SCHEME & SYLLABUS

For

B.Tech. PROGRAMME

in

CIVIL ENGINEERING



UNIVERSITY OF KASHMIR
SRINAGAR

JULY – 2026

(*Applicable to Batch 2025 & Onwards*)

COURSE STRUCTURE, B.Tech CIVIL ENGINEERING

THIRD SEMESTER TO EIGHTH SEMESTER

H	Humanities Social Science & Management Course
B	Basic Science Course
E	Engineering Science Course
C	Programme Core Course
D	Programme Elective Course
O	Open Elective Course
L	Laboratory Course
P	Project/Internship
Y	Seminar
A	Audit Course
M	Minor Degree

CIE	Continuous Internal Evaluation **(50 Marks)**	
	MSE	Mid Semester Evaluation **(35 Marks)**
	CA	Continuous Assessment **(Assignment + Quiz/ Viva Voce (10 Marks) + Attendence (5 Marks)**
ESA	End Semester Evaluation	

Semester - 3 (Three)								**Examination Scheme (Distribution of Marks)**										
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**No.of Hours/Week**	**Credits**	**CIE (Theory)**			**CIE (Practical)**			**Internal (Total)**	**ESA (Theory)**	**ESA (Practical)**	**External (Total)**	**Total Marks**
								MSE	**CA**	**Total**	**MSE**	**CA**	**Total**					
Programme Core Course	BCIVCSM325	Strength of Materials	2	1	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Programme Core Course	BCIVCBS325	Basic Surveying	3	0	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Programme Core Course	BCIVCFM325	Fluid Mechanics	2	1	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Programme Core Course	BCIVCBM325	Building Materials and Construction	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Basic Science Course	BCIVBPD325	Partial Differential Equations and Integral Transforms	2	1	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Lab Course	BCIVLCD325	Computer Aided Civil Engineering Drawing	0	0	4	4	2	-	-	-	35	15	50	50	0	50	50	100
			Total			**25**	**20**									**Total Marks of semester**		**900**

Semester - 4 (Four)								**Examination Scheme (Distribution of Marks) *****										
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**No.of Hours/Week**	**Credits**	**CIE (Theory)**			**CIE (Practical)**			**Internal (Total)**	**ESA (Theory)**	**ESA (Practical)**	**External (Total)**	**Total Marks**
								MSE	**CA**	**Total**	**MSE**	**CA**	**Total**					
Programme Core Course	BCIVCSA425	Structural Analysis	2	1	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Lab Course (Experiential Learning Course)	BCIVLAS425	Advanced Surveying	0	1	4	5	3	0	0	0	35	15	50	50	0	0	0	50
Humanities,Management & Social Science Course	BCIVHPM425	Project Management & Network Analysis	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Programme Core Course	BCIVCCT425	Concrete Technology	3	0	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Programme Core Course	BCIVCHE425	Highway Engineering	2	1	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Basic Science Course	BCIVBCA425	Complex Analysis and Special Functions	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
			Total			**24**	**20**									**Total Marks of semester**		**750**

Semester - 5 (Five)								**Examination Scheme (Distribution of Marks) *****										
Category	**Course Code**	**Course Title**	**L**	**T**	**P**	**No.of Hours/Week**	**Credits**	**CIE (Theory)**			**CIE (Practical)**			**Internal (Total)**	**ESA (Theory)**	**ESA (Practical)**	**External (Total)**	**Total Marks**
								MSE	**CA**	**Total**	**MSE**	**CA**	**Total**					
Programme Core Course	BCIVCIS525	Analysis of Indeterminate Structures	2	1	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Programme Core Course	BCIVCSM525	Soil Mechanics	2	1	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Lab Course (Experiential Learning Course)	BCIVLWS525	Water Supply and Sanitation Engineering	0	1	4	5	3	0	0	0	35	15	50	50	0	0	0	50
Programme Core Course	BCIVCRE525	Railway Engineering	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Programme Core Course	BCIVCFF525	Fluid Flow in Pipes & Channels	3	1	2	6	5	35	15	50	35	15	50	100	50	50	100	200
Lab Course	BCIVLSC525	Survey Camp	-	-	-	-	1	0	0	0	35	15	50	50	0	50	50	100
			Total			**24**	**20**									**Total Marks of semester**		**850**

Semester - 6 (Six)								Examination Scheme (Distribution of Marks) ***									
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits	CIE (Theory)			CIE (Practical)			Internal (Total)	ESA (Theory)	ESA (Practical)	External (Total)	Total Marks
								MSE	CA	Total	MSE	CA	Total					
Programme Core Course	BCIVCRC625	Design of Reinforced Concrete Structures	3	1	0	4	4	35	15	50	0	0	0	50	50	0	50	100
Programme Core Course	BCIVCFE625	Foundation Engineering	2	1	2	5	4	35	15	50	35	15	50	100	50	50	100	200
Lab Course (Experiential Learning Course)	BCIVLTE625	Traffic Engineering and Road Facilities	0	1	4	5	3	0	0	0	35	15	50	50	0	0	0	50
Programme Core Course	BCIVCIH625	Irrigation & Hydraulic Structures	2	1	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Programme Core Course	BCIVCEE625	Environmental Engineering	2	1	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Open Elective Course	BCIVO**625	Open Elective I	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
			Total			23	20									Total Marks of semester		650

Semester - 7 (Seven)								Examination Scheme (Distribution of Marks) ***									
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits	CIE (Theory)			CIE (Practical)			Internal (Total)	ESA (Theory)	ESA (Practical)	External (Total)	Total Marks
								MSE	CA	Total	MSE	CA	Total					
Programme Core Course	BCIVCDS725	Design Of Steel Structures	2	1	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Programme Core Course	BCIVCEH725	Engineering Hydrology	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Lab Course (Experiential Learning Course)	BCIVLQS725	Quantity Survey & Cost Estimation	0	1	4	5	3	0	0	0	35	15	50	50	0	0	0	50
Programme Elective Course	BCIVD**725	Programme Elective I	-	-	-	-	4	35	15	50	0	0	0	50	50	0	50	100
Programme Elective Course	BCIVD**725	Programme Elective II	-	-	-	-	3	35	15	50	0	0	0	50	50	0	50	100
Lab Course	BCIVPPW725	Pre-Project	0	0	8	8	4	0	0	0	35	15	50	50	0	50	50	100
			Total			26-27	20									Total Marks of semester		550

Semester - 8 (Eight)								Examination Scheme (Distribution of Marks)									
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits	CIE (Theory)			CIE (Practical)			Internal (Total)	ESA (Theory)	ESA (Practical)	External (Total)	Total Marks
								MSE	CA	Total	MSE	CA	Total					
Programme Elective Course	BCIVD**825	Programme Elective III	-	-	-	-	3	35	15	50	0	0	0	50	50	0	50	100
Programme Elective Course	BCIVD**825	Programme Elective IV	-	-	-	-	3	35	15	50	0	0	0	50	50	0	50	100
Open Elective Course	BCIVO**825	Open Elective II	3	0	0	3	3	35	15	50	0	0	0	50	50	0	50	100
Project /Internship	BCIVPPT825	Project	0	0	18	18	9	0	0	0	35	15	50	50	0	50	50	100
Project/Internship	BCIVPIP825	Internship/Industrial Training	0	0	0	0	2	0	0	0	35	15	50	50	0	0	0	50
			Total			27	20									Total Marks of semester		450

Programme Elective Course I							
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits
Programme Elective Course	BCIVDSD725	Structural Dynamics	2	1	2	5	4
Programme Elective Course	BCIVDNM725	Numerical Methods	3	1	0	4	4
Programme Elective Course	BCIVDAD725	Airport , Dock and Harbour Engineering	3	1	0	4	4
Programme Elective Course	BCIVDEG725	Engineering Geology	3	0	2	5	4

Programme Elective Course II							
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits
Programme Elective Course	BCIVDAC725	Advanced Reinforced Concrete Structures	2	1	0	3	3
Programme Elective Course	BCIVDAN725	Air and Noise Pollution Control Engineering	3	0	0	3	3
Programme Elective Course	BCIVDTP725	Transportation Planning and Economics	3	0	0	3	3
Programme Elective Course	BCIVDGI725	Ground Improvement Techniques	3	0	0	3	3

Programme Elective Course III							
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits
Programme Elective Course	BCIVDDB825	Design of Bridges	2	1	0	3	3
Programme Elective Course	BCIVDSW825	Solid Waste Management	3	0	0	3	3
Programme Elective Course	BCIVDIT825	Intelligent Transportation System	3	0	0	3	3
Programme Elective Course	BCIVDEG825	Environmental Geo-Technology	3	0	0	3	3

Programme Elective Course IV							
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits
Programme Elective Course	BCIVDER825	Earth Quake Resistant Design	2	1	0	3	3
Programme Elective Course	BCIVDHW825	Hazardous Waste Management	3	0	0	3	3
Programme Elective Course	BCIVDUT825	Urban Transportation Planing	3	0	0	3	3
Programme Elective Course	BCIVDSS825	Soil Stucture Interarction	2	1	0	3	3

Open Elective Course I							
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits
Open Elective Course	BCIVODM625	Disaster Management and Preparedness	3	0	0	3	3
Open Elective Course	BCIVORE625	Renewable Energy Technologies	3	0	0	3	3
Open Elective Course	BCIVOGB625	Green Buildings	3	0	0	3	3

Open Elective Course II							
Category	Course Code	Course Title	L	T	P	No.of Hours/Week	Credits
Open Elective Course	BCIVOSC825	Smart Cities	3	0	0	3	3
Open Elective Course	BCIVORS825	Remote Sensing and GIS Applications in Engineering	3	0	0	3	3
Open Elective Course	BCIVORM825	Research Methodology	3	0	0	3	3

Course Code	**BCIVCSM325**					
Category	**Programme Core Course**					
Course Title	**Strength of Materials**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**2**	**5**	**4**	
Pre requisites	**Physics, Mathematics.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand: Recognizing the correlations between strain, displacement, and Hooke's law in the theory of elasticity; and executing computations pertaining to the stability and strength of mechanical components and structures.

ii) CLO2: Analyze: Analysis of combined stresses in members and structures.

iii)CLO3: Apply: Identify characteristics and magnitude of combined stresses in both individual members and structures.

iv) CLO4: Evaluate : Identify the distribution of stresses in members in cross-sections and longitudinal directions under the influence of various loading circumstances.

v) CLO5: Analyze: Assess solid mechanics problems using classical methods

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Simple Stresses and strain: Introduction, Definition, concept, and types of stress and strain. Hooke's law, Stress-Strain diagrams for ductile and brittle materials, Elasticity and plasticity of materials, factor of safety. Principle of superposition, Elongation of bars. Saint Venant's principle, Compound bars, Temperature stresses, Compound sections subjected to temperature stresses. Elastic constants; Lateral strain, Poisson's ratio, and volumetric strain and their relationship.
Module 2.	Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Power transmitted by a shaft. Combined torsion and bending of circular shafts, principal stress under combined loading of bending and torsion.
Module 3.	Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.
Module 4.	Thin Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick Cylinders: Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.
Module 5.	Compound Stresses and Strains- State of stress at a point, Plane-Stress Transformation (Two-dimensional stress system), principal stresses, principal planes, Mohr circle of stresses. Principal Strain, principal stress from strain, Mohr circle of strain.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO2	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO3	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO4	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO5	3	3	2	3	0	1	1	1	0	0	0	0	1.17
Avg PLO	3	3	2	3	0	1	1	1	0	0	0	0	1.17

S.No:	Text Books	Author	Publisher
1	Mechanics of Materials.	R. C. Hibbeler.	Pearson Prentice Hall
2.	Elements of Strength of Materials	Timoshenko, S. and Young, D. H.,	DVNC
	References		
1.	An Introduction to the Mechanics of Solids	Crandall, S. H., N. C. Dahl, and T. J. Lardner	McGraw Hill
2.	Solid Mechanics	Kazmi, S. M. A.	TMH
3.	Strength of Materials	R. Subramanian	Oxford University Press

List Of Experiments	
S.No.	**Name of Experiments**
1.	Tensile Test of Structural Steel— To determine yield strength, ultimate tensile strength, percentage elongation, and modulus of elasticity of structural steel (Plot, stress-strain curve)
2.	Tensile Test of Reinforcement Steel To determine yield strength, ultimate tensile strength, percentage elongation, and modulus of elasticity of round steel bars (plot stress-strain curve),
3.	Tensile & Compressive strength of timber— a) Parallel to grains, b) Perpendicular to grains.
4.	Torsion test of steel: To measure the angle of twist, ultimate torsional strength, and stress-strain curve.
5.	Shear test of steel/timber—To measure ultimate shear strength, shear modulus, and plot shear stress-strain curve.
6.	Impact test of steel: To determine the impact strength of a notched mild steel test piece using the Charpy test.
7.	Buckling load of columns with various end conditions—To determine the crippling load of columns with different end conditions and compare theoretical values.
8.	Testing of bricks and stones as per IS: Code specifications.

Course Code	**BCIVCBS325**					
Category	**Programme Core Course**					
Course Title	**Basic Surveying**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 3 (Three)**
	3	**0**	**2**	**5**	**4**	
Prerequisites						

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Explain the fundamental principles of surveying and perform chain surveying to measure distances, compute areas, and identify sources of measurement errors.

***ii)* CLO2:** Apply compass and plane table surveying techniques to determine bearings, conduct traverses, detect and correct local attraction, and prepare survey plans.

***iii)* CLO3:** Perform levelling operations to determine Reduced Levels (RLs), prepare level books, and develop longitudinal profiles using appropriate reduction methods.

***iv)* CLO4:** Apply contouring techniques to prepare contour maps and estimate areas and earthwork volumes for civil engineering projects.

***v)* CLO5:** Operate a theodolite to measure horizontal and vertical angles, conduct traverses, compute coordinates, areas, and volumes, and apply surveying techniques for engineering applications.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to Surveying: Importance, Classification, and Principles of Surveying; Error and Types of Errors in Surveying; Sources of Errors. Chain Surveying: Definition- Classifications, Basic principles, Equipment and accessories for ranging and chaining, Methods of Ranging, well-conditioned triangles, Basic introduction to surveying Instruments, like Hand level, Abney Level, Clinometers, Gath Tracer, Sextant, Areas, Errors in linear measurement and their corrections, Obstacles
Module 2.	Compass Surveying: Basic principles; Types of bearings; Systems and conversions; Sources of Errors: Local attraction, Magnetic declination, Dip, Traversing, Plotting, Adjustment of closing error—applications; Plane Table Surveying: Plane table and its accessories; Merits and demerits; Methods; Sources of errors; Applications; Accuracy.
Module 3.	Levelling: Level line, Horizontal line, Datum, Benchmarks, Levels and staves, Temporary and permanent adjustments, Methods of levelling, Procedure in levelling, Booking, Reduction, Curvature and refraction, Reciprocal levelling, Trigonometrical levelling, Sources of errors in levelling, Precise levelling, Types of instruments, Adjustments, Field procedure.
Module 4.	Contouring and Earth Works: Contours: Characteristics, uses and methods of contouring. Earthwork Computation: Determination of area of a traverse, areas from plans, cross-sectional areas, volume from cross-sections.Computation of Areas and Volumes, area from latitude and departure, Simpson's rule and Trapezoidal rule
Module 5.	Theodolite Surveying: Vernier theodolite, Temporary and permanent adjustments, Measurement of horizontal and vertical angles, Methods of repetition and reiteration, Theodolite Traversing, errors in theodolite surveying, elimination of errors. Methods of Prolongation of lines,

	List of Experiments
1	Introduction to Surveying Instruments & Chaining & Ranging Methods
2	Setting of Right angles by Chain and Tape
3	Determination of Fore and Back Bearings by Compass
4	To find out the local attraction of a traverse by compass

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5	To plot the details of a small area (e.g., a building or garden) using the radiation method.
6	To locate inaccessible points (e.g., a flagpole or tree across a pond) using the intersection method.
7	To find out the missing instrument station by resection method.
8	To perform temporary adjustments of a dumpy level and determine the Reduced Levels (RLs) of points along a longitudinal section & cross section.
9	To transfer the datum over a long distance using differential levelling and reduce observations using both standard methods.
10	Preparation of Contour Map by Direct & Indirect Methods.
11	To become familiar with theodolite components and measure a horizontal angle by the method of repetition & reiteration.
12	To measure the vertical angle of an object and calculate its height (e.g., a building or tower) using trigonometry.
13	To prolongate lines by different methods.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	1	2	1	1	1	2	2	2	1	1	1.67
CLO2	3	3	2	2	2	1	1	2	2	3	1	1	1.92
CLO3	3	3	2	2	2	1	1	2	2	3	2	1	2.00
CLO4	3	3	3	2	3	2	2	2	2	2	3	2	2.42
CLO5	3	3	2	3	3	1	1	2	2	2	2	2	2.17
Avg PLO	3.0	3.0	2.0	2.2	2.2	1.2	1.2	2	2	2.4	1.8	1.4	2.03

S.No:	Text Books	Author	Publisher
1.	Surveying, Volume I	Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
2	Surveying and Levelling	N. N. Basak	McGraw-Hill Education
	References		
1.	Surveying, Volume II	Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
2.	Surveying	S. K. Duggal	McGraw-Hill Education
3.	Surveying and Geomatics	K. R. Arora	Standard Publishers Distributors



Course Code	**BCIVCFM325**					
Category	**Programme Core Course**					
Course Title	**Fluid Mechanics**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**2**	**5**	**4**	
Pre requisites						

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1:To analyze various Physical properties of fluids

ii) CLO2: Analyze and perform calculations on Pressure Intensity, force on a plane and curved surfaces, the center of pressure, and metacentric height

iii) CLO3: Perform calculations to determine Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, one, two, and three-dimensional flows, Streamlines, Streak lines, and path lines

iv) CLO4: Determine Euler's equation of motion along a streamline and its integration to yield Bernoulli's equation

v) CLO5: To carry out dimensional analysis for a physical phenomenon occurring in nature

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction Physical properties of fluids: mass density, viscosity,Newton's law of viscosity, compressibility, Bulk Modulous, vapour pressure, surface tension, capillarity; Ideal Fluids and Real Fluids; Newtonian and non-Newtonian fluids.
Module 2.	Fluid Statics Pressure Intensity; Pascal's law; Pressure density-height relationships; Manometers; Pressure on plane and curved surfaces; Centre of pressure; Buoyancy; Stability of immersed and floating bodies; Metacentric height; and its determination.
Module 3.	Fluid Kinematics Steady and unsteady; Uniform and non-uniform; Laminar and turbulent flows; One, two, and three-dimensional flows; Streamlines; Streak lines, and path lines; Conservation of mass; Velocity field and acceleration; Continuity equation; Flow Net, Rotation, circulation, and vorticity; Elementary explanation of stream function and velocity potential.
Module 4.	Fluid Dynamics Euler's equation of motion along a streamline and its integration to yield Bernoulli's equation; Flow measurement: flow through orifice-meter, venturimeter, orifices, mouth-pieces, pitot tube; Various types of notches and weirs under free and submerged conditions; Aeration of Nappe; Momentum equation.
Module 5.	Dimensional Analysis and Hydraulic Similitude Dimensional homogeneity; Buckingham's theorem; Important dimensionless numbers and their significance; Geometric, kinematic, and dynamic similarity; Model Analysis and similitude

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	2	3	2	2	1	1	0	1	0	1	1.58
CLO2	3	3	3	3	2	1	2	1	1	2	0	2	1.92

CLO3	3	3	2	2	1	2	2	1	1	1	1	2	1.75
CLO4	3	3	3	3	1	1	2	1	1	1	1	2	1.83
CLO5	3	3	3	2	2	2	1	1	2	2	1	2	2.0
Avg PLO	3.0	3.0	2.6	2.6	1.6	1.6	1.6	1.0	1.0	1.4	0.6	1.8	1.8

S.No:	Text Books	Author	Publisher
1.	A Textbook of Fluid Mechanics and Hydraulic Machines	R K Bansal	Laxmi Publication
2.	Engineering Fluid Mechanics	R. J. Garde, and A.G. Mirajgaokar	New Age International Publishers and Scitech Publications
	References		
1.	Fluid Mechanics	F. M. White	McGraw-Hill
2.	Fluid Mechanics	V. L. Streter, E. B. Wylie, and K. W. Bedford	McGraw Hill
3.	Fluid Mechanics: Fundamentals and Applications	Yunus A. Cengel and John M. Cimbala	McGraw Hill

List of experiments

1	To determine the metacentric height of a ship model experimentally.
2	To verify Bernoulli's equation experimentally.
3	To determine the coefficient of discharge, coefficient of velocity, and coefficient of Contraction of an orifice
4	To determine the coefficient of discharge, coefficient of velocity, and coefficient of Contraction of an venturimeter
5	To determine the coefficient of discharge, coefficient of velocity, and coefficient of Contraction of a mouthpiece
6	To calibrate an orifice meter and to study the variation of coefficient of discharge with Reynold's number.
7	To calibrate a Venturimeter and to study the variation of coefficient of discharge with Reynold's Number.
8	To calibrate the sharp-crested rectangular weir and the triangular weir

Course Code	BCIVCBM325					
Category	Programme Core Course					
Course Title	Building Materials and Construction					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 3 (Three)
	3	0	0	3	3	
Pre requisites						

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Identify and differentiate the basic materials used in building construction.

ii) CLO2: Understand the applications of modern and traditional materials.

iii) CLO3: Interpret building elements and their construction.

iv) CLO4: Understand the manufacturing process of various materials.

v) CLO5: Understand the function and materials used in building components like doors, windows, lintels.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction and Basics: functions of buildings; elements of a building; terminology; role of materials in construction; basic building materials: Lime, Cement, Aggregates, Mortar: classification, uses and their tests; Metals: steel (reinforcing steel, structural steel), cast iron, aluminium.
Module 2.	Timber: structure, classification, seasoning, defects, preservation, applications, plywood, veneers; Stone: types, properties, selection, dressing, deterioration and preservation of stonework; Bricks: Manufacture, properties, classification, defects, tests, special and advanced bricks; Concrete: Ingredients, classification, Concrete blocks, types of concrete blocks, advantages and disadvantages of concrete blocks.
Module 3.	Properties of building materials: Factors affecting properties of building materials, the importance of studying properties of building materials, introducing various properties of building materials e.g., structural properties, thermal, fire-related properties, and acoustic properties.
Module 4.	Construction Techniques/ Basic Building Construction: Foundations: Shallow, deep, pile, raft; Brick Masonry: Characteristics and requirements of good brick masonry, bonds in brick work; Stone Masonry: Requirements and classification of stone masonry; Plinth, Cavity Walls, Arches, Doors, Windows, Roofs, Trusses, Floors, Lintels, Beams, Columns, Slabs (Basic).
Module 5.	Finishes, Services, and Special Construction: Finishing Operations: Plastering, Pointing, Painting, Varnish, Distemper, Damp Proofing; Staircases, ramps, lift; Insulation and acoustics; Special materials/modern materials (composites, fiber reinforced etc).

