

P.22 Vision-Mission, POs, PEOs and Curriculum

VISION:

To prepare our students to become responsible, technically qualified professionals with high ethical and human values by providing adequate teaching-learning environment and exposure to research.

MISSION:

- M1.** Impart fundamental technical/engineering knowledge through learner-centric methodology.
- M2.** Empower students and faculty by involving them in co-scholastic, research and development.
- M3.** Enable students to face Scio-technical challenges in their career with ethical and human values.

PROGRAMME EDUCATIONAL OBJECTIVES

- PEO1.** To introduce latest methodologies in teaching and training the students to make them industry ready.
- PEO2.** To enhance the learning process as well as learning experience of the students by keeping abreast with the latest technological advances.
- PEO3.** To enhance students' employability, by keeping pace with the industry demands and expectations on a regular basis.
- PEO4.** To provide students with national and international exposure in research-oriented development.
- PEO5.** To minimize the gap between academia, industry and research through constant efforts and deliberations.

PROGRAM OUTCOMES:

Following are the outcomes in accordance with programme educational objectives:

- PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Curriculum and Evaluation Scheme



KAMLA NEHRU INSTITUTE OF TECHNOLOGY SULTANPUR-228118, U.P., INDIA Study & Evaluation Scheme

B.TECH. CIVIL ENGINEERING

(Effective from the Session 2017-18)

SEMESTER I

S. No.	Subject Category	Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit
							Sessional			End Semester				
				L	T	P	CT	TA	Total	PS	TE	PE		
1.	Theory	APB101	Engineering Mathematics I	3	1		30	10	40		60		100	4
2.		APB102	Engineering Physics	3	1		30	10	40		60		100	4
3.		EEB101	Basic Electrical Engineering	3	1		30	10	40		60		100	4
4.		APH101	Professional Communication	3	1		30	10	40		60		100	4
5.		MEB101	Basic Mechanical Engineering	3	1		30	10	40		60		100	4
6.	Lab	APB1L2	Engineering Physics Lab			2				20		30	50	1
7.		EEB1L1	Basic Electrical Engineering Lab			2				20		30	50	1
8.		APH1L1	Professional Communication Lab			2				20		30	50	1
9.		MEB1L1	Workshop Practice			2				20		30	50	1

10.		GP101	General Proficiency							50			50		
													Total	700	24

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SEMESTER II

S. No.	Subject Category	Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit		
							Sessional				End Semester					
				L	T	P	CT	TA	Total	PS	TE	PE				
1.	Theory	APB201	Engineering Mathematics-II	3	1		30	10	40			60		100	4	
2.		APB203	Engineering Chemistry	3	1		30	10	40			60		100	4	
3.		ELB201	Basic Electronics Engineering	3	1		30	10	40			60		100	4	
4.		CEB201	Basic Civil Engineering	3	1		30	10	40			60		100	4	
5.		CSB201	Computer System and Programming	3	1		30	10	40			60		100	4	
6.	Lab	APB2L3	Engineering Chemistry Lab			2						20		30	50	1
7.		ELB2L1	Basic Electronics Lab			2						20		30	50	1
8.		CEB2L1	Engineering Drawing Lab			2						20		30	50	1
9.		CSB2L1	Programming Lab			2						20		30	50	1
10.		GP201	General Proficiency									50			50	
Total												700	24			

CEB2L1

Engineering Drawing Lab

L T P
1 3 0

Introduction Drawing instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing, types of lines. **1- Sheet**

Orthographic Projections

Introduction, Definitions – Planes of projection, reference line and conventions employed. Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes **2- Sheets**

Orthographic Projections of Plane Surfaces

Introduction, Definitions-projections of plane surfaces-triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only. **2- Sheets**

Projections of Solids

Introduction, Definitions-projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. **2- Sheets**

Sections And Development of Lateral Surfaces of Solids

Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones resting with base on HP **2- Sheets**

Isometric Projection

Introduction, Isometric scale, isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron, right regular prisms, pyramids, cylinders, cones, spheres, cut spheres. **2- Sheets**

Auto CAD

layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints. **2-Sheets**

Text Books

1. Engineering Drawing – N.D. Bhatt & V.M. Panchai, 50th edition, 2012 Charotar Publishing House, Gujarat.
2. Engineering Graphics using AUTO CAD – T Jeyapooran – Vikas Publishing House Pvt. Ltd. New Delhi 110 002
3. A Text book of Engineering Drawing – R.K. Dhawan. S. Chand & Company Ltd. New Delhi – 110055
4. Engineering Graphics using AUTO CAD Venugopal New Age Publications.



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Study & Evaluation Scheme

B.TECH. CIVIL ENGINEERING

(Effective from the Session 2018-19)

SEMESTER III

S. No.	Subject Category	Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit
							Sessional			End Semester				
				L	T	P	CT	TA	Total	PS	TE	PE		
1.	Theory	APB301	Engineering Mathematics-III	3	1		30	10	40		60		100	4
2.		CEC301	Fluid Mechanics	3	1		30	10	40		60		100	4
3.		CEC302	Building Material and Construction	3	1		30	10	40		60		100	4
4.		CEC303	Surveying – I	3	1		30	10	40		60		100	4
5.		CEC304	Strength of Materials	3	1		30	10	40		60		100	4
6.		MAB301	Human Values & Professional Ethics	3					20		30		50	
7.	Lab	CEC3L1	Fluid Mechanics Lab			2				20		30	50	1
8.		CEC3L2	Building Material Lab			2				20		30	50	1
9.		CEC3L3	Surveying – I Lab			2				20		30	50	1
10.		CEC3L4	Building Planning and Drawing Lab			2				20		30	50	1
11.		GP301	General Proficiency							50			50	
Total												700	24	



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SEMESTER IV

S. No.	Subject Category	Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit
							Sessional				End Semester			
				L	T	P	CT	TA	Total	PS	TE	PE		
1.	Theory	CEC401	Structural Analysis I	3	1		30	10	40		60		100	4
2.		CEC402	Surveying II	3	1		30	10	40		60		100	4
3.		CEC403	Hydraulics and Hydraulic Machines	3	1		30	10	40		60		100	4
4.		CEC404	Transportation Engineering, I	3	1		30	10	40		60		100	4
5.		APB402	Environment & Ecology	3	1		30	10	40		60		100	4
6.		MAB402	Technical Writing and Presentation Skill	3					20		30		50	
7.	Lab	CEC4L1	Surveying II Lab			2			20		30		50	1
8.		CEC4L2	Hydraulics and Hydraulic Machines Lab			2			20		30		50	1
9.		CEC4L3	Engineering Geology Lab			2			20		30		50	1
10.		CEC4L4	Transportation Engineering Lab			2			20		30		50	1
11.		GP401	General Proficiency						50				50	
Total												700	24	

Fluid Mechanics

L T P
3 1 0

Unit - I

Introduction: Fluid and continuum, physical properties of fluids, rheology of fluids.

Fluid Statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, center of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

Kinematics of Fluid Flow: Continuum and free molecular flows, steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows-, one-, two- and three-dimensional flows, ideal and real flow. System versus control volume approach, fundamentals of flow visualization, streamlines, streak lines and path lines, continuity equation in Cartesian and polar co-ordinate system, rotation and circulation, stream function and potential function, flow nets.

Dimensional Analysis and Hydraulic Similitude: Rayleigh's method, Buckingham's Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies, distorted and undistorted models.

Unit - III

Potential flow: source, sink, doublet and half-body, free and forced vortex flow.

Dynamics of Fluid Flow: Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, flow through orifices, mouthpieces, notches and weirs, aeration of nappe, momentum equation and its application to pipe –bends, flow through nozzles.

Unit - IV

Laminar Flow: Relation between shear and pressure gradient in laminar flow, introduction to Navier-Stokes equations, Reynolds experiment, equation of motion for laminar flow through pipes, flow between parallel plates, Kinetic energy and Momentum correction factors.

Turbulent Flow: Types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, Prandtl's mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces.

Flow through Pipes: Major and minor losses, energy and hydraulic grade lines, combination of pipes, flow through siphon pipes, pipe network, power transmission through pipes, surge tanks, water hammer.

Unit - V

Theory of Boundary Layer: Boundary layer thickness, boundary layer over a flat plate, application of Von-Karman integral momentum equation, laminar sub-layer, boundary layer separation and its control.

Forces on Submerged Bodies: Drag and lift, drag on a sphere and on a cylinder, development of lift on a circular cylinder and an aerofoil, Magnus effect.

Compressible Flow: Thermodynamic relations, basic equations of compressible flow, expression for velocity of sound wave in a fluid.

