inclined surcharge.

Overhead water tanks- rectangular and circular with flat bottom- spherical and conical tank roofs- staging- Design based on IS 3370

Reference books

1. Reinforced Concrete Structural Elements- Purushothaman. P, Tata Mc Graw Hill
2. Design and Construction of Concrete Shell Roofs- G.S.Ramaswamy
3. Reinforced Concrete – Ashok K Jain, Nem Chand Bros. Roorkee
4. Plain and Reinforced Concrete – Jain & Jaikrishna, Vol. I & II, Nem Chand Bros. Roorkee
5. Reinforced Concrete Chimneys- Taylor C Pere,
6. Yield Line Analysis of Slabs- Jones L L, Thomas and Hudson
7. Design of deep girders, Concrete Association of India
8. Reinforced Concrete, Mallick & Gupta- Oxford & IBH
9. IS 456-2000
10. IS2210-1998- Criteria for design of reinforced concrete shell structures and folded plates
11. IS 4998-1998- Criteria for design of reinforced concrete chimneys
12. IS 3370- 1991- Part 1-4- Code of Practice for concrete structures for the storage of liquids

BTCE – 809 PRESTRESSED CONCRETE

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Note: IS 1343 is permitted in examination.

Materials for prestressed concrete and prestressing systems

High strength concrete and high tensile steel – tensioning devices – pretensioning systems – post tensioning systems.

Analysis of prestress and bending stresses

Analysis of prestress – resultant stresses at a sector – pressure line or thrust line and internal resisting couple – concept of load balancing – losses of prestress – deflection of beams.

Strength of prestressed concrete sections in flexure, shear and torsion

Types of flexural failure – strain compatibility method – IS:1343 code procedure – design for limit state of shear and torsion.

Design of prestressed concrete beams and slabs

Transfer of prestress in pre tensioned and post tensioned members – design of anchorage zone reinforcement – design of simple beams – cable profiles – design of slabs.

Books

1. N. Krishna Raju, Prestressed concrete, Tata McGraw Hill
2. T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons.
3. P. Dayaratnam, Prestressed Concrete, Oxford & IBH
4. R. Rajagopalan, Prestressed Concrete.
5. IS 1343 2012 **Code of Practice for Prestressed Concrete**

BTCE-810 GROUND IMPROVEMENT TECHNIQUES

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction to soil improvement without the addition of materials - dynamic compaction equipment used - application to granular soils - cohesive soils - depth of improvement - environmental considerations - induced settlements - compaction using vibratory probes - vibro techniques vibro equipment - the vibro compaction and replacement process - control of verification of vibro techniques - vibro systems and liquefaction - soil improvement by thermal treatment - preloading techniques - surface compaction introduction to bio technical stabilization

Introduction to soil improvement with the addition of materials - lime stabilization - lime column method - stabilization of soft clay or silt with lime - bearing capacity of lime treated soils - settlement of lime treated soils - improvement in slope stability - control methods - chemical grouting - commonly used chemicals - grouting systems - grouting operations - applications - compaction grouting - introduction - application and limitations - plant for preparing grouting materials - jet grouting - jet grouting process - geometry and properties of treated soils - applications - slab jacking - gravel - sand - stone columns

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development - soil types and reinforced earth - anchored earth nailing reticulated micro piles - soil dowels - soil anchors - reinforced earth retaining walls

Geotextiles - Behaviour of soils on reinforcing with geotextiles - effect on strength, bearing capacity, compaction and permeability - design aspects - slopes - clay embankments - retaining walls – pavements