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	2	1	1	1	1	1	2	0	1	1.33
CLO2	3	2	2	0	1	2	2	1	1	2	0	1	1.41
CLO3	3	2	3	1	2	0	1	2	1	1	1	0	1.42
CLO4	3	2	1	2	1	2	2	1	1	2	0	1	1.5

CLO5	**3**	**2**	**3**	**0**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**0**	**1.16**
Avg PLO	**3**	**2**	**2**	**1**	**1.2**	**1.2**	**1.4**	**1**	**1**	**1.6**	**0.4**	**0.6**	**1.364**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Building Materials and Construction, Ist Edition.	Bhavikatti, S.S. (2014)	Vikas Publishing House Pvt. Ltd.
2	Building Materials, 3rd Edition	Duggal S.K. (2010)	New Age International Pvt. Ltd.
	References		
1.	Building Materials and Construction, Ist Edition.	Sahu, Joygopal, (2015)	McGraw Hill
2.	Building Materials and Construction, Ist Edition.	Patil, R.Y, Dharane, S.S. (2024)	Shine Book Publishing
3.	Materials and Construction	Pratt (2025)	Hutson Street Press

Course Code	**BCIVBPD325**					
Category	**Basic Science Course**					
Course Title	**Partial Differential Equations and Integral Transforms**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**0**	**3**	**3**	
Pre requisites	**Mathematics-I, Mathematics-II**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1:** Classify and distinguish between linear and non-linear partial differential equations

ii) CLO2: Explain the fundamental concepts of Laplace transforms, vector spaces, and multivariate calculus structures.

iii) **CLO3**: Evaluate the consistency of systems of linear equations and analyze the physical and geometric meaning of mathematical models, such as wave equations, periodic functions, and optimization boundaries.

iv) **CLO4**: Synthesize concepts from linear algebra, integral calculus, and differential equations to model, solve, and analyze complex engineering systems

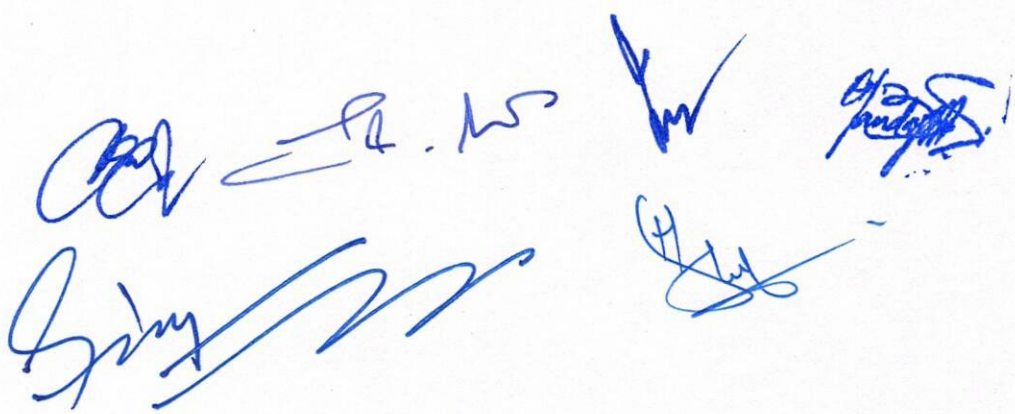
v) **CLO5:** Construct, formulate, and sketch geometric transformations, coordinate changes (Jacobians), and change of limits in multiple integrals to solve engineering boundary-value problems.

Theory Module(Internal and External Evaluation)

M.No:	**Topic**
Module 1.	Partial Differential Equations: Formation of partial differential, Partial differential equations of first order. Linear and non linear partial differential equations of order one, Lagrange's linear equations, standard forms, Charpit's method, Homogeneous and non homogeneous linear partial differential equations with constant coefficients.
Module 2.	Applications of partial differential equations: Vibration of a stretched flexible string, Heat flow equation, wave equation, solutions by the method of separation of variables
Module 3.	Laplace transform: Laplace transform, condition for the existence of Laplace transform, Laplace transform of some elementary functions, differentiation and integration of laplace transform, laplace transform of periodic functions, shifting theorem, Laplace transforms of different functions. Heavisides unit function, dirac delta function, its Laplace transform, Heaviside's expansion theorem.
Module 4.	Inverse Laplace transforms: initial and final value theorems, convolutions theorem and applications, uses of Laplace transforms in the solutions of linear differential equations.
Module 5.	Fourier transform: Finite Fourier transform, fourier integral formula, properties of fourier transform, fourier sine and cosine transform. Convolution theorem, parseval's identity for the fourier transform. Applications to the solutions for the boundary value problems

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO 1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg PLO
CLO1	3	2	0	0	0	0	0	0	0	0	0	1	0.50
CLO2	3	2	0	0	1	0	0	0	0	0	0	1	0.58
CLO3	3	3	2	2	2	0	0	0	0	0	0	1	1.08
CLO4	3	3	3	2	2	0	0	0	0	0	0	2	1.25
CLO5	3	3	2	3	2	0	0	0	0	0	0	2	1.25
Avg PLO	3	2.6	1.40	1.40	1.40	0	0	0	0	0	0	1.40	0.93

S.No:	Text Books	Author	Publisher
1.	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India
2	Advanced Engineering Mathematics,	H. K. Dass,	S. Chand Publishing.
3	Higher Engineering Mathematics	B. S. Grewal,	Khanna Publishers.
	References		
1.	Laplace Transforms (Schaum's Outline Series)	Murray R. Spiegel,	McGraw-Hill Education.
2.	Advanced Engineering Mathematics,	Michael D. Greenberg	Pearson Education.
3.	Elements of Partial Differential Equations	Ian N. Sneddon	McGraw-Hill Education.



Course Code	**BCIVLCD325**					
Category	**Programme Core Course**					
Course Title	**Computer Aided Civil Engineering Drawing**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 3 (Three)**
	0	**0**	**4**	**4**	**2**	
Pre requisites	**Computer Aided Design (CAD), Building construction, Building materials**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i)* CLO1*: Explain building classification, planning principles, building bye-laws and identify basic masonry and concrete structural components of buildings.

ii)* CLO2*: Prepare detailed 2D drawings of residential buildings with load-bearing wall systems, including plans, elevations, sections, joinery details, and service layouts as per standard specifications.

iii) CLO3: Model and draft multi-storey RCC residential buildings with non-load-bearing wall systems using column-beam framing, ensuring structural coordination, accuracy, and compliance with construction standards.

iv)* CLO4*: Develop functional planning and detailed drawings for commercial buildings and industrial buildings in accordance with building bye-laws and circulation requirements

v)* CLO5*: Use modern drafting, modelling and efficiently utilize basic commands, configuration toolbars, and establish foundational project settings for 3D structural modeling.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Classification of Buildings and Planning Principles: Classification of buildings, fundamental principles of planning, standard dimensions of buildings; building bye-laws relating to floor area ratio (FAR), open spaces, and setbacks; orientation of buildings; requirements of lighting and ventilation; introduction to masonry and concrete structural elements. Overview of building components
Module 2.	Residential Building Plans (Load Bearing Walls): Development of single-storey and multi-storey residential building plans using load-bearing (masonry) construction principles. Preparation of floor plans, elevations, and sectional views (2D & 3D) following standard specifications. Detailed representation of various building components . Introduction to joinery details, electrical and plumbing fixtures, fittings, and interior/exterior finishes.
Module 3.	Modelling Multi- storey Building Plans (Non-load bearing walls): Planning, modelling, and preparation of sketches and working 2D drawings for multi-storey (G+4) RCC structures using column-beam framed systems with flat roofs. Development of detailed component with plumbing layouts. Emphasis on structural coordination, drafting accuracy, and adherence to standard construction specifications.
Module 4.	Modelling Commercial Building Plans (Non-Load Bearing Walls): Preparation of building plans and elevations for commercial structures and single-storey industrial buildings. Detailed drawings of typical floor plans with elevations depicting staircases and framing arrangements. Focus on functional planning, circulation, service cores, and compliance with relevant building bylaws.

Module 5.	Modelling residential buildings (3-D): Working with basic commands & toolbars, Modeling of various 3D figures, Modeling the dimensional residential building – Creating layers, walls, floors, roofs, internal walls. Adding doors, windows, curtain walls, stairs, furniture. Modifying the elements. Developing multi sections and elevations, Modeling multi storey residential buildings

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	2	1	1	2	2	1	0	0	0	1	1.3
CLO2	3	3	3	2	2	1	1	1	1	1	1	1	1.8
CLO3	3	3	3	2	3	1	2	1	1	2	1	2	2.0
CLO4	3	3	3	2	2	2	2	1	1	2	2	1	2.0
CLO5	2	2	2	1	3	2	2	2	2	3	2	3	2.2
Avg PLO	2.8	2.6	2.6	1.6	2.2	1.6	1.8	1.2	1.0	1.8	1.2	1.6	1.86

S.No:	Text Books	Author	Publisher
1.	Computer Aided Civil Engineering Drawing	D.Chandra Mouli, B.Swathi	Khanna Publishing House
2	Autodesk Revit 2025	Gaurav Verma and Matt Weber	Cadcamcae Works
	References		
1.	Revit for Architecture:	Eric Wing	John Wiley & Sons (Sybex)
2.	National Building Code of India	(NBC)Bureau of Indian Standards	BIS, New Delhi
3.	Mastering Autodesk Revit	Robert Yori, Marcus Kim, Lance Kirby	John Wiley & Sons

Course Code	BCIVCSA425					
Category	Programme Core Course					
Course Title	Structural Analysis					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 4 (Four)
	2	1	0	3	3	
Pre requisites	Physics, Mathematics, Strength of Materials.					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i*) CLO1:** ***Understand: Apply basic concepts of structural mechanics for the analysis of statically determinate structures.

ii)* CLO2:** ***Analyze: Analysis deflection of statically determinate structures under various loading and support conditions.

iii)* CLO3:** ***Apply: Apply concepts of structural mechanics for the analysis of statically determinate arches and stiffened suspension bridges.

iv)* CLO4:** ***Analyze: Apply concept of Influence Line Diagram to statically determinate structures.

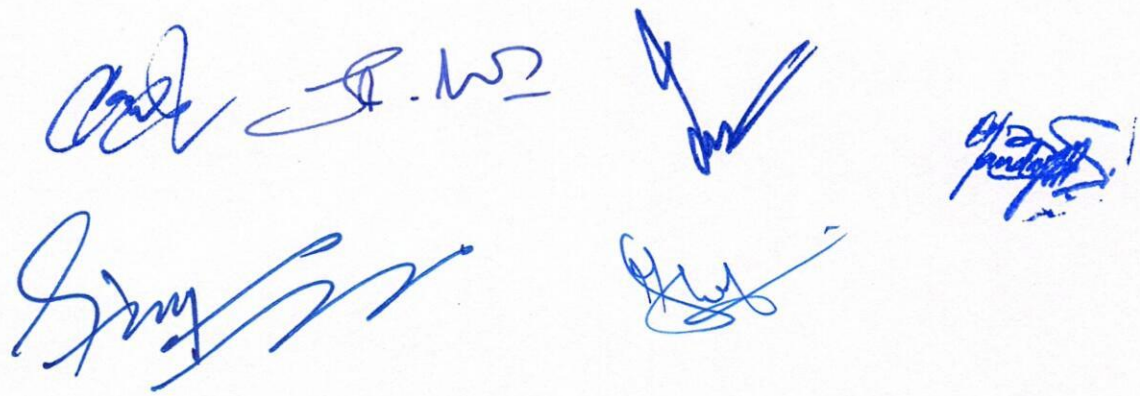
v)* CLO5:** ***Understand: Identify the behavior of statically determinate structures under various loading and support conditions

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to structural analysis, Significance of structural analysis, static and kinematic indeterminacy, stability and determinacy, methods of analysis based on equilibrium equations and compatibility requirements, principle of superposition.
Module 2.	Deflection of Beams: Definition of slope, Deflection, and curvature, Sign conventions in beams, Elastic beam theory, Double integration method, Moment area method and Conjugate beam method.
Module 3.	Influence lines for cantilever beam, simply supported beam, overhanging beam and pin jointed trusses. Criteria for maximum shear force and bending moment under moving loads for simply supported beams, absolute maximum bending moment.
Module 4.	Suspension cable with three hinged stiffening girders. Influence line diagrams for horizontal tension in the cable, shear force and bending moment at any section of the stiffening girder.
Module 5.	Struts subjected to axial loads, concept of buckling. Euler's buckling theory of struts with different boundary conditions. Rankine's buckling theory for columns. Struts subjected to eccentric and lateral loads and struts with initial curvature.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	3	2	0	1	1	1	0	0	0	1	1.17
CLO2	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO3	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO4	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO5	3	3	2	3	0	1	1	1	0	0	0	0	1.17
Avg PLO	3	2.8	2.2	2.8	0	1	1	1	0	0	0	0	1.17

S.No:	Text Books	Author	Publisher
1.	Structural analysis.	R. C. Hibbeler.	Pearson Prentice Hall
2	Basic Structural Analysis.	C.S. Reddy	Tata McGraw Hill
	References		
1.	Theory of Structures.	S. Timoshenko and Young	Tata McGraw Hill
2.	Structural Analysis.	L.S. Negi and R.S. Jangid	Tata McGraw Hill
3.	Fundamentals of Structural Analysis.	Kenneth Leet	Tata McGraw Hill



Course Code	BCIVLAS425					
Category	Lab Course					
Course Title	Advanced Surveying					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 4 (Four)
	0	1	4	5	3	
Prerequisites	Basic Surveying					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1:** Explain the principles of tacheometry, trigonometrical levelling, and geodetic observations, and determine horizontal distances and elevations using appropriate surveying methods.

ii) **CLO2:** Analyse and adjust survey observations by applying principles of error theory, traverse adjustment methods, and basic least squares techniques to improve the accuracy and reliability of survey data.

iii) **CLO3:** Apply surveying principles for setting out engineering works, including buildings, roads, bridges, tunnels, and horizontal curves, in accordance with design requirements.

iv) **CLO4:** Operate Electronic Distance Measurement (EDM) instruments and Total Station to perform topographic surveys, setting-out operations, and digital data processing for civil engineering applications.

v) **CLO5:** Explain the fundamentals and applications of modern geospatial technologies, including GPS/GNSS, Remote Sensing, GIS, and Aerial photogrammetry, for surveying and infrastructure development.

Theory Module (Internal Evaluation)

M. No.:	Topic
Module 1.	Tacheometry and Trigonometric Levelling: Tacheometry, Principles, Methods,, Methods with staff held vertical and normal, Anallactic Lens, Subtense bar, Tangential method, Trigonometric levelling, Observations for heights and distances, Introduction to Geodetic Surveying, Geodetic observations, Corrections for refraction, curvature, axis signal, Reciprocal observations
Module 2.	Types of errors, principles of error distribution, residuals, most probable value, weights of observations, Basic principles of Least Squares Adjustment and its applications in survey data processing, Adjustment of Level Networks, compass and theodolite traverses, Bowditch Rule, Transit Rule, closing error, precision, and accuracy.
Module 3.	Setting Out Works: Introduction, Equipment and Tools Used in the Setting Out, Fixing and Marking a Control Station, Horizontal and Vertical Control, Setting Out Buildings, Culverts and Bridges, Tunnels, Transfer of Alignment, Curve Setting, Horizontal Curves, Elements of Simple and Compound Curves, Methods of Setting Out, Reverse Curve, Transition Curve, Elements of Cubic Parabola, True Spiral, and Cubic Spiral.
Module 4.	Electromagnetic Distance Measurement (EDM) and Total Station: Electromagnetic Distance Measurement (EDM): Principle and Types. Total Station: Components, Working Principle, Temporary Setup and Orientation, Methods of Surveying Using Total Station, Topographic Survey, Control and Offset Survey, Contour Survey, Building Setting Out, Angle and Distance Measurement, Calculation of Area and Volume, Road Survey, Data Downloading and Processing, Generation of Digital Survey Maps, Applications of Total Station in Civil Engineering.
Module 5.	Advanced Survey Equipment and Techniques: Fundamentals of GPS and GNSS, Basics of GPS/GNSS (including DGPS), Principles of Remote Sensing (EMS, sensors), Working Principle of GPS, Satellite Ranging, Calculating Position, Ranging Errors and Their Correction, An Introduction to GIS, and Concepts of Aerial Photogrammetry (Parallax, Stereoscopy), Spatial and Attribute Data in GIS, Applications in Civil Engineering.

Activity Module	
1	**Tacheometric Survey for Contour Mapping** – Conduct a tacheometric survey of a selected site using a tacheometer/theodolite and prepare contour maps. Compare the results with conventional leveling.
2	**Trigonometric Leveling Exercise** – Determine the height of inaccessible objects such as buildings, towers, or hills using trigonometric leveling methods and compare the results with known values.
3	**Traverse Survey and Least Squares Adjustment** – Perform a closed traverse using a theodolite or total station, compute closing error, and adjust observations using Bowditch Rule and Least Squares Adjustment
4	**Setting-Out of a Building Layout** – Set out the foundation layout of a residential or institutional building using total station/theodolite, including centerlines, offsets, and benchmarks
5	**Horizontal Curve Setting-Out** – Design and set out a simple circular curve or transition curve for a proposed roadway alignment using field surveying techniques
6	**Topographic Survey Using Total Station** – Carry out a topographic survey of the campus or a selected area using a Total Station, process the collected data, and generate contour maps and digital terrain models
7	**Road Alignment and Earthwork Survey** – Survey a proposed road alignment, generate longitudinal and cross-sections, and estimate earthwork quantities using digital survey data
8	**GPS/GNSS Survey and Coordinate Determination** – Determine the coordinates of selected control points using handheld or DGPS/GNSS receivers and compare them with conventional survey results
9	**GIS-Based Survey Data Integration** – Import field survey data into GIS software (QGIS/ArcGIS), create thematic layers, attribute tables, and spatial maps for engineering applications
10	**Integrated Surveying Project** – Working in groups, execute a complete survey project involving reconnaissance, establishment of control points, Total Station/GNSS survey, contour mapping, GIS integration, quantity computation, and preparation of a final survey report with maps and drawings.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	1	2	1	1	1	2	2	2	2	1	1.67
CLO2	3	3	1	3	2	1	1	2	2	2	1	2	1.92
CLO3	2	3	3	2	2	3	2	2	3	3	3	2	2.50
CLO4	2	2	2	3	3	1	1	2	2	2	2	3	2.08
CLO5	2	1	1	2	3	2	3	2	1	2	1	3	1.92
Avg PLO	2.25	2.4	1.6	2.4	2.2	1.6	1.6	2	2	2.2	1.8	2.2	2.01

S. No.:	Text Books	Author	Publisher
1.	Surveying, Volume II	Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
2	Surveying and Geomatics	K. R. Arora	Standard Publishers Distributors
	References		
1.	Surveying	S. K. Duggal	McGraw-Hill Education
2.	Surveying and Levelling	N. N. Basak	McGraw-Hill Education
3.	Advanced Surveying	Satheesh Gopi	Pearson Education



Course Code	**BCIVHPM425**					
Category	**Humanities,Management & Social Science Course**					
Course Title	**Project Management & Network Analysis**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 4 (Four)**
	3	**0**	**0**	**3**	**3**	
Pre requisites	**Mathematics II, Engineering Graphics, Basic Surveying, Building Materials and Construction.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Understand the fundamental concepts, principles, life cycle, and significance of project management in civil engineering projects

***ii)* CLO2:** Compare various project planning and scheduling techniques, including bar charts, milestone charts, Work Breakdown Structure (WBS), CPM, and PERT, based on their applications, advantages, and limitations

***iii)* CLO3:** Interpret project schedules, network diagrams, earned value parameters, resource allocation strategies, and project risks to monitor and evaluate project performance

***iv)* CLO4:** Draw project schedules and network diagrams using Bar Charts, CPM, and PERT for planning, scheduling, and resource management of engineering projects

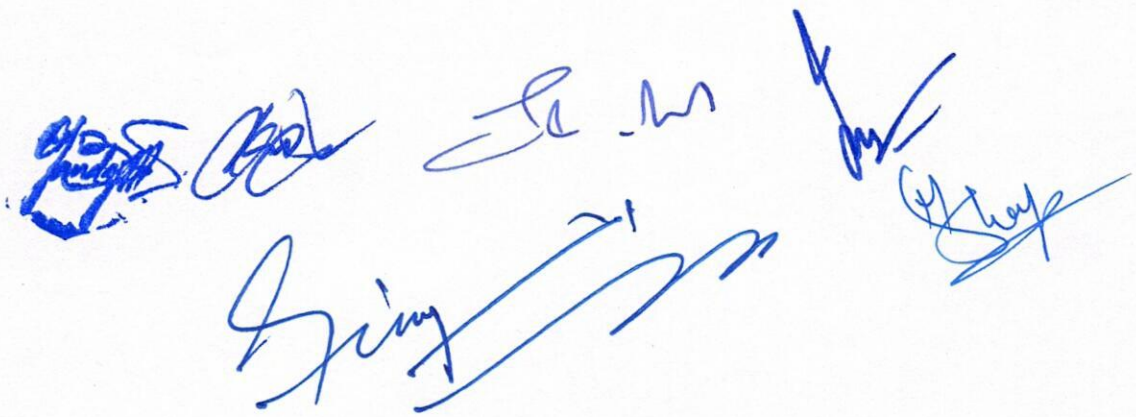
***v)* CLO5:** Integrate planning, scheduling, time-cost optimisation, resource management, and risk mitigation techniques for effective project execution

Theory Module (Internal and External Evaluation)

M. No.:	Topic
Module 1.	Introduction to Project Management: Definition and concept of a project; characteristics of projects and examples; project management concepts and definitions; importance and scope of project management; project management cycle; stages and methods of project management
Module 2.	Project Planning: Work breakdown structure, scheduling by bar charts, limitations of bar charts, milestone charts, and multiple calendar date scheduling using bar charts. Project planning framework, time, cost, and quality balancing, baseline planning, project monitoring and control techniques, earned value management (EVM) basics, risk identification and assessment, risk response planning, and contingency planning.
Module 3.	Network Techniques in CPM: Introduction to network techniques, classification of activities, rules for developing networks, network development, logic of networks, numbering events, network analysis, determination of project schedules, critical path, floats in activities, updating, resource allocation, resource smoothing, and resource levelling.
Module 4.	Network Techniques in PERT: Probability concept in network, optimistic time, pessimistic time, most likely time, lapsed time, deviation, variance, standard deviation, slack, critical path, probability of achieving completion time, and central limit theorem.
Module 5.	Cost-Time Analysis: Cost versus time, direct cost, indirect cost, total project cost, optimum duration, contracting the network for cost optimisation, and steps in time cost optimization.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	0	0	1	0	1	0	0	2	1	0.91
CLO2	2	3	3	1	2	0	0	0	0	1	2	1	1.25
CLO3	2	3	2	2	2	1	0	0	0	1	2	2	1.41
CLO4	2	2	3	1	3	0	0	0	0	2	1	1	1.25
CLO5	3	3	3	2	2	2	1	1	2	1	3	2	2.08
Avg PLO	2.4	2.6	2.4	1.2	1.8	0.8	0.2	0.4	0.4	0.8	2	1.4	1.38

S.No:	Text Books	Author	Publisher
1.	Project Management	Mantel, S.J., Meredith, J.R., Shafer, S.M.	Wiley
	References		
1.	Project Management	Cleland, Gray and Laudon,	Tata McGraw



Course Code	**BCIVCCT425**					
Category	**Programme Core Course**					
Course Title	**Concrete Technology**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 4 (Four)**
	3	**0**	**2**	**5**	**4**	
Pre requisites	**Building Materials and Construction.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy.

ii) CLO2: Acquire and apply fundamental knowledge of fresh and hardened properties of concrete.

iii) CLO3: Design a concrete mix that fulfills the required properties for fresh and hardened concrete.

iv) CLO4: Develop an awareness of the utilization of waste materials as a novel, innovative materials for use in concrete.

v) CLO5: Assemble the effect of the environment on service life performance, properties, and failure modes of structural concrete and demonstrate techniques of measuring the Non-Destructive Testing of concrete structure.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Cement: different types, and properties, manufacturing of Portland cement, chemical composition and hydration of cement, tests on cement as per IS specifications; Aggregates: classification, physical and mechanical properties and tests as per BIS, grading requirements, bulking of sand, moisture and deleterious substances; Water: Quality of water for use in concrete.
Module 2.	Introduction to shrinkage, creep and maturity of concrete, shrinkage accelerators, retarders, plasticizers, superplasticizers, waterproofers, mineral admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline, effects on concrete properties.
Module 3.	Workability, tests for the workability of concrete, segregation and bleeding of concrete, determination of strength properties of hardened concrete, compressive strength, split tensile strength, flexural strength, Non-destructive testing (Rebound hammer, UPV) stress-strain curve for concrete, modulus of elasticity, durability of concrete, water absorption, permeability, sulphate attack, chloride ingress, carbonation, corrosion test, acid resistance, mixing, transporting placing, compacting and curing of concrete.
Module 4.	Principles of mix proportioning, properties of concrete related to mix design, physical properties of materials required for mix design, design mix and nominal mix, BIS Method of Mix Design- Mix Design Examples.
Module 5.	Light weight concrete, foam concrete, self-compacting concrete, vacuum concrete, high strength concrete, fiber-reinforced concrete, ferro cement, ready mix concrete, SIFCON - shotcrete, polymer concrete, high-performance concrete, geopolymer concrete.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	3	1	1	0	1	0	0	0	1	1	1.16
CLO2	3	3	2	2	1	0	1	0	0	0	0	1	1.08
CLO3	3	3	3	2	2	0	2	0	1	1	2	1	1.67
CLO4	2	2	3	2	1	1	3	1	0	1	0	3	1.58

CLO5	3	3	2	3	3	1	3	1	1	1	1	2	1.92
Avg. PLO	2.8	2.8	2.6	2	1.6	0.4	2	0.4	0.4	0.6	0.8	1.6	1.48

S.No:	Text Books	Author	Publisher
1.	Concrete Technology, 2nd Edition	Neville, A.M, Brooks, J.J, (2010)	Pearson Education
2	Concrete Technology, 8th Edition	Shetty, M.S, (2022)	S. Chand & Company
	References		
1.	Properties of concrete, 5th Edition	Neville, A.M, (2011)	Pearson Education
2.	Concrete Construction Handbook, 3rd Edition	Waddel, (1993)	McGraw Hill.
3.	Relevant IS Codes- IS 456, IS 10262, IS 383,IS 516		Bureau of Indian Standards

List of Experiments

1.	Grading and Zoning of Fine Aggregates .
2.	Specific gravity of Fine Aggregates.
3.	Grading and Zoning of Coarse Aggregates.
4.	Determination of water absorption of Coarse Aggregates.
5.	Determination of Fineness of cement.
6.	Determination of Initial Setting Time and Final Setting Time of cement.
7.	Determination of Standard Consistency of cement.
8.	Determination of Unsoundness of cement.
9.	Determination of Consistency of fresh concrete by Slump test.
10.	Determination of Workability of freshly mixed concrete by Compaction Factor Test.
11.	Determination of Compressive Strength of concrete for different mixes and different W/C ratios.
12.	Determination of Tensile Strength of concrete by Cylinder Splitting Test.
13.	Determination of Flexural Strength of Concrete Beam.

