



BABU BANARASI DAS UNIVERSITY LUCKNOW



SCHOOL OF ENGINEERING

Syllabus for

Bachelor of Technology

in

Civil Engineering

(Effective from the Academic Session 2012-13)

COURSE STRUCTURE- B.Tech-2nd year (Civil Engineering)

2 nd -YEAR						SEMESTER-III					
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU-301 /BHU302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
2.	BAS-301	Mathematics-III	3	1	0	30	20	50	100	150	4
3.	BCE-301	Civil Engineering Materials	3	1	0	30	20	50	100	150	3
4.	BCE-302	Fluid Mechanics	3	1	0	30	20	50	100	150	4
5.	BCE-303	Surveying-I	3	1	0	30	20	50	100	150	3
6.	BCE-304	Geoinformatics	2	1	0	15	10	25	50	75	3
Practical / Training / Project											
7.	BCE-351	Civil Engineering Materials Lab	0	0	3	10	10	20	30	50	1
8.	BCE-352	Fluid Mechanics Lab	0	0	3	10	10	20	30	50	1
9.	BCE-353	Surveying Lab	0	0	3	10	10	20	30	50	1
10.	BCE-354	Geoinformatics Lab	0	0	3	10	10	20	30	50	1
	GP-301	General Proficiency	-	-	-	-	-	50	-	50	1
Total			16	5	12	Total				1000	24

2 nd -YEAR						SEMESTER-IV					
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU402/ BHU401	Industrial Sociology / Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	BAS-402	Numerical Techniques	2	1	0	15	10	25	50	75	3
3.	BCE-401	Structural Mechanics	3	1	0	30	20	50	100	150	4
4.	BCE-402	Building Construction & Practices	3	1	0	30	20	50	100	150	3
5.	BCE-403	Hydraulics & Hydraulic Machine	3	1	0	30	20	50	100	150	4
6.	BCS-405	Programming in 'C'	3	1	0	30	20	50	100	150	3
Practical / Training / Project											
7.	BCE-451	Civil Engineering Drawing Lab	0	0	3	20	20	40	60	100	2
8.	BCE-452	Hydraulic Machine Lab	0	0	3	10	10	20	30	50	1
9.	BCS-455	C Programming Lab	0	0	2	10	10	20	30	50	1
10.	GP-401	General Proficiency	-	-	-	-	-	50	-	50	1
Total			16	5	8	Total				1000	24



BCE -301: CIVIL ENGINEERING MATERIALS

Unit 1 Cement and aggregates: Methods of manufacturing of cement and its chemistry, Kinds of cement and their properties, hydration mechanism, testing of cement, Grading, shape and texture of aggregates, properties of aggregates.

Unit 2 Concrete: Properties of fresh concrete, tests on fresh and hardened concrete, factors affecting Strength of concrete, durability of concrete, introduction to mix design- IS code Method.

Unit 3 Bricks: Constituents of brick earth and their properties, manufacture of bricks Classification and tests for quality control, properties of masonry units and Masonry mortar, stone their type and uses, Classification of lime, setting of Lime, specifications.

Unit 4 Timber: Structure and characteristics of hard and soft wood; engineering Applications, defect in timber, seasoning, preservation, fire proofing, plywood Black boards and fire boards, steel, types and mechanical properties (ductility and strength) of mild steel, cold worked steel etc., effect of heat and fire resistance.

Unit 5 Properties and uses of glass, Asbestos, Bitumen, plastics etc, Industry and Environment, Use of waste, alternative and non standard construction materials, Retrofitting of structures.

Text/Reference Books:

1. S K Duggal: "Building Materials", New Age International Pvt. Ltd.
2. P.C. Varghese: "Building Materials", PHI
3. S. C. Rangawala: "Engineering Materials", Charotar Publishing House Pvt. Ltd



BCE-302: FLUID MECHANICS

Unit 1 Kinematics of fluid flow: Introduction, fluids properties and classification, Concept of Viscosity, compressibility and Elasticity, Surface tension and capillarity.

Unit 2 Fluid flow Properties: Flow Classification, Stream lines, Streak lines, Continuity equation, velocity, Tangential, Normal, local and convective Accelerations, Types of fluid motions, rotation, Circulation, velocity potential, stream function, flownet.

Unit 3 Hydrostatics: Pascal law, Hydrostatic law, Relative equilibrium, pressure Measurements, mano-metres, forces on impressed plane and curved surfaces, Buoyancy, stability of floating and submerged bodies.

Unit 4 Equation of motion: Bernoulli's equation, Energy correction factor, Coefficients of Contraction, Velocity and discharge, Differential head meters, free vortex motion, Analysis of free liquid jet, Cavitation. Linear momentum equation, Force on pipe Junctions and bends, Forces on moving plates and vanes due to fluid flow, Angular Momentum, Forced vortex.

Unit 5 Flow measurement: Orifices, Mouth pieces, Weirs, Flow under sluice gates, Time of emptying tanks with or without inflow, flow of liquid from one vessel to another.

Text/Reference Books :

1. S Narasimhan: "First Course in Fluid Mechanics" , University Press.
2. Som, S.K.&Biswas G.: "Introduction of fluid mechanics & Fluid Machines", TMH, 2000, 2nd edition.
3. M M Das: "Fluid Mechanics & Turbomachines" , Oxford University Press. 4. S.K.Agarwal: "Fluid Mechanics & Machinery", TMH.
5. Garde, R.J., " Fluid Mechanics through Problems", New Age International Pvt. Ltd, New Delhi, 2nd Edition.
6. Hunter Rouse: "Elementary Mechanics of Fluids", John Wiley & Sons. Omc. 1946.
7. I.H.Shames: "Mechanics of Fluids", McGraw Hill, Int. Student, Education, 1988.
8. K L Kumar : "Fluid Mechanics", Euresia Publishers
9. Vijay Gupta and S.K.Gupta: " Fluid Mechanics and its Applications", Wiley Eastern Ltd, 1984.
10. Modi, P.N., and Seth, S.H.: "Hydraulics and Fluid Machines", Standard Book House, 1989.



BCE-303: SURVEYING-I

Unit 1 Surveying: Fundamental definition and concepts, objects, classification, basic principles, **Planes and Maps:** Chain surveying, definition, methods, instruments for chaining, ranging out survey lines, chaining, errors due to incorrect chain, offsets, booking of field notes, basic problems in chaining, obstacles in chaining, conventional symbols.

Unit 2 Compass surveying: Bearing and angles, compass traversing, adjustment of compass traverse, Graphical methods, magnetic declination, local adjustments, plane table surveying, plane table and its accessories, working operations, methods of plane tabling, two point and three points problem.

Unit 3 Leveling: Definition, Instruments, Methods of leveling, Theory of direct leveling, spirit leveling, Differential leveling, curvature and refraction, reciprocal leveling, profile leveling, cross sectioning, Barometric leveling, sensitiveness of bubble tube, permanent adjustment of level.

Unit 4 Theodolite and Traverse Surveying: Essential parts of transit theodolite ,temporary and permanent Adjustment of transit theodolite, measurement of horizontal and vertical angles; methods of Traversing, closing error, balancing of traverse, traverse table, omitted measurements, tachometry, Stadia system, influence if staff tilt, analytic lens, tangential and subtense systems.

Unit 5 Areas and volumes: Computation of area by trapezoidal and simpson's rule, area of closed traverse, Measurement of volume from cross sections, capacity of reservoirs, setting out works.

Text/Reference Books:

1. Kanetkar, T.P., " Surveying and leveling " Vol-I and II, Pune vidyarthi griha prakashan, pune, India
2. B.C.Punmia: "Surveying Vol-I", Laxmi publications, Delhi, India. 3. S K Duggal : "Surveying Vol 1 & 2" , TMH.
4. R Subramanian : "Surveying & Leveling" , Oxford University Press.



BCE-304: GEOINFORMATICS

Unit 1 Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector formats, topology and Data models, Spatial modeling, Data output, GIS Applications.

Unit 2 Physics of remote sensing, Ideal remote sensing system, Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC, Satellite Image-Characteristics and formats, Applications of remote sensing.

Unit 3 Aerial Photographs: Basic terms & Definitions, scales, relief displacements, Flight Planning, Stereoscopy, Characteristics of photographic images, Fundamentals of aerial photo-interpretation

Unit 4 Introduction, Satellite navigation System, GPS- Space segment, Control segment, User segment, GPS satellite signals, Receivers, Static, Kinematic and Differential GPS

Text/Reference Books:

1. A M Chandra: "Higher Surveying", New Age International Pvt. Ltd.
2. B C Punamia: "Surveying Vol-II" , Laxmi Publications, India
3. S K Duggal: "Surveying: Volume 2" , TMH, India

BABU BANARASI DAS UNIVERSITY

WE BELIEVE IN SHAPING GENERATIONS



BCE-351: CIVIL ENGINEERING MATERIALS LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

Tests on cement

1. Normal consistency
2. Setting time
3. Compressive Strength
4. Tensile Strength
5. Soundness

Test on Aggregates:

6. Fineness modulus.
7. Bulking and silt content of sand

Test on fresh concrete:

8. Effect of water - cement ratio
9. Slump and compaction factor

Tests on Bricks:

10. Compressive Strength
11. Water Absorption
12. Dimension Tolerance

BCE-352: FLUID MECHANICS LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

1. Flow over weirs
2. Flow over notch
3. Verification of Bernoulli's Theorem
4. Discharge through an Orifice
5. Center of Pressure
6. Impact of Liquid jet
7. Head losses through sudden contraction and enlargement
8. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
9. Verification of meta-centric height



BCE-353: SURVEYING LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

1. Chain surveying ; offset measurement
2. Compass surveying
3. Plane tabling by radiation method.
4. Plane tabling by intersection method.
5. Solution of two point problem by resection method.
6. Solution of three point problem by resection method.
7. Differential leveling
8. Longitudinal sectioning. 9. Cross sectioning.
10. Measurement of horizontal and vertical angles with a theodolite.