Reference Books:

- [1]. Bansal, R.K., 'Fluid Mechanics and Hydraulics Machines', Laxmi Pub. Ltd., New Delhi
- [2]. Modi, L.P.N, Seth, S.M., 'Hydraulics and Fluid Mechanics', Std. Book House Pub.
- [3]. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N. 'Fluid Mechanics and Machinery', Oxford University Press.
- [4]. R. W. Fox, P. J. Pritchard, A. T McDonald, Introduction to Fluid Mechanics, John Wiley
- [5]. F. M White, Fluid Mechanics, Tata McGraw Hill Education.
- [6]. Cengel & Cimbala, 'Fluid Mechanics', TMH, New Delhi.
- [7]. Munson et.al, 'Fundamentals of Fluid Mechanics', Wiley New York.
- [8]. Garde, R.J., 'Fluid Mechanics'.
- [9]. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi.

CEC302

Building Material & Construction

L	T	P
3	1	0

Unit - 1

Material

Classification of Material, economics of building material, major construction material-

Stone: Requirement of good building stone, characteristics of stones, testing, common building stone, Production and Preservation of stone.

Bricks: Manufacturing of clay bricks, classification of bricks, Properties of Bricks and testing, common problems in bricks, and other product i.e. tiles.

Pozzolana: Natural and Artificial fly ash, surkhi, rice husk, and ash pozzolana, properties and specifications for use in construction.

Timber: Classification and identification of timber, Fundamental Engineering properties, Defect in timber, Factors affecting strength of timber, seasoning and preservation of timber. Wood based products.

Asphalt, Bitumen and Tar: Terminology, specifications and uses, bituminous materials.

Lime: manufacturing of lime, classification of limes, properties of lime.

Steel: Engineering, Physical and chemical properties of steel, types of steel, production and handling of steel.

Other material: FRP, Polymers.

Unit – 2

Non-structural materials

Introduction, type and properties of different non structural materials- Wood and Wood based products, Plastic, Paint, varnishes, Distemper, Glass, Aluminum, lead, Insulating material (Thermal and sound), Gypsum board, Epoxy, Resin, Water proofing materials, Tiles, grouting material, other chemical based products.

Unit - 3

Building and its Load bearing components

Building classification and types, Building Planning, Building bye laws, Components of building Area consideration, construction principle and methods for layout, Principle & method of building maintenance.

Anti-termite treatment, damp proofing, construction of flooring (Ground and Upper floors), RCC frame (Column, Beam, and Slab), Stair case, Brick and stone masonry, cavity wall, Waffle slab, Parapet wall, retaining wall.

Unit – 4

Non-Load bearing components

Construction and details of Doors, Windows, Ventilators, shutter, Transom, arches, Roof, floor and wall treatments, Lintels, chhajja, Balcony, porch, underground Tanks, Manholes, Plastering, Painting, Distemping, Tiling, stone work, wood work, metal works, False ceiling, PoP work, external development works.

Unit - 5

Utilities

Water supply system, Sewage collection and disposal system, Rain water harvesting, Fire fighting, Natural Ventilation, Heating Ventilation, Air conditioning, Mechanical Lift and Escalators, Electrification, Acoustics, Thermal insulation.

References

1. Civil Engineering materials ,TTTI, Chandigarh,TMH
2. Building Material: S K Duggal,New Age International.
3. Building Materials: P.C. Varghese,PHI
4. Building Construction:Shushil Kumar,Standard Publishers.
5. Building Construction : B.C.Pumia,Luxmi Publications
6. Building Construction:P C Varghese, PHI

CEC 303

Surveying-I

L	T	P
3	1	0

UNIT-1

Introduction, Classification of Survey, Principles of Surveying, Plans and Maps, Scale Accuracy and Errors

Horizontal Distance Measurement: Chain Surveying, Chain, Tapes, Accuracy of Chaining, Running Survey lines, Linear measurements with chains, Errors in chaining

UNIT-2

Compass Surveying: Bearing and Angles, Theory of Magnetic Compass, The Prismatic Compass, The Surveyor's Compass, Magnetic Declination, Local Attraction, Error in Compass Surveying

Theodolite Surveying: Classification of Theodolite, Temporary adjustments, Permanent adjustments, measurement of horizontal angles, measurement of vertical angles, electronic theodolite

Traversing: Methods of Traversing, Plotting Traverse Survey, Checks, Closing Errors, Balancing Traverse, Adjustment of Bearings, Omitted measurements

UNIT-3

Levelling: Methods of Levelling, Temporary adjustment of a level, Theory of direct leveling, Differential leveling, Balancing Back sight and Fore sight, Curvature and Refraction, Reciprocal Levelling, Cross Sectioning

Contouring: Contour Interval, Characteristics of Contours, Methods of Locating contours, Interpolation of contours, Contour gradient, Uses of Contour Maps

Trigonometric Levelling, Methods of Trigonometric Levelling

UNIT-4

Plane Table Surveying: Description of Plane Table, Methods of Plane Table Surveying, Radiation, Traversing, Intersection, Resection, The three-point problem, Two-point problem, Advantages and disadvantages of Plane Tabling

Tacheometric Surveying: Methods of Tacheometry, Fixed hair methods, Anallactic Lens, Subtense Method, Tangential Method, Range Finding

UNIT-5

Curves: Classification, Simple Circular Curves, Compound Curves, Reverse Curves, Transition Curves, Vertical Curves

Triangulation: Geodetic Surveying, Classification of Triangulation System, Reconnaissance, Signals and Towers, Base Line Measurements, Measurement of Horizontal Angles, Sattelite Station, Extension of Base

Text Books & References

1. S K Duggal : Surveying Vol 1 & 2 , TMH
2. R Subramanian : Surveying & Leveling , Oxford University Press
3. B C Punamia : Surveying & Leveling
4. C Venkatramaih : Text Book of Surveying , University Press
5. H . Kanitkar : Surveying & Levelling

CEC 304

Strength of Materials

UNIT-1

Analysis of stress Introduction, two-dimensional state of stress, transformation of stress, principal planes, principal stresses, maximum shear stress, Mohr's circle, normal and shear stress on octahedral planes, generalized Hook's law, total strain energy and distortion energy Theories of failure Introduction, principal stress theory, principal strain theory, strain energy theory, distortion energy and octahedral stress theory, applications,

UNIT-2

Stress in beams: Bending stress in beams, composite beams, shear stress in beams. Torsion. Torsion shaft of circular section, angle of twist, shear stress in shaft, principal stresses and maximum shear stress in a shaft subjected to combined bending and twisting moments Deflection of beam: Introduction equation of deflection curve, solution of differential equation by direct integration, Area -Moms mod, method of superposition, Castigliano's theorems, deflection of statically indeterminate beam

UNIT-3

Helical and leaf springs: Introduction, stress in springs, deflection of springs by energy me deflection of springs due to axial force and axial torque, laminated springs Short columns Stress eccentrically loaded short columns, middle third and middle quarter rules Long columns: Stability equilibrium, axially loaded columns with different end conditions, Euler theory and experimental res Rane Gordon formulae, Applications

UNIT-4

Thin cylinder and thin sphere: Hoop and axial stresses, axial strain, hoop strain and volumetric st thick cylinder: Radial and hoop stresses in thick cylinder due to external and internal pressure compound cylinder, stress due to interference.

UNIT-5

Cuned beams: Bending of beams with large initial curvature, position of neutral axis for rectangucetramidal, circular and T- section beams, stress in crane hooks Unsymmetrical bending Introducing bending stress in beams in unsymmetrical bending, shear centre

Reference books:

1. Engineering Mechanics of solids by Egor P. Popov, PH)
2. 2. Mechanics of solids by R. C. Hibbler, Pearson
3. Strength of materials by James M Gere and Barry I Goodnoo, Cengage Learning
4. Strength of materials by SS Rattan, Mc graw Hill.
5. Strength of materials, Patr -1, Elementary theory and problems by Stephen Timoshenko C Publishers and distributers.

CEC3L1

Fluid Mechanics Lab

L	T	P
0	0	3

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the metacentric height of a ship model experimentally.
3. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the mouth piece.
4. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
6. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
7. To verify the Bernoulli's theorem.
8. To calibrate and to determine the coefficient of discharge for rectangular and triangular notches.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
10. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
11. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
12. To determine the loss coefficients for a sudden enlargement in a pipe.
13. To determine the loss coefficients for a sudden contraction in a pipe.
14. To determine the loss coefficients for a pipe bend.
15. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
16. To draw a flow net using electrical analogy method.

CEC3L2
BUILDING MATERIALS LAB

L T P
0 0 3

I. Cement

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier's apparatus.
5. Soundness of cement.
6. Tensile strength

II. Coarse Aggregate

1. Crushing value of aggregate
2. Impact value of aggregate
3. Water absorption of aggregate
4. Sieve Analysis of Aggregate
5. Specific gravity & bulk density
6. Grading of aggregates.

III Fine Aggregate:

1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand

IV Destructive and non-destructive testing on concrete

V Physical and mechanical properties of reinforcing steel.