Reference books

1. Moseley, *Text Book on Ground Improvement*, Blackie Academic Professional, Chapman & Hall
2. Boweven R., *Text Book on Grouting in Engineering Practice*, Applied Science Publishers Ltd
3. Jewell R.A., *Text Book on Soil Reinforcement with Geotextiles*, CIRIA Special Publication, Thomas Telford
4. Van Impe W.E., *Text Book On Soil Improvement Technique & Their Evolution*, Balkema Publishers
5. Donald .H. Gray & Robbin B. Sotir, *Text Book On Bio Technical & Soil Engineering Slope Stabilization*, John Wiley
6. Rao G.V. & Rao G.V.S., *Text Book On Engineering With Geotextiles*, Tata McGraw Hill
7. Korener, *Construction & Geotechnical Methods In Foundation Engineering*, McGraw Hill
8. Shukla, S.K. and Yin, J.H. *Fundamental of Geosynthetic Engineering*, Taylor & Francis
9. Swamisaran, *Reinforced Soil and its Engineering Application*, New Age Publication
10. Gulati, S.K. and Datta, M., *Geotechnical Engineering*, TMH

BTCE-811 SOIL DYNAMICS & MACHINE FOUNDATION

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction - nature of dynamic loads - stress conditions on soil elements under earthquake loading - dynamic loads imposed by simple crank mechanism - type of machine foundations - special considerations for design of machine foundations - theory of vibration: general definitions - properties of harmonic motion - free vibrations of a mass-spring system - free vibrations with viscous damping - forced vibrations with viscous damping - frequency dependent exciting force - systems under transient forces - Raleigh's method - logarithmic decrement - determination of viscous damping - principle of vibration measuring instruments - systems with two degrees of freedom - special response

Criteria for a satisfactory machine foundation - permissible amplitude of vibration for different type of machines - methods of analysis of machine foundations - methods based on linear elastic weightless springs - methods based on linear theory of elasticity (elastic half space theory) - methods based on semi graphical approach - degrees of freedom of a block foundation - definition of soil spring constants - nature of damping - geometric and internal damping - determination of soil constants - methods of determination of soil constants in laboratory and field based on IS code provisions

Vertical, sliding, rocking and yawing vibrations of a block foundation - simultaneous rocking, sliding and vertical vibrations of a block foundation - foundation of reciprocating machines - design criteria - calculation of induced forces and moments - multi-cylinder engines - numerical example (IS code method)

Foundations subjected to impact loads - design criteria - analysis of vertical vibrations - computation of dynamic forces - design of hammer foundations (IS code method) - vibration isolation - active and passive isolation - transmissibility - methods of isolation in machine foundations

Note: Use of I.S 2974 Part I and II will be allowed in the university examination

Reference books

1. Shamsher Prakash, *Soil Dynamics*, McGraw Hill
2. Das and Ramana, *Principle of Soil Dynamica*, Cengage Learning
3. Alexander Major, *Dynamics in Soil Engineering*
4. Sreenivasalu & Varadarajan, *Handbook of Machine Foundations*, Tata McGraw Hill
5. IS 2974 - Part I and II, *Design Considerations for Machine Foundations* *
6. IS 5249: *Method of Test for Determination of Dynamic Properties Of Soils*

* IS code marked with * is permitted in examination.

BTCE-812 EARTH AND EARTH RETAINING STRUCTURES

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Earthen Dam

Introduction to Earthen dams, types of dams, selection of type of dam based on material availability, foundation conditions and topography

Design details – crest, free board, upstream and down stream slopes, upstream and down stream slope protection – central and inclined cores – types and design of filters

Seepage analysis and control – seepage through dam and foundations – control of seepage in earth dam and foundation

Stability analysis – critical stability conditions – evaluation of stability by Bishop's and sliding wedge methods under critical conditions

Construction techniques – methods of construction – quality control

Instrumentation – measurement of pore pressures

Earth pressure theories – Rankine's and Coulomb's earth pressure theories for cohesionless and cohesive backfills – computation of earth pressures for various cases – inclined – with surcharge – submerged and partly submerged – stratified backfills

Rigid retaining structures – active and passive earth pressures against gravity retaining walls – computation of earth pressures by Trial wedge method – a mathematical approach for completely submerged and partly submerged backfills – Perched water table – importance of capillary tension in earth pressure.

Graphical methods of earth pressure computation – trial wedge method for coulomb's and Rankine's conditions, for regular and irregular ground and wall conditions – Rebhan's construction for active pressure – friction circle method – logarithmic spiral method.