Course Code	**BCIVCHE425**					
Category	**Programme Core Course**					
Course Title	**Highway Engineering**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 4 (Four)**
	2	**1**	**2**	**5**	**4**	
Prerequisites	**Engineering Graphics, Basic Surveying, Building Material & Construction, Strength of Materials.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Understand the fundamentals of highway engineering, road development, road classification, transportation systems, and geometric design principles.

***ii)* CLO2:** Compare different highway alignment options, pavement types, construction materials, and pavement design approaches based on their characteristics, applications, and performance.

***iii)* CLO3:** Evaluate the engineering properties of highway materials, pavement design parameters, and causes of pavement failures for design modifications and maintenance decisions.

***iv)* CLO4:** Draw highway geometric design elements, pavement cross-sections, and alignment layouts in accordance with IRC guidelines.

***v)* CLO5:** Design highway pavements by integrating material selection, pavement design, and modern recycling technologies.

Theory Module (Internal and External Evaluation)

M. No.:	**Topic**
Module 1.	Introduction: History of road development in India, classification of roads, modes of transportation & its socio-economic impact.
Module 2.	Alignment and Geometric Design: Highway location and alignment, factors controlling alignment, Highway cross-section elements, Sight distances, Design of horizontal alignment, Design of vertical alignment.
Module 3.	Highway materials and construction: Soil characteristics and tests, soil stabilization, aggregate characteristics and tests, bituminous materials, and cement. Bituminous mix design (Marshall Method), Introduction to advanced & recycled road materials.
Module 4.	Pavement design: Types of pavements, Design factors, Design of flexible and rigid pavements by IRC method
Module 5.	Pavement Maintenance & Evaluation: Pavement failures, maintenance techniques and recycling, Evaluation and strengthening of existing pavements, New technologies such as FDR, CTB, and cold mix.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	0	0	0	2	0	0	0	0	1	0.75
CLO2	2	3	2	1	0	0	2	0	0	0	0	1	0.92
CLO3	3	3	2	2	1	0	2	0	0	0	0	0	1.08
CLO4	2	2	3	1	3	0	1	0	0	2	0	0	1.16
CLO5	3	3	3	2	2	2	3	1	0	0	2	2	1.2
Avg PLO	2.6	2.6	2.2	1.2	1.2	0.4	2	0.2	0	0.4	0.4	0.8	1.02

S.No:	Text Books	Author	Publisher
1.	Highway Engineering.	Khanna, S.K. and Justo.	Nem Chand & Bros., Roorkee, India
	References		
1.	Principles of Transportation and Highway Engineering.	Rao, G.V.	Tata McGraw-Hill Education Pvt. Ltd., New Delhi
2.	Highway and Traffic Engineering	Saxena, S. C.,	CBS Publishers & Distributors Pvt. Ltd., New Delhi
3.	Highway Engineering	Bhanot, K.L.	Satya Prakashan, New Delhi

Highway Materials Lab	
Experiment No:	**Name of Experiment**
1.	Gradation Test
2.	Aggregate Impact Test
3.	Los Angeles Abrasion Test
4.	Aggregate Crushing Value Test
5.	Specific Gravity and Water Absorption Tests
6.	Shape Tests
7	Soundness Test
8.	Stripping Value of Road Aggregates
9.	Penetration Test
10.	Ductility and Elastic Recovery Tests
11.	Softening Point Test
12.	Specific Gravity Test on Bitumen
13.	Flash and Fire Point Tests
14.	Marshall Stability Test
15.	CBR Test.

Lab Manual	Highway Materials and Pavement Testing	S.K. Khanna, C.E.G Justo, A. Veeraragavan	Nem Chand & Bros., Roorkee

Course Code	BCIVBCA425					
Category	Basic Science Course					
Course Title	Complex Analysis and Special Functions					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 4 (Four)
	3	0	0	3	3	
Pre requisites	Engineering Mathematics-I, Engineering Mathematics-II					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1** Compare the fundamental characteristics and fields of application for periodic functions and Fourier analyses against various numerical methods.

ii) **CLO2:** Draw and analyze interpolating curves and surfaces that precisely fit diverse structural and scientific data.

iii) **CLO3**: Interpret complex engineering systems by determining efficient numerical solutions for large linear algebraic equations and non-linear root-finding problems.

iv) **CLO4:** Assemble innovative system models by synthesizing the principles of Fourier transforms, numerical integration, and iterative methods to solve multi-disciplinary problems.

v) **CLO5**: Understand and evaluate model accuracy and fit using methods of interpolation and advanced regression analysis.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Review of complex numbers, Cartesian and polar form of a complex number, Functions of a complex variable, Limits, continuity and Differentiability of complex functions, Analytic functions, The necessary condition for the function to be analytic functions, Harmonic functions.
Module 2.	Cauchy's fundamental theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives Cauchy's inequality and Liouville's theorem, Taylor's and Laurent's expansions,
Module 3.	Zeros and poles of analytic functions, Residues, Cauchy's residue theorem, Evaluation of integrals with the help of residue and Contour integration. Conformal Mappings,
Module 4.	Power series solutions of differential equations, ordinary point, solution about singular point, Frobenius Method.
Module 5.	Bassel's functions, Recurrence formulae and Bessel's functions of integral order Legendre's functions, Rodrigues's formula, generations functions for Legendre's polynomials and recurrence formulae.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg PLO
CLO1	3	3	0	0	0	0	0	0	0	0	0	1	0.58
CLO2	3	2	0	1	2	0	0	0	0	0	0	1	0.75
CLO3	3	3	2	3	2	0	0	0	0	0	0	1	1.17
CLO4	3	3	2	3	2	0	0	0	0	0	0	2	1.25
CLO5	3	3	2	3	2	0	0	0	0	0	0	2	1.25
Avg PLO	3	2.8	1.2	2	1.6	0	0	0	0	0	0	1.4	0.92

S.No:	Text Books	Author	Publisher
1.	Advance Engineering Mathematics	R.k.Jain and S.R.K Iyengar	Narosa Publishing House
2	Advance Engineering Mechanics	Erwin Kreyszig	John wiley and sons
3.	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications
	References		
1.	Complex Variables and Applications Transfer	J.W. Brown and R.V. Churchill	McGraw- Hill
2.	Theory of Functions fo complex variables	E.T. Copson	Oxford University Press

Course Code	BCIVCIS525					
Category	Programme Core Course					
Course Title	Analysis of Indeterminate Structures					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 5 (Five)
	2	1	2	5	4	
Pre requisites	**Physics, Mathematics, Strength of Materials. Structural analysis.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Identify, understand and determine the degree of kinematic and static degree of indeterminacy of various types of structures.

***ii)* CLO2:** Analysis of the deflections, bending moments and shear force through energy methods in determinate and indeterminate structures.

iii)* CLO3:*: Understand the basic concepts of force and displacement methods.

***iv)* CLO4:**: Analysis of structures through force and displacement methods.

***v)* CLO5:** Analysis of determinate and indeterminate beams, plane frames and space frames.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Force methods: Analysis of Propped cantilevers, Continuous and Fixed Beams, frames and trusses using energy methods; Betti-Maxwell's Reciprocal theorem, Castigliano's 1st and 2nd theorem of minimum energy, and Method of consistent deformation. Clapeyron's Three Moment equation for fixed and continuous beams.
Module 2.	Displacement methods: Slope and deflection method: Analysis of indeterminate Beams (with and without yielding supports) and Frames (with and without Sway).
Module 3.	Distribution factors, analysis of indeterminate Beams (with and without yielding supports) and Frames (with and without sway) by moment distribution method.
Module 4.	Influence Line Diagrams (ILDs): Analysis of statically indeterminate beams using Muller-Breslau's principle. Arches: Normal thrust, shear force, and bending moment for two and three hinged arches. Influence lines for normal thrust, shear force and bending moment for three hinged parabolic arches.
Module 5.	Plastic analysis of beams and rectangular portal frames using plastic modulus, load factor, and relevant theorems.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	3	3	0	1	1	1	0	0	0	1	1.17
CLO2	3	3	3	3	0	1	1	1	0	0	0	0	1.17
CLO3	3	3	3	3	0	1	1	1	0	0	0	0	1.17
CLO4	3	3	3	3	0	1	1	1	0	0	0	0	1.17
CLO5	3	3	3	3	0	1	1	1	0	0	0	0	1.17
Avg PLO	3	3	2.2	2.8	0	1	1	1	0	0	0	0	1.17

S.No:	Text Books	Author	Publisher
1.	Structural analysis.	R. C. Hibbeler.	Pearson Prentice Hall
2	Indeterminate Structural Analysis	C. K. Wang	Tata McGraw Hill
	References		
1.	Theory of Structures.	S. Timoshenko and Young	Tata McGraw Hill
2.	Structural Analysis.	L.S. Negi and R.S. Jangid	Tata McGraw Hill
3.	Elementary Theory of Structures.	Yuan Yu Hsieh	Prentice Hall
4.	Fundamentals of Structural Analysis.	Kenneth Leet	Tata McGraw Hill

List Of Experiments	
S.No.	**Name Of Experiments**
1.	Deflection of curved beams.
2.	Behavior of portal frame under different load combinations.
3.	Deflection of Truss.
4.	Behavior of a cantilever beam under symmetrical and unsymmetrical loading.
5.	Analysis of a redundant joint.
6.	Verification of Maxwell's Theorem— To verify the principle of Maxwell's theorem.
7.	Analysis of two hinged arches.
8.	Verification of Horizontal Thrust in a 3-Hinged Arch To evaluate experimentally horizontal thrust in a 3-hinged arch and draw an influence line diagram for the horizontal thrust.

Course Code	**BCIVCSM525**					
Category	**Programme Core Course**					
Course Title	**Soil Mechanics**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 5 (Five)**
	2	**1**	**2**	**5**	**4**	
Prerequisites	**Physics, Strength of Materials**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Classify soils and understand their origin, phase relationships, and fundamental engineering properties.

ii) CLO2: Analyse the significance of soil permeability (k) and its role in soil behaviour.

iii) CLO3: Solve and interpret problems related to consolidation settlement and field compaction.

iv) CLO4: Compute stress distribution in soil masses and analyse effective stress principles.

v) CLO5: Apply appropriate field and laboratory soil investigation methods.

Theory Module (Internal and External Evaluation)

M.No:	**Topic**
Module 1.	Historical development of soil engineering; Origin and general types of soils; Three-phase system; Index properties; Identification and Classification of soils; Clay mineralogy.
Module 2.	Flow through soils; Darcy's Law; Permeability factors and determination in lab and field; Permeability factor for stratified soil; Seepage force; Laplace equation for steady-state flow; Flow net for homogeneous embankments.
Module 3.	Compaction; Laboratory compaction tests; Compaction curve; Control on field compaction; One-dimensional consolidation; Terzaghi's equation; Consolidation test; e-log p curves; Consolidation settlement; Time required for settlement.
Module 4.	Total and effective stresses; Pore water pressure; Stress distribution under concentrated load; Influence factors; Isobars; Boussinesq's equation, Westergaard's Method and Newmark's Influence Chart; Contact pressure under rigid and flexible area; computation of displacements from elastic theory.
Module 5.	Sub-soil exploration; Planning; Auger boring; Sampling; Penetration methods; Geophysical methods – electrical resistivity and seismic method; Suitability of tests.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	**Avg CLO**
CLO1	3	3	2	3	1	2	1	0	2	0	0	3	**1.67**
CLO2	3	3	3	2	1	2	1	0	2	0	0	3	**1.67**
CLO3	3	3	3	2	2	2	1	0	2	1	1	3	**1.92**
CLO4	3	3	3	2	2	1	1	0	1	1	0	3	**1.75**
CLO5	3	3	3	3	3	1	1	0	2	2	0	3	**2**
Avg PLO	**3**	**3**	**2.8**	**2.4**	**1.8**	**1.6**	**1**	**0**	**1.8**	**0.8**	**0.2**	**3**	**1.80**

S.No:	Text Books	Author	Publisher
1.	Geotechnical Engineering	Gulhati, S.K. and Datta Manoj	Tata McGraw Hill
References			
1.	Fundamentals of Geotechnical Engineering	Braja M. Das and Nagaratnam Sivakugan	Cengage Learning
2.	Principles of Geotechnical Engineering	Braja M. Das and Khaled Sobhan	Cengage Learning
3.	Soil Mechanics & Foundation Engineering	K.R.Arora	Standard Publisher Distribution
4.	Principles of Foundation Engineering	Braja M. Das	Cengage Learning

LIST OF EXPERIMENTS	
Experiment No.	Experiment Name
1.	Soil Identification Test
2.	Water Content Determination Test
3.	Field Density Measurement Test
4.	Specific Gravity Test
5.	Sieve Analysis Test
6.	Sedimentation Analysis Test
7.	Atterberg Limits Test
8.	IS Light Compaction Test
9.	Constant Head Permeability Test
10.	Falling Head Permeability Test

Course Code	BCIVLWS525					
Category	Lab Course					
Course Title	Water Supply and Sanitation Engineering					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 5 (Five)
	0	1	4	5	3	
Pre requisites	Engineering Chemistry,Fluid Mechanics					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Explain the principles of water supply engineering, water demand estimation, population forecasting, and the selection of suitable water sources

ii) CLO2:. Analyze water quality using physical, chemical, and biological parameters

iii) CLO3: Design the major components of water treatment plant

iv) CLO4: Describe different types of water supply systems and illustrate preliminary treatment processes and layout of water treatment plants.

v) CLO5: Apply the principles of plumbing, sanitary fixtures, and building water supply systems to ensure safe water distribution and sanitation

Theory Module (Internal Evaluation)

M.No:	Topic
Module 1.	Water supply engineering and its importance, Sources of water, Criteria for selection of a water source, Water demands, Types of water demand, Variation in demand and supply, Population forecasts.
Module 2.	Intake Structures, Factors governing location of intakes, Types of intakes, Types of conduits for conveyance, Pipe materials and joints, Types of pumps, Power and efficiency of pumps, Location of pumping station, Typical layout of pumping station.
Module 3.	Water Quality, Drinking Water Standards (IS 10500), Types of Impurities, Analysis of Water: Physical : colour, taste and odour, turbidity, Chemical: total solids, pH, hardness, chloride content, nitrogen content, alkalinity, Biological: E-coli. Waterborne diseases and their control
Module 4.	Water treatment, Methods of treatment, Screening, Sedimentation (Type 1), Coagulation and Flocculation, Filtration (rapid and slow sand), Disinfection (Chlorination), Water Softening.
Module 5.	Water distribution systems, classification, systems of supply, service reservoirs and its types, layout of distribution system, appurtenances in distribution system, leakage prevention. Water supply in buildings, plumbing and fixtures, sanitation of buildings

Activity Module	
1	**Field Visit to a Water Supply Scheme** – Visit the water source, intake, pumping station, treatment plant, service reservoir, and distribution network of a municipal water supply system. Prepare a technical report.
2	**Household Water Demand Survey** – Conduct a survey of 25–50 households to estimate per capita water consumption, peak demand, and daily water usage patterns. Compare results with CPHEEO recommendations.
3	**Water Source Assessment** – Identify nearby surface and groundwater sources and evaluate them based on quantity, quality, reliability, and suitability for potable water supply.

4	**Drinking Water Quality Analysis** – Collect water samples from different sources (tap, borewell, river, spring, etc.) and determine pH, turbidity, TDS, hardness, alkalinity, chlorides, and residual chlorine in the laboratory. Compare results with IS 10500 standards.
5	**Study of Pumps and Pumping Stations** – Visit a pumping station to identify different pumps, valves, motors, and accessories. Record pump specifications and estimate pump efficiency from field observations.
6	**Visit to a Water Treatment Plant** – Observe unit operations including screening, sedimentation, coagulation-flocculation, filtration, chlorination, and sludge handling. Prepare a process flow diagram with observations.
7	**Design of a Small Water Distribution Network** – Using suitable software, design a simple water distribution network for a residential colony, including reservoirs, pipelines, and junctions.
8	**Leakage Detection and Water Audit** – Conduct a campus or locality survey to identify visible leakages, estimate water losses, and recommend measures for reducing non-revenue water.
9	**Sanitation and Plumbing Audit of a Building** – Study the plumbing fixtures, water supply lines, drainage system, overhead storage, and sanitation facilities of an institutional or residential building. Suggest improvements based on relevant standards.
10	**Community Awareness Programme on Safe Water and Hygiene** – Organize an awareness campaign in a nearby village or school covering safe drinking water, waterborne diseases, household disinfection methods, sanitation, and water conservation.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	2	0	0	0	0	2	0	0	0	0	0	0.58
CLO2	3	3	0	3	3	0	3	0	0	0	0	0	1.25
CLO3	3	3	3	2	2	0	3	0	0	0	0	0	1.33
CLO4	3	2	2	2	2	0	2	0	0	0	0	0	1.08
CLO5	2	2	3	2	2	0	3	0	0	0	0	0	1.17
Avg. PLO	2.80	2.40	1.60	1.80	1.80	0.00	2.60	0.00	0.00	0.00	0.00	0.00	1.08

S.No:	Text Books	Author	Publisher
1	Water Supply Engineering	P.N. Modi	Standard Book House
	References		
1.	Water Supply Engineering	S.K. Garg	Khanna Publishers

2.	Water Treatment: Principles and Design	John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe , George Tchobanoglous.	John Wiley & Sons
3	Water and Wastewater Technology	Mark J. Hammer Sr. Mark J. Hammer Jr.	Pearson Education Limited

Course Code	BCIVCRE525					
Category	Programme Core Course					
Course Title	Railway Engineering					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 5 (Five)
	3	0	0	3	3	
Pre requisites	Building Materials, Highway Engineering					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Identify various components of Permanent way and know the construction process of railway track.

ii) CLO2: Design railway alignments and track geometry.

iii) CLO3: Plan stations, yards, points and crossings.

iv) CLO4: Apply signaling and interlocking principles.

v) CLO5: Understand maintenance practices and modern railway systems.

Theory Module (Internal and External Evaluation)

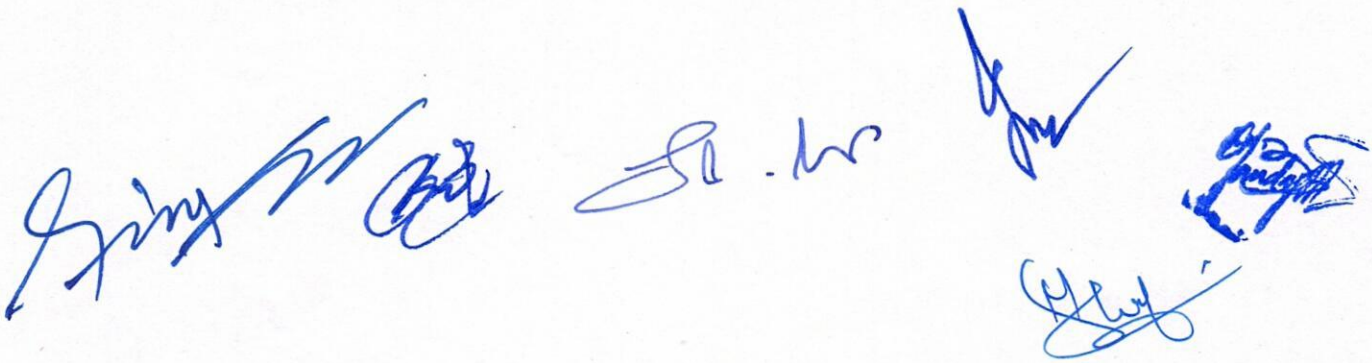
M.No:	Topic
Module 1.	Historical development of Indian Railways; Railway track alignment- basic requirements, engineering surveys for track alignment; Permanent way- typical cross-section, requirements, concept of gauges, coning of wheels; Rails- functions, requirements, types of rail sections, creep and tilt in rails; Sleepers- functions, requirements, types, sleeper density; Ballast- functions, materials, ballast less tracks; Formation- types and functions; Track fittings and fastenings.
Module 2.	Gradients, grade compensation, speed of train; superelevation, cant deficiency, superelevation distribution (near branching of curves); horizontal/vertical curves- necessity; transition curves, design of transition curves; widening of gauges on curves; Track resistance and tractive effort.
Module 3.	Points and crossings- design of turnouts; working principles; Passenger and goods stations: Types of yards: Passenger yards, Goods yards, Marshalling yards, Locomotive yard; Station equipment and layouts; Junctions and terminals.
Module 4.	Objectives of Railway Signalling; Types of Signals and signal aspects; Block systems; Centralized Traffic Control; Interlocking Principles and Methods; Route Relay Interlocking; Modern Train Control and Communication Systems; Railway Safety Measures.
Module 5.	Inspection and maintenance of track, Track drainage; Track renewal and rehabilitation; Modern track maintenance methods; High-speed rail systems; Metro and urban rail transit systems; Railway Safety and accident prevention.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. PLO
CLO1	3	2	1	1	1	0	1	2	2	0	0	1	1.16
CLO2	3	3	3	2	2	1	2	0	0	0	1	1	1.5
CLO3	3	3	3	2	2	2	1	0	1	1	2	1	1.75
CLO4	2	3	2	2	3	3	1	2	1	1	1	1	1.83
CLO5	2	2	2	3	3	2	3	2	1	1	2	3	2.16

Avg. CLO	**2.6**	**2.6**	**2.2**	**2**	**2.2**	**1.6**	**1.6**	**1.2**	**1**	**0.6**	**1.2**	**1.4**	**1.68**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Principles of Railway Engineering	Rangawala, S.C, (2015)	Charotar Publishers, Anand
2	A textbook of Railway Engineering	Arora, S.P. and Saxena, 2010	Dhanpat Rai & Sons
	References		
1.	Railway Engineering	Satish Chandra, M. M. Agarwal, (2013)	Oxford University Press
2.	Railway Transportation- Engineering, Operation and Management	Ponnuswamy, S, (2016)	Narosa Publishing House, New Delhi
3.	Railway Track Engineering	Mundrey, J.S. (2015)	McGraw Hill Education



Course Code	BCIVCFF525					
Category	Programme Core Course					
Course Title	Fluid Flow in Pipes & Channels					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 5 (Five)
	3	1	2	6	5	
Pre requisites	Fluid Mechanics					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Analyze and perform calculations on pipe flow problems involving turbulent flow, understand the concept of friction factor, head loss, and design

ii) CLO2: Apply the principles of boundary layer theory to evaluate laminar and turbulent boundary layer characteristics and their engineering significance.

iii) CLO3: Apply the principles of fluid mechanics to determine the drag and lift forces acting on submerged bodies under fluid flow conditions.

iv) CLO4: Analyze and perform calculations on open-channel flows, compute water surface profiles and hydraulic jump characteristics.

v) CLO5: Analyze the operating characteristics and performance of hydraulic turbines and pumps for engineering applications.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Flow through pipes Major and Minor losses through pipes; Hydraulic and energy grade lines; pipes in series and parallel; equivalent pipe; Transmission of power; Water Hammer and surge tanks: location and types, Analysis of pipe networks (Hardy-Cross method)
Module 2.	Boundary layer analysis Boundary layer thickness; Boundary layer over a flat plate; Laminar boundary layer; Application of momentum equation (von-Karman); Turbulent boundary layer; Hydrodynamically smooth and rough boundaries; Local and average friction coefficients; Separation of flow and its control
Module 3.	Fluid flow past submerged bodies Submerged Bodies: Forces on submerged bodies; Boundary layer development over submerged bodies; Drag force and lift force; Pressure drag and skin friction drag; Streamlined and Bluff bodies; Flow past flat plate, Flow past a sphere, Terminal Velocity of spherical bodies, Flow past a cylinder, Magnus effect and circulation
Module 4.	Flow in open channels Introduction, Classification of flows, Resistance formulae; Hydraulically efficient channel sections; Specific energy; Critical depth; Normal depth; Hydraulic jump and its characteristics, Gradually varied flow equations; Classification of water surface profiles; Computation of water surface profiles: step-by-step method and graphical integration method.
Module 5.	Hydraulic machines Turbines: classification; Impulse and reaction turbines; Unit quantities and specific speed; Cavitation; Draft tube, Types of Draft tubes Pumps: Centrifugal pumps: working principle and specific speed; Reciprocating pumps: working principle

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	3	2	3	0	2	2	0	2	2	0	2	1.75
CLO2	3	3	3	3	0	2	2	2	2	2	2	2	2.17
CLO3	3	2	0	3	2	0	0	1	2	0	0	1	1.17
CLO4	3	3	2	0	2	2	2	1	2	0	0	3	1.67
CLO5	3	2	3	0	2	2	2	1	1	2	2	2	1.83
Avg. PLO	3.0	2.6	2.0	1.8	1.2	1.6	1.6	1.0	1.8	1.2	0.8	2.0	1.7

S.No:	Text Books	Author	Publisher
1.	Fluid Mechanics and Hydraulic Machines	R.K. Bansal	Laxmi Publications (P) Ltd
2	Fluid Mechanics and Fluid Power Engineering	D. S Kumar	S. K. Kataria & Sons Publishers, New Delhi
	References		
1.	Fluid Mechanics	F. M. White	McGraw-Hill
2.	Open channel Flow	K. Subramanaya	Tata Mc Graw Hill, New Delhi.
3.	Engineering Fluid Mechanics	R. J. Garde, and A.G. Mirajgaokar	New Age International Publishers and Scitech Publications

List of Experiments

1	To find friction factors for pipes of different materials.
2	To determine the minor head loss coefficient for different pipe fittings.
3	To determine the surface profile and total head distribution of a vortex.
4	To determine the elements of a hydraulic jump in a rectangular channel.
5	To determine the Manning's rugosity coefficient of a laboratory flume.
6	To obtain the velocity distribution for an open channel and to determine the values of α, β, and n.