VI Bricks:

1. Water absorption.
2. Dimension Tolerances
3. Compressive strength
4. Efflorescence

CEC3L3

Surveying-I LAB

L	T	P
0	0	3

1. Measurement of distance and locating various objects by chain & cross staff surveying.
2. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
3. Measurement of horizontal and vertical angles with theodolite.
4. Determination of elevation of various points with dumpy level
5. Creation of L-Section and cross section of road.
6. Determination of elevation of point by trigonometric levelling.
7. Creation of Contour plan of given area.
8. Solution of two-point problem by plane table traversing.
9. Solution of three-point problem by plane table traversing.
10. To set out a simple circular curve by Rankine's method.

CEC 3L4

BUILDING PLANNING & DRAWING LAB.

L	T	P
0	0	3

1. Drafting of following Using Any CAD software
2. Symbols used in Civil Engineering drawing, Masonry Bonds
3. Doors, Windows and staircases.
4. Plumbing & Electrical fitting drawing.
5. Comprehensive Drawing of Residential building (Layout, plan, elevation & sectional elevation, plumbing & electrical fillings in out)
6. Preparation of Layout planning of different civil engg. Projects.
Preparation of lay out plan/Maps and building drawing using computer

CEC401

STRUCTURAL ANALYSIS – I

L	T	P
3	1	0

UNIT-1

Classifications of Structures, Degrees of Freedom, Static and Kinematic Indeterminacy. Classification of Pin-jointed trusses. Analysis of Plane Trusses by Method of Joint and Method of Section. Methods of Tension Coefficient. 08

UNIT-2

Rolling loads, Influence lines for beams and trusses, Absolute maximum bending moment, Muller-Breslau's principle & its application for determinate structures. 08

UNIT-3

Analysis of Arches. Linear arch, Eddy's theorem, three hinged parabolic and circular arch, moving loads and influence lines for arches. 08

UNIT-4

Strain energy of deformable systems, Maxwell's reciprocal theorem and Betti's theorem. Castigliano's first theorem, Unit load & Conjugate beam methods. 08

UNIT-5

Unsymmetrical bending, location of neutral axis, computation of stresses and deflection. Shear centre and its location for common structural sections. Bending of curved bars with small and large initial curvatures. 08

Text Books and References

1. Jain, A.K., "Basic Structural Analysis", Nem Chand & Bros, Roorkee.
2. Jain, O.P. and B. K. Jain, "Theory & Analysis of Structures", Nem Chand & Bros, Roorkee.
3. Wilbur and Norris, "Elementary Structural Analysis", Tata Mc Graw Hill.
4. Hibbler, "Structural Analysis", Pearson Education.
5. Coates, R.C, M.G. Coutie and F.K. Kong, "Structural Analysis", English Language Book Society & Nelson.

CEC402

Surveying-II

L	T	P
3	1	0

UNIT-1

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

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

UNIT-3

Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Supervised Classification, Applications of remote sensing

UNIT-4

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

UNIT-5

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

Text Books & References

1. A M Chandra : Higher Surveying
2. B C Punamia : Surveying & Leveling , Vol 2
3. M Anjireddy : Remote Sensing & GIS , BS Publications
4. T M Lillesand et al: Remote Sensing & Image Interpretation , Wiley India , 5 th
5. A M Chandra : Remote Sensing & GIS , Narosa
6. S K Duggal : Surveying Vol 2 , TMH
7. N K Agarwal : Essentials of GPS , Spatial Networks: Hyderabad.

CEC 403

Hydraulics and Hydraulic Machines

L	T	P
3	1	0

Unit - I

Introduction: Difference between open channel flow and pipe flow, channel geometry, hydraulic parameters of various shapes of channels, types of open channel flow, velocity and pressure distribution, mass, energy and momentum conservation principles for prismatic and non-prismatic channels, continuity equation for steady and unsteady flow.

Energy-Depth Relations: Concept of specific energy, specific force, critical flow and its computation, flow in vertical and horizontal channel transitions.

Unit – II

Uniform Flow: Characteristics of uniform flow, Manning's and Chezy's formula, normal depth, normal, critical and limit slopes, equivalent roughness coefficient, flow in compound sections, hydraulically efficient channel sections, flow in circular channels.

Unit – III

Gradually Varied Flow: Dynamic equation of gradually varied flow and its limitations, classification and analysis of flow profiles, control sections, transitional depth.

Computation of GVF Profile: Integration of varied flow equation by analytical, graphical and advanced numerical methods, flow profiles in dividing and combining channels, role of end conditions.

Spatially Varied Flow: Differential SVF equations for increasing and decreasing discharge conditions.

Unit – IV

Rapidly Varied Flow: Types of RVFs, hydraulic jump, types of jump, characteristics of jump in rectangular and non-rectangular channels on horizontal and sloping beds, length and location of jump, jump as an energy dissipator.

RVF Measurement: Flow in sharp crested, narrow crested and broad crested weirs, critical depth flumes, sluice gates, end depth in a free overfall.

Centrifugal Pumps: Difference between centrifugal and reciprocating pumps, classification of centrifugal pumps on the basis of various parameters, priming of a centrifugal pump, fundamental equation of a centrifugal pump, types of heads and efficiencies, cavitation in pumps, characteristic curves.

Unit – V

Turbines: Layout of a hydroelectric plant, classification of turbines on the basis of various parameters, important terms used, Surge Tanks.

Power produced by an impulse turbine, efficiencies.

Velocity triangle and work done for Pelton wheel.

Reaction turbines classification and expression for work done.

Propeller and Kaplan turbines.

Performance of turbines, similarity laws and specific speed, characteristic curves,

Rapidly Varied Unsteady Flow: Celerity of wave, types of surges, analysis of positive and negative surges in a rectangular channel.

Reference Books :

- [1]. Subramanya,K, 'Flow through Open Channels', Tata McGraw Hill.
- [2]. Srivastava, R , 'Flow through Open Channels' , Oxford University Press.
- [3]. V.T. Chow: "Open-channel hydraulics." McGraw Hill .Publications
- [4]. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N. 'Fluid Mechanics and Machinery', Oxford University Press.
- [5]. H. Chaudhry: "Open channel flow".
- [6]. Henderson, "Open channel flow".
- [7]. Ranga Raju, K.G., Flow through open channels, T.M.H.

CEC404

TRANSPORTATION ENGINEERING-I

L T P
3 1 0

UNIT – 1

Introduction: Role of Transportation, Modes of Transportation, History of road development, Nagpur Road plan, Bombay Road plan & 3rd 20 Year Road Plan, Road types and pattern. Geometric Design: Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves.

UNIT – 2

Traffic Engineering: Traffic characteristic, volume studies, speed study, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection. 8

UNIT – 3

Design of Highway Pavement: Types of Pavements, Design factors, Design of Flexible Pavement by CBR method (IRC: 37-2001), Design of rigid pavement, Vestergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC : 58 – 2002). 8

UNIT – 4

Road Construction Methods: WBM, Surface dressing, bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete road construction. 8

UNIT – 5

Traffic and Parking Studies: Traffic and Parking Problems, Ill effects of Parking, Design Standards for On Street Parking Facilities, Traffic Regulatory Measures for On Street Parking Facilities, Peripheral Parking Schemes, Truck Terminals, Long Distance Bus Terminals

Reference Books

1. Highway Engineering by S. K. Khanna & C.E.G. Justo.
2. Transportation Engineering by L. R. Kadiyali.
3. Highway Engineering by S. K. Sharma
4. Principles of Transportation Engineering by P. Chakraborty & A. Das.

CEC 4L1

Surveying-II LAB

L	T	P
0	0	3

1. Demonstration and working on Electronic Total Survey Station
2. Demonstration and working with Pocket/ Mirror stereoscopes and Aerial photographs
3. Demonstration and working with Parallax bar and Aerial photographs
4. Visual Image Interpretation of satellite imagery.
5. Demonstration and practice work with hand held GPS.

CEC4L2

Hydraulics and Hydraulic Machines Lab

L	T	P
0	0	3

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 flow over an abrupt drop and to determine the end (brink) depth for a free over fall in an open channel
7. To study the characteristics of free hydraulic jump.
8. To study rotodynamic pumps and their characteristics
9. To study characteristics of Francis turbine.
10. To study characteristics of Kaplan turbine.
11. To study characteristics of Pelton turbine.

CEC4L3
ENGINEERING GEOLOGY LAB.

L T P
0 0 3

1. Identification of minerals in hand specimen; physical & chemical characteristics
2. Study of crystal forms/habits
3. Igneous rocks in hand specimens; texture, structure and origin of rocks.
4. Sedimentary Igneous rocks in hand specimens; texture, structure and origin of rocks.
5. Metamorphic Igneous rocks in hand specimens; texture, structure and origin of rocks.
6. Strike and dip using models and numerical problems
7. Interpretation of geological maps
8. Topographic maps and construction of topographic profile
9. Preparing geological cross-section
10. Point load test

CEC4L4
TRANSPORTATION ENGINEERING LAB.