BCE-354: GEOINFORMATICS LAB

Note: Minimum of 5 experiments to be performed by students:

List of experiments:

1. Demonstration and working on Electronic Total Survey Station (2 Turns)
2. To layout a precise traverse in a given area and to compute the adjusted coordinates of survey stations (2 Turns)
3. Demonstration and working with Pocket/ Mirror stereoscopes, Parallax bar and Aerial photographs
4. Visual Interpretation using IRS false colour composite. 5. Demonstration and practice work with hand held GPS .
6. Lay out of circular curve by Rankine's method



BCE-401: STRUCTURAL MECHANICS

Unit 1 Compound stress and strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle.

3-D Stress, Theory of failure, Castiglione's Theorem, Impact load: Three-dimensional state of stress & strain, equilibrium equations. Generalized Hook's Law. Theories of Failure. Castiglione's Theorem. Impact load & stresses.

Unit 2 Stresses in Beams: Review of pure Bending. Direct and shear stresses in beams due to transverse and axial loads, composite beams.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams.

Torsion: Review of Torsion, combined bending & torsion of solid & hollow shafts.

Unit 3 Columns and Struts: Combined bending and direct stress, middle third and middle quarter rules, Struts with different end conditions, Euler's theory and experimental results, Ranking Gordon Formulae, Examples of columns in mechanical equipments and machines.

Unit 4 Thin cylinders & spheres: Hoop and axial stresses and strain. Volumetric strain.

Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders, Stresses in rotating shaft and cylinders, Stresses due to interference fits.

Unit 5 Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel-section.

Text/Reference Books:

1. R. S. Khurmi: "Strength of Materials", S.Chand & Company Limited
2. S. Ramamrutham, R. Narayan : "Strength of Materials" , Dhanpat Rai Publishing Company.
3. Andrew Pytel : "Mechanics of Materials", Cengage Learning
4. Ryder : "Strength of Materials", Macmillan, 1969
5. Timoshenko and Youngs: "Strength of Materials", Krieger Publishing Company 6. Bear & Johnston: "Mechanics of Materials", TMH.

BCE-402: BUILDING CONSTRUCTION & PRACTICES

Unit 1 Building planning, site selection, orientation, principles of planning the building, open air space, Requirement of parts of buildings, lighting and ventilation, requirements of various rooms, building By laws.

Unit 2 Components of building and their purpose and types, foundations, walls, columns, roofs, doors, Windows, bands and openings in the buildings-seismic requirements, vertical transport in structures, Building finishes, basic design of foundation of buildings, term used in brick masonry, Bond and Types of mortars.

Unit 3 Excavation, dewatering, shoring, Underpinning and Scaffolding, Drilling, Blasting, Well sinking and Pile driving, Cofferdams, form work- fabrication and use construction techniques for special Structures such as high rise buildings, Road construction, dams bridges, offshore platforms.

Unit 4 Damp proofing: Causes and effects of dampness, material and method of damp proofing, termite Proofing, pre and post construction treatment, thermal insulation, methods of thermal insulation Thermal insulation of roofs, exposed walls, doors and windows, stair case, parts and type of stairs, Dimensioning of stair case.

Unit 5 Fire protection: Fire hazards, characteristics of fire resisting materials and common building Materials, cracks in walls, floors and ceilings-causes and repairs techniques, routine maintenance of building and structures.

Text/Reference Books:

1. Eldridge, H.J.:"Construction defects in buildings" ,HMSO,BKJT printers ltd , London UK. B.C.
2. Punmia : "A Text Book of Building Construction" , Luxmi Publications, Delhi.
3. S.P. Arora at al.: "A Text Book of Building Construction" ,Dhanpat Rai & Sons, S.
4. C. Rangawala: "Building Construction" , Charotar Publishing House Pvt. Ltd
5. S. Singh: "Engineering Materials", Konark, Delhi,India
6. C. Ray Wylie & Louis C. Barrett: "Advanced Engineering Mathematics" , Tata Mc Graw-Hill Publishing Company Ltd. 2003

BCE-403: HYDRAULICS & HYDRAULIC MACHINE

Unit 1 Difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation, Critical depth, concepts of specific energy and specific force, Application of specific energy principle for interpretation of open channel phenomena, Flow through vertical and horizontal contractions.

Unit 2 Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section.

Unit 3 Equation of gradually varied flow and its limitations, Flow classification and surface profiles, Integration of varied flow equation by analytical, Graphical and numerical methods, flow in channels of non-linear alignment.

Unit 4 Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, open channel surge, celerity of the gravity wave, deep and shallow water waves.

Unit 5 Rotodynamic pumps, Classification on different basis, Basic equations, Velocity triangles, manometric head, efficiencies, cavitation in pumps, characteristics curves, Introduction, Rotodynamic Machines, Pelton Turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation, characteristic curves.

Text/Reference Books:

1. R. J. Garde: "Fluid Mechanics through Problems", New Age International
2. V.L. Streeter and E.B. White: "Fluid Mechanics", McGraw Hill, New York, 8th
3. G.L. Asawa: "Experimental Fluid Mechanics", Vol.1, Nem Chand and Bros.
4. K.G. Ranga Raju: "Flow through open channels", T.M.H. 2nd edition
5. Rajesh Srivastava: "Flow through Open Channels", Oxford University Press
6. K. Subramanya : "Flow through Open Channels", TMH
7. P.N. Modi and S.N. Seth : "Hydraulics and Fluid Mechanics", Standard Book House, India
8. V.T. Chow: "Open Channel Hydraulics", MGH, New York



BCE-451: CIVIL ENGINEERING DRAWING LAB

Note: Minimum of 6 experiments to be performed by students:

List of Drawings:

1. Types of bonds.
2. Index plan with estimation of boundary wall.
3. Plan, sectional elevation and foundation plan of two room set.
4. Different types of staircase, stair well, plan and section of staircase.
5. Plan and sectional elevation of Slab Culvert.
6. Plan, sectional elevation and elevation of duplex unit.
7. Single line drawing of laying of sewer and water supply line.

BCE-452: HYDRAULIC MACHINE LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
2. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study rotodynamic pumps and their characteristics
8. To study characteristics of any two turbines (Francis/ Kaplan / Pelton)

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COURSE STRUCTURE- B.Tech-3rd year (Civil Engineering)

3 rd -YEAR						SEMESTER-V					
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU501	Engineering & Managerial Economics	3	1	0	30	20	50	100	150	4
2.	BCE501	Geotechnical Engg	2	1	0	15	10	25	50	75	3
3.	BCE502	Environmental Engg-I	2	1	0	15	10	25	50	75	3
4.	BCE503	Transportation Engg.	3	1	0	30	20	50	100	150	5
5.	BCE504	Design of Concrete Structures-1	3	1	0	30	20	50	100	150	4
6.	BCE505	Structural Analysis-1	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
7.	BCE551	Geotechnical Engg Lab	0	0	2	10	10	20	30	50	1
8.	BCE552	Environmental Engg Lab	0	0	2	10	10	20	30	50	1
9.	BCE553	Transportation Engg. Lab	0	0	2	10	10	20	30	50	1
10.	BCE554	Engineering Geology Lab	0	0	3	10	10	20	30	50	1
11.	GP-501	General Proficiency	-	-	-	-	-	50	-	50	1
Total			16	6	9	Total			1000	26	

3 rd -YEAR						SEMESTER-VI					
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BCE011/ BCE015	Professional Elective – I	3	1	0	30	20	50	100	150	3
2.	BCE601	Foundation Engg.	2	1	0	15	10	25	50	75	3
3.	BCE602	Construction Technology & Management	3	1	0	30	20	50	100	150	5
4.	BCE603	Environmental Engineering - II	2	1	0	15	10	25	50	75	3
5.	BCE604	Design of Concrete Structures-II	3	1	0	30	20	50	100	150	4
6.	BCE605	Structural Analysis-II	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
7.	BCE651	Structural Detailing Lab	0	0	2	10	10	20	30	50	1
8.	BCE652	CAD Lab-I	0	0	2	10	10	20	30	50	1
9.	BCE654	Survey Camp*	0	0	0	10	10	20	30	50	1
10.	BCE658	Seminar	0	0	2	10	10	50	-	50	1
11.	GP-601	General Proficiency	-	-	-	-	-	50	-	50	1
Total			16	6	6	Total			1000	25	

- **One week survey camp should be held in winter break of Vth semester and evaluated in VIth semester**

PROFESSIONAL ELECTIVE – I

BCE011	Traffic Engineering
BCE012	Matrix Analysis of Structures
BCE013	Earth and Earth Retaining Structures
BCE014	Advanced Foundation Design
BCE015	Surveying – II

COURSE STRUCTURE- B.Tech-4th year (Civil Engineering)

4 th -YEAR						SEMESTER-VII					
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	OE01- OE06	Open Elective-I*	3	1	0	30	20	50	100	150	4
2.	BCE021- BCE025	Professional Elective – II	3	1	0	30	20	50	100	150	5
3.	BCE031/ BCE035	Professional Elective - III	3	1	0	30	20	50	100	150	5
4.	BCE701	Design of Steel Structures	3	1	0	30	20	50	100	150	4
5.	BCE702	Engineering Hydrology	3	1	0	30	20	50	100	150	5
Practical / Training / Project											
6.	BCE751	Quantity Survey & Estimation Lab	0	0	4	20	20	40	60	100	1
7.	BCE752	CAD Lab-II	0	0	2	10	10	20	30	50	1
8.	BCE757	Industrial Training**	-	-	-	-	50	50	-	50	2
9.	GP-701	General Proficiency	-	-	-	-	-	50	-	50	1
Total			15	5	6	Total			1000	22	

* Students are to opt for the courses floated by the other departments.