Course Code	**BCIVLSC525**					
Category	**Lab Course**					
Course Title	**Survey Camp**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 5 (Fifth)**
	-	-	-	-	1	
Pre requisites	**Basic Surveying, Advanced Surveying, CAD**					

Description of Survey Camp: Survey camp shall be conducted to provide hands-on experience in utilising surveying instruments. The survey should preferably be organized in a local area. Each student shall maintain a complete record of original field observations, computations, maps, contour plans, drawings, and the Survey Camp Report.

Course Learning Outcomes (CLOs)

Upon successful completion of this course, the students will be able to:

i) CLO1. Demonstrate proficiency in handling and operating modern surveying instruments such as Total Station, GPS/GNSS, Auto Level, Theodolite, Compass, Plane Table, and other field equipment for engineering surveys.

ii) CLO2. Plan, execute, and document various engineering surveys for roads, buildings, bridges, dams, irrigation works, campuses, and other civil engineering projects while following standard field procedures.

iii) CLO3. Apply modern surveying technologies, including Electronic Distance Measurement (EDM), GPS/GNSS, photogrammetry, remote sensing, and digital mapping techniques in solving real-world civil engineering problems

iv) CLO4. Collect, analyze, reduce, and interpret field observations to prepare field books, contour maps, longitudinal and cross-sections, site plans, and engineering drawings using CAD software.

v) CLO5. Prepare comprehensive survey reports, technical drawings, computations, and project documentation while demonstrating teamwork, professional ethics, safety practices, effective communication, and project management skills.

Means of Assessment:

1. Practical work
2. Report Writing
3. Presentation
4. Drawing
5. Viva-voce

List of Activities

M. No:	Topic to Cover
Module 1.	Reconnaissance survey of the area or place of surroundings, familiarizing with survey equipment like digital theodolites, levels, total stations, and other surveying instruments for distance and angle measurement
Module 2.	Surveying of campus roads or proposed pathways using levels. This ensures proper grading and drainage. Preparation of Site Plan, Contour Map, L- Section & X–Section of the above works using AutoCAD
Module 3.	Contouring of parking lawn/ playgrounds/steep grounds by using Auto level and Total Station. Prepare a detailed contour map of a specific undulating open area or lawn within the campus to understand its topography.
Module 4.	Setting out and plot layout of building plans. Mark points and dimensions on the grounds for construction projects based on architectural drawings of the buildings.
Module 5.	Process and analyse survey data using software like AutoCAD or GIS to create detailed maps and prepare the Survey Camp Report.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	-	3	3	-	-	1	2	1	1	2	2.25
CLO2	3	3	2	3	3	2	2	-	2	1	2	2	2.55
CLO3	3	2	-	2	3	-	-	-	-	-	-	2	2.50
CLO4	3	3	2	3	3	-	-	-	1	2	-	2	2.56
CLO5	2	-	-	-	2	2	1	3	3	3	3	2	1.78
Avg PLO	2.25	2.4	1.6	2.4	2.8	2.5	2	2.75	2.8	2	1.5	2	2.3

S.No:	Text Books	Author	Publisher
1	Surveying, Volume I	Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
2	Surveying and Levelling	N. N. Basak	McGraw-Hill Education
	References		

3	Surveying, Volume II	Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
2	Surveying	S. K. Duggal	McGraw-Hill Education
3	Surveying and Geomatics	K. R. Arora	Standard Publishers Distributors

Course Code	**BCIVCRC625**					
Category	**Programme Core Course**					
Course Title	**Design of Reinforced Concrete Structures**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 6 (Six)**
	3	1	0	4	4	
Pre requisites	**Strength of Materials, Structural Analysis, Concrete Technology, Building Materials, Construction Technology**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Explain material behaviour, design philosophies, and codal provisions (IS 456) for reinforced concrete design.

***ii)* CLO2:** Analyse+ and design RCC beams for flexure, shear, torsion, and serviceability requirements.

iii)* CLO3*: Design RCC slabs and understand bond, development length, and detailing requirements.

***iv)* CLO4:** Analyze and design RCC columns under axial load and combined bending as per codal provisions.

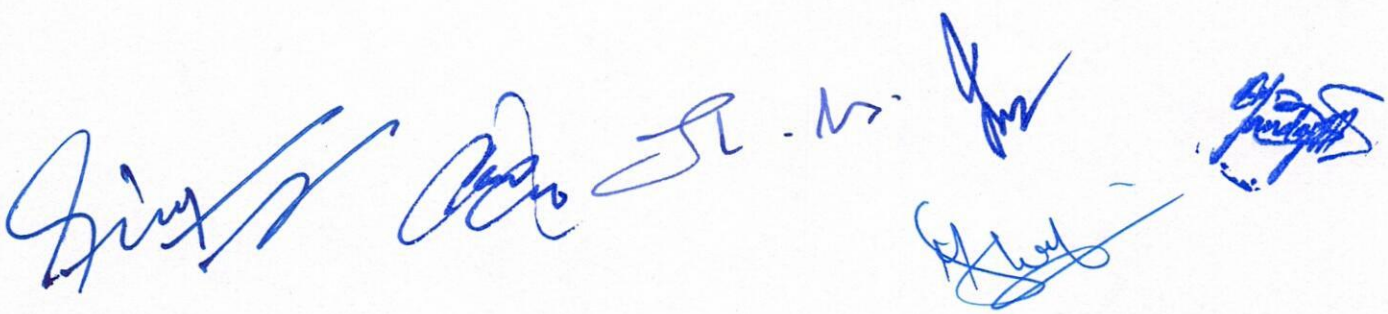
***v)* CLO5:** Explain fundamentals of prestressed concrete including methods, losses, and analysis of prestressed members

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Stress-strain curves for concrete and steel; Characteristic strength; Design strength; IS specifications. Design philosophies: Working Stress Method, Ultimate Load Method, and Limit State Method of design. Probabilistic Analysis and Design, Characteristic strength and load, Partial safety factor, Codal recommendations
Module 2.	Analysis and design of flexural behaviour of reinforced concrete beams; Analysis and design of rectangular,T and L sections; codal provisions. Behaviour of RCC beams in shear; Design for shear; Anchorage and slipping of reinforcement. Torsion of beams and design; Detailing of reinforcement as per IS:456. Serviceability;limit state of deflection and cracking, calculation of deflection and codal requirements. Design Problems for Beams and checks for Codal Provisions.
Module 3.	Design of one-way and two-way RCC slabs with and without corners held down, design for bond, bond failure and strength, splicing of reinforcement, development length, detailing, introduction to design of slabs by Moment Coefficient Method. Introduction to flat slabs.
Module 4.	Types of RCC columns; short and long columns; Analysis and design of axially loaded RCC columns. Design of RCC columns for uni-axial and bi-axial moments; Helical reinforcement and transverse reinforcement.
Module 5.	Introduction to prestressed concrete. Advantages and disadvantages of prestressing; methods of prestressing; materials used in prestressed concrete; Pre-tensioning and post-tensioning systems; losses in prestress; Analysis of prestressed concrete symmetrical and unsymmetrical beams, Concept of kern, pressure line, load balancing method.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	0	0	0	0	0	0	0	0.42
CLO2	3	3	3	2	2	0	0	0	0	0	1	0	1.17
CLO3	3	3	3	2	2	0	0	0	0	0	1	0	1.17
CLO4	3	3	3	2	2	0	0	0	0	0	1	0	1.17
CLO5	2	2	2	2	1	0	0	0	0	0	0	1	1.00
Avg PLO	2.8	2.6	2.2	1.6	1.4	0.0	0.0	0.0	0.0	0.0	0.6	0.2	0.98

S.No:	Text Books	Author	Publisher
1.	Reinforced Concrete Design	Pillai, S. U. and Menon	McGraw Hill Education Private Limited, New Delhi, India, 3rd Edition, 2009.
2	Prestressed Concrete	N. Krishna Raju	McGraw Hill
	References		
1.	Design of Reinforced Concrete Structures	Subramanian, N	Oxford University Press



Course Code	**BCIVCFE625**					
Category	**Programme Core Course**					
Course Title	**Foundation Engineering**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 6 (Sixth)**
	2	**1**	**2**	**5**	**4**	
Pre requisites	**Soil Mechanics**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the concept of shear strength and determine strength parameters through laboratory testing.

ii) CLO2: Understand the practical aspects of earth pressure and retaining structures.

iii) CLO3: Understand the concepts of slope stability along with its practical application.

iv) CLO4: Evaluate the bearing capacity of foundations and apply design principles for shallow and deep foundations.

v) CLO5: Select and recommend suitable soil stabilisation techniques for improving soil performance.

M.No:	**Topic**
Module 1.	Shear strength concept; Mohr-Coulomb equation; Laboratory determination: Direct shear test, Triaxial compression test under different drainage conditions (undrained, drained), unconfined compression test, Vane shear test, Strength envelope.
Module 2.	Lateral earth pressure, Rankine's theory of active and passive states; Lateral earth pressure under various conditions: Surcharge, sloping backfill; High-water table; Earth pressure diagrams, Total thrust, Tension cracks
Module 3.	Fundamental concepts, Types of slope failure, Analysis of infinite slopes, Methods of slope stability analysis; Stability considerations under: Submergence, Complete drawdown, Steady seepage conditions, Stability number
Module 4.	Basic definitions and principles related to bearing capacity, Methods of determining bearing capacity, Terzaghi's ultimate bearing capacity equation, Effects of: Size and shape of footing, Rigidity of footing, Footing types: Isolated footings, Raft foundations, Foundations on clays and sands; Pile foundations: Classification of piles, Determination of load-carrying capacity of piles, Pile groups and group efficiency, Negative skin friction
Module 5.	Purpose and need for soil stabilisation, Methods of stabilisation and applications: Mechanical stabilisation, Cement stabilisation, Lime stabilisation, Bituminous stabilisation, Chemical stabilisation; Brief introduction to: Shotcrete, Geo-reinforcement techniques

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	3	3	1	3	0	0	0	0	0	3	**1.58**
CLO2	3	3	3	3	1	3	0	0	0	0	0	3	**1.58**
CLO3	3	3	3	3	1	3	2	0	0	0	0	3	**1.75**
CLO4	3	3	3	3	3	3	0	1	2	1	1	3	**2.17**
CLO5	3	3	3	3	3	3	2	1	2	2	1	3	**2.42**
Avg PLO	**3**	**3**	**3**	**3**	**1.8**	**3**	**0.8**	**0.4**	**0.8**	**0.6**	**0.4**	**3**	**1.90**

S. No.:	Text Books	Author	Publisher
1.	Principles of Foundation Engineering	Braja M. Das	Thomson Asia Pvt. Ltd., Singapore
References			
1.	Physical and Geotechnical Properties of Soils	J.E. Bowles	McGraw-Hill Publishers
2.	Theoretical Soil Mechanics	Karl Terzaghi	Wiley, New York
3.	Soil Mechanics in Engineering Practice	Karl Terzaghi, Ralph B. Peck & Gholamreza Mesri	Wiley India / John Wiley & Sons

List of Experiments	
Experiment No.	Experiment Name
1	1-D Consolidation Test: To determine soil compressibility and settlement.
2	Direct Shear Test: To determine soil shear strength.
3	Unconfined Compressive Strength Test: To determine the undrainedshear strength of clay.
4	Unconsolidated Undrained Triaxial Test: To determine short-term shear strength.
5	Consolidated Undrained Triaxial Test: To determine shear strength after consolidation.
6	Vane Shear Test: To determine the in situ shear strength of soft clay.
7	Standard Penetration Test: To determine soil penetration resistance.
8	Plate Load Test: To determine the bearing capacity of soil.

5	**Rate Analysis of Civil Engineering Items** – Prepare detailed rate analysis for selected items such as brick masonry, RCC, plastering, and concrete flooring using the latest Schedule of Rates (SOR)
6	**Preparation of Detailed Cost Estimate** – Prepare a detailed estimate, abstract estimate, and cost summary for a residential building using prevailing SOR and market rates.
7	**Preparation of BOQ and Tender Documents** – Develop a Bill of Quantities (BOQ), Notice Inviting Tender (NIT), tender schedule, and contract documents for a small construction project
8	**Construction Site Visit for Quantity Verification** – Visit an ongoing construction site to verify executed quantities, compare them with estimated quantities, and identify causes of variations.
9	**Digital Quantity Take-Off Using CAD/BIM or Estimation Software** – Extract quantities from AutoCAD/Revit drawings or prepare estimates using MS Excel, CostX, PlanSwift, or equivalent software
10	**Mini Quantity Surveying Project** – Working in groups, prepare complete estimates, BOQ, rate analysis, project budget, and presentation for a small residential or institutional building, including field verification of selected quantities

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	2	2	1	1	0	0	2	1	0	0	**1.25**
CLO2	3	3	3	2	2	1	1	0	2	1	0	0	**1.5**
CLO3	3	3	3	3	2	1	1	0	1	2	0	0	**1.58**
CLO4	3	3	2	3	2	1	1	1	1	2	1	0	**1.75**
CLO5	3	2	2	2	3	2	2	1	1	1	1	1	**1.75**
Avg PLO	**3**	**2.8**	**2.4**	**2.4**	**2**	**1.2**	**1**	**0.4**	**1.4**	**1.4**	**0.4**	**0.2**	**1.56**

S.No:	Text Books	Author	Publisher
1.	Estimating and Costing in Civil Engineering	B.N. Dutta	UBS Publishers
References			
1.	J&K Schedule of Rates (JKSoR), Latest Edition.	-	Jammu & Kashmir Public Works Department (R&B),
2.	Delhi Schedule of Rates (DSR), Latest Edition.	-	Central Public Works Department (CPWD
3.	Estimating and Costing in Civil Engineering	D.D. Kohli & R.C. Kohli	S. Chand Publications.



Course Code	**BCIVCIH625**					
Category	**Programme Core Course**					
Course Title	**Irrigation & Hydraulic Structures**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 6 (Sixth)**
	2	**1**	**0**	**3**	**3**	
Pre requisites	**Nil**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the necessity, importance, and methods of irrigation, and analyse crop water requirements.

ii) CLO2: Analyse the soil-water- plant relationship and understand the crop water requirements.

iii) CLO3: Analyse canal irrigation systems and apply regime theories to estimate canal parameters, losses, and design considerations for efficient water conveyance.

iv) CLO4: Identify, classify, and explain the design principles of cross drainage works for safe and effective canal operation.

v) CLO5: Evaluate problems of water logging and soil salinity and recommend suitable drainage and reclamation measures for sustainable irrigated agriculture.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Necessity and importance of irrigation in India; Advantages of irrigation; Types and methods of irrigation; Techniques of water distribution in farms; Soil moisture relationship and crop water requirements; Duty, Delta and Base Period; Crop period and consumptive use of water; Irrigation requirements.
Module 2.	Canal Irrigation: Types of canals and canal irrigation systems; Parts of a canal system; Canal alignment and assessment of water requirements; Estimation of canal losses; Design of irrigation channels; Regime theory and semi-theoretical approaches; Canal lining: types, advantages and design considerations.
Module 3.	Diversion Headworks: Selection of site and layout, Parts of diversion head works, types of weirs and barrages, Design of weirs on permeable foundations, control of silt entry into canal, Silt excluders and different types of silt ejectors
Module 4.	Cross Drainage Works: Necessity and classification of cross drainage works; Selection of suitable cross drainage structures; Types of cross drainage works: Aqueduct, Syphon aqueduct, Super passage, Syphon, Level crossing, Design principles of cross drainage works.
Module 5.	Water logging: Causes, preventive and curative measures, drainage of irrigated lands, saline and alkaline lands.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	2	0	0	0	0	3	0	0	0	0	0	0.67

CLO2	3	3	0	2	2	0	3	0	0	0	0	0	1.08
CLO3	3	3	3	2	2	0	2	0	0	0	0	0	1.25
CLO4	3	2	3	2	2	0	2	0	0	0	0	0	1.17
CLO5	3	3	2	2	2	0	3	0	0	0	0	0	1.25
Avg. PLO	3.00	2.60	1.60	1.60	1.60	0.00	2.60	0.00	0.00	0.00	0.00	0.00	

S.No:	Text Books	Author	Publisher
1	Irrigation and Hydraulic Structures.	S.K. Garg	Khanna Publishers
	References		
1.	Irrigation and Water Power Engineering	B.C. Punmia	Standard Publisher
2.	Irrigation and water resources engineering	G.L. Asawa	New Age International Publishers
3.	Irrigation, Water Power and Water Resources Engineering	K.R. Arora	Standard Publishers Distributors

Course Code	**BCIVCEE625**					
Category	**Programme Core Course**					
Course Title	**Environmental Engineering**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 6 (Sixth)**
	2	**1**	**0**	**3**	**3**	
Pre requisites	**Water Supply and Sanitation Engineering**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the sources and impacts of environmental pollution.

ii) CLO2: Calculate sewage flow and sewer design parameters.

iii) CLO3: Analyze the impact of sewage disposal on receiving water bodies.

iv) CLO4: Explain wastewater treatment processes.

v) CLO5: Evaluate solid waste and air pollution control methods.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Sources and effects of land, water, and air pollution; Sewage—definition, types (domestic, industrial, etc.), and the need for sewage treatment, Elements of Sewage Management System, Types of Sewerage Systems.
Module 2.	Calculation of sewage flow (dry weather flow) and storm water flow, Sewage flow variations, Self-cleaning velocity, Types of sewers (circular and non-circular), Hydraulic design of circular sewers.
Module 3.	Composition of sewage, Characteristics of sewage, Tests for Oxygen demand (BOD, COD, TOC), Sewage disposal by dilution, Self-purification of streams, Oxygen-sag curve, Streeter-Phelps equation, Sewage disposal by land treatment.
Module 4.	Unit operations in sewage treatment, Classification of sewage treatment (Preliminary, Primary, Secondary etc.), Screening, Grit removal, Sedimentation, Activated sludge process, Filtration, Septic and Imhoff tanks.
Module 5.	Solid waste management: Classification, Composition, Quantity, and Collection of solid wastes. Methods of disposal of solid waste. Air pollution: Definitions, Sources of air pollution, Classification of air pollutants (primary and secondary), Effects of air pollution, Methods and Equipment to control air pollution.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	2	0	0	0	0	3	0	0	0	0	0	0.67
CLO2	3	3	2	2	2	0	2	0	0	0	0	0	1.17
CLO3	2	3	0	3	2	0	3	0	0	0	0	0	1.08

CLO4	3	2	2	2	2	0	3	0	0	0	0	0	1.17
CLO5	2	2	2	0	2	0	3	0	0	0	0	0	0.92
Avg. PLO	2.60	2.40	1.20	1.40	1.60	0.00	2.80	0.00	0.00	0.00	0.00	0.00	1.00

S.No:	Text Books	Author	Publisher
1.	Sewage Treatment Disposal and Wastewater Engineering	P. N. Modi	Sewage Treatment Disposal and Wastewater Engineering
	References		
1	Sewage Waste Disposal and Air Pollution Engineering	S.K. Garg	Sewage Waste Disposal and Air Pollution Engineering
2	Wastewater Engineering (Volume 1)	Metcalf & Eddy	McGraw-Hill Education
3	Water and Wastewater Technology	Mark J. Hammer Sr. Mark J. Hammer Jr.	Pearson Education Limited

Course Code	BCIVLTE625					
Category	Lab Course					
Course Title	Traffic Engineering and Road Facilities					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 6 (Sixth)
	0	1	4	5	3	
Prerequisites	Engineering Graphics, Basic Surveying, Highway Engineering,					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1: Understand** the fundamental concepts of traffic engineering, traffic stream characteristics, pedestrian facilities, highway capacity, and transportation planning

ii) **CLO2: Compare** different traffic control devices, intersection control methods, Level of Service (LOS) criteria, and Indo-HCM with US-HCM for traffic analysis

iii) **CLO3: Interpret** data obtained from traffic studies, including speed, traffic volume, parking, accident, and origin-destination (OD) studies for traffic management and planning

iv) **CLO4: Draw** traffic control layouts, road markings, intersection designs, traffic rotaries, and signal timing plans using standard engineering practices

v) **CLO5: Integrate** appropriate traffic management and transportation planning solutions by travel demand modelling

Theory Module (Internal Evaluation)

M. No.:	Topic
Module 1.	Introduction to traffic engineering: Components and characteristics of traffic stream, pedestrian facilities, and flow characteristics
Module 2.	Highway Capacity and Level-of-Service Analysis: Design traffic volume, PHF, Concept of LOS, Indo HCM vs US HCM.
Module 3.	Traffic studies Speed and Traffic volume studies, Accident studies, Parking studies, OD studies
Module 4.	Traffic control and Intersection design Traffic signs, road markings, Types of intersections and controls, Design of traffic rotaries, Signal design by Webster's method
Module 5.	Transportation Planning and Analysis: Introduction to urban and regional transportation planning, Travel demand modeling—trip generation, mode and destination choice, highway route choice

Activity Module	
1	**Traffic Volume Count Survey** – Conduct classified traffic volume counts at a selected urban intersection or highway section during peak and off-peak hours. Determine Average Daily Traffic (ADT), Peak Hour Volume (PHV), and Peak Hour Factor (PHF).
2	**Speed Study** – Perform spot speed studies using radar guns/mobile applications or stopwatch methods and determine average speed, 85th percentile speed, pace speed, and speed distribution.