L T P
0 0 3

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)



**KAMLA NEHRU INSTITUTE OF TECHNOLOGY
SULTANPUR-228118, U.P., INDIA**

Study & Evaluation Scheme

B.TECH. CIVIL ENGINEERING

(Effective from the Session 2019-20)

SEMESTER V

S. No.		Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit		
							Sessional			End Semester						
				L	T	P	CT	TA	Total	PS	TE	PE				
	Theory															
1.	M/M	KAS501	Managerial Economics / Industrial Management	3	1		30	10	40			60		100	4	
2.	DC	CEC501	Geotechnical Engineering-I	3	1		30	10	40			60		100	4	
3.	DC	CEC502	Environmental Engineering-I	3	1		30	10	40			60		100	4	
4.	DC	CEC503	Design of Concrete Structures I	3	1		30	10	40			60		100	4	
5.	DC	CEC504	Structural Analysis II	3	1		30	10	40			60		100	4	
	Lab															
6.	DC	CEC5L1	Geotechnical Engineering-I Lab			2						20		30	50	1
7.	DC	CEC5L2	Environmental Engineering Lab			2						20		30	50	1
8.	DC	CEC5L3	Concrete Lab			2						20		30	50	1
9.	DC/ PST	CEC5L4/ CEP501	Structural Analysis Lab/ Minor Project I			2						20		30	50	1
10.		GP501	General Proficiency									50			50	
Total												700	24			

**KAMLA NEHRU INSTITUTE OF TECHNOLOGY
SULTANPUR-228118, U.P., INDIA**

Study & Evaluation Scheme

B.TECH. CIVIL ENGINEERING

(Effective from the session 2019-20)

SEMESTER VI

S. No.		Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit	
							Sessional				End Semester				
				L	T	P	CT	TA	Total	PS	TE	PE			
	Theory														
1.	M/M	KAS601	Industrial Management/ Managerial Economics	3	1		30	10	40			60	100	4	
2.	DC	CEC601	Geotechnical Engineering II	3	1		30	10	40			60	100	4	
3.	DC	CEC602	Environmental Engineering II	3	1		30	10	40			60	100	4	
4.	DC	CEC603	WATER RESOURCES ENGINEERING I	3	1		30	10	40			60	100	4	
5.	DE	CEC604	Elective Department Course I	3	1		30	10	40			60	100	4	
	Lab														
6.	DC	CEC6L1	Geotechnical Engineering II Lab			2					20		30	50	1
7.	DC	CEC6L2	STRUCTURAL DETAILING LAB			2					20		30	50	1
8.	DC	CEC6L3/ CEP601	Survey Camp/ Minor Project II			2					20		30	50	1
9.	PST	CES601	Seminar			2					20		30	50	1
10.	GP	GP501	General Proficiency								50			50	
													Total	700	24

CEC-501

GEOTECHNICAL ENGINEERING-I

L	T	P
3	1	0

UNIT – 1

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, Particle size analysis, Soil classification. 8

UNIT – 2

Soil Hydraulics: Modes of occurrence of water in soil. Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Bernaulli's equation, Darcy's Law, hydraulic conductivity, laboratory determination of hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage- Laplace equation of continuity, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, critical hydraulic gradient and quick sand condition.

Soil compaction, water content – dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method. 8

UNIT – 3

Stresses in soils: Normal and shear Stresses on a plane, Stresses due to applied loads, Boussinesq's solution for a point load, line load, strip load, uniformly loaded circular and rectangular areas, Isobar and pressure bulb concept, stress distribution on horizontal and vertical planes, Newmark's chart and its application, contact pressure.

Consolidation: Consolidation and compaction, primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normally and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation, consolidation under construction loading. 8

UNIT – 4

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination: direct and tri-axial shear test, unconfined compression test, vane shear test. Other methods of determining the un-drained shear strength of soil, sensitivity and thixotropy of clay, Pore pressure, Skempton's pore pressure coefficients. 8

UNIT – 5

Earth pressure: Classical theories, Coulomb and Rankine approaches for frictional and $c-\phi$ soils, Smooth and rough walls, inclined backfill, graphical methods of earth pressure determination. Types of retaining structures.

Stability of Slopes: Terminology, stability of finite and infinite slopes, Swedish slip circle method and friction circle method of analysis of slopes, Taylor stability Number and stability curves, Bishops Method. 8

Text Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering

References

1. Alam Singh – Modern Geotechnical Engineering
2. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
3. I.H. Khan – Text Book of Geotechnical Engineering
4. C. Venkataramaiah – geotechnical Engineering
5. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
6. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics

CEC – 502

ENVIRONMENTAL ENGINEERING – I

L	T	P
3	1	0

UNIT – 1

Public Water supply: Hydrosphere, Hydrological cycle and Natural water. Beneficial uses of water, water demands, variations in demands; population forecasting; basic needs and factors affecting consumption; design period.

4

Sources of water: Surface and underground sources, relation and development of source in r/o quality and quantity of water, Development of wells, Storage reservoir-balancing and service storage, capacity determination by mass curve method. Intake systems.

4

UNIT – 2

Quality and Examination of Water: Necessity for examination of impurities in water, sampling of water, physical, chemical and bacteriological quality for domestic water supply. Drinking water quality standards and criteria.

3

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures.

5

UNIT – 3

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, general design guidelines for distribution systems, Hardy - Cross, Newton – Raphson and equivalent pipe methods of pipe network analysis.

5

Water supply and plumbing systems in buildings and houses.

3

UNIT – 4

Wastewater collection: Systems of sanitation and wastewater collection; choice of sewerage system and suitability to Indian conditions.

4

Estimation of wastewater flows and variations in wastewater flows. Storm water: Collection and estimation of storm water by different methods.

4

UNIT – 5

Wastewater Transmission: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems.

6

Planning of sewerage systems.

2

Text Books

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering
2. Metcalf and Eddy Inc.: Wastewater Engineering
3. Garg: Water Supply Engineering (Environmental Engineering Vol. – I)
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).

References

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee: Water Supply and Sewerage
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Arceivala: Wastewater Treatment for Pollution Control
6. Hammer and Hammer Jr.: Water and Wastewater Technology
7. Raju: Water Supply and Wastewater Engineering
8. Sincero and Sincero: Environmental Engineering: A Design Approach
9. Pandey and Carney: Environmental Engineering
10. Rao: Textbook of Environmental Engineering

CEC - 503
DESIGN OF CONCRETE STRUCTURE I

L T
P
3 1
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UNIT – 1

Concrete Making materials, 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.

8

UNIT – 2

Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method.

8

UNIT – 3

Behaviour 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. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments.

8

UNIT – 4

Design of one way and two-way solid slabs by Limit State Design Method, Serviceability Limit States, Control of deflection, cracking and vibrations.

8

UNIT – 5

Design of Columns by Limit State Design Method- 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.

8

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

Text Books & References

1. IS : 456 – 2000, “ Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.
2. Jain, A.K., “Reinforced Concrete : Limit State Design”, Nem Chand & Bros., Roorkee.
3. Gambhir, M L, ”Fundamentals of Reinforced Concrete”, Prentice Hall of India.
4. Unnikrishna Pillai, S. & D. Menon, “ Reinforced Concrete Design”, Tata Mc-Graw Hill Company Limited.
5. Jain, O. P. & Jai Krishna, “ Plain and Reinforced Concrete”, Vol. I & II, Nem Chand & Bros., Roorkee.
6. Park, R. and T. Pauley, ” Reinforced Concrete Structures”, John Wiley & Sons.
7. Dayaratnam, P, ”Reinforced Concrete Design”, Oxford & IBH.

CEC - 504
STRUCTURAL ANALYSIS II

L T
P
3 1
0

UNIT – 1

Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint, method of Consistent Deformation, Slope-Deflection method, Moment Distribution method, Strain Energy method.

8

UNIT – 2

Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged arches, Influence line diagrams for maximum bending moment, Shear force and thrust.

8

UNIT – 3

Suspension Bridges, Analysis of cables with concentrated and continuous loadings, Basics of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders.

8

UNIT – 4

Basics of Force and Displacement Matrix methods for beams , frames and trusses.

8

UNIT – 5

Basics of Plastic Analysis, Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Frames.

8

Text Books & References

1. Jain, A. K., "Advanced Structural Analysis ", Nem Chand & Bros., Roorkee.
2. C. S. Reddy "Structural Analysis", Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Jain, O. P. and B. K. Jain, "Theory and Analysis of Structures", Vol. I & II, Nem Chand & Bros., Roorkee.
4. Timoshenko, S. P. and D. Young, " Theory of Structures" , Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
5. Dayaratnam, P. " Analysis of Statically Indeterminate Structures", Affiliated East-West Press.
6. Wang, C. K. " Intermediate Structural Analysis", Mc Graw-Hill Book Publishing Company Ltd.
7. Martin, H. C." Introduction to Matrix Methods of Structural Analysis", Mc-Graw Hill Book Publishing Company Ltd.