Design of gravity retaining wall – cantilever retaining walls

Flexible retaining structure – type and methods of construction – design strength parameters – safety factor for sheet pile walls – computation of earth pressures against cantilever sheet piles in cohesionless and cohesive soils – anchored sheet piles – free earth method – fixed earth method – Rowe's moment reduction method – stability of sheet piling

Diaphragm walls and coffer dams – type of diaphragm walls and their construction techniques in various soil types – earth pressure on braced cuts and coffer dams – design of coffer dams

Reference books

1. Huntington, Earth pressure on retaining walls.
2. Bowles, Foundation Analysis and Design.
3. Jones, Earth Reinforcements & Soil structures.
4. Prakash, Ranjan & Sasan, Analysis & Design of Foundation & Retaining Structures.

BTCE-813 REINFORCED EARTH AND GEOTEXTILES

Internal Marks : 40 L T P

External Marks : 60 3 1 0

Total Marks : 100

Reinforced Earth – The mechanisms of the reinforced earth techniques – Design principles – Materials used for construction – Advantages of reinforced earth – Reinforced earth construction with GI sheets and strips

An overview of Geosynthetics, Description of Geotextiles – Geogrids – Geonets – Geomembranes – Geocomposites – Geocells – Designing with Geotextiles – Geotextile properties and test methods – Functions of Geotextile – Design methods for separation – stabilization – filtration – Drainage, Soil anchors.

Designing with Geogrids – Geogrid properties and test methods – Designing with Geonets – Geonet properties and test methods – Designing with Geomembranes – Geomembrane properties and test methods – construction practices with Geotextiles, Geogrids, Geonets, Geomembranes

Design of liquid Contaminant liners – liquid contaminant liners – Covers for reservoirs- Water conveyance (Canal liners)-- solid material liners – underground storage tanks – Design of pavements Geo composites as liquid / Vapour Barriers –Improvement in bearing capacity – Erosion Control for waterways.

Reference books

1. Robert M. Koerner, *Designing with Geosynthetics*, Prentice Hall – 1989
2. G.V Rao & GVS Suryanarayana Raju, *Engineering with Geosynthetics*, Tata Mc Graw Hill Publishing Co. New Delhi
3. Korener, *Construction & Geotechnical Methods In Foundation Engineering*, McGraw Hill
4. Shukla, S.K. and Yin, J.H. *Fundamental of Geosynthetic Engineering*, Taylor & Francis
5. Swamisaran, *Reinforced Soil and its Engineering Application*, New Age Publication
6. Gulati, S.K. and Datta, M., *Geotechnical Engineering*, TMH

BTCE-814 ENVIRONMENTAL IMPACT ASSESSMENT

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Concepts of environmental impact analysis - key features of the National Environmental Policy Act and its implementation, screening in the EIA process, role of the USEPA, environmental protection and EIA at the national level, utility and scope of the EIA process

Planning and management of environmental impact studies

Environmental impact - factors for consideration in assessing the impacts of water related projects, power projects, waste water treatment facilities etc .

Concepts and terms in the impact assessment process, Socioeconomic impact analysis.

Simple methods for impact identification – matrices, net works and checklists.

Description of the environmental setting

Environmental indices and indicators for describing the affected environment.

Prediction and assessment- Prediction and assessment of the impact on surface water, soil, groundwater, air, water quality, vegetation and wild life and biological environments. Case studies and examples.

Prediction and assessment of visual impacts and impacts on the socio-economic setting, decision methods for evaluation of alternatives, public participation in decision-making

Preparing the EIA document

Environmental monitoring.

Reference books

1. Larry W Canter, Environmental Impact Assessment, McGraw Hill, Inc., 1996
2. Betty Bowers Marriot, Environmental Impact Assessment A Practical Guide, McGraw Hill, Inc., 1997.
3. C.J. Barrow, Environmental & Social Impact Assessment – An Introduction, Edward Arnold, 2002.
4. Evan. K. Paleologos and Ian Lerche, Environmental Risk Analysis, McGraw Hill Inc., 2001
5. Peter Morris (ed.) and Riki Therivel (ed.), Methods of Environmental Impact Assessment, Routledge, 2001.