3	**Level of Service (LOS) Assessment** – Evaluate the operational performance of a selected road segment or intersection using Indo-HCM/HCM procedures and recommend improvements.
4	**Pedestrian Facilities Audit** – Survey pedestrian infrastructure such as footpaths, crossings, ramps, and signage around the campus or commercial areas. Suggest measures to improve pedestrian safety and accessibility
5	**Road Safety and Accident Analysis** – Collect accident data from police records or public databases for a selected location, identify accident-prone spots (black spots), analyze causes, and propose remedial measures.
6	**Parking Survey** – Conduct on-street or off-street parking studies to determine parking accumulation, duration, turnover, occupancy, and parking index. Recommend parking management strategies.
7	**Intersection Study and Traffic Control Evaluation** – Observe an existing intersection to evaluate traffic signs, road markings, channelization, and signal operations. Design suitable traffic control improvements based on IRC guidelines.
8	**Traffic Signal Design Using Webster's Method** – Collect turning movement counts at a signalized intersection and compute optimum cycle length, green time allocation, and signal phasing using Webster's method.
9	**Origin–Destination (OD) Survey and Travel Pattern Analysis** – Conduct a sample OD survey using questionnaires or mobile-based surveys to study travel behavior, trip purpose, and modal choice
10	**Transportation Planning Mini Project** – Prepare a transportation improvement proposal for a selected locality by integrating traffic surveys, LOS analysis, pedestrian facilities, parking management, intersection improvements, and travel demand assessment. Present findings using GIS/CAD and technical reports.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	0	1	2	0	0	0	0	1	0.92
CLO2	2	3	2	2	1	0	2	0	0	0	0	1	1.08
CLO3	2	3	2	3	2	1	2	0	1	2	1	2	1.75
CLO4	2	2	3	2	3	0	1	0	1	3	0	1	1.5
CLO5	3	3	3	2	2	2	3	1	2	2	2	2	2.2
Avg PLO	2.4	2.6	2.2	2	1.6	0.8	2	0.2	0.8	1.4	0.6	1.4	1.49

S.No:	Text Books	Author	Publisher
1.	Traffic Engineering and Transportation Planning	L.R. Kadiyali	Khanna Publishers
	References		
1.	Fundamentals of Transportation Engineering	Ricardo G. Sigua	UP Press
2.	Indo-HCM (Indian Highway Capacity Manual)	CSIR-Central Road Research Institute	
3.	Transportation Engineering	C.J. Khisty & B. Kent Lall	Pearson Education

Course Code	**BCIVODM625**					
Category	**Open Elective Course**					
Course Title	**Disaster Management and Preparedness**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 6 (Sixth)**
	3	**0**	**0**	**3**	**3**	
Pre requisites	**Nil**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Explain fundamental concepts of disasters, hazards, vulnerability, and disaster classification.

***ii)* CLO2:** Analyse causes, impacts, and trends of natural and man-made disasters, including climate and socio-economic aspects.

***iii)* CLO3:** Apply disaster preparedness strategies, early warning systems, and institutional frameworks for risk reduction.

***iv)* CLO4:** Evaluate disaster response mechanisms, including rescue, relief, and emergency management practices.

***v)* CLO5:** Propose sustainable reconstruction, rehabilitation, and disaster-resilient engineering solutions.

Theory Module (Internal and External Evaluation)

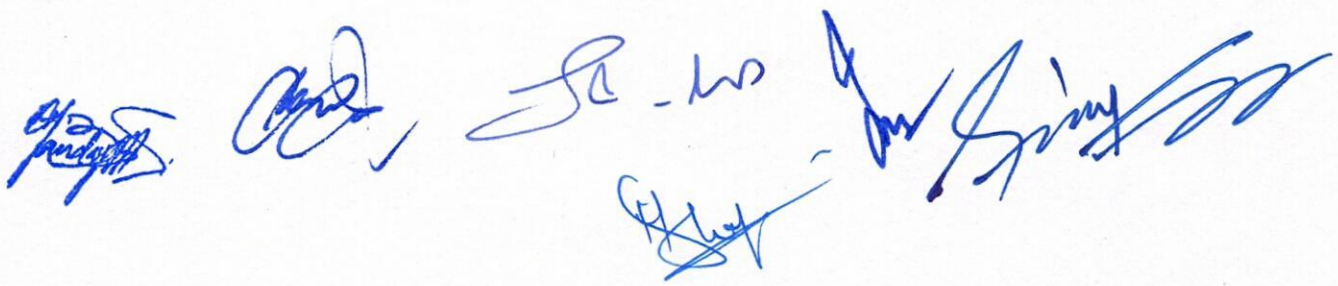
M.No:	Topic
Module 1.	Concepts and definitions: disaster, hazard, vulnerability, risk, severity, frequency, capacity, impact, prevention, preparedness, mitigation; Types and classification of disasters: Natural disasters: flood, cyclone, earthquakes, tsunami, volcanoes, landslides, coastal erosion, soil erosion, forest fires, Man-made disasters: fire, industrial pollution, chemical spills, nuclear disasters, biological disasters, transportation accidents (air, sea, rail, road), structural failures (buildings and bridges), war and terrorism Causes, effects, and practical examples of disasters.
Module 2.	Environmental, physical, and social impacts; economic and political impacts; health and psychosocial issues; demographic impacts (age, gender, special needs); global and national disaster trends; climate change and urban disasters; post-disaster environmental problems (water safety, waste management, disease control, sanitation, food safety); impact of development projects on vulnerability (dams, land-use changes, urbanization).
Module 3.	Concept and nature of disaster preparedness plans; prediction and early warning systems; Roles in preparedness: government, community, NGOs, international agencies, local institutions, engineers (civil engineering focus); use of IT in communication systems; disaster management policies; Disaster Risk Reduction (DRR); National Disaster Management Authority (NDMA); and other Indian agencies.
Module 4.	Disaster response: concept and phases; disaster response plan; activation of emergency preparedness plan; search and rescue operations; evacuation planning; logistic and resource management; structural vs non-structural measures; medical health response; trauma and psychology (rumors, panic, stress management); relief and recovery actions.
Module 5.	Reconstruction and rehabilitation as development; damage assessment; post-disaster effects and remedial measures; Long-term job creation; reconstruction techniques and disaster-resistant construction; sustainable and environment-friendly recovery; role of education and awareness; Dealing

	with victims, long-term counter-disaster planning; community-based and environment-friendly approaches.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	2	3	0	0	0	0	0	0.83
CLO2	2	3	2	2	0	2	3	0	0	0	0	0	1.33
CLO3	2	3	2	2	2	3	3	0	2	1	1	0	1.75
CLO4	2	2	2	2	2	3	2	1	2	2	1	0	1.75
CLO5	2	3	3	2	2	3	3	1	2	1	1	1	2.00
Avg PLO	2.2	2.6	1.8	1.6	1.2	2.6	2.8	0.4	0.8	0.8	0.6	0.2	1.53

S.No:	Text Books	Author	Publisher
1.	Disaster Management	Dr. Mrinalini Pandey	Wiley India Pvt. Ltd
2	Introduction to International Disaster Management	Damon P. Coppola	Butterworth-Heinemann
	References		
1.	Handbook of Disaster Management: Techniques & Guidelines	Singh B. K	2008, Rajat Publication
2.	Disaster Science and Management	Tushar Bhattachary	McGraw Hill Education



Course Code	BCIVORE625					
Category	Open Elective Course					
Course Title	Renewable Energy Technologies					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 6 (Sixth)
	3	0	0	3	3	
Pre requisites	Nil					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Explain different energy sources, their availability, and significance of renewable energy systems.

***ii)* CLO2:** Analyze solar energy systems, including radiation geometry and measurement techniques.

***iii)* CLO3:** Evaluate wind and biomass energy systems, including conversion technologies and performance factors

***iv)* CLO4:** Explain principles and applications of emerging energy systems such as geothermal, hydrogen, fuel cells, MHD, and OTEC

***v)* CLO5:** Assess the potential, advantages, and limitations of renewable energy technologies for sustainable development.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Energy Sources & Availability: Conventional, non-conventional, renewable, non-renewable sources of energy, prospects, advantages. Introduction to different types of nonconventional sources of energy: solar, wind, biomass, Ocean Thermal Energy Conversion (OTEC), geothermal, hydrogen energy, fuel cells, MHD, thermionic power conversion, thermoelectric power conversion.
Module 2.	Solar Energy: Solar constant, solar radiation geometry, local solar time, day length, solar radiation measurement, radiation on inclined surfaces, solar radiation data, solar charts.
Module 3.	Wind Energy: Wind as a source of energy, characteristics of wind, wind data. horizontal-vertical axis wind turbines
Module 4.	Introduction to biomass, biofuels & their heat content, biomass conversion technologies. Aerobic & anaerobic digesters, factors affecting bio-digestion, biogas plants–types, description, utilisation of biogas, Biomass gasification: Gasifier types, direct thermal application of gasifiers, Advantages & problems in development of gasifiers
Module 5.	Other Renewable Energy Sources: Geothermal Energy: Status & estimates, geothermal resources, geothermal systems & their characteristics, Hydrogen energy, Fuel Cells: Principle, classification, types; MagnetoHydroDynamic (MHD) power conversion: Principle, types; Ocean Thermal Energy Conversion (OTEC); Tidal energy; Wave energy.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	2	3	0	0	0	0	0	0.83
CLO2	3	3	2	2	2	0	3	0	0	0	0	0	1.42
CLO3	2	3	2	2	2	0	3	0	0	0	0	0	1.33
CLO4	2	2	2	2	2	0	3	0	0	0	0	1	1.17
CLO5	2	3	3	2	2	2	3	1	2	1	1	1	2.00
Avg PLO	2.4	2.6	1.8	1.6	1.6	0.8	3.0	0.2	0.4	0.2	0.2	0.4	1.35

S.No:	Text Books	Author	Publisher
1.	Non-Conventional Energy Resources	G D Rai	Khanna Publisher
	References		
1.	Renewable Energy Engineering and Technology: Principles and Practice	V. V. N. Kishore	Routledge

Course Code	**BCIVOGB625**					
Category	**Open Elective Course**					
Course Title	**Green Buildings**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 6 (Sixth)**
	3	**0**	**0**	**3**	**3**	
Pre requisites	**Nil**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1:** Explain concepts of global warming, carbon footprint, and the role of buildings in environmental sustainability.

ii) **CLO2:** Analyze green building features, energy-efficient systems, and life cycle cost of buildings.

iii) **CLO3:** Apply environment-friendly construction technologies and sustainable materials in building design.

iv) **CLO4:** Evaluate green building rating systems and principles of sustainable building design.

v) **CLO5:** Propose sustainable solutions for energy, water, and waste management in buildings.

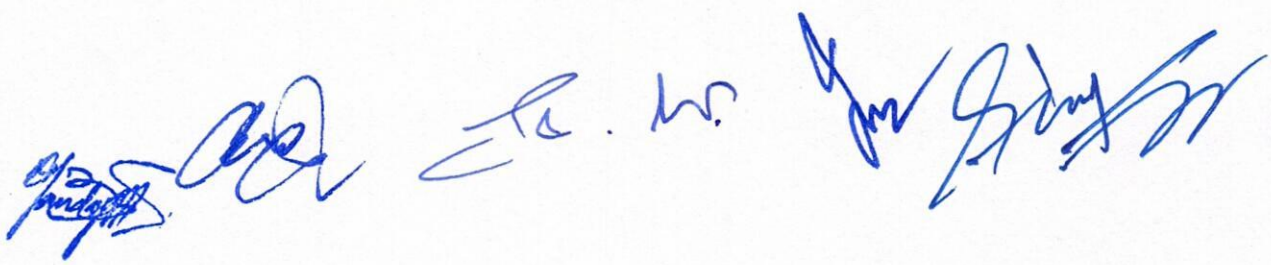
Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Global warming: Definition, Causes and Effects, Contribution of buildings towards global warming, Carbon footprint, Global efforts to reduce carbon Emissions, Green buildings: (definition, features, necessity, environmental benefit, economical benefits, health and social benefits); major energy-efficient areas for buildings, Embodied energy in materials, green materials, Comparison of initial cost of green Vs conventional building, life cycle cost of buildings
Module 2.	Environment friendly building technologies, Net Zero Energy Buildings (NZEB), alternative masonry techniques such as rat trap bond, cavity walls, sustainable materials including fly ash bricks, AAC blocks, hollow blocks, ferrocement, bamboo, recycled aggregates and geopolymer materials; precast and prefabricated components (beams, columns, door and window frames); alternative roofing systems; modern systems (pre-engineered buildings, modular prefabrication)
Module 3.	Green building rating Systems, BREEAM, LEED, GREEN STAR, GRIHA, Green rating for integrated habitat assessment for new buildings, Point system with differential weightage; Green design: (definition, principles of sustainable development in building design)
Module 4.	Utility of solar energy in buildings, Concepts of solar passive cooling and heating of buildings. Low-Energy Cooling. Case studies of solar-passive cooled and heated buildings.
Module 5.	Water utilisation in Buildings, low-energy approaches to water management; Management of solid wastes. Management of sullage water and sewage. Urban environment, green cover, and built environment.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	2	3	0	0	0	0	0	0.83
CLO2	3	3	2	2	2	2	3	0	0	0	1	0	1.50
CLO3	2	3	3	2	2	2	3	0	0	0	1	0	1.50
CLO4	2	2	3	2	2	2	3	1	0	0	1	0	1.50
CLO5	2	3	3	2	2	3	3	1	2	1	1	1	2.00
Avg PLO	2.4	2.6	2.2	1.6	1.6	2.2	3.0	0.4	0.4	0.2	0.8	0.2	1.44

S.No:	Text Books	Author	Publisher
1.	Handbook of Green Building Design and Construction	Sam Kubba	Butterworth-Heinemann
	References		
1.	Green Building Fundamentals	HarharaIyer G,	Notion Press



Course Code	BCIVCEH725					
Category	Programme Core Course					
Course Title	Engineering Hydrology					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	3	0	0	3	3	
Pre requisites	Fluid Flow in Pipes & Channels					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Analyze the hydrological cycle and estimate various hydrological processes, including precipitation, evaporation, evapotranspiration, infiltration, and runoff, using standard hydrological methods.

ii) CLO2: Analyze streamflow data and apply hydrograph analysis techniques to determine runoff characteristics, base flow separation, and unit hydrograph parameters.

iii) CLO3: Apply flood estimation and routing techniques to analyze flood design and evaluate reservoir and channel routing for water resources planning.

iv) CLO4: Analyze groundwater movement through aquifers by applying Darcy's law, well hydraulics, and groundwater flow principles to engineering problems.

v) CLO5: Analyze reservoir planning and parameters to determine storage capacity, yield, sedimentation characteristics, and reservoir performance for water resource management.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Hydrology and Hydrological Abstractions Hydrologic cycle; Forms of precipitation; Rainfall and its measurement; Rain gauge network and missing rainfall data; Hyetographs and methods of determining average rainfall; Hydrological abstractions; Water budget equation; Factors affecting and methods of determining evaporation; Transpiration; Evapotranspiration; Infiltration and Infiltration indices
Module 2.	Stream Flow Measurements and Hydrographs Direct and indirect methods of stream flow measurement; Stage-discharge relationship; Factors affecting runoff; Rainfall-runoff relationships; Storm hydrograph; Components of hydrograph and base flow separation; Effective rainfall; Unit hydrograph: Derivation, applications, and limitations
Module 3.	Flood Estimation and Modelling Occurrence and distribution of floods; Flood estimation methods: Rational method, Empirical methods, Unit hydrograph method; Flood routing: Reservoir routing (Modified Puls method), Channel routing (Muskingham method)
Module 4.	Groundwater Hydrology Occurrence and distribution of groundwater; Geological formations and types of aquifers; Aquifer properties; Darcy's law; Pumping tests; Well hydraulics: Steady flow to confined and unconfined aquifers
Module 5.	Reservoir Design Studies Investigations for reservoir planning; Selection of site for a reservoir; Types of reservoirs; Determination of storage capacity and yield using mass curve technique; Reservoir sedimentation and Trap efficiency; Life of reservoirs; Sediment control measures

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO 1	PLO 2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	2	2	2	1	0	2	2	2	2	0	3	1.75
CLO2	3	3	2	0	3	2	3	2	0	0	3	2	1.92
CLO3	3	3	2	2	0	0	3	1	0	2	2	2	1.67
CLO4	3	2	2	3	0	0	2	1	0	2	1	2	1.5
CLO5	2	2	3	2	2	2	3	2	2	2	3	2	2.25
Avg. PLO	2.8	2.4	2.2	1.8	1.2	0.8	2.6	1.6	0.8	1.6	1.8	2.2	1.82

S.No:	Text Books	Author	Publisher
1.	Engineering Hydrology	Subramanya, K.	Tata McGraw-Hill, New Delhi.
2	Irrigation and Water Power Engineering	Punmia, B.C.	Standard Publishers.
	References		
1.	Irrigation, Water Power, and Water Resources Engineering	Arora, K.R.,	Standard Publishers Distributors, Delhi.
2.	Engineering Hydrology	Wilson, E.M.,	ELBS, English Language Book Society, Macmillan Education Ltd., London.



Course Code	BCIVLQS725					
Category	Lab Course					
Course Title	Quantity Survey & Cost Estimation					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	0	1	4	5	3	
Pre requisites	Building Materials and Construction, Basic Surveying, Computer Aided Civil Engineering Drawing					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i). CLO1: Interpret engineering drawings and identify quantities of various civil engineering components.

ii). CLO2: Perform quantity measurements for building and infrastructure works using standard methods.

iii). CLO3: Prepare rate analyses and detailed cost estimates for construction projects.

iv). CLO4: Prepare Bills of Quantities (BOQ), tender documents, and project cost reports.

v). CLO5: Apply modern tools, software, and field measurement techniques for practical quantity surveying and cost management.

Theory Module (Internal Evaluation)

M.No:	Topic
Module 1.	Introduction to quantity surveying and cost estimation. Methods of measurement as per relevant standards. Units and modes of measurement. Interpretation of architectural and structural drawings. Introduction to schedule of rates (SOR), and State Schedule of Rates (SSR).
Module 2.	Estimation of earthwork and foundations. Quantity calculations for masonry works. Estimation of reinforced cement concrete (RCC) works and reinforcement. Flooring, roofing, plastering, painting, and finishing works. Preparation of quantity take-off sheets. Basic Estimation of Building Services (water supply, sanitary, and electrical works).
Module 3.	Material, labour and equipment requirements. Analysis of rates for major civil engineering items. Preparation of detailed estimate, abstract estimate, revised estimate and supplementary estimate. Cost computation using prevailing market rates and SOR.
Module 4.	Preparation of bills of quantities (BOQ), tender documents and contract schedules. Cost control and project budgeting. Valuation principles and depreciation concepts. Introduction to quantity surveying in project management.
Module 5.	Introduction to estimation software and digital quantity take-off. Spreadsheet-based estimation and cost analysis. Quantity extraction from CAD/BIM drawings. Field verification of quantities and measurements.

Activity Module	
1	**Interpretation of Engineering Drawings** – Study architectural and structural drawings of a residential building and identify all measurable components required for quantity estimation
2	**Field Measurement of Building Components** – Measure dimensions of an existing building (classroom, laboratory, or residential unit) using measuring tapes/laser distance meters and prepare measurement sheets as per IS 1200
3	**Preparation of Quantity Take-Off Sheets** – Compute quantities of earthwork, brick masonry, RCC, plastering, flooring, and painting for a simple building using engineering drawings
4	**Estimation of Building Services** – Estimate quantities and approximate costs for water supply, sanitary, and electrical installations of a small building

5	**Rate Analysis of Civil Engineering Items** – Prepare detailed rate analysis for selected items such as brick masonry, RCC, plastering, and concrete flooring using the latest Schedule of Rates (SOR)
6	**Preparation of Detailed Cost Estimate** – Prepare a detailed estimate, abstract estimate, and cost summary for a residential building using prevailing SOR and market rates.
7	**Preparation of BOQ and Tender Documents** – Develop a Bill of Quantities (BOQ), Notice Inviting Tender (NIT), tender schedule, and contract documents for a small construction project
8	**Construction Site Visit for Quantity Verification** – Visit an ongoing construction site to verify executed quantities, compare them with estimated quantities, and identify causes of variations.
9	**Digital Quantity Take-Off Using CAD/BIM or Estimation Software** – Extract quantities from AutoCAD/Revit drawings or prepare estimates using MS Excel, CostX, PlanSwift, or equivalent software
10	**Mini Quantity Surveying Project** – Working in groups, prepare complete estimates, BOQ, rate analysis, project budget, and presentation for a small residential or institutional building, including field verification of selected quantities

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	2	2	1	1	0	0	2	1	0	0	**1.25**
CLO2	3	3	3	2	2	1	1	0	2	1	0	0	**1.5**
CLO3	3	3	3	3	2	1	1	0	1	2	0	0	**1.58**
CLO4	3	3	2	3	2	1	1	1	1	2	1	0	**1.75**
CLO5	3	2	2	2	3	2	2	1	1	1	1	1	**1.75**
Avg PLO	**3**	**2.8**	**2.4**	**2.4**	**2**	**1.2**	**1**	**0.4**	**1.4**	**1.4**	**0.4**	**0.2**	**1.56**

S.No:	Text Books	Author	Publisher
1.	Estimating and Costing in Civil Engineering	B.N. Dutta	UBS Publishers
References			
1.	J&K Schedule of Rates (JKSoR), Latest Edition.	-	Jammu & Kashmir Public Works Department (R&B),
2.	Delhi Schedule of Rates (DSR), Latest Edition.	-	Central Public Works Department (CPWD
3.	Estimating and Costing in Civil Engineering	D.D. Kohli & R.C. Kohli	S. Chand Publications.

Course Code	BCIVCDS725					
Category	Programme Core Course					
Course Title	Design Of Steel Structures					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	2	1	0	3	3	
Pre requisites	**Physics, Mathematics, Strength of Materials. Structural analysis, Analysis of Indeterminate Structures.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Identify different types of structural steel and explain design philosophies.

***ii)* CLO2:** Design riveted, bolted, and welded joints under axial and shear loads and assess their efficiency and failure modes, including eccentric connections.

***iii)* CLO3:** Analyze and design axially loaded compression members, determine effective length, and detail built-up columns with lacing and batten plates.