CEC5L1

Geotechnical Engineering Lab-1

L	T	P
0	0	3

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (particle-size analysis).
7. Classify the soil as per the IS 1498- 1970 based on the results obtained from experiments at serial nos. 5 & 6 (grain size distribution and consistency limits).
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.

CEC5L2

Environmental Engg. Lab

L	T
P 0	0
	3

1. Determination of turbidity, colour and conductivity of a given water sample.
2. Determination of pH, alkalinity and acidity of a given water sample.
3. Determination of hardness of a given water sample.
4. Determination of chlorides content of a given water sample.
5. Determination of residual chlorine in a given water sample.
6. Determination of Kjeldahl nitrogen of a given water/wastewater sample.
7. Determination of total, suspended and dissolved solids of a given water/wastewater sample.
8. Determination of BOD in a given water/wastewater sample.
9. Determination of COD in a given water/wastewater sample.
10. Determination of most probable number of coliforms in a given water /wastewater sample.
11. Measurement of air pollutants with a high-volume air sampler. Measurement of ambient sound level with a sound level meter

CEC5L3 CONCRETE LAB

L	T	P
0	0	3

1. Determination of Normal Consistency of cement, Initial & final setting time of cement
2. Determination of Compressive strength of cement
3. Determination of Fineness of cement by air permeability and Le-Chatelier's apparatus.
4. Determination of Soundness of cement.
5. Determination of Tensile strength
6. Determination of Crushing value & Impact value of aggregate
7. Determination of water absorption of aggregate
8. Sieve Analysis of Aggregate and determination of Specific gravity & bulk density
9. Sieve analysis of sand and determination of Silt content of sand
10. Determination of Bulking of sand
11. Demonstration of Non-destructive testing on concrete

CEC5L4 STRUCTURAL ANALYSIS LAB

L	T	P
0	0	3

1. To determine Flexural Rigidity (EI) of a given beam
2. To verify Maxwell's Reciprocal theorem.
3. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal
4. Thrust end Bending moment.
5. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
6. To find deflection of curved members.
7. To find bar forces in a three members structural frames with pin jointed bar
8. To find Critical load in Struts with different end conditions.
9. To find deflections in Beam having unsymmetrical bending.

CEC601

GEOTECHNICAL ENGINEERING-II

L	T	P
3	1	0

UNIT – 1

Sub-soil Investigations: Objectives of soil investigation; Preliminary and detailed investigations; Methods of soil exploration; Geophysical, SPT, CPT and DCPT methods. IN situ soil sampling, Depth of exploration and spacing of bore Holes. Types of soil sample and samplers. Design features of sampler affecting sample disturbance. Depth of groundwater. Bore-hole log and investigation report.

6

Sub-Structures: Introduction to foundations- types and differences; choice; loads; design philosophies.

2

UNIT – 2

Bearing Capacity: Safe bearing capacity and allowable bearing pressure, Terzaghi's bearing capacity equation for general shear failure and modifications. General and local shear failure conditions, Factors affecting bearing capacity of Soil; I.S. code provisions. Allowable bearing pressure based on N-values, bearing capacity from plate load tests.

4

Shallow Foundations: Factors affecting location, type, size and depth of foundations. Design considerations of shallow foundations. Settlement analysis- types and causes of settlement, Computation of settlement, allowable settlement. Measures to reduce settlement.

4

UNIT – 3

Pile Foundations: Types, Construction, load carrying capacity of single pile – Dynamic Formula, Static formula, Pile load tests, Load carrying capacity of pile groups, settlement of pile groups, Negative skin friction.

5

Caissons: Types of caissons, pneumatic caissons, Different shapes of well foundations. Relative advantages and disadvantages. Different Components of wells and their function. Grip length, problems in well sinking and remedial measures.

3

UNIT – 4

Retaining Wall & Sheet Pile Structures: Proportions of retaining walls, stability checks, cantilever and anchored sheet piles, free earth and fixed earth method of analysis of anchored bulkheads.

6

Earthwork and Earthmoving Equipment: Planning of earthwork; Earthmoving equipment- multitask; excavators; loaders; haulers; graders etc.

2

UNIT – 5

Ground Improvement and modification: Need, technologies- compaction piles; vibratory compaction; compaction with dynamic loads; preloading; grouting.

5

Reinforced Soil: Need, applications, reinforcement-soil interactions.

1

Geosynthetics: Types; functions; applications; properties and functional requirements.

2

Text Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering

References

1. Alam Singh – Modern Geotechnical Engineering
2. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
3. I.H. Khan – Text Book of Geotechnical Engineering
4. C. Venkataramaiah – geotechnical Engineering
5. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
6. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics

CEC602

ENVIRONMENTAL ENGINEERING – II

L T P
3 1 0

UNIT – 1

Pollutants of Water, their Origin and Effects; Oxygen demanding wastes, pathogens, nutrients, Salts, thermal applications, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution. Effects of oxygen demanding wastes on surface waters. 3

Wastewater quality and Characteristics. 2

Water borne diseases and their control. 1

Objectives of treatment: Water and wastewater treatment, unit operations and processes and flow sheets. 2

UNIT – 2

Sedimentation: Determination of settling velocity, efficiency of ideal sedimentation tank, short circuiting; different classes of settling; design of primary and secondary settling tanks; removal efficiency for discrete and flocculent settling. 5

Coagulation: Mechanisms of coagulation, coagulants and their reactions, coagulant aids; design of flocculators and clariflocculators. 3

UNIT – 3

Filtration: Theory of filtration; hydraulics of filtration; Carmen - Kozeny and other equations; slow sand, rapid sand and pressure filters, backwashing; brief introduction to other filters; design of filters. 4

Disinfection: Requirements of an ideal disinfectant; kinetics of disinfection, various disinfectants, chlorination and practices of chlorination. 2

Water softening and ion exchange: calculation of dose of chemicals. Adsorption. 2

UNIT – 4

Wastewater Treatment: Preliminary, primary, secondary and tertiary treatment processes. Primary Treatment: Screens, grit chamber and their design, sedimentation and chemical treatment to be given. Secondary Treatment: Theory of organic matter removal; activated sludge process, design of different units and modifications, extended aeration systems; trickling filters, R.B.C. 5

Community and Low-Cost Treatment Systems: aerated lagoons, waste stabilization ponds, oxidation ditches. 3

UNIT – 5

Anaerobic digestion of sludge: Design of low and high-rate anaerobic digesters and septic tanks. 2

Basic concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, Fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor. 3

Disposal of wastewater on land and in water bodies. 1

Introduction to Duckweed Pond, vermiculture and root zone technologies and other emerging technologies for wastewater treatment. 2

Text Books

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering
2. Metcalf and Eddy Inc.: Wastewater Engineering
3. Garg: Water Supply Engineering (Environmental Engineering Vol. – I)
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).

References

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee: Water Supply and Sewerage
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Arceivala: Wastewater Treatment for Pollution Control
6. Hammer and Hammer Jr.: Water and Wastewater Technology
7. Raju: Water Supply and Wastewater Engineering
8. Sincero and Sincero: Environmental Engineering: A Design Approach
9. Pandey and Carney: Environmental Engineering
10. Rao: Textbook of Environmental Engineering

11. Davis and Cornwell: Introduction to Environmental Engineering
12. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
13. Punmia: Water Supply and Wastewater Engineering Vol. I and II
14. Birdie: Water Supply and Sanitary Engineering
15. Ramalho: Introduction to Wastewater Treatment Processes
16. Parker: Wastewater Systems Engineering
17. Mara: Sewage Treatment in Hot climates.

CEC603

Water Resources Engineering-I

L	T	P
3	1	0

UNIT – 1

Introduction: Hydrologic cycle and hydrologic system concept, water budget equation.

Precipitation: Forms of precipitation, types or mechanism of precipitation, measurements and analysis, error in estimation, missing data, consistency of rainfall records, depth area duration, intensity duration frequency and probable maximum precipitation curves.

Initial Losses: Interception and depression storage, **Evaporation and Consumptive Use:** Process, measurement and estimation, **Infiltration:** Process, measurement, estimation, infiltration capacity, Φ and W indices.

UNIT – 2

Runoff: Components and factors affecting runoff, stage-discharge relationship, runoff characteristics and types of streams, rainfall-runoff relationship, empirical equations, Soil Conservation System (SCS-CN) method, flow duration curve, Mass curve.

Hydrographs: Classification of hydrographs, components of a flood hydrograph, base flow separation, effective rainfall hyetograph and direct runoff hydrograph.

Unit Hydrograph: Definition, application and limitations of unit hydrographs, derivation of unit hydrograph, method of superposition and S-curve, derivation of synthetic unit hydrograph, and introduction to instantaneous unit hydrographs.

UNIT – 3

Irrigation: Historical development of irrigation in Indian subcontinent, present status and future requirements of irrigation in India, irrigation techniques and quality of irrigation water, water requirements of crops, irrigation frequency, irrigation efficiencies, principal crops and crop season, crop rotation, soil-moisture-irrigation relationship.