BTCE 815 ADVANCED ENVIRONMENTAL ENGG.

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

INTRODUCTION

Environment, Biosphere, Ecosystems; their interrelationships and pollution.

AIR POLLUTION & CONTROL

Air pollution, Physical & chemical fundamentals, Air pollution standards, Effects of air pollution; climate change, Air pollution meteorology, Atmospheric dispersion of pollutants, Indoor air quality models, Air pollution control of stationary & mobile sources.

NOISE POLLUTION & CONTROL:

Introduction, Rating Systems, Sources & Criteria, Noise prediction and Control

SOLID WASTE MANAGEMENT:

Perspectives & properties, collection, transfer & transport, Life cycle assessment, Disposal in a landfill, Waste to energy, Composting, Resource conservation & recovery for sustainability

HAZARDOUS WASTE MANAGEMENT:

The hazard, risk, definition & classification RCRA & HSWA, CERCLA & SARA, Hazardous waste management, Treatment technologies,
Land disposal, Groundwater contamination & remediation

BOOKS:

- 1..Davis & Cornwell, Environmental Engineering, Mc Graw Hill Int Ed
- 2..Peavy, H.S, Rowe, D.R, Tchobanoglous, G, Environmental Engineering, Mc Graw Hill
- 3..E.P. Odum, Fundamentals of Ecology, Oxford and IBH Pub.
4. Vesilind, Worrell and Reinhart, Solid Waste Engineering, Cengage Learning India
5. Rao and Rao, Air Pollution, Tata McGraw Hill Pub

BTCE 816 FLOOD CONTROL & RIVER ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	
Introduction:		

River Engineering, Flood forecasting, Flood Estimation, Estimating Design flood, Empirical formulate, statistical or Probability methods, Unit hydrograph method

Flood control and Economics of Flood control

River Regime theories, River Modeling, Meandering

River Training, Channel improvements; cut offs, River control structures

Sediment load, Resistance to flow,

Social and environmental impacts.

BOOKS:

- 1.R.J. Garde, K.G. Ranga Raju, 1. Mechanics of Sedement Transportation and Alluvial Stream problems, Wiley Eastern Ltd.
2. V.A. Vanoni , Sedimentation Engg, John Wiley and Sons
3. .A. Raudkivi, Loose Boundary Hydraulics, Pergamon Press, Inc
4. P.N. Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House
5. Manual on rivers, their behaviour and Training, Pub No. 60, CBIP, New Delhi

BTCE - 817 HYDROLOGY AND DAMS

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

- 1) Introduction, Precipitation: Importance of hydrological data in water resources planning. The hydrologic cycle. Mechanics of precipitation, types and causes, measurement by rain gauges, Gauge net-works, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves, depth area-duration curves.
- 2)
 - a) Interception, Evapo-transpiration and Infiltration: Factors affecting interception, evaporation from free water surfaces and from land surfaces, transpiration, Evapo-transpiration.
 - b) Infiltration Factors affecting infiltration, rate, Infiltration capacity and its determination.
- 3) Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Snyder's synthetic unit hydrograph.
- 4) Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph.
- 5) Gravity Dams-Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, elementary profile of a dam.
- 6) Gravity Dams-Spillways: Creagers profiles neglecting velocity of approach, profile taking velocity of approach into account, Upstream lip and approach ramp, Advantages of gated spillways, Discharge characteristics of spillways.
- 7) Arch and Buttress Dams: Classification of arch dam- constant radius, constant angle and variable radius, Cylinder theory, Expression relating central angle and Cross-Sectional area of arch. Types of buttress dams, Advantages of buttress dams.
- 8) Earth Dams: Components of earth dams and their functions, Phreatic line determination by analytical and graphical methods.