***iv)* CLO4:** Analyze and design axial loaded tension members using limit state design and built-up sections

***v)* CLO5:** Analyze and design beams considering plastic behaviour, laterally supported/unsupported conditions, and uniaxial/biaxial loading

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction: Structural elements, Types of steel sections, Design philosophy, and Design methods. Working loads and factored loads.
Module 2.	Connections: Riveted, bolted, and welded connections; failure of joints; efficiency of joints; design of bolted, riveted, & welded joints for axial and shear force; HS friction bolts; Design of eccentric connections.
Module 3.	Compression members: Design of compression members for axial force, effective lengths, built-up columns, Design of lacing and batten plates
Module 4.	Tension members: Steel members subject to axial tension, L.S. Design of tension members, Design rules, Built-up sections.
Module 5.	Flexural members: Plastic analysis, laterally supported and unsupported beams, Stability consideration, uniaxial loading, and biaxial loading.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	3	2	0	1	1	1	0	0	0	1	1.17
CLO2	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO3	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO4	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO5	3	3	2	3	0	1	1	1	0	0	0	0	1.17
Avg PLO	3	2.8	2.2	2.8	0	1	1	1	0	0	0	0	1.17

S.No:	Text Books	Author	Publisher
1.	Design of steel structures: Theory and practice	N. Subramanian.	Oxford University Press
2	Limit state design of steel structures	Shashi Kant Duggal	Tata McGraw Hill
	References		
1.	Structural steel design	J. C. McCormac.	Prentice Hall
2.	Design of steel structures	E. H. Gaylord.	Tata McGraw-Hill
3.	Limit state design of steel structures	V.L. Shah and V. Gore	Structures

Course Code	BCIVDSD725					
Category	Programme Elective Course					
Course Title	Structural Dynamics					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	2	1	2	5	4	
Pre requisites	Physics, Mathematics, Strength of Materials, Structural analysis, Analysis of Indeterminate Structures.					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1:** Understand the fundamental principles of structural dynamics for single and multi-degree of freedom systems

ii) **CLO2:** Analyze natural frequencies, mode shapes, and damping ratios of dynamic systems

iii) **CLO3:** Analyze the dynamic response of structures under harmonic, impulse and earthquake excitations using numerical techniques.

iv) **CLO4:** Formulate the equation of motion for generalized SDOF dynamic problems

v) **CLO5:** Evaluate modal participation and use modal superposition to estimate response of MDOF systems

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to basic concepts of Structural Dynamics: Concept of vibration, Causes of vibrations, Types of vibrations, consequences of vibration, vibration control in structural design, Dynamic loading, Causes of dynamic loadings, Response of the system, Degrees of Freedom, Simple harmonic motion.
Module 2.	Single Degree of Freedom Systems: Analysis of Free Vibrations – undamped and damped systems, estimation of damping by logarithmic decrement method
Module 3.	Formulation of equation of motion for generalized SDOF dynamic problems using virtual work method, Response of SDOF systems to Harmonic, Periodic and Impulse Loads
Module 4.	Formulation of equation of motion for multiple DOF systems. Finding mode shapes and frequencies by solving the determinantal equation and iterative techniques. Use of sweeping matrices for obtaining higher modes. Proof of Convergence. Modal superposition and Response Spectrum Methods.
Module 5.	Response of single and multiple DOF systems to Earthquake Loading using Time Stepping, Methods based on Forward Cauchy Euler, Backward Cauchy Euler and Trapezoidal Rule. Accuracy, stability and algorithmic damping in step-by-step methods.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	3	2	0	1	1	1	0	0	0	1	1.17
CLO2	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO3	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO4	3	3	2	3	0	1	1	1	0	0	0	0	1.17
CLO5	3	3	2	3	0	1	1	1	0	0	0	0	1.17
Avg PLO	3	2.8	2.2	2.8	0	1	1	1	0	0	0	0	1.17

S.No:	Text Books	Author	Publisher
1.	Dynamics of Structures	A. K. Chopra.	Pearson Education
2	Structural Dynamics	Mario Paz and William Leigh.	CBS
	References		
1.	Dynamics of Structures	R.W Clough & J. Penzin.	McGraw Hill
2.	Advanced Dynamics	S. Timoshenko.	McGraw Hill
3.	Introduction of Structural Dynamics	J.M. Biggs.	McGraw Hill

List Of Experiments	
S.No.	**Name of Experiment**
1.	Free vibration of a simple pendulum: To study undamped free oscillations of a simple pendulum and determine the natural frequency of oscillations.
2.	Free vibration of a spring mass: To study undamped free vibrations of a spring-mass system and to determine the natural frequency of vibrations.
3.	Forced Vibration of S.D.O.F System: To study forced vibrations of a SDOF system and determine the natural frequency of vibrations.
4.	Vibration of M.D.O.F system: To find out natural frequencies and natural mode shapes of multi-degree of freedom system
5.	Free vibration of a damped second order system: To study the free vibration of a damped second order system and determine the frequency of damped vibrations. Also, draw the decay curve and determine the logarithmic decrement.
6.	Vibration in beams: To study the vibrations of different types of beams.
7.	Vibration Control of a structure: To understand how dampers or isolators can control vibration of structures

Course Code	BCIVDNM725					
Category	Programme Elective Course					
Course Title	Numerical Methods					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	3	1	0	4	4	
Pre requisites	Calculus and Linear Algebra.					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1: Solve** algebraic and transcendental equations using numerical methods for real world problem solving.

ii) **CLO2: Apply** numerical techniques to solve linear systems of equations in scientific and engineering computations.

iii) **CLO3: Use** interpolation methods to approximate functions in data analysis and modelling.

iv) **CLO4: Compute** derivatives and integrals for complex mathematical and physical problems.

v) **CLO5: Solve** ordinary differential equations numerically for dynamic system modelling and simulations.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Finite Difference and Interpolation: Difference Table and its usage. The difference operators Δ, ∇ and the operator E. Interpolation with equal intervals, Newton's advancing difference formula. Newton's backward difference formula. Interpolation with unequal intervals. Newton's divided difference formula. Lagrange's interpolation formula.Spline functions.
Module 2.	Central Differences: The central difference operator δ and the overraging operator μ. Relations between the operators.Gauss forward and backward interpolation formula, Sterling's, Bessel's, Laplace and Everett's formulae
Module 3.	Numerical solution of algebraic and Transcendental Equations: Equations Graphic Method, Regula-Fast method, Balzano's Process of bisection of intervals, Newton-Raphson Method and its geometrical significance.
Module 4.	Numerical Integration: Numerical Integration, General Quadrature Formula, Simpson's one-third and three-eight rules, Weddles' rule, Hardy's rule, Trapezoidal rule.
Module 5.	Numerical Solution of ordinary differential equations : Picard's method. Numerical solution of ordinary differential equations, Taylor's series method, Euler's method, Runge-Kutta Method.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg PLO
CLO1	3	3	1	2	2	0	0	0	0	0	0	1	1
CLO2	3	3	2	2	2	0	0	0	0	0	0	1	1.08
CLO3	3	3	2	3	2	0	0	0	0	0	0	1	1.17
CLO4	3	3	2	3	2	0	0	0	0	0	0	2	1.25
CLO5	3	3	3	3	2	0	0	0	0	0	0	2	1.33

Avg PLO	3	3	2	2.60	2	0	0	0	0	0	0	1.40	1.17

S.No:	**Text Books**	**Author**	**Publisher**
1.	Introductory Methods in Numerical Analysis	S. S. Sastry	PHI Learning Pvt Ltd
2	Mathematical Numerical Analysis	S. C. Scarborough	CBS Publishers & distributors
	References		
1.	Numerical Methods for scientists and Engineering	M..K.. Jain, S.R. Iyenger 7 R. K. Jain	New age publications
2.	Numerical Methods for Mathematics, Science and Engineering	J. H. Mathews	Prentice hall college division
3.	Theory and Problems in Numerical methods	T. Veerrarjan and T.Ramachandra	Tata McGraw-Hill

Course Code	**BCIVDAD725**					
Category	**Programme Elective Course**					
Course Title	**Airport, Dock and Harbour Engineering**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 7 (Seventh)**
	3	**1**	**0**	**4**	**4**	
Pre requisites						

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1**: Explain airport planning principles, aircraft characteristics, airport components, and site selection criteria.

ii) **CLO2:** Design runway orientation, runway length, and geometric elements considering operational and environmental factors.

iii) **CLO3**: Analyze the planning and design of taxiways, aprons, terminal facilities, airport lighting, and air traffic control systems.

iv) **CLO4:** Explain harbour planning principles and assess the effects of oceanographic factors on harbour design.

v) **CLO5:** Analyze and design major harbour and port structures including breakwaters, docks, quays, jetties, and cargo handling facilities.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to airport engineering: Airport planning concepts, Components of an airport, Functions of airport components, Airport classification, Aircraft characteristics affecting airport planning, Airport site selection, Airport master planning, Airport zoning, Obstruction criteria, Safety requirements
Module 2.	Runway Engineering: Wind rose diagram, Runway orientation, Basic runway length, Corrections for: elevation, temperature and gradient, Numerical problems on runway length, Runway geometric design, Runway width, Longitudinal slope, Transverse slope, Camber, Runway safety areas.
Module 3.	Taxiways and Airport Facilities: Taxiway planning, Taxiway layout, Factors affecting taxiway design, Taxiway geometry, Exit taxiways, Holding bays, Turning radius, Aprons, Aircraft parking systems, Airport markings, Airport lighting, Visual aids, Air Traffic Control (ATC), Instrument Landing System (ILS).
Module 4.	Docks and Harbours: Classification of harbours, Components of harbours, Site selection, Harbour planning ,Requirements of a good harbour, Layout of harbours, Wet docks, Dry docks, Construction and maintenance of docks.
Module 5.	Harbour Structures: Breakwaters, Lock gates, Quays, Jetties, Landing piers, Dolphins, Fenders, Slipways, Aprons, Transit sheds, Warehouses.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. PLO
CLO1	3	2	1	1	1	1	2	0	0	0	0	1	1
CLO2	3	3	3	2	2	2	3	1	0	1	2	1	1.9

CLO3	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**2**	**2.25**
CLO4	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**1**	**0**	**0**	**1**	**1**	**1.75**
CLO5	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**2.4**
Avg. CLO	**3**	**3**	**2.4**	**2.2**	**2.2**	**2**	**2.6**	**1.2**	**0.4**	**0.6**	**1.6**	**1.4**	**1.86**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Airport Planning and Design	S.K. Khanna & M.G. Arora	S.K. Nem Chand & Bros., Roorkee
2	Dock and Harbour Engineering	H.P. Oza & G.H. Oza	Charotar Publishing House Pvt. Ltd., Anand
	References		
1.	Airport Engineering: Planning, Design and Development of 21st Century Airports	N.J. Ashford, Saleh Mumayiz & Paul H. Wright	John Wiley and Sons
2.	Planning and Design of Airports	Robert Horonjeff & Francis X McKelvey	Mc. Graw Hill
3.	Design and Construction of Ports and Marine Structures	Alonzo Def. Quinn	Mc. Gram Hill

Course Code	**BCIVDEG725**					
Category	**Professional Elective I**					
Course Title	**Engineering Geology**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 7 (Seventh)**
	3	**0**	**2**	**5**	**4**	
Pre requisites	**Engineering Chemistry**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the behavior of rocks at different scales, under loading conditions at the ground surface and in the subsurface.

ii) CLO2: Understand the link between rock mechanics, geology, and hydrogeology.

iii) CLO3: Understand the various engineering properties of Earth's materials.

iv) CLO4: Identify geologically significant places to learn the in-situ character of rocks in quarries, outcrops, road cuttings, dams, tunnels, and underground excavations.

v) CLO5: Analyse earthquake mechanisms and their effects on civil structures.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Physical Geology: Scope and importance of engineering geology in civil engineering; Internal structure of the earth; Weathering, erosion, and denudation processes; Geological work of wind, rivers, underground water, and glaciers. Occurrence and engineering significance of groundwater.
Module 2.	Mineralogy and Petrology Definition and classification of minerals; Physical and chemical properties of common rock-forming minerals; Formation processes and classification of igneous, sedimentary, and metamorphic rocks; Textural and structural characteristics; laboratory/field identification of rocks; Suitability of rocks and natural geological materials as construction and foundation materials.
Module 3.	Structural Geology: Outcrop; Stratification; Dip and strike relation; Unconformities: types, recognition methods and engineering relevance; Joints: types, causes and impacts on stability; Faults and folds: classification, mechanics of formation, recognition and significance; Remote sensing and GIS applications in engineering geology; Geological maps and map interpretation
Module 4.	Engineering Applications in Infrastructure Projects: Geological investigations: surface and subsurface investigations; Engineering geological considerations in site selection, feasibility, and design of dams, reservoirs, tunnels, highways, bridges, and underground excavations; Rock mass classification systems (RQD, RMR, and Q-System)
Module 5.	Geological Hazards and Disaster Risk Management: Earthquake mechanisms and seismicity; Seismic hazard assessment and microzonation; Liquefaction and ground failure; Geological hazards including landslides, subsidence, and coastal erosion; Geological aspects of climate change; Risk mitigation and resilience in civil engineering projects; Case studies of major engineering failures due to geological factors.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO 1	PLO 2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO

CLO1	3	2	0	1	0	2	0	0	1	0	2	2	1.1
CLO2	3	3	3	1	1	2	1	0	1	0	0	2	1.4
CLO3	3	2	2	3	3	2	1	0	2	2	1	3	2.0
CLO4	3	3	3	3	2	2	2	0	1	2	2	3	2.2
CLO5	3	3	3	3	2	3	2	0	1	2	2	3	2.3
Avg. PLO	3.0	2.6	2.2	2.2	1.6	2.2	1.2	0	1.2	1.2	1.4	2.6	1.8

S.No:	Text Books	Author	Publisher
1.	Principles of Engineering Geology,	Bangar, K.M.,	Standard Publishers Distributors, New Delhi.
2	Engineering Geology	Singh, P.,	Katson Publishers, New Delhi.
	References		
1.	Geology for Civil Engineers	Gribble, C. & McLean, A.,	(2nd Edition), CRC Press, Taylor & Francis Group, London

List of Experiments

1	Identification of common rock-forming minerals based on physical properties (colour, lustre, streak, hardness, cleavage, fracture, and specific gravity).
2	Identification and interpretation of geological structures (outcrop, dip, strike, joints, faults, folds, and unconformities) using models and hand specimens.
3	Determination of Rock Quality Designation (RQD) and introduction to Rock Mass Rating (RMR) using core samples/data.
4	Demonstration of the Point Load Strength Index Test on rocks.
5	Demonstration of the Uniaxial Compressive Strength (UCS) test on rock cores.

Course Code	BCIVDAC725					
Category	Programme Elective Course					
Course Title	Advanced Reinforced Concrete Structures					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	2	1	0	3	3	
Pre requisites	**Physics, Mathematics, Strength of Materials. Structural analysis, Analysis of Indeterminate Structures, Concrete Technology, Building Materials, Design of reinforced concrete structures.**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1:** Analysis and design of footings for reinforced concrete structures.

ii) **CLO2:** Analysis and design of retaining walls for unstable soil embankments.

iii) **CLO3:** Analysis and design of water tanks.

iv) **CLO4:** Analysis and design of Domes

v) **CLO5:** Analysis and design of Deep beams.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to the footings, Various types of RCC footings, design considerations, design of RCC isolated and combined footings.
Module 2.	Introduction to retaining walls, types of retaining walls, stability requirements of retaining walls, design of cantilever and counter-fort retaining walls.
Module 3.	Introduction to liquid resting structures; types, Design considerations; Design of circular & rectangular water tanks resting on the ground and underground, with reference to IS:3370 (2009).
Module 4.	Analysis and design of spherical & conical domes by statical methods.
Module 5.	Deep Beams: General features, Parameters influencing design, Flexural bending and shear stresses in deep beams. Design provisions of IS-456, check for local failures, detailing of reinforcement in deep beams.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	3	3	0	1	1	1	0	0	0	0	1.25
CLO2	3	3	3	3	0	1	1	1	0	0	0	0	1.25
CLO3	3	3	3	3	0	1	1	1	0	0	0	0	1.25
CLO4	3	3	3	3	0	1	1	1	0	0	0	0	1.25
CLO5	3	3	3	3	0	1	1	1	0	0	0	0	1.25
Avg PLO	3	3	3	3	0	1	1	1	0	0	0	0	1.25

S.No:	Text Books	Author	Publisher
1.	Reinforced Concrete Design	S Unnikrishna Pillai, Devdas Menon	McGraw Hill
2	Advanced R.C.Design	Krishna Raju	CBS
	References		
1.	Advanced Reinforced Concrete	P.C. Vargese	Prentice Hall

Course Code	**BCIVDAN725**					
Category	**Programme Elective Course**					
Course Title	**Air and Noise Pollution Control Engineering**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 7 (Seventh)**
	3	**0**	**0**	**3**	**3**	
Pre requisites	**NIL**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the sources, effects, and control of air and noise pollution.

ii) CLO2: Explain air pollutant sampling, monitoring, and dispersion principles.

iii) CLO3: Apply air pollution control technologies for particulate and gaseous pollutants.

iv) CLO4: Analyze air quality and noise pollution problems using engineering principles.

v) CLO5: Select suitable pollution control methods to meet environmental standards.

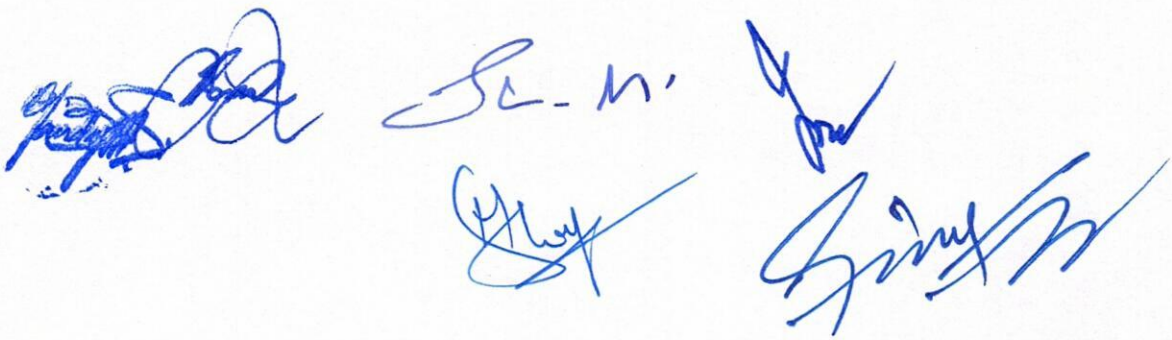
Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Composition and structure of atmosphere, Air pollutants, Sources and sinks, Classification of pollutant,, effect on human health vegetation and property, Reactions of pollutants and their effects, Smoke, smog and ozone layer disturbance, Greenhouse effect
Module 2.	Basic Principles of Sampling, Source and ambient sampling, Analysis of pollutants, Principles, Wind roses, Lapse rate, Atmospheric stability and turbulence, Plume rise, Dispersion of pollutants, Dispersion models, Emission Factors
Module 3.	Control strategies and policies, Choosing appropriate air pollution control technology, Particulate Pollutant Control, Settling chambers, Filtration, Electrostatic precipitation, Cyclone separation, Wet collectors
Module 4.	Gaseous Pollutant Control, Gas absorption in tray and packed towers, Absorption, Adsorption in fixed beds, Breakthrough. Control technologies for removal of SO2, NOx, VOC, Control technologies for motor vehicles
Module 5.	Noise Pollution, definition, sources, effects, measurement, standards and limit values, instrumentation and monitoring procedure, and control.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO 1	PLO 2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	2	0	0	0	0	3	0	0	0	0	0	0.67
CLO2	3	3	0	2	3	0	2	0	0	0	0	0	1.08
CLO3	3	2	3	2	2	0	3	0	0	0	0	0	1.25
CLO4	2	3	2	3	2	0	3	0	0	0	0	0	1.25
CLO5	2	3	2	2	2	0	3	0	0	0	0	0	1.17
Avg. PLO	2.60	2.60	1.40	1.80	1.80	0.00	2.80	0.00	0.00	0.00	0.00	0.00	1.008

S.No:	Text Books	Author	Publisher
1.	Environmental Pollution Control Engineering	Rao C.S	New Age International Ltd
2	Noise Pollution and Its Control	K.N.Rao and S.L.Patil	Daya Publishing House
	References		
1.	Air pollution control Engineering	Noel de Nevers	Waveland Press, INC
2.	Environmental Engineering	Peavy H.S., Rowe D.R., Tchobanoglous G	McGraw Hills
3.	Environmental Noise Pollution	Cunniff P.F	McGraw Hill



Course Code	BCIVDTP725					
Category	Programme Elective Course					
Course Title	Transportation Planning and Economics					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 7 (Seventh)
	3	0	0	3	3	
Pre requisites	Highway Engineering, Traffic Engineering, Project Management & Network Analysis, Basic Surveying					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the fundamentals of transportation planning and economics

ii) CLO2: Compare public transportation systems and transit operations.

iii) CLO3: Interpret transportation planning models and demand forecasting techniques

iv) CLO4: Apply economic evaluation methods to highway projects

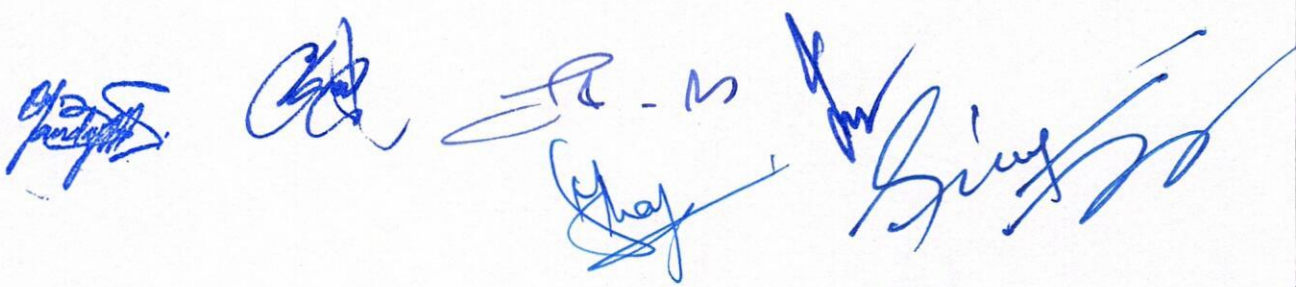
v) CLO5: Evaluate transportation investment alternatives using economic analysis techniques.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction: Scope of transportation planning and transportation economics, transportation planning issues.
Module 2.	Public Transportation: public transport modes, desirable characteristics of public transport systems, transit system operations, route development, stopping policy, stop location, scheduling, the capacity of transit systems, socially optimal pricing.
Module 3.	Transport analysis and forecasting: Transport planning process, transportation and land use, transport planning strategies, transport planning models, travel demand analysis, operational transportation, and land use, models.
Module 4.	Pavement Economics and Highway Cost Components: Pavement economics, construction cost; maintenance cost and vehicle operation cost, economic evaluation of highway projects- basic principles.
Module 5.	Transportation Economics : Time value of money; costs and benefits; net present value (NPV) method; benefit cost (B/C) ratio method; internal rate of return (IRR) method; comparison of evaluation techniques, freight transport-trends, and economic growth.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	0	1	2	0	0	0	0	1	0.92
CLO2	2	3	2	2	1	0	2	0	1	1	0	1	1.25
CLO3	2	3	2	3	2	1	2	0	1	2	1	2	1.75
CLO4	2	2	3	2	3	0	1	0	1	2	2	1	1.58
CLO5	3	3	3	2	2	2	3	1	2	2	2	2	2.25
Avg PLO	2.4	2.6	2.2	2	1.6	0.8	2	0.2	1	1.4	1	1.4	1.55

S.No:	Text Books	Author	Publisher
1.	Transport Planning and Traffic Engineering	CA O'Flaherty	Wiley & Sons, Inc., New York; Toronto.
	References		
1.	Principles of Transportation Engineering	Chakarborty & Das	Prentice-Hall of India



Course Code	**BCIVDGI725**					
Category	**Programme Elective Course**					
Course Title	**Ground Improvement Techniques**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 7 (Seventh)**
	3	**0**	**0**	**3**	**3**	
Pre requisites	**Soil Mechanics and Foundation Engineering**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Identify problematic soil conditions and explain the need, objectives, and selection criteria for appropriate ground improvement techniques.

ii) CLO2: Analyze and apply mechanical ground improvement methods such as compaction and densification based on soil type and field requirements.

iii) CLO3: Evaluate hydraulic ground improvement techniques, including dewatering, drainage, preloading, and vertical drains for different geotechnical applications.

iv) CLO4: Understand the effects of chemical stabilization and grouting methods on engineering properties of soils for foundations, embankments, and pavements.

v) CLO5: Interpret practical case studies and field applications to select suitable ground improvement solutions for real-world engineering problems.