Canal Irrigation: Types of canals, channel alignment, parts of a canal irrigation system, channel alignment, curves in channels, commanded area, channel losses.

UNIT – 4

Alluvial channels Design: Initiation of motion of sediment in alluvial channels, bed forms, design of stable channels, regime channels, Kennedy's and Lacey's design procedure for irrigation channels, Garret's diagram, estimation of bed load and suspended load, Einstein's approach.

Water Logging: Causes and anti-water logging measures, reclamation of saline and alkaline lands, surface and sub surface drainage systems.

UNIT – 5

Ground Water Hydrology: Occurrence of groundwater, zones of storage, aquifers and their characteristics, Darcy's law, compressibility of aquifers, storage coefficients, general flow equations through porous media, heterogeneity and anisotropy, ground water flow rates and flow directions, steady flow to a well in a confined and unconfined aquifer, partial penetration of an aquifer by a well, interference among wells.

Text Books & References:

1. Punmia, B.C. 'Irrigation and water Power engineering', Laxmi Publications.
2. Garg, S.K., 'Irrigation Engg. and Hydraulic Structures', Khanna Publishers, Vol 1&2.
3. Arora, K.R. 'Irrigation Water Power and Water Resource Engg.'.
4. Subramanya, K, 'Engineering Hydrology', McGraw Hill Publications.
5. Ojha, C.S.P., Berndtsson, R., Bhunya, P., 'Engineering Hydrology', Oxford University Press.
6. P.Jayarami Reddy, 'a textbook of Hydrology'.
7. Todd, D. K., 'Groundwater Hydrology', Wilay India Edition.
8. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd.
9. Larry W. Mays, Water Resources Engg., John Wiley India.
10. R.J. Garde, 'Fluivial Hydraulics'.
11. R.A. Wurbs & W.P.James, 'Water Resources Engineering', PHI.

CEE601
DESIGN OF CONCRETE STRUCTURE II

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UNIT – 1

Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs.
8

UNIT – 2

Analysis and design of beam curved in plan. Structural behavior of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings.
8

UNIT – 3

Structural behavior 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.
10

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.
8

UNIT – 5

Advantages of prestressing, methods of prestressing, losses in prestress, analysis of simple prestressed rectangular and T-section.
6

Text Books & References

1. IS : 456 – 2000, “ Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.
2. Jain, A.K., “Reinforced Concrete : Limit State Design”, Nem Chand & Bros., Roorkee.
3. Gambhir, M L ,”Fundamentals of Reinforced Concrete”, Prentice Hall of India.
4. Unnikrishna Pillai, S. & D. Menon, “ Reinforced Concrete Design”, Tata Mc-Graw Hill Company Limited.
5. Jain, O. P. & Jai Krishna, “ Plain and Reinforced Concrete”, Vol. I & II, Nem Chand & Bros., Rookee.
6. Park, R. and T. Pauley,” Reinforced Concrete Structures”, John Wiley & Sons.
7. Dayaratnam, P,”Reinforced Concrete Design”, Oxford & IBH.

CEC6L1

Geotechnical Engineering Lab-2

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1. Determination of permeability of a remolded soil sample by constant head &/or falling head method.
2. Determination of consolidation characteristics of a remolded soil sample by an oedometer test.
3. Determination of shear strength parameters of a given soil sample by Direct Shear Test.
4. Determination of shear strength characteristics of a given soil sample by U/U test from Triaxial Compression Machine.
5. Determination of CBR value of a remolded soil sample.
6. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.
7. Static cone penetration test (SCPT) on site
8. Dynamic cone penetration test (DCPT) on site.

CEC6L2

STRUCTURAL DETAILING LAB

L	T	P
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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.



**KAMLA NEHRU INSTITUTE OF TECHNOLOGY
SULTANPUR-228118, U.P., INDIA**

Study & Evaluation Scheme

B.TECH. CIVIL ENGINEERING

(Effective from the Session 2020-21)

SEMESTER VII

S. No.		Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit	
							Sessional			End Semester					
				L	T	P	CT	TA	Total	PS	TE	PE			
	Theory														
1.	M/M		Open Elective Course 1	3	1		30	10	40			60		100	4
2.	DE	CEE701	Elective Department Course 2	3	1		30	10	40			60		100	4
3.	DE	CEE702	Elective Department Course 3	3	1		30	10	40			60		100	4
4.	DC	CEC701	Transportation Engineering II	3	1		30	10	40			60		100	4
5.	DC	CEC702	Design of Steel Structures	3	1		30	10	40			60		100	4
	Lab														
6.	DC	CEC7L1	CAD Lab 1			2					20		30	50	1
7.	PST	CET701	Industrial Training			2					50			50	1
8.	PST	CEP701	Project I			4					100			100	2
9.		GP701	General Proficiency								50			50	
Total												700	24		



**KAMLA NEHRU INSTITUTE OF TECHNOLOGY
SULTANPUR-228118, U.P., INDIA**

Study & Evaluation Scheme

B.TECH. CIVIL ENGINEERING

(Effective from the session 2019-20)

SEMESTER VIII

S. No.		Subject Code	Subject Name	Periods			Evaluation Scheme						Total	Credit	
							Sessional				End Semester				
				L	T	P	CT	TA	Total	PS	TE	PE			
	Theory														
1.	M/M		Open Elective Course 2	3	1		30	10	40			60		100	4
2.	DE	CEE801	Elective Department Course 4	3	1		30	10	40			60		100	4
3.	DE	CEE802	Elective Department Course 5	3	1		30	10	40			60		100	4
4.	DC	CEC801	Water Resources Engineering II	3	1		30	10	40			60		100	4
	Lab														
5.	DC	CEC8L1	CAD Lab II			2					20		30	50	1
6.	PST	CEP801	Project II			4					150		100	250	7
7.		GP701	General Proficiency								50			50	
Total												700	24		

CEE701

DE34 Quantity Survey and Estimation

L	T	P
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UNIT – 1

Quantity survey

Introduction to quantity survey, item specifications (general and detailed), unit of measurement of various items, Mode of measurement (IS: 1200), coefficient of cement consumption, inventory, Bill of quantity, Reconciliation of major construction material such as cement, steel, pipes, aggregates, sand, earthwork.

UNIT – 2

Cost Analysis

Definition, Prime cost, Market rate, Work charge establishment, Whole sale price index, coefficient of manpower consumption, material consumption, over heads expenditures, contingency, tool and plants component, taxes, Schedule of rates, rate analysis of different items.

UNIT – 3

Estimates

Importance of estimate, Types of estimates, method of estimations, detail estimates of civil and structural works of single and double storey building, Road, hydraulic structures, canal, water ways, culvert, bridges, Water supply, sanitary works.

UNIT – 4

Valuation

Purpose of valuation, Gross income, Net income, Outgoing, Scrap values, Salvage value, Book value, Market value, obsolescence, Annuity, Capitalized cost, Capitalized value, Sinking Fund, Depreciation, Year's purchase, Valuation of building, method of valuation, Fixation of rent, Balance sheet.

UNIT – 5

Working Procedures

Working procedures of organizations and Duties and responsibilities of the officers in Public works organization, M.E.S., Indian railways.

Text Books & References:

1. Estimating and costing in Civil Engineering, B.N.Dutta, UBS publishers.
2. Estimating, Costing, Specification & Valuation In Civil Engineering, M Chakraborti.
3. Central and/or State Government Schedule of rates

CEC701
TRANSPORTATION ENGINEERING - II

L T P
3 1 0

UNIT – 1

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 – 2

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.

UNIT – 3

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.

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

UNIT – 4

Airport Engineering

Air craft characteristics affecting airport design; Runway operation; Runway pavement design, design of overlay; Runway lighting and marking heliport.