** 4 weeks Industrial Training after VI semester to be evaluated in VII semester.

PROFESSIONAL ELECTIVE – II

BCE021
BCE022
BCE023
BCE024
BCE025

Bridge Engineering
Machine Foundation Design
Rural Water Supply and Sanitation
Ground Improvement Techniques
Prestressed Concrete

PROFESSIONAL ELECTIVE – III

BCE031
BCE032
BCE033
BCE034
BCE035

Hydraulic Structures
Tunnel Engineering
Energy Efficient Building Design
Advanced Concrete Design
Environmental Geotechnology

4 th -YEAR						SEMESTER-VIII					
Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	OE21-OE25	Open Elective – II*	3	1	0	30	20	50	100	150	4
2.	BCE041- BCE045	Professional Elective - IV	3	1	0	30	20	50	100	150	5
3.	BCE801	Water Resource Engineering	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
4.	BCE858	Seminar	0	0	0		50	50	-	100	1
5.	BCE859	Project	0	0	8		200	200	200	400	12
6.	GP-801	General Proficiency	-	-	-	-	-	50	-	50	1
Total			9	3	8		Total			1000	25

* Students are to opt for the courses floated by the other departments.

PROFESSIONAL ELECTIVE – IV

BCE041
BCE042
BCE043
BCE044
BCE045

Hydraulic Machines
Open Channel Flow
Industrial Air Pollution
Municipal Engineering
Remote Sensing in Civil Engineering





List of Open Electives

Open Elective –I			Department
1	OE-01	Entrepreneurship Development Program	Humanities
2	OE-02	Graph Theory	Mathematics
3	OE-03	Operations Research	Mathematics
4	OE-04	E-Commerce	Computer Science
5	OE-05	Energy Management	Electrical Engineering
6	OE-06	Quality Management	Mechanical Engineering

Open Elective –II			Department
1	OE-21	Disaster Management, Guidelines & Control	Civil Engineering
2	OE-22	Human Computer Interaction	Computer Science
3	OE-23	Nano Technology	Electronics & Communication
4	OE-24	Non-Conventional Energy Resources	Electrical Engineering
5	OE-25	Product Development	Mechanical Engineering



BCE501: GEOTECHNICAL ENGG.

Unit 1: Soil: Origin and types, Identification and classification of soils, Index properties, phase relationship, consistency, sensitivity, clay mineralogy.

Unit 2: Seepage: Darcy's law of permeability, Determination of Coefficient of permeability, Equivalent permeability for stratified soil, Flow nets – principles, construction and application, Effective stress analysis, quick sand condition, piping, filtration criteria.

Unit 3: Compaction: Principle of compaction, Light and heavy compaction, field compaction control, factors affecting compaction.

Compressibility and Consolidation: Terzagli's theory of one-dimensional consolidation, Secondary Consolidation, estimation of consolidation settlement.

Unit 4: Shear Strength of Soil: Strength envelope, total and effective stress paths, pore pressure, evaluation of shear strength parameters, direct shear, triaxial shear, vane shear, unconfined compression test.

Unit 5: Lateral Earth Pressure: Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, Graphical Solutions.

Stability of Slope: Stability of infinite slope, stability of finite slope, slope protection.

Text/Reference Books:

1. V.N.S. Murthy, "Soil Mechanics and Foundation Engineering" (Fifth Edition)
2. K.R. Arora, "Soil Mechanics and Foundation Engineering"
3. Alam Singh, "Modern Geotechnical Engineering"
4. Brij Mohan Das, "Geotechnical Engineering", CENGAGE Learning
5. I.H. Khan, "Text Book of Geotechnical Engineering"
6. C. Venkataramaiah, "Geotechnical Engineering"
7. Gopal Ranjan and A.S.R. Rao, "Basic and Applied Soil Mechanics", Dhanpat Rai & Sons.

BCE502: ENVIRONMENTAL ENGG. - 1

Unit 1: Public Water Supply Scheme: Objectives, Planning and Components

Water Demand: Population forecasting, design period, estimation of water demand for various uses, factors affecting consumption and fluctuation of demand.

Unit 2: Source of Water: Surface source - types, selection, storage reservoir – yield and capacity estimation. Sub-surface water - types, selection, well hydraulics.

Intakes: Intake Structure- site selection, types; pumps-types, selection.

Unit 3: Water Quality: Impurities – types and their effects, sampling & analysis, water borne diseases and their control, water quality standard – potable and industrial.

Water Purification: Sedimentation, Coagulation and Flocculation, Filtration, Disinfection, Miscellaneous Methods.

Unit 4: Distribution System : Requirements, Classification, Layout and Design, Analysis, Detection and Prevention of Wastage of Water. Distribution Pipe – types, selection, laying, jointing, testing, maintenance.

Unit 5: Water Supply Projects: Introduction, Data to be collected, Analysis of data, Project formulation, Project drawings, Projects estimates, Project reports

Text/Reference Books:

1. S K Garg: “Water Supply Engineering”, Khanna Publishers
2. Kshirsagar: “Water Supply Engineering”
3. Mc Ghee: “Water Supply and Sewerage”
4. Peavy: “Environmental Engg.”

BCE503: TRANSPORTATION ENGG.

Unit 1: Introduction: Field, Objectives, Modes and Role of Transportation Engineering, Terminals, Modes of travel and their co-ordination, Transportation demand & supply.

Highway Planning and Surveying: Necessity, Road Development Plans, Classification of Roads, Road Patterns & Networking. Highway Alignment & Re-Alignment, Surveys.

Geometric Design: Elements, Specifications and Design principles.

Unit 2: Highway Materials: Properties of Subgrade, Aggregates & Binding materials, various tests and specifications. Marshall Mix Design.

Pavement Design: Types and Functions of Pavement Components, Design factors, Tyre Pressure and Contact Pressure, ESWL, EWLF and Stresses in Pavement. Design of Flexible and Rigid Pavements (IRC method)

Traffic Engineering: Traffic studies & their uses, Controls, Intersections.

Unit 3: Indian railways: Development and organization of Indian Railways.

Permanent way : Sub-grade, formation, embankment and cutting, track drainage.

Rails : Rail gauges, types of rails, defects in rails, rail failure, creep of rail.

Rail Fastenings : Fish plates, spikes, chairs, keys, bearing plates.

Sleepers : Timber, steel, cast iron, concrete and prestressed concrete sleepers, manufacturing of concrete sleepers, sleeper density.

Ballast : Ballast materials, size of ballast, screening of ballast, specification of ballast, tests on ballast.

Unit 4: Railway Track Geometry : Gradients, horizontal curves, super-elevation, safe speed on curves, cant deficiency, negative super elevation, compensation for curvature on gradients, track resistance and tractive power.

Points & Crossings : Elements of a simple turn-out, details of switch, details of crossings, number & angle of crossings, design of turn-out.

Stations & Yards : Site selection for a railway station, layout of different types of stations, classification of stations, types of railway yard, functions of Marshalling yards.

Signalling & Interlocking : Classification of signals, method of train working, absolute block system, mechanical interlocking of a two line railway station.

Unit 5: Airport Engineering Air craft characteristics affecting airport design; Runway operation; Runway pavement design, design of overlay; Runway lighting and marking heliport.

Water Transport Harbors; Layout and port facilities; Inland waterways; Inland water operation.

Text/Reference Books:



1. S K Garg: "Water Supply Engineering", Khanna Publishers
2. S.K. Khanna & CEG Justo, "Highway Engineering", Nemchand Bros.
3. E.J Yoder & M.W.Wittezal, "Principles of Pavement Design", John Willey & Sons.
4. William W. Hay, "An Introduction to Transportation Engg.", Toppan Co. Ltd, Tokyo
5. Kadiyali L.R., "Traffic Engineering & Transport Planning", Khanna Publisher, Delhi
6. S. P. Arora & S. C. Saxena, "A Text Book of Railway Engineering"
7. M. M. Aggrawal, "Railway Engineering".



BCE504: Design of Concrete Structures - 1

Unit 1: Concrete Making materials , mix design , Properties of concrete and reinforcements , testing of concrete , Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method.