Theory Module (Internal and External Evaluation)

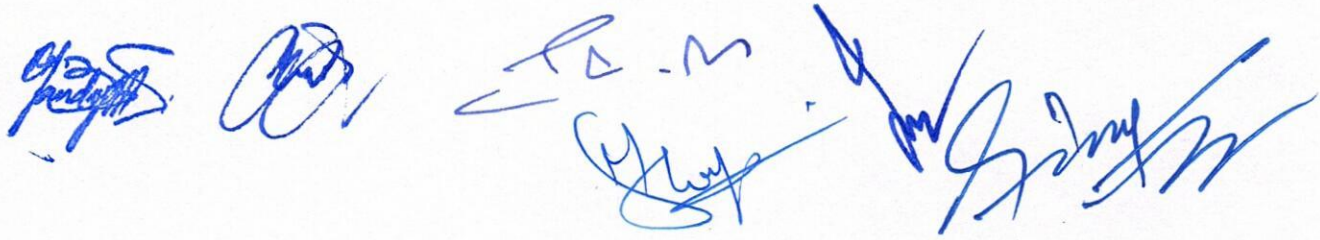
M.No:	Topic
Module 1.	Problematic ground conditions; Soil investigation and classification relevant to ground improvement; Need and objectives of engineered ground improvement; Classification of ground improvement techniques; Selection criteria based on suitability, feasibility, and desirability; Overview of current practices and future developments in ground improvement.
Module 2.	Mechanical methods of ground improvement; Principles of soil densification and compaction; Methods of compaction control and quality assurance; Compaction specifications and field requirements; Types, selection, and performance of compaction equipment.
Module 3.	Hydraulic methods of ground improvement; Objectives and techniques of dewatering; Soil-water interaction; Single-well and multi-well dewatering systems; Slope drainage systems; Filtration and seepage control; Preloading techniques with vertical drains; Electrokinetic dewatering and stabilization.
Module 4.	Chemical stabilization of soils; Effects of stabilizing agents such as cement, lime, fly ash, bitumen, and cement–lime–fly ash mixtures on engineering properties of soils; Use of chemical additives including NaCl, $CaCl_2$, $CaSO_4$, $Ca(OH)_2$, and NaOH; Grouting techniques and applications to embankments, foundations, and sensitive soils; Role of admixtures in pavement engineering; Bio-Enzyme Stabilization
Module 5.	Thermal methods of ground improvement; Thermal properties of soils; Heat treatment and ground freezing techniques; Strength and deformation behavior of frozen ground; Ground improvement using inclusions and confinement; Principles and evolution of soil reinforcement; Applications of geosynthetics; Soil nailing and ground anchoring systems.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	3	3	2	1	1	1	0	1	1	3	3	1.8
CLO2	3	3	3	2	2	1	0	0	1	1	3	3	1.8

CLO3	3	3	3	2	2	1	0	0	2	1	3	3	1.9
CLO4	3	3	3	2	2	1	0	0	2	1	3	3	1.9
CLO5	3	3	3	2	3	1	0	0	1	1	3	3	1.9
Avg. PLO	3.0	3.0	3.0	2.0	2.0	1.0	0.2	0.0	1.4	1.0	3.0	3.0	1.9

S.No:	Text Books	Author	Publisher
1.	Ground Improvement	Moseley, M.P. and Kirsch, K.,	2nd Edition, CRC Press / Taylor & Francis
2	Engineering Principles of Ground Modification	Hausmann, M.R.,	McGraw-Hill.
	References		
1.	Principles of Foundation Engineering	Braja M. Das,	Cengage Learning.
2.	Principles and Practice of Ground Improvement	Han, J.	John Wiley & Sons.
3.	Soil Improvement and Ground Modification Methods	Nicholson, P.G.,	Butterworth-Heinemann.



Course Code	**BCIVPPW725**					
Category	**Lab Course**					
Course Title	**Project Pre Work**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 7 (Seventh)**
	0	**0**	**8**	**4**	**4**	
Pre requisites	**Fundamental Knowledge of Civil Engineering**					

Course Outcomes (COs) Upon successful completion of this course, the students will be able to:

CLO1: Identify and define a research problem through literature review and industrial interaction.

CLO2: Develop a project methodology for the proposed investigation, including the design of experiments.

CLO3: Evaluate and select appropriate analytical, experimental, computational, or field-based methods for the proposed project.

CLO4: Assess the technical feasibility and expected outcomes of the proposed project.

CLO5: Prepare and present the project proposal through technical reports and presentations

Description:

The project pre-work is an essential component of the B.Tech. program, where students apply the knowledge and skills acquired during their studies to identify real-world engineering problems. The students develop methodologies to solve these problems by applying appropriate analytical, experimental, computational, or field-based methods.

Course Plan:

Projects will be undertaken in groups that will nurture the concept of teamwork. Assessment will be by means of a presentation, submission of a report, and a demonstration of work undertaken. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres. Each group of students shall identify a topic(s) from the civil engineering discipline or interdisciplinary type, approved by the Project and Training Incharge (PTI), and eventually it will be assessed later before an expert committee constituted by the concerned department on the basis of the following:

- Quality of content presented.
- Proper planning for a presentation.
- Effectiveness of presentation.
- Report writing based on the state of the art, fundamentals of the topic and its viability.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	1	3	2	2	2	1	2	2	1	2	**2**
CLO2	2	3	2	3	2	1	2	2	2	1	3	2	**2.08**
CLO3	3	3	2	3	3	1	2	3	2	1	2	2	**2.25**
CLO4	2	3	3	3	2	3	3	2	1	1	3	2	**2.33**
CLO5	1	1	1	1	2	1	1	2	3	3	3	3	**1.83**
Avg PLO	**2.2**	**2.6**	**1.8**	**2.6**	**2.2**	**1.6**	**2**	**2**	**2**	**1.6**	**2.4**	**2.2**	**2.1**

Course Code	**BCIVDER825**					
Category	**Programme Elective Course**					
Course Title	**Earthquake Resistant Design**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	2	1	0	3	3	
Pre-requisites	**Strength of Materials, Structural Dynamics**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i*) CLO1:** Explain earthquake phenomena, seismic hazards, and ground motion characteristics.

ii) CLO2: Apply structural dynamics principles to determine seismic response.

iii) CLO3: Analyse structures using IS 1893 (Part 1): 2016 provisions and seismic analysis methods.

iv) CLO4: Design and detail earthquake-resistant RC members as per IS 13920:2016.

v) CLO5: Evaluate retrofitting strategies, performance-based design concepts, and seismic analysis software applications.

Theory Module (Internal and External Evaluation)

M. No.:	Topic
Module 1.	Introduction to earthquakes, Basic Terminology, Causes of Earthquakes, Magnitude & intensity, Ground Motion Parameters, Response Spectra, Design Spectra, Past Earthquakes and lessons learned
Module 2.	Theory of Vibrations, Free and Forced Vibrations, Undamped and Damped Vibration, Logarithmic Decrement, Deterministic Analysis, Lateral forces, Application of Green's Theorem in Earthquake Engineering.
Module 3.	Overview of IS 1893 (Part 1): 2016. General Provisions and Building Configuration. Load Combinations. Seismic Weight and Distribution of Seismic Forces. Analysis Methods (Equivalent Static Method, Response Spectrum Method). Torsion in Buildings and Methods to Counteract. Introduction to Seismic Design of Masonry Structures.
Module 4.	Overview of IS 13920: 2016. Importance of Ductility in Seismic Design. Detailing Requirements for Beams, Columns, and Joints. Detailing Requirements for Shear Walls and Frame-Shear Wall Systems.
Module 5.	Seismic Retrofitting, Introduction to Advanced Topics in Seismic Design. Performance-Based Seismic Design. Nonlinear Static and Dynamic Analysis (Pushover Analysis). Introduction to Seismic Analysis and Design Software.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	1	0	0	0	0	0	1	**0.58**
CLO2	3	3	2	2	1	0	0	0	0	0	0	1	**1**
CLO3	3	3	3	2	2	0	0	0	0	0	0	1	**1.17**
CLO4	3	3	3	1	1	2	0	1	0	0	0	2	**1.33**
CLO5	2	3	3	3	3	2	1	1	0	1	0	3	**1.83**
Avg PLO	**2.8**	**2.8**	**2.2**	**1.6**	**1.4**	**1**	**0.2**	**0.4**	**0**	**0.2**	**0**	**1.6**	**1.18**

S.No:	Text Books	Author	Publisher
1.	Earthquake-Resistant Design of Building Structures	Duggal, S. K.	Oxford University Press.
	References		
1.	Dynamics of Structures: Theory and Applications to Earthquake Engineering	Chopra, A. K.	Pearson Education
2.	Earthquake Resistant Design of Structures	Agarwal, Pankaj & Shrikhande, Manish	Prentice Hall of India (PHI)
3.	Fundamentals of Earthquake Engineering	Elnashai, A. S. & Di Sarno, L.	John Wiley & Sons
4.	IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures	IS Code	BIS, New Delhi
5.	IS 13920: 2016 – Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces	IS Code	BIS, New Delhi
6.	IS 4326: 2013 – Earthquake Resistant Design and Construction of Buildings	IS Code	BIS, New Delhi

Course Code	BCIVDHW825					
Category	Programme Elective Course					
Course Title	Hazardous Waste Management					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 8 (Eighth)
	3	0	0	3	3	
Pre requisites	NIL					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand hazardous waste concepts, classification, and regulations.

ii) CLO2: Compare hazardous waste management and treatment methods.

iii) CLO3: Interpret contaminant behavior, risks, and remediation approaches.

iv) CLO4: Illustrate hazardous waste treatment, disposal, and remediation processes.

v) CLO5: Develop an integrated hazardous waste management and contaminated site remediation plan.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Hazardous Waste Fundamentals: Definition, landmark episodes, classification, generation, Basel Convention, U.S. regulatory framework (RCRA and CERCLA/Superfund), Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, physiochemical properties (partition coefficients, octanol-water, soil-water, organic-carbon, bioconcentration factor)
Module 2.	Fate and Transport of Contaminants: Contaminant release in air, soil, and water; transport mechanisms (advection, dispersion, diffusion); non-ideal contaminant transport; contaminant fate in the subsurface (retardation, attenuation, mobility enhancement). Toxicology: Definition; exposure (absorption mechanisms, distribution and storage, biotransformation, elimination, pharmacokinetics, exposure duration); toxic effects (structural affinity, classification of toxic actions and effects); dose–response relationships; non-carcinogens (threshold, NOAEL, ADI, RfD, risk calculation); carcinogens (classification and dose–response relationships).
Module 3.	Current Management Practices: Environmental audit (types, features of effective environmental audit, program planning, preaudit preparation, on-site activities, evaluation and presentation; Pollution prevention (management strategies, volume reduction methods, toxicity reduction methods, recycling); Facility types, operations and site selection.
Module 4.	Treatment and Disposal Methods: Physicochemical processes (air stripping, carbon adsorption, steam stripping, chemical oxidation, membrane processes); Biological processes (treatment of liquids, slurry phase treatment, solid and vapor phase treatment, monitored natural attenuation, enhanced degradation).
Module 5.	Remediation of Contaminated Sites: Quantitative risk assessment (risk and hazard definition, purpose of risk assessment, hazard identification, exposure assessment, toxicity assessment, risk characterization, risk communication); Methods of site characterization (geophysical methods, boring and sampling, monitoring wells); Remedial technologies.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO1	3	2	0	0	0	0	3	0	0	0	0	0	0.67

CLO2	3	3	2	2	2	0	3	0	0	0	0	0	1.25
CLO3	2	3	2	3	2	0	3	0	0	0	0	0	1.25
CLO4	3	2	3	2	2	0	3	0	0	0	0	0	1.25
CLO5	2	3	3	2	2	0	3	0	0	2	2	0	1.58
Avg. PLO	2.60	2.60	2.00	1.80	1.60	0.00	3.00	0.00	0.00	0.40	0.40	0.00	1.2

S.No:	Text Books	Author	Publisher
1.	Hazardous Waste Management	LaGrega, M.D., Buckingham, P.L. and Evans, J.C.,	McGRAW-HILL
	References		
1.	Standard Handbook of Hazardous Waste Treatment and Disposal	Freeman, H.W.	McGraw Hill

Course Code	BCIVDUT825					
Category	Programme Elective Course					
Course Title	Urban Transportation Planning					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 8 (Eighth)
	3	0	0	3	3	
Pre requisites	Highway Engineering, Traffic Engineering & Road Facilities, Surveying					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the fundamentals of transportation systems and socio-economic activities

ii) CLO2: Analyze urban transportation planning processes and transport models

iii) CLO3: Evaluate transportation survey data for travel demand analysis.

iv) CLO4: Apply urban structure concepts to transportation planning

v) CLO5: Develop urban goods movement strategies using transportation planning principles

Theory Module(Internal and External Evaluation)

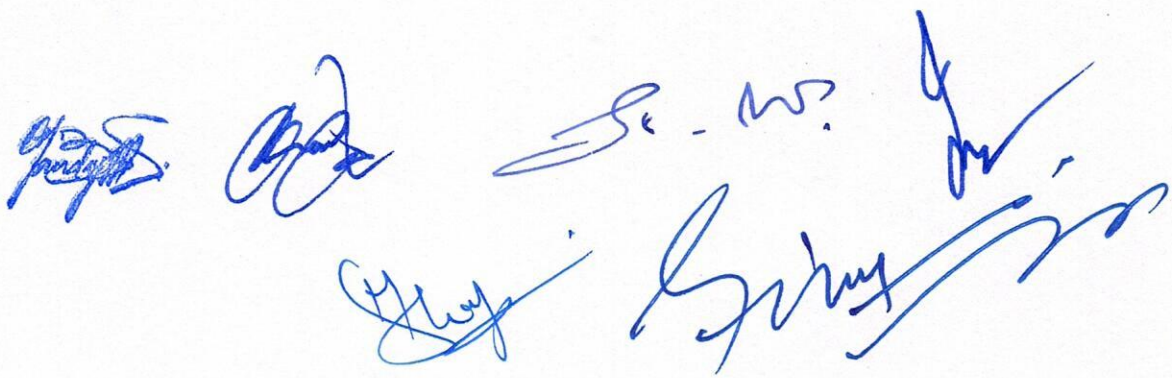
M.No:	Topic
Module 1.	Introduction: Transport and Socioeconomic Activities; Historical Development of Transport; Transportation in the Cities; Freight Transportation; Future Developments.
Module 2.	Urban Transportation System Planning Conceptual Aspects: Transport Planning Process, Problem Definition, Solution Generation, Solution Analysis, Evaluation and Choice, Implementation, Sequence of Activities Involved in Transport Analysis. Trip generation, trip distribution , mode choice, traffic assignment, Transport system models
Module 3.	Transportation Survey: Definition of Study Area, Zoning, Types of Movements,Types of Surveys, Home-Interview Survey, Commercial Vehicle Survey, Intermediate Public Transport Survey, Cordon-Line Survey, Post-Card Questionnaire Survey, Registration-Number Survey, Tag-on-Vehicle Survey.
Module 4.	Urban Structure: Urban Activity Systems, Urban Movement Hierarchies, Types of Urban Structure, Centripetal - Type Urban Structure, Grid-Type Urban Structure, Linear-Type Urban Structure, Directional Grid Urban Structure
Module 5.	Urban Goods Movement: Classification of Urban Goods Movements. Methodology of Approach to Analysis of Goods Movement. Modelling Demand for Urban Goods Transport.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	0	2	2	1	0	1	0	1	1.17
CLO2	2	3	3	2	2	1	2	0	1	1	1	2	1.67
CLO3	2	3	2	3	3	1	2	0	2	2	1	2	1.92
CLO4	2	2	3	2	2	1	3	0	1	2	0	2	1.67
CLO5	3	3	3	3	2	2	3	1	2	2	2	2	2.33

Avg PLO	**2.4**	**2.6**	**2.4**	**2.2**	**1.8**	**1.4**	**2.4**	**0.4**	**1.2**	**1.6**	**0.8**	**1.8**	**1.75**

S.No:	Text Books	Author	Publisher
1.	Principles of Urban Transport Systems Planning	Hutchinson,B.G.,	McGraw Hill Book Company
	References		
1.	Traffic Engineering and Transport Planning	Kadiyali, L.R.,	Khanna Publishers, New Delhi



Course Code	**BCIVDSS825**					
Category	**Programme Elective Course**					
Course Title	**Soil Structure Interaction**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	2	1	0	3	3	
Pre requisites	**Soil Mechanics**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i*) CLO1:** Explain the fundamentals of soil–structure interaction and dynamic loading.

ii) CLO2: Apply elastic foundation models to analyse soil–foundation interaction.

iii) CLO3: Analyse beams and foundations on elastic media.

iv) CLO4: Evaluate the response of pile foundations under vertical and lateral loading.

v) CLO5: Interpret numerical modelling approaches and engineering applications of soil–structure interaction.

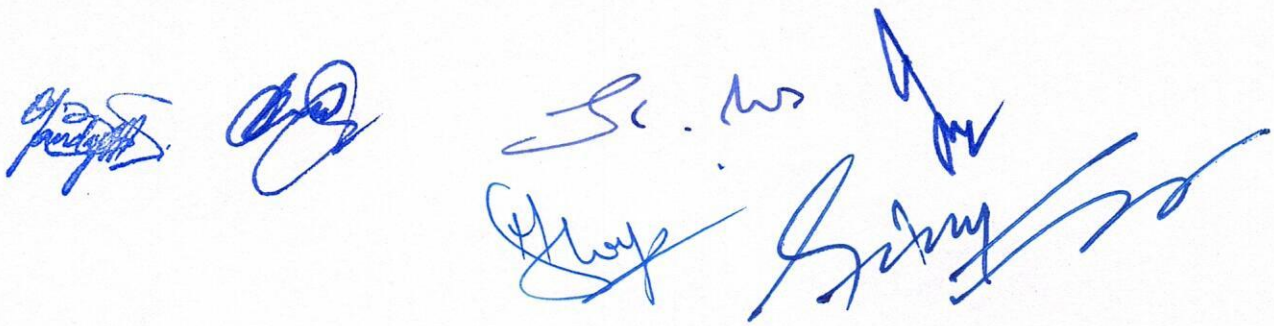
Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Importance of Soil–Structure Interaction, Foundation and Soil–Foundation Interface Behaviour, Dynamic Loading, Limiting Movements, Criteria for Design under Dynamic Loading.
Module 2.	Elastic Models of Soil Behaviour, Winkler Model, Isotropic Elastic Continuum Model, Two-Parameter Elastic Models, Pasternak Model, Filonenko-Borodich Model, Time-Dependent Behaviour of Soils.
Module 3.	Soil–Foundation Interaction Models, Bernoulli–Euler Beam Theory, Infinite and Finite Beams, Beams Resting on Winkler and Pasternak Foundations.
Module 4.	Soil–Pile Interaction, Long and Short Piles, Elastic Analysis of Single Piles, Settlement and Load Distribution, Laterally Loaded Piles, Elastic Solutions, Broms' Method.
Module 5.	Introduction to Numerical Modelling of Soil–Structure Interaction, Computational Approaches, Interpretation of Numerical Results, and Engineering Applications.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	0	0	0	0	0	0	1	**0.5**
CLO2	3	3	2	2	2	0	0	0	0	0	0	0	**1**
CLO3	3	3	3	3	2	0	0	0	0	0	0	0	**1.17**
CLO4	3	3	3	3	2	0	0	0	0	0	2	0	**1.33**
CLO5	2	3	3	3	3	0	0	0	0	0	2	2	**1.5**

Avg PLO	**2.8**	**2.8**	**2.2**	**2.2**	**1.8**	**0**	**0**	**0**	**0**	**0**	**0.8**	**0.6**	**1.10**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Foundation Analysis and Design	Bowles, J. E.	McGraw-Hill
References			
1.	Elastic Analysis of Soil–Foundation Interaction	Selvadurai, A. P. S.	Elsevier
2.	Soil–Structure Interaction Analysis in Time Domain	Wolf, J. P.	Prentice Hall



Course Code	**BCIVORS825**					
Category	**Open Elective Course**					
Course Title	**Remote Sensing and GIS Applications in Engineering**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	3	0	0	3	3	
Pre requisites	**Nil**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Explain fundamental concepts of remote sensing, electromagnetic radiation, and data acquisition systems.

***ii)* CLO2:** Describe remote sensing platforms, sensor types, and characteristics of remotely sensed data.

***iii)* CLO3:** Apply image interpretation and digital image processing techniques for classification and thematic mapping.

***iv)* CLO4:** Analyze GIS concepts, spatial data models, and perform spatial data integration and analysis.

***v)* CLO5:** Evaluate the application of remote sensing and GIS in areas such as land use planning, water resources, disaster management, and infrastructure development.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Fundamental concepts of remote sensing; historical development; scope and significance in engineering applications; components of a remote sensing system; energy sources; electromagnetic radiation; interaction with Earth's surface and atmosphere.
Module 2.	Types of remote sensing platforms: ground-based, airborne, and satellite; principles of active and passive sensors; applications; characteristics of remotely sensed data including spatial, spectral, radiometric, and temporal resolutions.
Module 3.	Fundamentals of visual image interpretation (tone, texture, size, shape, pattern, shadow, and association); digital image processing techniques (preprocessing, enhancement, filtering, and transformation); classification techniques (supervised and unsupervised); accuracy assessment; thematic map generation
Module 4.	GIS concepts; components, functions, and advantages; spatial and attribute data; GIS data models (raster and vector); map projections; coordinate systems; georeferencing; spatial data integration and analysis in engineering applications.
Module 5.	Applications in land use and land cover mapping, urban and regional planning, transportation network analysis, water resources and watershed management, environmental impact assessment, disaster management (flood and earthquake studies), infrastructure planning and monitoring for sustainable development

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	0	1	0	0	0	0	0	0.50
CLO2	3	2	0	0	2	0	1	0	0	0	0	0	0.67
CLO3	2	3	2	3	3	0	2	0	0	0	0	0	1.25
CLO4	2	3	2	3	3	0	2	0	0	0	1	0	1.33
CLO5	2	3	3	2	3	2	3	1	2	2	1	1	2.08
Avg PLO	2.4	2.6	1.4	1.6	2.2	0.4	1.8	0.2	0.4	0.4	0.4	0.2	1.16

S.No:	Text Books	Author	Publisher
1.	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
	References		
1.	Remote Sensing and GIS: Principles, Techniques, and Uses	Apperdeep Kaur and Yugendra Devidas Chincholkar	Addition Publishing House

Course Code	**BCIVORM725**					
Category	**Open Elective Course**					
Course Title	**Research Methodology**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	3	0	0	3	3	
Pre requisites	**Nil**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Explain fundamentals of research methodology, types of research, and problem formulation.

***ii)* CLO2:** Conduct literature survey and evaluate research quality using impact factor, citations, and indices.

***iii)* CLO3:** Apply data collection methods, sampling techniques, and statistical tools for data analysis and hypothesis testing.

***iv)* CLO4:** Prepare technical documents including research papers, reports, and presentations using proper referencing styles.

***v)* CLO5:** Demonstrate understanding of intellectual property rights, ethics, and plagiarism in research.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to Research: Meaning, objective, and importance of research, types of research, steps involved in research, defining research problem
Module 2.	Literature Survey: Overview of literature survey, Literature survey using various journals, Various factors like Impact factor, citation, H-Index
Module 3.	Data Collection: Classification of Data, Methods of Data Collection, Sampling, Sampling techniques, Procedure and Methods, Ethical considerations in research. Data analysis, statistical techniques, hypothesis, hypothesis testing, data processing software (SPSS), statistical inference, interpretation of results.
Module 4.	Technical Writing, Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation, Referencing and referencing styles, Research Journals, Indexing and citation of Journals,
Module 5.	Intellectual property, Intellectual Property Rights, Introduction to Patent, Copyright, trademark, Trade Secret, Plagiarism

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	2	2	2	0	1	0	0	0	0	0	0	0	2
CLO2	2	2	3	0	2	2	0	0	0	0	0	0	2
CLO3	2	2	3	2	3	2	0	0	0	0	0	1	2
CLO4	1	1	2	2	1	2	0	0	0	2	3	1	2
CLO5	1	1	1	0	0	0	2	0	3	0	1	0	2
Avg PLO	1.6	1.6	2.2	0.8	1.4	1.2	0.4	0	0.6	0.4	0.8	0.4	2.0

S.No:	Text Books	Author	Publisher
1.	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	2nd Edition,
	References		
1.	Research Methodology Methods and Techniques	R. Kothari, Gaurav Garg	New age International Publishers

Course Code	**BCIVOSC825**					
Category	**Open Elective Course**					
Course Title	**Smart Cities**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	3	0	0	3	3	
Pre requisites	**Nil**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i*) CLO1:** Explain concepts, components, policies, and challenges of smart cities and their development.