UNIT – 5

Water Transport

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

Text Books:

1. A Text Book of Railway Engineering by S. P. Arora & S. C. Saxena
2. Airport Planning & Design by S. S. Jain, M. G. Arora & S. K. Khanna
3. Harbour dock and Tunnel Engineering by R. Srinivasan

References:

1. Railway Engineering by M. M. Aggrawal.
2. Airport Engineering by Rangwala

CEC702

DESIGN OF STEEL STRUCTURE

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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, Loads, Dead Load, Live Loads, Environmental Loads, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Local Buckling of Plate Elements. 8

Introduction to Limit State Design

Introduction, Limit States for Steel Design, Limit States of Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design, Design Criteria 8

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 8

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 8

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. 8

UNIT – 5

Beams

Introduction, Types of Sections, Behavior 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 8

Text Books & References:

1. IS 800-2007," General Construction in Steel – Code of Practice, Bureau of Indian Standards, New Delhi.
2. Duggal, S. K., "Limit State Design of Steel Structures", Tata Mc Graw Hill.
3. Sairam, K S,"Design of Steel Structures", Pearson Education India.
4. Subramanian, N., "Design of Steel Structures", Oxford University Press.
5. Steel Structures by Robert Englekirk. Hohn Wiley & sons inc.
6. Structural Steel Design by Lambert tall (Ronald Press Comp. Newyork.
7. Design of steel structures by Willam T Segui , CENGAGE Learning
8. Structural Steel Design By D MacLaughlin , CENGAGE Learning

CEC7L1
CAD LAB-I

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1. Working on analysis softwares like ANSYS , ADINA , NISA
2. WORKING on Design Softwares LIKE STAAD PRO / STRUDS / SAP / ETAB / STRAP
3. Working on Transportation Engg softwares / Surveying Softwares
4. Working on GIS softwares (Arc GIS / Envi / GePSy)

CEE 802
DE54 CONSTRUCTION TECHNOLOGY & MANAGEMENT

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3 1 0

UNIT – 1

Elements of Management: Project cycle, Organization, 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 Equipment for earth moving , Hauling equipment, Hoisting equipment , Conveying equipment , Concrete Production equipment

Text Books & References:

1. “Construction Planning”, Equipment and Methods. : R.L. Peurify. T.M.H., International Book Company.
2. “PERT & CPM Principles and Applications” L.S. Srinath, E.W.P. Ltd., New Delhi.
3. “Network Analysis Techniques” S.K. Bhatnagar, Willey Eastern Ltd.
4. Construction Technology by Sarkar , Oxford

CEC801

Water Resources Engineering-II

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UNIT – 1

Floods and Flood Routing: Necessity and functions of flood forecasting, flood forecasting methods, hydrologic methods, Muskingham method.

Lining of Irrigation Canals: Types of linings, their construction and uses, factors affecting selection of a particular type, design of lined channels, drainage arrangement systems, economics of canal lining.

Design of Irrigation Channels: Cross-section of an Irrigation canal, balancing depth, fixing the L-section of canal, maintenance of irrigation canals.

UNIT – 2

Seepage Theory: Failure of hydraulic structures founded on pervious foundations, Bligh's creep theory, Lane's weighted creep theory, Khosla's theory, critical and safe exit gradient, Khosla's method of independent variables.

Layout of diversion head works and its components, design of weirs and barrages founded on permeable foundations.

UNIT – 3

Canal Regulation Works: Types and design of cross regulator and distributary head regulator, types of canal escapes and metering flumes, cattle crossing and bed bars.

Canal Falls: Definition and location of a canal fall, design of various types of canal falls.

UNIT – 4

Cross Drainage Works: Types and selection of a suitable type of cross-drainage work, design consideration and design of cross drainage works.

Canal Outlets: Requirements of a good module, types and design procedure of canal outlets.

UNIT – 5

Well Hydraulics: Well losses, specific capacity, efficiency, unsteady flow to a well in a confined and unconfined aquifers, drawdown and recovery tests, open and tube wells, well development, well shrouding and well boring, infiltration galleries, infiltration wells, springs, natural and artificial ground water recharge, water harvesting and its types.

Water Resources System Analysis: Definition and types of a system, system approach and analysis, basic Problems in system analysis, basic introduction to linear programming, dynamic programming and simulation.

Text Books & References:

1. Garg, S.K., 'Irrigation Engg & Hydraulic Structures', Khanna Publishers, Vol 1&2.
2. Punmia, B.C. 'Irrigation and water Power engineering', Laxmi Publications.
3. Arora, K.R. 'Irrigation Water Power and Water Resource Engg.'.
4. Larry W. Mays, Water Resources Engg., John Wiley India.
5. R.A.Wurbs & W.P.James, 'Water Resources Engineering', PHI.
6. S. Vedula & P.P. Majumdar, 'Water Resources Systems' TMH Publ.
7. Ossenbruggen, P. J. – 'System Analysis for Civil Engineering', John Wiley, New York
8. Jain, S. K. and Singh, V. P. – 'Water Resources Systems Planning & Management', Elsevier, Amsterdam.

CEC8L1
CAD LAB-II

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1. WORKING ON Geotechnical Softwares like GEO-5 / Plaxis
2. 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)
3. Working on Project Management softwares (Primaveera / MS Project)

CEE701
DE24 BRIDGE ENGINEERING

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3 1 0

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.

10

UNIT – 2

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

8

UNIT – 3

T-beam bridge, box culverts,

6

UNIT – 4

Design and detailing of plate girder and steel Truss type bridges,

8

UNIT – 5

Design of piers and pier caps. Abutments, and bearings

8

Text Books & References:

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

CEE601
DE11 Engineering Hydrology

L T P
3 1 0

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; Evapotranspiration- 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 Books & References:

1. 'Hydrology for Engineers' by Linsley R. K., Kohler M. A. and Paulhus J. L. H.
2. 'Engineering Hydrology' by K. Subramanya
3. 'Hydrology: Principles. Analysis. Design' by Raghunath H. M.
4. 'Handbook of Applied Hydrology' by Chow V. T.
5. 'Irrigation: Theory & Practice' by Michael A. M.

CEE701

DE23 Reservoir and Dam Engineering

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UNIT – 1

Floods: Classification of floods, estimation of flood peak, rational method, empirical methods, unit hydrograph technique, introduction to flood frequency studies, risk, reliability and safety factor.

Flood Routing: Types of flood routing, hydrologic storage routing, hydrologic channel routing, Muskingham method, introduction to methods of flood control.

UNIT – 2

Reservoirs: Zones of storage, designing reservoir capacity, estimation of demand and optimal reservoir operations, reservoir regulation, reservoir sedimentation, trap efficiency and life of a reservoir.

River Training works: Types of rivers and their characteristics, methods of river training works: levees, guide banks, groyne, cut-offs, pitching of banks, pitched islands.

UNIT – 3

Dams: Classification and selection criteria.

Earthen and Rockfill Dams: Classification, methods of construction, causes of failure and their control, determination of phreatic line in an earthen dam, design criteria, seepage analysis, introduction to stability analysis, cross-section of a Rockfill Dam and its advantages over an earthen dam.

Arch and Butress Dams: Introduction and design aspects of Arch and Butress dams.

UNIT – 4

Gravity Dams: Classification and typical cross-section, forces acting on gravity dam, modes of failure, stability analysis and construction of gravity Dams, elementary profile of a gravity dam: low and high gravity dam, types and functions of galleries and joints, control of cracking.

UNIT – 5

Spillways: Location of a spillway, classification and design considerations for the spillways, types of spillway gates.

Stilling Basin: Energy dissipation below the spillways, classification of stilling basins, and design of stilling basins with horizontal and sloping aprons.

Hydropower Engineering: Features and characteristics of hydropower generation, classification of hydel plants, principal components of a hydropower station, important terms used, intakes, tunnels, surge tanks, penstocks, anchor blocks, comparison of hydro-power with other sources power with reference to Indian conditions, hydropower potential of India.

Text Books & References:

1. Garg, S.K., 'Irrigation Engg & Hydraulic Structures', Khanna Publishers, Vol 1&2.
2. Punmia, B.C. 'Irrigation and water Power engineering', Laxmi Publications.
3. Arora, K.R. 'Irrigation Water Power and Water Resource Engg.'.
4. Larry W. Mays, Water Resources Engg., John Wiley India.
5. Subramanya, K, 'Flow through Open Channels', Tata McGraw Hill.
6. R.A.Burbs & W.P.James, 'Water Resources Engineering', PHI.
7. Srivastava, R, 'Flow through Open Channels', Oxford University Press.
8. Subramanya, K, 'Engineering Hydrology', McGraw Hill Publications.
9. Ojha, C.S.P., Berndtsson, R., Bhunya, P., 'Engineering Hydrology', Oxford University Press.

CEE802
DE53 Principles of Town Planning and Architecture

L	T	P
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UNIT – 1

Principles of town planning, Land use patterns, Population survey, Density concepts, and transportation planning,

UNIT – 2

Concept of habitat including environmental pollution, problems of metropolis, Satellite town concepts, Garden city movement, Neighbourhood planning, Brief history of architecture,

UNIT – 3

Impact of development of materials through ages, Evolution of architectural forms, Anesthetics and functional proportions,

UNIT – 4

Principles of architecture Design, Building Bye-Laws, Scale, Forms, Texture, Colour, Balance, Composition of Space, Role of architects and town planners,

UNIT – 5

Architectural Drawing, Different symbols used in building industry, Design of typical buildings such as school, hospital, residential and commercial complex, etc.

CEE701
DE21 ADVANCED CONCRETE DESIGN

L T P
3 1 0

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, Design of Intze tank. 8

UNIT – 2

Design of staging for Overhead tanks, Braces, Columns and Raft Foundation. 8

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. 8

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. 8

UNIT – 5

High performance concrete, Production and no-conventional concrete. Design of composite Sections: Composite beam and slabs in simple conditions. 8

Text Books & References:

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

CEE701

DE22 Open Channel Flow

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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 Books & References:

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

CEE601
DE12 Industrial Pollution Control and Environmental Audit

L T P
3 1 0

UNIT – 1

Industrial wastes & their sources: various industrial processes, sources and types of wastes solid, liquid, gaseous, noise & radiation emissions. Sources for industrial water usages and various industrial processes requiring water use and water quality.