REFERENCE

1. Engineering Hydrology - J.Nemec, Prentice Hall
2. Engineering Hydrology by Stanley Buttlar, John. Wiley
3. Ground Water Hydrology by TODD, John. Wiley
4. Engineering for Dams Vol. II & III by Creager Justin & Hinds. John. Wiley
5. Hydrology by. S.K.Garg, Khanna Pub
6. Hydrology Principles, Analysis and Design by. Raghunath, H M, New Age Int. Pub

BTCE-818 PAVEMENT DESIGN

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Note: Use of IRC:37-2012 and IRC:58-2011 shall be allowed in the examination.

1. **Introduction:** Types of pavement structure. Functions of pavement components, Factors affecting pavement design, Design wheel load, Strength characteristics of pavement materials. Comparison of flexible and rigid pavements.
2. **Design of Flexible Pavements:** General design considerations, Methods for design of flexible pavements – Group Index Method, Triaxial Test Method, Hveem Stabilometer Method, McLeod's Method, Indian Roads Congress Method.
3. **Design of Bituminous Mixes:** Mix Design Approaches, Marshall Method of Bituminous Mix Design, Superpave
4. **Design of Rigid Pavements:** General design considerations, Westergard's Analysis, Methods for design of rigid pavements - PCA method, AASHTO Method, Indian Roads Congress Method, Types and design of Joints in cement concrete pavements.
5. **Modern Design Concepts:** Reinforced Concrete Pavement, Airport Pavement Design, Bituminous Pavement with Cemented Base, Interlocking Concrete Block Pavement, Full Depth Bituminous Pavement, Ultrathin White Topping, Perpetual Pavement, Pavement Overlays.

Books Recommended:

1. Yoder, E. J., and M. W. Witczak, "Principals of Pavement Design", Wiley Publication.
2. Khanna, S. K., and C. E. G. Justo, "Highway Engineering", Nem Chand & Bros., Roorkee.
3. Sharma, S. K., "Principles, Practice and Design of Highway Engineering", S. Chand & Co.
4. Chakraborty, P. and A. Das, "Principles of Transportation Engineering", Prentice Hall India.
5. Yang H. Huang, "Pavement Analysis and Design", Prentice Hall.

BTCE-819 TRAFFIC ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

1. **Introduction:** Elements of Traffic Engineering, Components of traffic system – road users, vehicles, highways and control devices.
2. **Vehicle Characteristics:** IRC standards, Design speed, volume, Highway capacity and levels of service, capacity of urban and rural roads, PCU concept and its limitations.
3. **Traffic Stream Characteristics:** Traffic stream parameters, characteristics of interrupted and uninterrupted flows.
4. **Traffic Studies:** Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, parking studies, accident studies.
5. **Traffic Regulation and Control:** Signs and markings, Traffic System Management, At-grade intersections, Channelisation, Roundabouts.
6. **Traffic Signals:** Pre-timed and traffic actuated. Design of signal setting, phase diagrams, timing diagram, Signal co-ordination.
7. **Grade Separated Intersections:** Geometric elements for divided and access controlled highways and expressways.
8. **Traffic Safety:** Principles and practices, Road safety audit.
9. **Intelligent Transportation System:** Applications in Traffic Engineering

Books Recommended:

1. William, R.M. and Roger, P.R., “Traffic Engineering”, Prentice Hall.
2. Hobbs, F.D., “Traffic Planning and Engineering”, Pergamon Press.
3. Khisty, C.J. and Kent, B.L., “Transportation Engineering – An Introduction”, Prentice Hall of India Pvt. Ltd.
4. Kadiyali, L.R., “Traffic Engineering & Transport Planning”, Khanna Publishers, New Delhi.
5. Mannering, “Principles of Highway Engineering & Traffic Analysis”, Wiley Publishers, New Delhi.