***ii)* CLO2:** Analyze infrastructure systems, asset management, and sustainable planning approaches in smart cities.

***iii)* CLO3:** Apply principles of smart construction, green buildings, and energy-efficient systems in urban development.

***iv)* CLO4:** Evaluate smart transportation systems including ITS, traffic management, and mobility solutions.

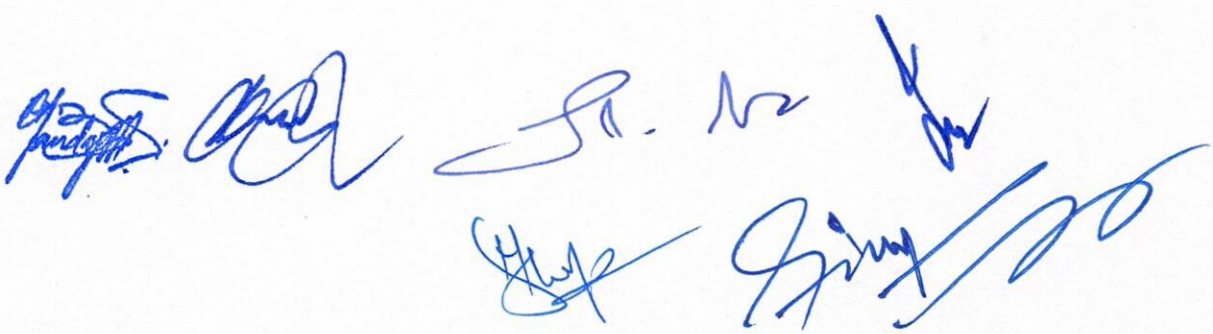
***v)* CLO5:** Propose sustainable solutions for water supply, sanitation, flood management, and urban services in smart cities.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Definition, concept, need and importance, benefits of smart cities, history of smart city in India, features, components of a smart city, characteristics and factors of smart cities, smart structures, classification of smart structures, challenges faced in developing smart cities, scope of smart cities, worldwide policies for smart cities, Government of India: India "100 Smart Cities" Policy and Mission, smart cities in India, case studies of smart cities.
Module 2.	Infrastructure management in India, challenges, objectives, various types of infrastructure services, asset management and lifecycle assessment of infrastructure, Resilient and sustainable infrastructure planning, Infrastructure financing and cost optimisation, predictive and preventive maintenance systems
Module 3.	Dimensions of smart cities, smart construction, planning and design, theory and principles, sustainable building – housing, introduction to green buildings, features of green building rating systems in India: LEED, GRIHA, energy-saving systems, solar energy for smart city, project management.
Module 4.	Smart transportation systems; intelligent transportation systems (ITS); smart roads, traffic management systems, public transport integration, electric mobility, GIS and GPS applications, traffic safety management, parking management.
Module 5.	Storage and conveyance system of water; sustainable water and sanitation; sewerage system; flood management; conservation system methods

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	3	3	0	0	0	0	0	0.92
CLO2	3	3	2	2	2	2	3	0	0	0	1	0	1.50
CLO3	2	3	3	2	2	2	3	0	0	0	1	0	1.50
CLO4	2	3	3	2	3	2	2	0	2	1	1	0	1.75
CLO5	2	3	3	2	2	3	3	0	2	1	1	1	1.92
Avg PLO	2.4	2.8	2.2	1.6	1.8	2.4	2.8	0	0.8	0.4	0.8	0.2	1.51

S.No:	Text Books	Author	Publisher
1.	A city for all: valuing differences and working with diversity	Joel Beall	Zed Books Limited, London (ISBN: 1-85649-477-2).
2	Insights into Inclusive Growth, Employment and Wellbeing in India	Arup Mitra	Springer (2013), New Delhi (ISBN: 978-81-322-0655-2)
	References		
1.	Urban Planning and Cultural Identity	William J. Neill	Routledge, London (ISBN: 0-415-19747-3



Course Code	**BCIVODB825**					
Category	**Programme Elective Course**					
Course Title	**Design of Bridge**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	2	1	0	3	3	
Pre requisites	**Strength of Materials, Structural Analysis, Design of Reinforced Concrete Structures, Steel Structures, Geotechnical Engineering, Hydrology, Fluid Mechanics, Transportation Engineering**					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i*) CLO1:** Explain types, components, loading standards (IRC), and hydraulic aspects of bridges.

ii) CLO2: Analyse and design RCC culverts using codal provisions

iii) CLO3: Analyse and design RCC bridge deck slabs using IRC specifications.

iv) CLO4: Design steel plate girder bridges and understand composite bridge concepts.

v) CLO5: Analyse and design steel truss bridges under standard IRC loadings.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to bridges and classification of bridges; history and development of bridges; components of bridges; various types of loads acting on bridges; standard loadings for highway bridges as per IRC provisions; introduction to hydraulic design of bridges; concepts of scour depth, afflux, and stream flow (discharge measurements); introduction to bridge substructure and types of loads acting on substructure components.
Module 2.	Introduction to culverts; classification and types of culverts; components of culverts; design principles of RCC culverts; design of RCC solid slab culverts.
Module 3.	Analysis and design of RCC bridge deck slabs; effective width of slab; design considerations as per IRC specifications; Courbon's method for analysis of bridge deck slabs.
Module 4.	Introduction to plate girder bridges; analysis and design of steel plate girder bridges; design considerations for main girders and cross girders; introduction to composite bridges and their advantages.
Module 5.	Various forms of steel truss bridges; components of truss bridges; analysis and design of steel truss bridges based on standard IRC loadings; design of stringers and cross girders for single-lane and multi-lane bridges under IRC loading.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	0	0	0	2	1	0	0	0	0	0	0.67
CLO2	3	3	3	2	2	0	1	0	0	0	1	0	1.25
CLO3	2	3	2	3	2	0	1	0	0	0	0	0	1.08
CLO4	3	3	3	2	2	0	1	0	0	0	1	0	1.25
CLO5	3	3	3	2	2	0	1	0	2	1	1	1	1.58
Avg PLO	2.8	2.8	2.2	1.8	1.6	0.4	1.0	0	0.4	0.2	0.6	0.2	1.16

S.No:	Text Books	Author	Publisher
1.	Design of Bridges	Krishna Raju, N	Oxford & IBH Publishing Co., New Delhi
	References		
1.	Design of Bridge Structures	T.R. JAGADEESH	PHI Learning Pvt.Ltd



Course Code	BCIVDSW825					
Category	Programme Elective Course					
Course Title	Solid Waste Management					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 8 (Seventh)
	3	0	0	3	3	
Pre requisites	Environmental Engineering					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) CLO1: Understand the sources, characteristics, and composition of municipal solid waste

ii) CLO2: Compare the physical, chemical, and biological properties of municipal solid waste.

iii) CLO3: Interpret solid waste generation, collection, and material recovery practices

iv) CLO4: Apply waste handling, separation, and storage techniques for municipal solid waste management.

v) CLO5: Develop suitable processing and disposal strategies for municipal solid waste.

Theory Module(Internal and External Evaluation)

M.No:	Topic
Module 1.	Sources and Composition of Municipal Solid Waste: Sources of solid waste. Types of solid waste. Characteristics of Solid waste, composition of solid waste and its determination.
Module 2.	Properties of Municipal Solid Waste :Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste and Transformation of Municipal Solid Waste.
Module 3.	Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements, and methods to measure solid waste quantities. Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.
Module 4.	Handling, Separation, and Storage of Solid Waste: Handling and separation of solid waste at site. Material separation by pick in, screens, float and separator magnets, and electromechanical separator, and other latest devices for material separation. Waste handling and separation at Commercial and industrial facilities. Storage of solid waste at the sources.
Module 5.	Processing and disposal of Solid Waste: Processing of solid waste at residence e.g. Storage, conveying, compacting, shredding, pulping, granulating etc. Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of Combustion, Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design, landfill operation.

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	1	0	2	3	1	0	0	0	1	1.17
CLO2	2	3	2	2	1	2	3	1	0	1	0	1	1.50
CLO3	2	3	2	3	2	2	3	0	1	2	1	2	1.92
CLO4	2	2	3	2	3	2	3	0	1	2	1	1	1.83
CLO5	3	3	3	3	3	2	3	1	2	2	2	2	2.42
Avg PLO	2.4	2.6	2.2	2.2	1.8	2	3	0.6	0.8	1.4	0.8	1.4	1.77

S.No:	Text Books	Author	Publisher
1.	Solid Waste Technology & Management	Christensen, H. T.	Wiley, 2010, Volume 1 & 2.
	References		
1.	Integrated Solid Waste Management: Engineering Principles and Management Issues	Tchobanoglous, G., Theisen and Vigil,	McGraw Hill

Course Code	BCIVDIT825					
Category	Programme Elective Course					
Course Title	Intelligent Transportation System					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 8 (Eighth)
	3	0	0	3	3	
Pre requisites	Traffic Engineering					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

***i)* CLO1:** Identify the multiple components of Intelligent Transportation Systems (ITS), including user services and support technologies.

***ii)* CLO2:** Understand the importance of ITS and its practical applications in improving transportation efficiency, proposing recommendations for appropriate ITS technologies corresponding to real traffic problems.

***iii)* CLO3:** Analyze advanced sensor data, gather extensive information, roadway, and traffic data, and estimate traffic congestion levels.

***iv)* CLO4:** Implement and execute suitable Intelligent Transportation Systems (ITS) and services to optimize transportation effectiveness by utilizing various ITS-based design and control elements.

***v)* CLO5:** Summarize about ITS issues in terms of various factors and emerging issues

Theory Module (Internal and External Evaluation)

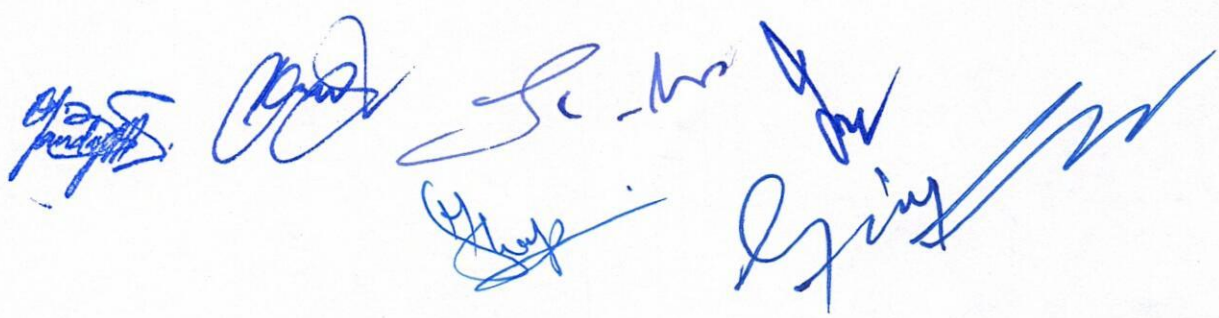
M.No:	Topic
Module 1.	Intelligent Transportation Systems (ITS) (History and Applications: Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques, Introduction to Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS) and application overview
Module 2.	ITS Functional Areas: Advanced Traveler Information Systems (ATIS) Trip Planner and its impact, Traffic density measurement, Variable message signs, Parking guidance, Weather information and variable speed limits, Impacts of ATIS
Module 3.	Telecommunications in ITS: The importance of telecommunications in the ITS system, information management, and traffic management center (TMC). Vehicle – Roadside communication – Vehicle Positioning System. Security CCTV systems, Wireless Sensor Networks and RFID, Blue-tooth and Wi-Fi sensors, inductive loop detectors and image processing techniques, Impacts of AVMS
Module 4.	ITS-based Design and Control Element: Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS), Communication tools Dedicated

	Short-Range Communication (DSRC), Communications Access for Land Mobiles (CALM), traveler information tools, data handling, processing, and management TCM, and it's working
Module 5.	ITS Standards: ITS standards, development process, legal issues, financial issues, Mainstream ITS, integration and up-gradation, Future of ITS, case studies. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO 5	PLO 6	PLO 7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. CLO
CLO 1	3	0	0	0	2	0	0	0	0	0	0	3	0.66
CLO 2	2	3	0	2	0	0	0	0	0	0	0	2	0.75
CLO 3	2	2	0	3	3	0	0	0	0	2	0	0	1.0
CLO 4	3	2	3	0	3	3	0	0	0	0	0	2	1.3
CLO 5	2	0	0	0	0	2	2	2	1	0	3	3	1.25
Avg. PLO	2.4	1.40	0.60	1.00	1.6	1.0	0.40	0.40	0.2	0.40	0.6	2	1

S.No:	Text Books	Author	Publisher
1.	Fundamentals of Intelligent Transportation Systems Planning	M.A. Chowdhury and A. Sadek	Artech House Publishers. , 2003 publications or the latest
2	Intelligent Transportation Systems: New Principles and Architectures"	Ghosh, S., Lee, T.S	CRC Press, 2000.
	References		
1.	Perspectives on Intelligent Transportation Systems	Sussman, J.M	Springer, Berlin, 2010.
2.	Traffic Engineering	R.P Roess, E.S. Prassas, W.R. McShane	Pearson Educational International, 3rd Edition, 2004.



Course Code	BCIVDEG825					
Category	Programme Elective Course					
Course Title	Environmental Geo-Technology					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- 8 (Eighth)
	3	0	0	3	3	
Pre requisites	Engineering Mechanics, Soil Mechanics, Fluid Mechanics, Environmental Engineering					

Course Learning Outcomes (CLOs)

At the end of the course, the student will be able to:

i) **CLO1:** Explain the principles of geoenvironmental engineering, soil chemistry, and characterize contaminated soils and subsurface environments

ii) **CLO2:** Analyse contaminant transport mechanisms in saturated and unsaturated soils and groundwater using physical, chemical, and biological principles.

iii) **CLO3:** Design and evaluate engineered waste containment systems, including liners, leachate collection systems, and geosynthetic barriers.

iv) **CLO4:** Select appropriate remediation and ground improvement techniques for contaminated soils and groundwater considering technical, environmental, and economic aspects.

v) **CLO5:** Apply sustainable geoenvironmental engineering principles for waste management, environmental monitoring, and contaminated land restoration.

Theory Module (Internal and External Evaluation)

M.No:	Topic
Module 1.	Introduction to Environmental Geotechnology: scope, objectives, and applications, Environmental issues in geotechnical engineering, Soil as a multiphase system, Soil mineralogy, clay-water interaction, and diffuse double layer theory, Physical, chemical, and biological properties of soils, Soil-water-air relationships in saturated and unsaturated soils, Adsorption, cation exchange capacity (CEC), pH, and redox potential, Sources and classification of soil and groundwater contaminants, Environmental regulations and standards Site investigation and laboratory characterization techniques
Module 2.	Contaminant Transport in Soil and Groundwater: Characteristics of organic, inorganic, heavy metal, and emerging contaminants, Groundwater flow fundamentals, Mechanisms of contaminant migration, Sorption, desorption, ion exchange, and chemical reactions, Biodegradation and attenuation mechanisms, Contaminant transport in saturated and unsaturated soils, Mathematical concepts of contaminant transport, Environmental monitoring and groundwater quality assessment, Environmental risk assessment
Module 3.	Waste Management and Engineered Containment Systems: Municipal, industrial, hazardous, mining, and agricultural wastes, Waste characterization and engineering properties, Principles of integrated solid waste management, Landfill planning, siting, and design, Engineered landfill components, Leachate generation, collection, and treatment, Landfill gas generation and utilization, Cover systems and landfill closure, Stability analysis of waste containment facilities, Instrumentation and monitoring of landfills
Module 4.	Remediation of Contaminated Sites: Site investigation and contaminated land assessment, Remediation objectives and selection criteria, Physical remediation methods, Chemical remediation methods, Biological remediation techniques, Phytoremediation, Soil vapour extraction, Pump-and-treat systems, Electrokinetic remediation Stabilization and solidification, Permeable Reactive Barriers (PRBs), Ground improvement techniques for contaminated sites, Monitoring and performance evaluation of remediation systems
Module 5.	Sustainable Geoenvironmental Engineering and Emerging Applications: Sustainable waste management practices, Utilization of fly ash, GGBS, red mud, mine tailings, and dredged materials, Circular economy in geoenvironmental engineering, Carbon sequestration and climate-resilient geotechnical systems. Geosynthetics in environmental protection, Environmental Impact Assessment

(EIA), GIS and Remote Sensing applications, Life Cycle Assessment (LCA) of waste management systems, Environmental monitoring and instrumentation, Recent advances in geoenvironmental engineering, Case studies on contaminated land restoration and landfill failures

CLO-PLO Mapping Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	2	1	2	1	2	3	2	1	1	1	1	1.67
CLO2	3	3	1	3	2	2	3	2	1	1	1	1	1.92
CLO3	3	3	3	2	2	3	3	2	2	3	3	1	2.42
CLO4	3	3	2	3	2	3	3	3	2	3	3	2	2.58
CLO5	3	2	3	2	3	3	3	2	2	3	3	3	2.58
Avg PLO	3.0	2.6	2.0	2.4	2.0	2.62	3.0	2.2	1.6	2.2	2.2	1.6	2.3

S.No:	Text Books	Author	Publisher
1.	Geotechnical and Geoenvironmental Engineering Handbook	Rowe, R. K	Kluwer Academic
2	Geoenvironmental Engineering: Site Remediation, Waste Containment and Emerging Waste Management Technologies.	Sharma, H. D. & Reddy, K. R	Wiley
	References		
1.	Designing with Geosynthetics.	Koerner, R. M	
2.	Hazardous Waste Management. Coduto, D. P., Geotechnical Engineering: Principles and Practices.	LaGrega, M. D., Buckingham, P. L., & Evans, J. C	McGraw-Hill
3.	USEPA Technical Manuals on landfill design, contaminated site remediation, and groundwater monitoring	-	USEPA (United States Environmental Protection Agency)
4.	Geoenvironmental Engineering: Principles and Applications.	Reddi, L. N. & Inyang, H	CRC Press

Course Code	BCIVPIP825					
Category	Lab Course					
Course Title	Internship/Industrial Training					
Scheme and Credits	L	T	P	No. of Hrs./Week	Credits	Semester- (Eighth)
	-	-	-	-	2	
Pre requisites	Fundamental knowledge of civil engineering.					

Course Learning Outcomes (CLOs)

Upon successful completion of this course, the students will be able to:

CLO1: Demonstrate an understanding of professional practices, construction methodologies, material production processes, safety regulations, and quality control measures adopted in the Civil Engineering industry.

CLO2: Correlate theoretical concepts learned in the classroom with practical engineering applications through exposure to construction sites, industries, laboratories, or consultancy organizations.

CLO3: Analyze engineering practices, project management techniques, quality assurance procedures, and environmental and safety considerations observed during the industrial training.

CLO4: Prepare a comprehensive industrial training report and effectively communicate the acquired knowledge through technical presentations and viva-voce, demonstrating professional ethics, teamwork, and lifelong learning skills.

Description: The four week training shall be undertaken in a recognized construction organization, consultancy, industry, government department, research organization, or any other approved Civil Engineering establishment to provide practical exposure to professional engineering practices. The Internship/Industrial Training must be of minimum four weeks and should take place during the vacation period. The duration of Internship/Industrial Training can be extended to additional two weeks during the academic session, after the prior permission granted by Head of the Department.

Industrial Training/Internship Report: The Industrial Training/Internship report duly signed and stamped by the competent authority of the host organization, shall be submitted along with all details, pictures, figures drawing and attendance certificate. Failure to submit the report to satisfy requirements may result in the training being treated as incomplete and the student may be required to undergo the training again, as per the Department/University regulations.

The evaluation of Industrial Training-I shall be conducted after the successful completion of both training/internship components and shall be based on the submission of a comprehensive Detailed Industrial Training/Internship Report, duly certified by the concerned organization, followed by a viva voce examination before a designated committee or faculty members nominated by the Head of the Department. The assessment shall be based on the quality of the practical training, the technical knowledge acquired, the quality and comprehensiveness of the report, professional conduct, and overall performance in the viva voce examination.

Module (Internal and External Evaluation)

M. No:	Topic
Module 1.	Bridging the gap between theoretical knowledge with practical applications and execution.
Module 2.	Detailed investigation and understanding of materials, instrumentation, quality control, construction practice and management.
Module 3.	Project planning and scheduling, resource management, socio-economic aspects, and application of the project.
Module 4.	Execution and management of planned project.
Module 5.	Industrial training report writing, technical documentation, presentation skills, professional communication, and future learning outcomes.

CLO-PLO Mapping Matrix

CLO \ PLO	PLO 1	PLO 2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg. PLO
CLO1	3	3	3	2	2	1	1	1	3	2	3	1	2.08
CLO2	3	3	3	2	2	1	1	1	3	2	3	1	2.08
CLO3	3	3	3	2	2	1	1	1	3	2	3	1	2.08
CLO4	3	3	3	2	2	1	1	1	3	2	3	1	2.08
CLO5	3	3	3	2	2	1	1	1	3	2	3	1	2.08
Avg. CLO	3	3	3	2	2	1	1	1	3	2	3	1	2.08

Course Code	**BCIVPPT825**					
Category	**Lab Course**					
Course Title	**Project**					
Scheme and Credits	**L**	**T**	**P**	**No. of Hrs./Week**	**Credits**	**Semester- 8 (Eighth)**
	0	0	18	18	**9**	
Pre requisites	**Pre-Project, Fundamental Knowledge of Civil Engineering**					

Course Learning Outcomes (CLOs)

Upon successful completion of the course, students will be able to:

CLO1: Execute the proposed project work by applying appropriate analytical, experimental, computational, or field-based techniques.

CLO2: Analyse and interpret data/results to draw meaningful engineering conclusions.

CLO3: Evaluate the performance, reliability, and limitations of the developed solution.

CLO4: Integrate engineering knowledge with societal, environmental, and sustainability considerations.

CLO5: Prepare a comprehensive technical report and deliver an effective presentation demonstrating project outcomes

Description

The Project course is the culmination of undergraduate studies in Civil Engineering, where students implement the project proposal developed during the pre-work phase. Students work in groups to solve real-world engineering problems through experimental investigation, fieldwork, simulation, or analytical studies. Emphasis is placed on execution, data analysis, interpretation of results, and development of practical and sustainable engineering solutions.

Course Plan

Projects will be undertaken in groups to strengthen technical competency, teamwork, and project management skills. Each group shall carry forward the problem identified during the Project Pre Work course, duly approved by the Project and Training Incharge (PTI). The project work shall involve detailed implementation, experimentation/analysis, validation of results, and formulation of conclusions.

Students are expected to carry out systematic work including data collection, design/analysis, validation, and interpretation using appropriate tools and techniques. Regular interaction with the project supervisor shall be maintained to monitor progress and ensure timely completion.

Assessment will be carried out through continuous evaluation of progress and a final evaluation by an expert committee constituted by the department. The evaluation shall be based on the following:

- Quality and completeness of project implementation
- Data collection, analysis, and interpretation of results
- Application of appropriate engineering tools and techniques
- Innovation, originality, and problem-solving approach
- Consideration of societal, environmental, and sustainability aspects
- Quality of report writing including technical content and organization
- Effectiveness of presentation and demonstration of work
- Ability to answer questions during viva voce

CLO-PLO Mapping Matrix													
CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Avg CLO
CLO1	3	3	3	3	3	2	2	2	2	2	3	2	**2.5**
CLO2	3	3	2	3	3	2	2	2	2	2	2	2	**2.33**
CLO3	2	3	3	3	2	3	3	2	1	1	2	2	**2.25**
CLO4	2	2	2	2	2	3	3	3	2	2	2	3	**2.33**
CLO5	1	1	1	1	2	1	1	2	3	3	2	3	**1.83**
Avg PLO	**2.2**	**2.4**	**2.2**	**2.4**	**2.4**	**2.2**	**2.2**	**2.2**	**2**	**2**	**2.2**	**2.4**	**2.23**