UNIT – 2

Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radioactivity etc.

Wastewater re-uses & recycling, concept of zero discharge effluent.

UNIT – 3

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

UNIT – 4

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

UNIT – 5

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

Text Books & References:

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

CEE601
DE13 DESIGN OF CONCRETE STRUCTURE II

L T
P
3 1
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UNIT – 1

Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs. 8

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. 8

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. 10

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. 8

UNIT – 5

Advantages of prestressing, methods of prestressing, losses in prestress, analysis of simple prestressed rectangular and T-section. 6

Text Books & References

1. IS : 456 – 2000, “ Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi.
2. Jain, A.K., “Reinforced Concrete : Limit State Design”, Nem Chand & Bros., Roorkee.
3. Gambhir, M L ,”Fundamentals of Reinforced Concrete”, Prentice Hall of India.
4. Unnikrishna Pillai, S. & D. Menon, “ Reinforced Concrete Design”, Tata Mc-Graw Hill Company Limited.
5. Jain, O. P. & Jai Krishna, “ Plain and Reinforced Concrete”, Vol. I & II, Nem Chand & Bros., Rookee.
6. Park, R. and T. Pauley,” Reinforced Concrete Structures”, John Wiley & Sons.
7. Dayaratnam, P,”Reinforced Concrete Design”, Oxford & IBH.

CEE802
DE51 Tunnel Engineering

L T P
3 1 0

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 Books & References:

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

CEE702
DE31 Precast and Modular Construction Practices

L T P
3 1 0

UNIT – 1

Overview of reinforced and prestressed concrete construction Design and detailing of precast/prefabricated building components,

UNIT – 2

Structural design and detailing of joints in prefabricated structures, Production of ready mixed concrete, quality assurance,

UNIT – 3

Use of equipment in precast prefabricated structure, Productivity analysis, Economics of form work, Design of Formwork and their reusability,

UNIT – 4

Modular construction Practices, Fibonacci series, its handling and other reliable proportioning concepts.

UNIT – 5

Modular coordination, Standardization, system building, Lamination and Advantages of modular construction.

Text Books & References:

1. Handbook of low cost housing by A K Lal
2. Precast Concrete Structures by Kim Elliot

CEE802
DE52 WATER RESOURCES SYSTEMS

L T P
3 1 0

UNIT – 1

Concept of System & System Analysis: Definition and types of a system, System Approach and analysis, Basic Problems in System Analysis.

UNIT – 2

System Techniques in Water Resources: Optimization using calculus, Linear programming, Dynamic programming and Simulation, Combination of Simulation and Optimization.

UNIT – 3

Economic Considerations in Water Resources Systems: Basics of Engineering Economics, Economic Analysis, Conditions of project optimality, Benefit-cost Analysis

UNIT – 4

Multi-objective Planning: Non-inferior solutions, Plan Formulation & Plan Selection.

UNIT – 5

Applications of Linear Programming: Irrigation water allocation for single and multiple crops, Multi –reservoir system for irrigation Planning, Reservoir operation for Irrigation and Hydro-power Optimization

Application of Dynamic Programming: Optimal crop water allocation, Steady State, Reservoir Operation policy for Irrigation.

Text Books & References:

1. Ossenbruggen, P. J. – System Analysis for Civil Engineering, John Wiley, New York
2. Taha, H. –Operational Research-An Introduction, Vth Edn, Prentice Hall.
3. Loucks, D. P., Stedenger, and Haith, D. A. – Water Resources Systems Planning & Analysis, Prentice Hall.
4. Jain, S. K. and Singh, V. P. – Water Resources Systems Planning & Management, Elsevier, Amsterdam

CEE702
DE32 Transportation System Planning

L T P
3 1 0

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, Goals and objectives of transportation planning,

UNIT – 2

Type of transportation system: Intermediate Public Transport (IPT), Public Transport, Rapid and mass transport system. Traffic Flow and traffic stream variables.

UNIT – 3

Travel demand: Estimation and forecasting, trip classification, trip generation: factors and methods, multiple regression analysis. Trip distribution methods, modal split, trip assignment.

UNIT – 4

Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods, net-present-Value methods, Benefit Cost method, Internal rate of return method.

UNIT – 5

Transportation Facilities: Pedestrian facilities, Bicycle facilities, parking and terminal facilities. Transport system management. Long term and short term planning, use of IT in transportation.

Text Books & References:

1. Introduction to Transportation Engineering: William W. Hay.
2. Introduction to Transportation Engineering planning – E.K. Mortak.
3. Metropolitan transportation planning – J.W. Dickey.
4. Traffic Engineering, L.R. Kadiyali

CEE801
DE42 Advanced Foundation Engineering

L T P
3 1 0

UNIT – 1

General requirements of Shallow and Deep foundations, Review of bearing capacity of shallow foundations, Factors affecting bearing capacity of shallow foundations, Design of raft foundations, foundations for Chimney and Tower, Construction of shallow foundations.

UNIT – 2

Review of Deep foundations, Design of Pile raft foundation, Construction of Deep foundations (Pile & Well foundations)

UNIT – 3

Machine Foundations: Types, Design criteria of machine foundation, Method of analysis, Design procedure for reciprocating machine – cyclic loading and hammer- impact loading for a block foundation.

UNIT – 4

Geotechnical construction techniques, Earth work, compaction and Earth moving equipments. Selection of equipments.

UNIT – 5

Foundations on Shrinking (Expansive) soil, strengthening of existing foundations, soil support systems.

Text Books & References:

1. Geotechnical Engineering by- Shashi K Gulhati, Manoj Datta
2. Foundation Engineering by P.C. Varghese
3. Principles of Foundation Engineering – by Brijia M Das
4. Basic and applied soil mechanics – by Gopal Ranjan & ASR Rao.

CEE801

DE44 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

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UNIT – 1

Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes,

UNIT – 2

Response of Structure to Earthquake motion, Modeling of structures, Dynamics of single degree of freedom system,

UNIT – 3

Dynamics of multi degree of freedom system, Idealization of structures, Dynamics of soils and seismic response, Conceptual design,

UNIT – 4

Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Design of Masonry buildings,

UNIT – 5

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

Text Books & References:

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

CEE801
DE41 RIVER ENGINEERING

L T P
3 1 0

UNIT – 1

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

UNIT – 2

Behaviour of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control.

UNIT – 3

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration.

UNIT – 4

Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data.

UNIT – 5

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

Text Books & References:

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.

CEE801

DE43 Finite Element Methods

L	T	P
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UNIT – 1

Introduction to FEM, Brief history of development, advantages and disadvantages of FEM, basic concepts of FEM, Introduction to elasticity, steps in FEM.

Virtual work and Variational principles, Galerkin method. Displacement approach, stiffness matrix and boundary conditions.

UNIT – 2

One dimensional finite element, Stiffness matrix for the basic bar and beam element, Representation of distributed loading, the assembly approach within the principle of minimum potential energy approach, element stresses, shape functions and interpolation polynomials.

UNIT – 3

Finite elements for two-dimensional Planer bodies, Triangular elements for plane stress or strain conditions, rectangular elements for plane stress or strain conditions.

UNIT – 4

Finite Elements for Three-Dimensional Analysis, tetrahedral and hexahedral elements, Numerical Integration.

UNIT – 5

Natural co-ordinates, Area or triangular co-ordinates, Serendipity elements, isoperimetric concept, properties of isoperimetric elements, Axisymmetric elements.

Text Books & References:

1. Finite Element Analysis -C.S. Krishnanmoorthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
2. Introduction to the Finite Element method -Desai / ABEL-C.B.S. Publishers & Distributors, New Delhi.
3. Chennakesava R. Alavala, 'Finite Element Methods', PHI Publ.
4. Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Wiley, 2005.
5. Reddy, J. N., an Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
6. Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.
7. Concepts and Applications of Finite Element Analysis: COOK. D. Robert. Malus.S.David, Plesha E. Michel, John wiley & sons 3rd Edn. New York, 2000.

CEE702

DE33 Application of Remote Sensing in Civil Engineering

L	T	P
3	1	0

UNIT – 1

Definition of terms, space and airborne imageries, characteristics of photographic images, color, tone and texture, Techniques of Photo-interpretation, Special equipment, Photo-interpretation keys. 8

UNIT – 2

Ground truth collection and verification, Photo-interpretation for Civil Engineering Project sites such as for buildings, railways, highways, etc. 8

UNIT – 3

Principles of Remote Sensing and platform for remote sensing, different platform sensor combinations. 8

UNIT – 4

The Multi-concept, remote sensing in visible and other spectral bands, Different methods of interpretation of Satellite imageries. 8

UNIT – 5

Applications of Remote Sensing in Change Detection, Forestry, Geology, Water Resources Management, Traffic & Transportation, Route Planning, Environmental Planning. 8

Text Books & References:

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