Unit 2: Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams, continuous beams.

Unit 3: Behavior of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear, Introduction to development length, Anchorage bond, flexural bond, Failure of beam under shear, Concept of Equivalent Shear and Moments.

Unit 4: Design of one way and two way solid slabs, Serviceability Limit States, Control of deflection, cracking and vibrations.

Unit 5: Design of Columns- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts.

Note: All designs shall be conforming to IS : 456 – 2000.

Text/Reference Books:

1. O. P. Jain & Jai Krishna, "Plain and Reinforced Concrete Vol. I & II", Nem Chand & Bros.
2. R. Park and Pauley , "Reinforced Concrete Structures".
3. P. Dayaratnam , "Reinforced Concrete Design", Oxford & IBH
4. M L Gambhir , "Fundamentals of Reinforced Concrete", PHI
5. S. Unnikrishna Pillai & D. Menon , "Reinforced Concrete Design", Tata Mc-Graw

BCE505: STRUCTURAL ANALYSIS - 1

Unit 1: Introduction to Structural analysis: Forms of structures, Loads and Forces, Free body diagram, conditions of equilibrium of forces, support and connections – reactions, Difference between determinate and indeterminate structures.

Unit 2: Statically Determinate Beams: Axial Thrust, Bending moment, Torsion & Shear Force in beams with concentrated load and distributed load. Points of contraflexures.

Unit 3: Deflection in Beams: Computation of slope and deflection by double integration, moment area method, conjugate beam method, applications to simply supported, overhang and cantilever beams.

Unit 4: Strain Energy and Virtual work: Strain energy for axial force, bending, shear and torsion. Castigliano's theorems and their applications to find deflection and redundant forces in simple cases.

Unit 5: Analysis of Pin-Jointed Structure: Method of joints and sections, Graphical method, Deflection of joints, Truss with single redundancy, Maxwell's reciprocal theorem, Betti's theorem and their applications.
Arches (Three hinge and Two hinge arch).
Cables, Three hinge stiffening Girder.

Unit 6: Column and Strut: Buckling load for different end conditions, columns with initial curvature, eccentrically loaded column, Beam Column – stresses for combined bending and axial load.

Text/Reference Books:

1. Timoshenko & Young , "Theory of Structural Analysis".
2. Marshall , "Structures".
3. Wilbur & Norris , "Structural analysis".
4. C S Reddy, "Basic Structural analysis".

BCE551: GEOTECHNICAL ENGINEERING LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

1. Sieve Analysis
2. Hydrometer Analysis
3. Liquid & Plastic Limit Tests
4. Shrinkage Limit Test
5. Proctor Compaction Test
6. Relative Density
7. In Situ Density – Core cutter & Sand Replacement
8. Permeability Test
9. Direct Shear Test
10. Auger Boring
11. Static Cone Penetration Test
12. Standard / Dynamic Cone Penetration Test

BCE554: ENGINEERING GEOLOGY LAB

Note: Minimum of 6 experiments to be performed by students:

List of experiments:

1. Study of Crystal Models.
2. Study of Mineral Hands Specimens.
3. Study of Rock Hand Specimens, (Igneous, Sedimentary and metamorphic rocks).
4. Study of Optical Properties of rocks and minerals.
5. Classification of rocks based on Hardness.(Hardness Scale)
6. Study of Faults and Folds.
7. Study of Geological maps.

BCE552: ENVIRONMENTAL ENGINEERING LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

1. Determination of turbidity, colour and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of most probable number of coliforms.
6. Measurement of air pollutants with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total, suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.

BCE553: TRANSPORTATION ENGINEERING LAB

Note: Minimum of 8 experiments to be performed by students:

List of experiments:

1. Crushing Value Test of Aggregate
2. Impact Value Test of Aggregate
3. Los Angeles Abrasion Value of Aggregate
4. Shape Test (Flakiness Index, Elongation Index) of Aggregate
5. Penetration Test of Bituminous Sample
6. Softening Point Test of Bituminous Sample
7. Stripping Test of Bituminous Sample
8. Ductility Test of Bituminous Sample
9. Flash & Fire Point Test of Bituminous Sample
10. Classified both directional Traffic Volume Study
11. Traffic Speed Study (Using Radar Speedometer or Enoscope)

BCE601: FOUNDATION ENGG.

Unit 1: Soil Exploration and Site Investigation: Planning of subsurface exploration, methods, sampling and samplers, In situ tests – plate load test, standard penetration test, static and dynamic cone test, Vane shear test, Sub soil investigation report.

Foundation: Classification, Shallow and Deep foundations.

Unit 2: Shallow Foundations: Bearing Capacity, Terzaghi , Meyerhoff, IS code methods for determination of bearing capacity, Effect of depth of water table, eccentricity and inclination of load. Bearing capacity in slopes and layered soil. Bearing capacity from in situ tests. Immediate and consolidation settlement. Correction for pore pressure, depth and rigidity. Settlement from field tests.

Stresses in Soil: Bossiness Equation, Newmark's Chart, computation of stresses in horizontal direction as well as in vertical direction.

Unit 3: Deep Foundations: Pile load capacity, group action, settlement, negative skin friction, lateral load capacity, pile load tests.

Cassion Foundations: Types and selection, forces and moments, fitting of caisson, depth determination.

Unit 4: Ground Improvement Techniques: Methods, compaction stabilisation using Admixtures, stone columns, sand drains, grouting.

Unit 5: Soil Dynamics and Machine Foundation: Concept of modulus of sub grade reaction, elastic half space theory, dynamic soil parameters, Design Criteria for machine foundation, natural frequency determination.

Text/Reference Books:

1. B.M. Das, "Introduction to Soil Mechanics", Galgotia Publication.
2. B.C. Punmia, "Soil Mechanics and Foundation Engg.", Dhanpat Rai & Sons.
3. Gopal Ranjan and AVS Rao, "Basic and Applied Soil Mechanics", Dhanpat Rai & Sons.
4. Whitman & Lambe, "Soil Mechanics", John Willey.
5. VNS Murthy, "Soil Mechanics and Foundation Engg.", Dhanpat Rai & Sons.

BCE602: CONSTRUCTION TECHNOLOGY & MANAGEMENT

Unit 1: Elements of Management : Project cycle, Organisation, planning, scheduling monitoring updating and management system in construction.

Unit 2: 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. Project monitoring, cost planning, resource allocation through network techniques. Line of balance technique.

Unit 3: 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.

Unit 4: 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.

Unit 5: 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/Reference Books :

1. S. Seetharaman, "Construction Engg. & Management", Umesh Publication,
2. Mahesh Verma, "Construction Equipment its Planning land Application", Metropolitan Book Co. Ltd.
3. B.S. Patil, "Contract & Estimates".
4. S.S. Rao, "Optimization Theory & Application", Wiley Eastern Ltd., New Delhi.
5. R.L. Peurify, "Construction Planning : Equipment and Methods", T.M.H.
6. L.S. Srinath, "PERT & CPM Principles and Applications", E.W.P. Ltd., New Delhi.
7. S.K. Bhatnagar, "Network Analysis Techniques", Willey Eastern Ltd.
8. Sarkar, "Construction Technology", Oxford.

BCE603: ENVIRONMENTAL ENGG. - II

Unit 1: Sanitary Engineering: Important terms, sewage treatment system and waste water management.

Collection and Conveyance of Sewage: Conservancy and water carriage system, comparison, classification of water carriage system.

Unit 2: Waste Water Flow: Estimation of Dry Weather Flow and Storm Water, Variation of flow, Estimation of design discharges.

Sewer Design, Construction and Maintenance: Sewer-types, materials, shapes, hydraulic design, minimum & maximum flow. Planning of sewerage system, testing and maintenance.

Unit 3: Waste Water Characteristics: Constituent of sewage – physical & chemical, oxygen demand, BOD, COD, Relative Stability, population equivalent, Biological characteristics.

Waste Water Disposal: Dilution, self-purification, land disposal, sewage sickness, comparison of disposal methods.

Unit 4: Waste Water Treatment: Flow diagram of conventional sewage, treatment plant, Primary treatment – screens, Grit Chambers, detritus tank, skimming tank, sedimentation – Plain & Chemical. Secondary treatment – Trickling fitters, Biological contactor, Activated sludge process, oxidation pond and ditches, aerated lagoon. Septic tank – design consideration, soak pit and soak trench.

Unit 5: Treatment and Disposal of Sludge : Aerobic and anaerobic digestion, disposal of sludge.

Rural Sanitation:

Text/Reference Books:

1. B.C. Purmia, "Environmental Engineering (Vol -2)", Laxmi Publication.
2. S.K. Garg, "Environmental Engineering (Vol -2)", Khanna Publication.
3. McGhee, "Environmental Engineering", McGraw Hill.

BCE604: DESIGN OF CONCRETE STRUCTURES - II

Unit 1: Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs. (IS Code Method).

Unit 2: Analysis and design of beam curved in plan.
Structural behaviour of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings, Design of strap footing.

Unit 3: Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of T-shaped retaining wall, Concept of Counter fort retaining wall. Loads, forces and I.R.C. bridge loadings, Design of R.C. slab culvert.

Unit 4: Design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground / underground, design of overhead tanks.