BTCE-820 BRIDGE ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

- 1. Introduction:** Definition and components of a bridge, Classification of bridges, Choice of a bridge type.
- 2. Investigation for Bridges:** Need for investigation, Selection of bridge site, Determination of design discharge for River Bridge, Linear waterway, Economical span, Vertical clearance, Scour depth, Afflux, Traffic projection.
- 3. Standard Specifications for Road Bridges:** IRC Bridge Codes, Width of carriageway, Clearances, Dead load, I.R.C. standard live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.
- 4. Reinforced Concrete Bridges:** Types of RCC bridges; Culverts - Box Culvert, Pipe Culvert, Solid slab bridge, T-beam girder bridges, Hollow girder bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Arch bridges, Pre-stressed concrete bridges.
- 5. Steel Bridges:** Types of Steel bridges; Beam bridges, Plate girder bridges, Box girder bridges, Truss bridges, Arch bridges, Cantilever bridges, Cable stayed bridges, Suspension bridges.
- 6. Sub-structure and Foundation:** Piers and abutments, materials for piers and abutments, Types of foundations; Shallow, Pile, and Well foundations. Relative merits of piles and well foundations, Pneumatic Caissons, Box Caissons.
- 7. Bearings, Joints & Appurtenances:** Importance of Bearings, Different types of bearings- Expansion Bearings, Fixed Bearings, Elastomeric Bearings, Expansion joints, Wearing Course, Approach Slab, Footpath, Handrails.
- 8. Construction and Maintenance of Bridges:** Methods of construction of concrete and steel bridges. Formwork and falsework for concrete bridges, Causes of Bridge failures, Inspection and maintenance.

Books Recommended:

1. Johnson, Victor, "Essentials of Bridge Engineering", Oxford University Press.
2. Khadilkar, C. H., "A Text book of Bridge Construction", Allied Publishers.
3. Rangwala, S. C., "Bridge Engineering", Charotar Publishing House Pvt. Ltd.
4. Raina, V. K., "Concrete Bridges Handbook", Shroff Publishers and Distributors.
5. Ponnuswamy, S. "Bridge Engineering", McGraw Hill Education.

BTCE-821 INFRASTRUCTURE DEVELOPMENT & MANAGEMENT

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction: Impact of Infrastructure development on economic development, standard of living and environment. Reasons for rise of public sector and government in infrastructural activities. Changed socio-economic scenario and current problems and related issues.

Policies on Infrastructure Development: A historical review of the Government policies on infrastructure. Current public policies on transportations, power and telecom sectors. Plans for infrastructure development. Legal framework for regulating private participation in roads and highways, Ports & Airports, Power and Telecom.

Construction and Infrastructure: Construction component of various infrastructure sectors. Highway, ports and aviation, oil and gas, power, telecom, railways, irrigation. Current scenario, future needs, investment needed, regulatory framework, government policies and future plans. Technological and methodological demands on construction management in infrastructure development projects.

Infrastructure Management: Importance, scope and role in different sectors of construction.

- **Highway Sector:** Repayment of Funds, Toll Collection Strategy, Shadow tolling, and direct tolls, Maintenance strategy, Review of toll rates & structuring to suit the traffic demand,
- **Irrigation Projects:** Large / Small Dams - Instrumentation, monitoring of water levels, catchments area, rainfall data management, prediction, land irrigation planning & policies, processes Barrages, Canals.
- **Power Projects:** Power scenario in India, Estimated requirement, Generation of Power distribution strategies, national grid, load calculation & factors, Hydropower - day to day operations, management structures, maintenance, Thermal Power, Nuclear Power.
- **Airports:** Requisites of domestic & International airports & cargo & military airports, facilities available, Terminal management, ATC.
- **Railways:** Mass Rapid Transport System MRTS, LRT, Multi-modal Transport System.

Books Recommended:

1. Chandra, Prassanna, "Projects, Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw-Hill, New Delhi, 2006.
2. Raghuram, G. & Jain, R., "Infrastructure Development & Financing Towards a Public-Private Partnership", Macmillan India Ltd., New Delhi, 2002.
3. India Infrastructure Report 2001 & 2002, Oxford University Press, New Delhi, 2001/02.
4. NICMAR, "Construction Business Opportunities in Infrastructure Development in India", NICMAR, Mumbai, 2001.
5. Parikh Kirit S., "India Development Report, 1999-2000", Oxford University Press, New Delhi, 2002.
6. GOI Rakesh Mohan Committee, "The India Infrastructure Report", National Council of Applied Economic Research, New Delhi, 1996.