Unit 5: Advantages of prestressing, methods of prestressing, losses in prestress, analysis of simple prestressed rectangular and T-section.

Text/Reference Books:

1. O. P. Jain & Jai Krishna, "Plain and Reinforced Concrete Vol. I & II", Nem Chand & Bros.
2. R. Park and Pauley, "Reinforced Concrete Structures".
3. P. Dayaratnam, "Reinforced Concrete Design", Oxford & IBH
4. M L Gambhir, "Fundamentals of Reinforced Concrete", PHI
5. S. Unnikrishna Pillai & D. Menon, "Reinforced Concrete Design", Tata Mc-Graw
6. N Krishna Raju, "Prestressed Concret", New Age International

BCE605: STRUCTURAL ANALYSIS - II

Unit 1: Introduction to indeterminate structures, Static and Kinetic indeterminacy and their calculation.

Indeterminate Beams: Propped cantilever, Fixed Beam, Continuous beams, Sinking of support, temperature effect, three moment equation.

Unit 2: Maxwell's & Betti's Reciprocal Deflections, Strain Energy in Elements & Systems.

Unit 3: Classical Displacement Method: Slope deflection method, Moment distribution method, Kanis Method – application to analysis of indeterminate Beams and Building frames.

Unit 4: Classical Force Method: Trusses and rigid frames by consistent deformation method Column analogy method and elastic centre method.

Unit 5: Matrix Methods of Structural Analysis: Introduction, Stiffness & Flexibility Coefficients, Member Stiffness & Flexibility Matrices.

Text/Reference Books:

1. Timoshenko & Young , “Theory of Structural Analysis”.
2. Marshall , “Structures”.
3. Wilbur & Norris , “Structural analysis”.
4. C S Reddy, “Basic Structural analysis”.

BCE651: STRUCTURAL DETAILING LAB

Note: Minimum of 6 experiments to be performed by students:

Preparation of working drawings for the following using any drafting software

1. RC Beams- Simply supported, Continuous, Cantilever
2. T – beam / L-beam floor
3. Slabs – Simply supported, Continuous, One way and two way slabs.
4. Columns – Tied Columns and Spirally reinforced columns.
5. Isolated footings for RC Columns.
6. Combined rectangular and trapezoidal footings.
7. Detailing of Buildings with respect to Earthquake Resistant Design.

BCE652: CAD LAB - I

List of experiments:

1. Working on Environmental Engineering softwares for Analysis and Design of water & waste water treatment and distribution systems (Water Cad / Sewer Cad / Water Gem / Sewer Gem /Loop)
2. WORKING Transportation Engg softwares / Surveying Softwares



BCE701: DESIGN OF STEEL STRUCTURES

Unit 1: General Considerations

Introduction, Advantages of Steel as a Structural Material, Disadvantages of Steel as a Structural Material, Structural Steel, Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Convention for Member Axes, Dead Load, Live Load, Environmental Load, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Load Buckling of Plate Elements.

Introduction to Limit State Design

Introduction, Limit States for Steel Design, Limit States for Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design, Design Criteria.

Unit 2: Simple Connections—Riveted, Bolted and Pinned Connections

Introduction, Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Working Load Design, Pin Connections.

Simple Welded Connections

Introduction, Types, Symbols, Welding Process, Weld Defects, Inspection of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Section of Fasteners, Working Load Design.

Unit 3: Tension Members

Introduction, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio (λ), Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate, Working Load Design.

Unit 4: Compression Members

Introduction, Effective Length, Slenderness Ratio (λ), Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Encased Column, Splices, Design of Column Bases.

Unit 5: Beams

Introduction, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web

Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Lintels, Purlins, Beam Bearing Plates, Castellated Beam, Effect of Holes in Beam, Introduction to Plate Girder , Introduction to Gantry Girder.

Text/Reference Books:

1. S. K. Duggal, "Limit State Design of Steel Structures", Tata Mcgraw Hill.
2. K S Sairam, "Design of Steel Structures", Pearson Education
3. N. Subramanian, "Design of Steel Structures", Oxford University Press
4. Robert Englekirk, "Steel Structures", John Wiley & sons inc.
5. Lambert tall, "Structural Steel Design", Ronald Press Comp. New York.
6. Willam T Segui, "Design of steel structures", CENGAGE Learning
7. D MacLaughlin, "Structural Steel Design", CENGAGE Learning



BCE702: ENGINEERING HYDROLOGY

Unit 1: Introduction: hydrologic cycle, water budget equations, world water balance, application in engineering. Precipitation: Forms of precipitation, measurement, depth-area-duration & intensity- duration- frequency relationships, probable maximum precipitation.

Unit 2: Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapo- transpiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities, indices, measurement & estimation.

Unit 3: Runoff and Hydrographs : Hydrograph, runoff characteristics of stream, Yield, Rainfall-runoff correlations, flow duration curve, mass curve, droughts and floods. Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs.

Unit 4: Flood: Rational method, empirical formulae, unit hydrograph method, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing.

Unit 5: Groundwater: introduction, forms of subsurface water, aquifers & its properties, Compressibility of aquifers, flow equations for confined and unconfined aquifers, well hydraulics- steady and unsteady flow to a well in confined aquifer, well losses, specific capacity, ground water irrigation, rain water harvesting.

Text/Reference Books:

1. Linsley, Kohlew Paulhors, "Hydrology for Engineers", Mc Graw Hill
2. V.T. Chow, "Hand Book of Applied Hydrology", Mc Graw Hill
3. K subramanya, "Engineering Hydrology", Mc Graw Hill
4. H.M. Raghunath, "Hydrology", New Age International, Delhi.

BCE751: QUANTITY SURVEY & ESTIMATION LAB

1. Procedure of Estimating: Methods of Estimating, items of works, long-wall, short wall method of estimate, centre-line method, Types of estimate-preliminary, approximate, plinth area estimate, detailed estimate, revised estimate, supplementary estimate, Building Cost Index, Administration Approval, Expenditure sanction, Technical sanction, Schedule of rates & Measurement Book.
2. Estimate of Building: Different items of works as per CPWD/APWD schedule such as earthwork, brickwork, cement-concrete, RCC-floors, roofs, openings, painting, white & colour washing, plastering etc.
3. RCC Works & structures: Different items of RCC work – RCC, shuttering, measurement of reinforcing bars, standard hooks & bends, Bar-bending schedule, Estimate of RCC beam, slab column, footing & staircase.
4. Roads & Bridges :Introduction to the different items as per CPWD/APWD schedule, estimate of earthwork of road, estimate of metalled road, estimate of RCC slab culvert, T-beam decking, Pier & well foundation, Pipe Culvert.
5. Analysis of Rates: Analysis of Rates of Building works-RCC, PCC, Brickwork, Plastering, flooring, colour wash, Distempering, cement painting, woodwork, DPC, Doors & Windows, Roofing.
6. Specifications: General specifications for building works-RCC, Brickwork, Plastering, Flooring, Painting, white & colour wash, Woodworks, Doors & windows, DPC, terracing, rainwater exclusion, specifications for Roadwork.
7. Valuations: The mathematics of valuation, valuation of freehold & leasehold properties, Fixation of Rent, Methods of valuation, Investment Method, Comparison Method, Residual Method, rein-statement Method, Contractors Method. Methods of valuation of land-comparative method, abstractive method & belting method.

BCE752: CAD LAB - II

List of experiments:

1. Working on GIS Softwares (Arc GIS / Envi /GePSy)
2. Working on Project Planning Management Softwares (Primavera, MS-Project, etc.)



BCE801: WATER RESOURCE ENGINEERING

Unit 1: Irrigation: Developments in India, Necessity and types Advantages & disadvantages of irrigation. Functions of water in plant growth, Methods of Irrigation, Water requirement of crops. Irrigation frequency, Irrigation efficiencies, Principal crops and crop season, crop rotation.

Canal irrigation: Classes and alignment, Parts of a canal system, Commanded area, curves in channels, channel losses.

Unit 2: Sediment Transportation: Suspended and Bed load and its estimation.

Irrigation channels: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, Longitudinal cross section, Schedule of area statistics and channel dimensions, use of Garret's Diagrams in channel design, cross sections of an Irrigation channel, Computer programmes for design of channels.

Unit 3: Lining of Irrigation Canals: Advantages and types, factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining.

Water Logging: Definition, effects, causes and anti-water logging measures, Drainage of water logged land, Types of drains open and closed, spacing of closed drains.

Unit 4: River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge.

Diversion Head Works: Weir and Barrage, Layout of a Diversion Head Works and its Components, Theory of Seepage and Design of Weirs and Barrages.

Canal Falls: Definition and location of Canal Falls, Types of Falls and their Design.

Unit 5: Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects.

Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion.

Cross Drainage Works: Introduction and Types of Cross Drainage Works and their selection.

Text/Reference Books:

1. Linsley & Franzine, "Water Resources Engg.", McGraw Hill Ltd, N.Y.
2. Duggal & Soni, "Elements of Water Resources Engg.", New Age International
3. S. K. Garg, "Irrigation Engg. And Hydraulic Structures", Khanna Publishers, Delhi

Professional Elective - I



BCE011: TRAFFIC ENGINEERING

Unit 1: Introduction: Overview of transportation system, nature of traffic problems in cities, Present Scenario of road transport and transport assets. Role of transportation: Social, Political, Environmental, etc.

Unit 2: Traffic Studies: Speed, journey time, delay, traffic flow, volume, capacity, forecasting and statistical methods in traffic engineering, road user & vehicular characteristics, level of service, sampling technique.

Unit 3: Traffic controls and Regulations: Traffic signs, signals, road markings and traffic control aids, parking and street lighting, accidents studies, traffic management and regulations, pollution, intersection design, safety.

Unit 4: Traffic Flow Theory: Diagram of traffic flow, relationship, Lighthill & Witham's theory, Car following theory, Queuing theory and headways & gaps.

Unit 5: Transport system management: Long term and short term planning, use of IT in transportation.

Text/Reference Books:

1. Kadiyali L.R., "Traffic Engg. & Transport Planning", Khanna Publisher, Delhi.
2. Khanna S.K. & Justo CEG, "Highway Engineering", Nemchand Bros.
3. Morlok E.R., "An Introduction to Transportation Engg.& Planning", Mc. Graw Hill.
4. Wright P.H., "Highway Engineering", John Wiley & Sons, NewYork.
5. Relevant IRC & IS codes.

BCE012: MATRIX ANALYSIS OF STRUCTURES

Unit 1: Introduction of Flexibility and stiffness method. Hand computation of problems

Unit 2: Hand computation of problems on trusses, frames and grids.

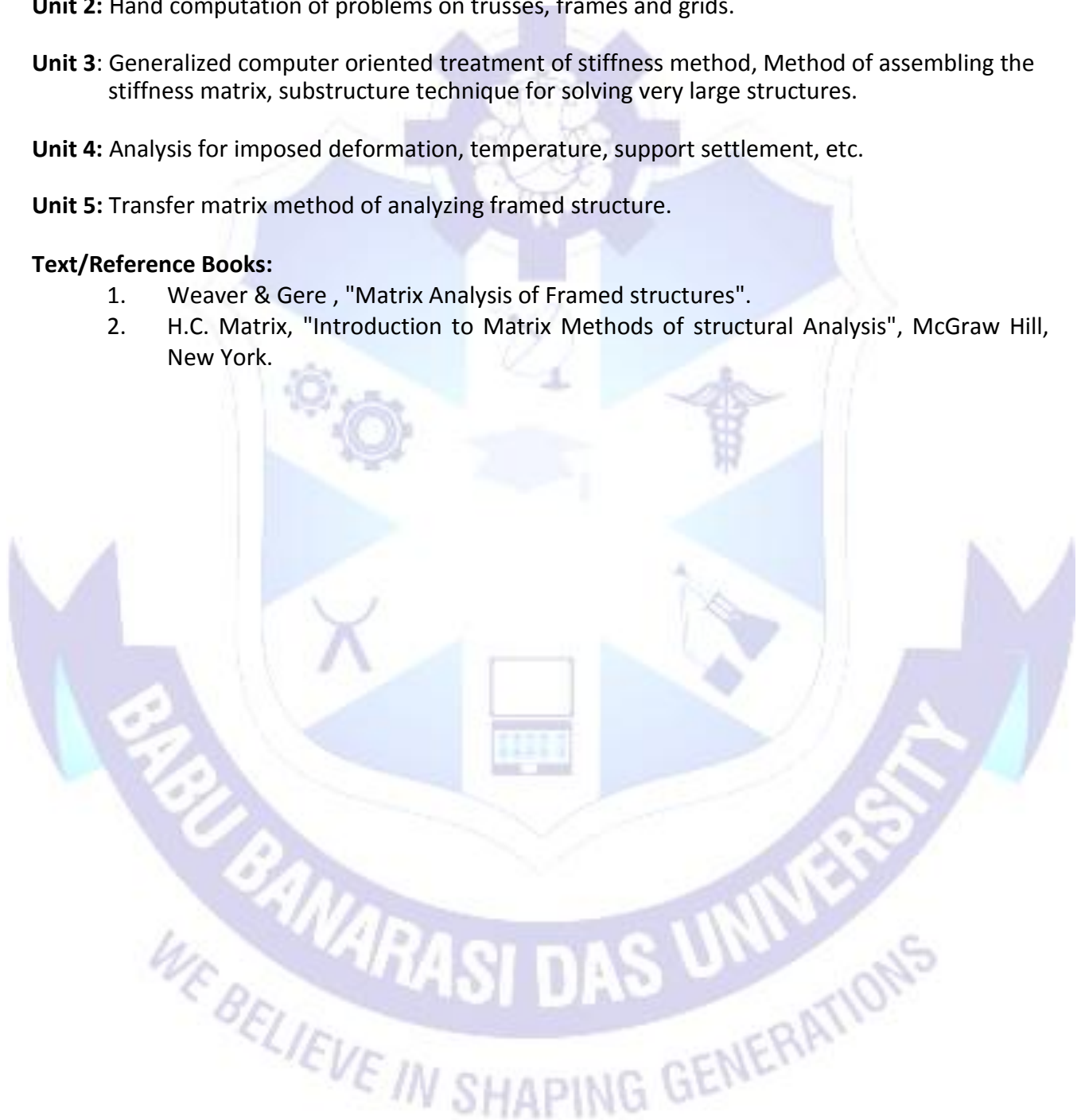
Unit 3: Generalized computer oriented treatment of stiffness method, Method of assembling the stiffness matrix, substructure technique for solving very large structures.

Unit 4: Analysis for imposed deformation, temperature, support settlement, etc.

Unit 5: Transfer matrix method of analyzing framed structure.

Text/Reference Books:

1. Weaver & Gere , "Matrix Analysis of Framed structures".
2. H.C. Matrix, "Introduction to Matrix Methods of structural Analysis", McGraw Hill, New York.



BCE013: EARTH & EARTH RETAINING STRUCTURES

Unit 1: Earth and Rock Fill Dam, Choice of types, material, foundation, requirement of safety of earth dams, seepage analysis

Unit 2: Mechanically Stabilized Earth retaining walls: General considerations, backfill and reinforced materials, construction details, design method, stability.

Unit 3: Soil nailing: applications, advantages, limitations, methods of soil nailing, case histories, analysis and design.

Unit 4: Reinforced Soil: Introduction, basic components, strength characteristics, soil-reinforcement interface friction.
Reinforced Earth wall: Stability analysis, construction procedure, drainage, design Procedure.

Unit 5: Foundation on Reinforced Soil Bed: Pressure ratio, analysis of strip, isolated, square and rectangular footing on reinforced soil bed, Ultimate bearing capacity of footing on reinforced earth slab. Fiber reinforced soil.

Text/Reference Books:

1. V N S Murthy, "Soil Mechanics and Foundation Engg".
2. Swami Saran, "Reinforced Soil and its Engineering Application".
3. J. E. Bowles, "Analysis and Design of Foundation"

BABU BANARASI DAS UNIVERSITY

WE BELIEVE IN SHAPING GENERATIONS

BCE014: ADVANCED FOUNDATION DESIGN

Unit 1: Vertical pressures under surface loads, Elastic Solution, Boussinesq and Newmark Charts, Westergaard's equation, approximate solution.

Unit 2: Bearing capacity and settlement analysis of shallow foundations: Meyerhof and Hansen's bearing capacity equations, BIS bearing capacity equation, immediate and consolidation settlements in cohesive soil, De-Beer and Schmertman's methods of settlement prediction in non cohesive soil.

Unit 3: Classification of piles, load carrying capacity of single piles in clay, silt and sand by dynamic and static methods, Pile load test, Pile group, Negative skin friction, Settlement of pile group.

Unit 4: Foundation on expansive soil, Construction on expansive soil, Alteration of soil condition, under-reamed piles.
Elements of well foundation, Shape, Depth of scour, Well sinking, Tilt, shift and their prevention.

Unit 5: Stability of slopes, Limit equilibrium method, Method of slices, Simplified Bishop method, Stability Charts.
Machine foundation: classification, definitions, design principle in brief, Barken's method.

Text/Reference Books:

1. K. R. Arora, "Soil Mechanics & Foundation Engineering".
2. Alam Singh, "Modern Geotechnical Engineering".
3. Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics".
4. J. E. Bowles, "Analysis and Design of Foundation".
5. V. N. S. Murthy, "Soil Mechanics and Foundation Engineering".
6. B. M. Das, "Foundation Engineering", CENGAGE Learning.

BCE015: SURVEYING - II

Unit 1: Tacheometry: Principles, Stadia and Tangential methods, Error and Precision in Tacheometry.

Unit 2: Curves: Classification, setting out of circular curve and transition curve.

Unit 3: Triangulation: Triangulation systems, Intervisibility, Signals, satellite stations, computations and adjustments.

Calculation of Area and Volumes: Different methods, Trapezoidal, Prismoidal rules.

Unit 4: Setting out Works: setting out of buildings, bridges.

General Survey and Specifications: Preliminary survey and final location of highways, Railways, Tunnels, Canals.

Unit 5: Field Astronomy: Definitions of Astronomical terms, Astronomical co-ordinate systems.

Time: Types, Equation of time, Conversion of times.

Hydrographic Survey: Shoreline surveys, soundings – methods and plotting.

Text/Reference Books:

1. B.C. Punmia, "Surveying (Vol II & III)", Laxmi Publication.
2. K.R. Arora, "Surveying (Vol I & II)", Standard Book House.
3. A.M. Chandra, "Plane Surveying", Newage International.
4. A.M. Chandra, "Higher Surveying", Newage International.



Professional Elective - II



BCE021: BRIDGE ENGINEERING

Unit 1: 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.

Unit 2: Courbon's method of load distribution. Detail design of slab culvert.

Unit 3: T-beam bridge, box culverts.

Unit 4: Design and detailing of plate girder and steel Truss type bridges.

Unit 5: Design of piers and pier caps. Abutments, and bearings.

Text/Reference Books:

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



BCE022: MACHINE FOUNDATION DESIGN

Unit 1: Vibration of elementary Systems: Vibration motion, vector representation of harmonic motion, Single degree of freedom system: Free Vibrations- damped and undamped, Forced Vibrations – damped and undamped.

Unit 2: Dynamics of soil-foundation System: types of machine foundation, design criteria, dynamic loads, physical modeling and response analysis, Barken's approach, Ford & Haddow's analysis, Hammer foundation, I. S. Codes.

Unit 3: Dynamic soil testing techniques: cyclic plate load test, block vibration test, shear modulus test, geophysical methods, Resonance-column test, Two & three borehole techniques, Model tests using centrifuge and shake table, recent developments

Unit 4: Vibration isolation and control: vibration transmitted through soil media, active and passive isolation, vibration isolation – rigid foundation and flexible foundation, method of isolation, properties of material and media used for isolation, vibration control of existing machine, foundation isolation by barriers.

Unit 5: Guidelines for design and construction of machine foundation: data required for design of reciprocating, impact and rotary type machines, guidelines for the design of different type machines, construction guidelines, guidelines for providing vibration absorbers.

Text/Reference Books:

1. S. Prakash, "Machine Foundation".
2. B. B. Prasad, "Fundamentals of Ground Vibration".
3. Richard, Hall and Wood, "Vibrations of Soil and Foundations".

BCE023: RURAL WATER SUPPLY AND SANITATION

Unit 1: Concept of environment and scope of sanitation in rural areas. Magnitude of problems of rural water supply and sanitation. Population to be covered, difficulties. National policy.

Unit 2: Water supply: Design population and demand loads. Various approaches of planning of water supply schemes in rural areas. Development of proffered sources of water springs. Wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source. Specific practices and problems encountered in rural water supply.

Unit 3: Improved methods and compact systems of treatment of surface and ground waters for rural water supply. Brief Details of multi-bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges. Pumps, pipe materials, appurtenances and improved devices for use in rural water supply. Planning of distribution system in rural areas.

Unit 4: Community and sanitary latrines. Various methods of collection and disposal of night soil. Planning of waste water collection system in rural areas. Treatment and Disposal of waste water. Compact and simple waste water treatment units and systems in rural areas such as stabilization ponds, septic tanks, Imhoff tank, soak pit etc. Disposal of waste water soakage pits and trenches.

Unit 5: Disposal of Solid Wastes. Composting, land filling, incineration, Biogas plants, Rural health. Other specific issues and problems encountered in rural sanitation.

Text/Reference Books:

1. Mann H.T. and Williamson D., "Water Treatment and Sanitation – Simple Method for Rural Area".
2. Wanger E.G. and Lanoix J.N., "Water Supply for Rural Areas & Small Communities", WHO.
3. by E.W.Steel & T.J.McGhee, "Water Supply and Sewerage", McGraw Hill.
4. D. Srinivasan, "Environmental Engineering", PHI Learning Pvt. Ltd. 2009.
5. "Manual on Water Supply and Treatment", CPHEEO, Mini. Of Urban Development, Govt. of India.
6. "Manual on Sewerage and Sewage Treatment", CPHEEO, Mini. Of Urban Development, Govt. of India.

BCE024: GROUND IMPROVEMENT TECHNIQUES

Unit 1: 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.

Unit 2: In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement.

Unit 3: In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method.

Unit 4: 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.

Unit 5: Underpinning of foundations: importance and situations for underpinning, methodology, typical examples.

Geotextiles: types, functions, specifications, precautions in transportation and storage.

Text/Reference 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".

BCE025: PRESTRESSED CONCRETE

Unit 1: Concrete of Prestressing, Type of concrete and steel used in Prestress work.

Unit 2: Allowable stresses, Losses in prestressing, Effect of shrinkage, Creep and Stretching of wires, etc.

Unit 3: Analysis and Design of Prestressed concrete Beams in bending and shear, Cable profiles, Design of End Blocks.

Unit 4: Calculation of Deflection and Ultimate Strength of a Prestressed Beam, Use of Prestressed Concrete in Tension and Compression Members.

Unit 5: Analysis and Design of Continuous Prestressed Concrete Beams, Application of Prestressed Concrete in Bridges.

Text/Reference Books:

1. N Krishna Raju, "Prestressed Concrete".
2. N Rajgopalan, "Prestressed Concrete".
3. Melvin K Hurst, "Prestressed Concrete Design".
4. Edward G. Nawy, "Prestressed Concrete: A fundamental Approach".



Professional Elective - III



BCE031: HYDRAULIC STRUCTURES

Unit 1: Dams and their Characteristics: Classification of dams, Features, advantages and disadvantages of each type, Selection of type of dam.

Investigation of Dam Site: Various phases of investigation, Geological investigation, Sub-surface exploration, Choice of location, Foundation treatment, Economic height of dam.

Unit 2: River Diversion: Diversion schemes, Phases of diversion, Diversion flood, Tunnels, Cofferdams.

Unit 3: Gravity Dams: Forces acting on gravity dams, Load combinations for design, Modes of failure and stability requirements, Structural competency of gravity dams, Practical profile, Stability analysis, Design of non-overflow and overflow sections by single-step method.

Arch Dams: Types of arch dams, Forces acting on arch dams, Method of analysis, Most economical central angle, Design of arch dams based on cylinder theory.

Unit 4: Embankment Dams: Types of embankment dams, Earth dams- types , Causes of failure and stability requirements, Design criteria, Preliminary design, Seepage analysis-Flow net, Phreatic line, Stability analysis- Safety of u/s slope against rapid draw-down, Safety of d/s slope against steady seepage.

Hollow and Buttress Dams: Hollow gravity dams, Buttress dams- Types of buttress dams, Forces acting on buttress dams, Design of deck-slab type buttress dams.

Unit 5: Instrumentation: Instrumentation in dams, Types of instruments, Deformation measurement of dam body and its foundation, Surveying instruments.

Text/Reference Books:

1. Punmia & Lal, "Irrigation and Water Power Engineering", Standard Publishers, New Delhi.
2. Garg, "Irrigation Engineering & Hydraulic Structures", Khanna Publishers, New Delhi.
3. Arora, "Irrigation, Water Power & Water Resources Engineering", Standard Publishers, New Delhi.
4. Sharma, "Concrete Dams", Metropolitan, New Delhi.
5. Linsley, "Water Resource Engineering", McGraw Hill, New Delhi.

BCE032: TUNNEL ENGINEERING

Unit 1: Site investigations , Geotechnical Considerations of tunneling.

Unit 2: Design of Tunnels.

Unit 3: Construction & Excavation methods , soft ground tunnels , Rock tunnels.

Unit 4: Micro tunneling techniques , Tunnel support design.

Unit 5: Ventilation of tunnels , tunnel utilities , safety aspects.

Text/Reference Books:

1. J O Bickel & T R Kuesel, "Tunnel Engineering Handbook".
2. Z T Bieniawski, "Rock Mechanics Design in Mining & Tunneling".



BCE033: ENERGY EFFICIENT BUILDING DESIGN

Unit 1: Introduction: Environment and man, external environment and built environment, Built-environment – integrated approach.

Unit 2: Climate: elements of climate, classification of climate, Micro-climate, site climate.

Comfort: desirable conditions, thermal comfort factors, comfort indices, effective and corrected effective temp. Tropical summer index.

Unit 3: Thermal Design: heat loss from a building under steady state condition, heat gains due to solar radiation, steady state and cyclic conditions, Means of thermal control – mechanical, structural control, air infiltration into buildings by natural means, shape of buildings,- thermal cube, fabric heat loss, ventilation loss and volume.

Unit 4: Light & Lighting: illumination requirement, day-lighting, artificial lighting, energy conservation.

Noise Control: Sources of noise, means of control, control requirements, behaviour of sound in rooms, vibration & vibration control.

Unit 5: Building Services: Mechanical & electrical services in building, lifts, escalators.

Text/Reference Books:

1. T.A. Markus & E.N. Morris, "Building, Climate & Energy", Pitman Pub Ltd, London.
2. O.H. Koenig-Sbrerger et.al, "Manual of Tropical Housing & Building - Part-I", Orient Longman Ltd., Madras.
3. Handbook of Functional Requirements of Building by SP:41-1987, Bureau of Indian Standard, New Delhi.

BCE034: ADVANCED CONCRETE DESIGN

Unit 1: Design of over-head tanks: Design of RC domes and beams curved in plan, design of Cylindrical and rectangular tanks with different end conditions using IS: 3370 tables, Intze tank design based on membrane analysis with mention of continuity effects.

Unit 2: Design of staging: Braces, Columns and Raft Foundation.

Unit 3: Building Frames: Dead, Live, Wind and Earthquake loads, Analysis of framed building by approximate methods for vertical and horizontal loads, concept of Exact Analysis, joint detailing.

Unit 4: Design of Bridges: Loads, Forces and Permissible Stresses, Code Recommendations regarding design and detailing, Design of slabs under concentrated loads using, Effective width and Pigeaud's method, Courbon's method of load distribution, Detailed design of Highway Bridges: RC slab, and R.C. T-beam types.

Unit 5: High performance concrete, Production and no-conventional concrete. Design of composite Sections: Composite beam and slabs in simple conditions.

Text/Reference Books:

1. M L Gambhir, "Reinforced Concrete Design".
2. B C Punamia, "Reinforced Concrete Design".
3. D.J. Victor, "Essentials of Bridge Engineering".

BCE035: ENVIRONMENTAL GEOTECHNOLOGY

- Unit 1:** Introduction, Development of Environmental Geotechnology, Aims, Environmental Cycle and their interaction with geotechnology, Natural environment, cycles of nature, environmental geotechnical problems.
- Unit 2:** Identification and characteristics of contaminated soil, classification, Characteristics of dust, dust in environment, ion- exchange reaction and ion exchange capacity, ion exchange reaction in contaminated soil- water system, Site Investigation for detection of sub- surface contamination.
- Unit 3:** Load- 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.
- Unit 4:** Ash Pond and Mine Tailing Impoundments, Geotechnical re- use of waste materials and fills, Grouting and injection process, Grout used for controlling hazardous wastes, Sinkhole: interaction with environment and remedial action.
- Unit 5:** 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/Reference Books:

1. Fang, H., "Introduction to Environmental Geotechnology".
2. Sharma, H. D. and Sangeeta, P.L., "Waste containment systems, waste stabilization and landfills: design and evaluation".
3. Koerner, R. M., "Designing with geosynthetics".

Professional Elective - IV



BCE041: HYDRAULIC MACHINES

Unit 1: Introduction: Types of hydraulics machines-turbines, pumps. Theory of rotodynamic machines-Euler's equation.

Unit 2: Impulse Turbines: Work done by impulse turbine, Power produced by an impulse turbine, Efficiencies of an impulse turbine, Design of Pelton wheel turbine, Other Impulse turbines.

Reaction Turbines: Differences between an impulse and a reaction turbine, Classification of reaction turbines, Power produced by a reaction turbine, Efficiencies of reaction turbine, Francis Turbine, Kaplan Turbine, Cavitation in reaction turbines, Draft tube, Types of draft tubes, Efficiencies of Draft tube, Other reaction turbines.

Unit 3: Governing Of Turbines: Purpose of governing, Elements of governing system, Double regulation of turbines, Governing of impulse turbine, Governing of reaction turbines, Relief valve or pressure regulator.

Performances Of Turbines: Characteristic of turbines, Unit power, unit speed and unit discharge, Specific speed of a turbine their significances, Selection of turbines based on head of water and also based on specific speed, Characteristic curves of turbines.

Unit 4: Reciprocating Pump: Pumps and its classifications, Reciprocating pump, Types, Discharge, Power required, Slip of the pump, Indicator diagram, Variation of pressure in the suction and delivery pipes, Effect of acceleration of the piston on indicator diagram, Effect of friction in the suction and delivery pipes on the indicator diagram, Maximum speed of the rotating crank with air-vessels, Work done against friction with or without air-vessels, Work saved against friction.

Centrifugal Pump: Advantages of centrifugal pump over reciprocating pump, Components of a centrifugal pump, Working of a centrifugal pump, Workdone by the impeller, Heads of pumps, Losses and efficiencies, Multistage centrifugal pumps, Specific speed, Characteristic of a centrifugal pump, Priming, Minimum starting speed, Selection of pumps, Operational difficulties in centrifugal pump.

Unit 5: Hydro- Electric Developments: Water Wheels - their types and working principles, Advantages and disadvantages of water wheels, Development of water turbines their classification and working principles, Advantages of water turbines, Hydro-electric plants their classification, Essential components and layouts, Advantages and disadvantages of hydro- electric plants, Pumped storage plants.

Text/Reference Books:

1. Dr. Jagadish Lal, "Hydraulic Machines", Metropolitan Publication.
2. S.S Rattan, "Fluid Machines", Khanna Publishers.
3. Vasandani, "Hydraulic Machine: Theory & Design", Khanna Publishers.
4. Banga & Sharma, "Hydraulic Machines", Khanna Publishers.

BCE042: OPEN CHANNEL FLOW

Unit 1: 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.

Unit 2: 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.

Unit 3: 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,

Unit 4: 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.

Unit 5: 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/Reference 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.
4. Ranga Raju, K.G., "Flow through open channels", T.M.H.
5. M. Hanif Chaudhry, "Open Channel Flow", PHI.
6. French, R.H., "Open channel Hydraulics", McGraw Hill International.

BCE043: INDUSTRIAL AIR POLLUTION

Unit 1: Air Pollution: Sources, effects and regulations of air pollutants.

Unit 2: Meteorology of Air Pollution: Meteorology and dispersion of air pollutants. Sampling and analysis of gaseous and particulate air pollutants. Photochemical air pollution and mobile sources.

Unit 3: Particulate Emission Control Devices: Mechanisms to remove particulate contaminants from gas streams, Gravitational settling chambers, Centrifugal separators, Wet scrubbers, Fabric Filters, Electrostatic precipitators

Unit 4: Gaseous Pollutants Control: Mechanisms to remove particulate contaminants from gas streams, Combustion stoichiometry, Adsorption, Absorption

Unit 5: Plant Compliance for Managers: EIA, Environmental Audit, Clean Technologies, Case studies of various industries.

Text/Reference Books:

1. Paul N. Cheremiseriniff, "Air Pollution Control and Design for Industry".
2. R.D. Ross, "Air Pollution and Industry".
3. Herbert F. Land, "Industrial Pollution Control Handbook".
4. Work and Warner, "Air Pollution".
5. Muralikrishna, "Introduction to Air Pollution and Control".

BCE044: MUNICIPAL ENGINEERING

Unit 1: Planning of Urban Water Supply Project & Its Implementation. River flow and reservoir analysis. Availability of ground water resources.

Diffusion, dispersion and pollutant transport mechanisms.

Functions of watershed models for hydraulic design, environmental assessment and flood warning.

Unit 2: Communicable Diseases, Rodents and Vector Control, Urban Sanitation including Refuse Disposal. Early warning and Control Measures.

Unit 3: Water Treatment within Municipal Authority. Water resources and sustainable development. Technology and impacts of water conservation practices and policies on municipal service infrastructure

Unit 4: Municipal Rules, Regulations & Acts, Agencies involved. Global and national water problems, laws and legislation.

Unit 5: General Sanitation of Schools, Hospitals, Bathing Places and houses, etc.

Text/Reference Books:

1. Mays, L. , Water Resources Handbook, McGraw Hill, 1996, ISBN: 0070411506
2. Biswas A., Water Resources: Environmental Planning, Management, and Development, McGraw Hill, 1997. ISBN 0070054835
3. Ward, R.C., Loftis J.C. and McBride, G.B., Design of Water Quality Monitoring Systems. Wiley Interscience, 1990. ISBN: 0471283886
4. Veissman, W. and Hammer, M., Water Supply and Pollution Control (6th Ed.), Addison Wesley, 1998. ISBN: 032101460X

BCE045: REMOTE SENSING IN CIVIL ENGINEERING

Unit 1: Definition of terms, space and airborne imageries, characteristics of photographic images, color, tone and texture, Techniques of Photo-interpretation, Special equipments, Photo-interpretation keys.

Unit 2: Ground truth collection and verification, Photo-interpretation for Civil Engineering Project sites such as for buildings, railways, highways, etc.

Unit 3: Principles of Remote Sensing and platform for remote sensing, different platform sensor combinations.

Unit 4: The Multi-concept, remote sensing in visible and other spectral bands, Different methods of interpretation of Satellite imageries.

Unit 5: Applications of Remote Sensing.

Text/Reference Books:

1. M. Anjireddy, "Remote Sensing & GIS", BS Publications.
2. T. M. Lillesand et.al., "Remote Sensing & Image Intrepretation", Wiley India, 5th edition
3. A. M. Chandra, "Remote Sensing & GIS", Narosa.

OPEN ELECTIVE



OE21: DISASTER MANAGEMENT, GUIDELINES & CONTROL

Unit 1: - Introduction

Types of disasters: Man-made disasters, Natural disasters.

Unit 2: Administration

NDMA guidelines for administrative officers, Public responsibilities.

Unit 3: Earthquake

Codal provisions for design of masonry buildings, framed structures and Retrofitting.

Unit 4: Flood

Causes of flood, Effects of flood, Flood forecasting, Benefits of flood control, Flood mitigation works and Evacuation and flood proofing

Water logging: Causes, Effects and Control.

Unit 5: Manmade disasters

Industrial Hazards: Nuclear, Chemical, Biological hazards; Historical background; Present scenario.

Terrorism/War: Nuclear, Chemical, Biological threats.

Safety measures: Preventive measures, response mechanism.

Text/Reference Books: