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.

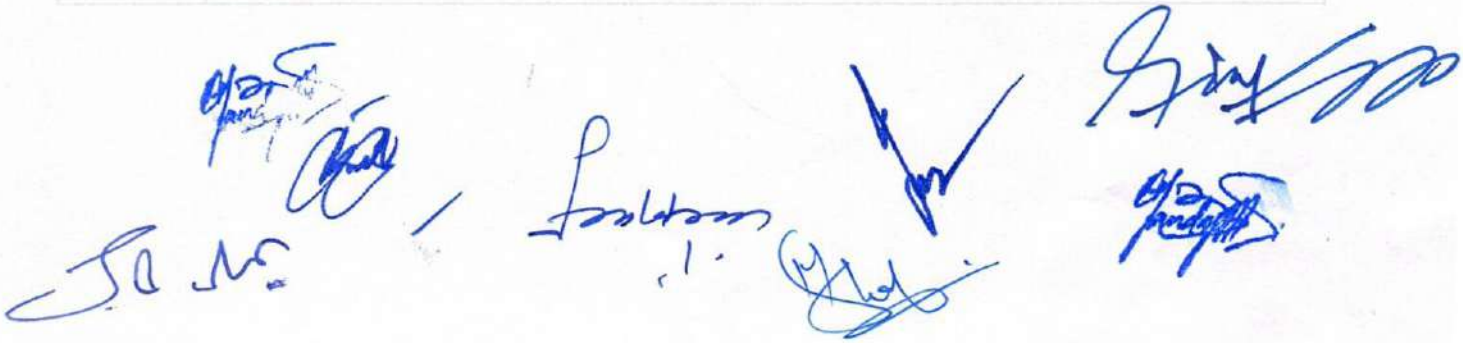
iii)CLO3: Apply: Identify characteristics and magnitude of combined stresses in both individual members and structures.

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

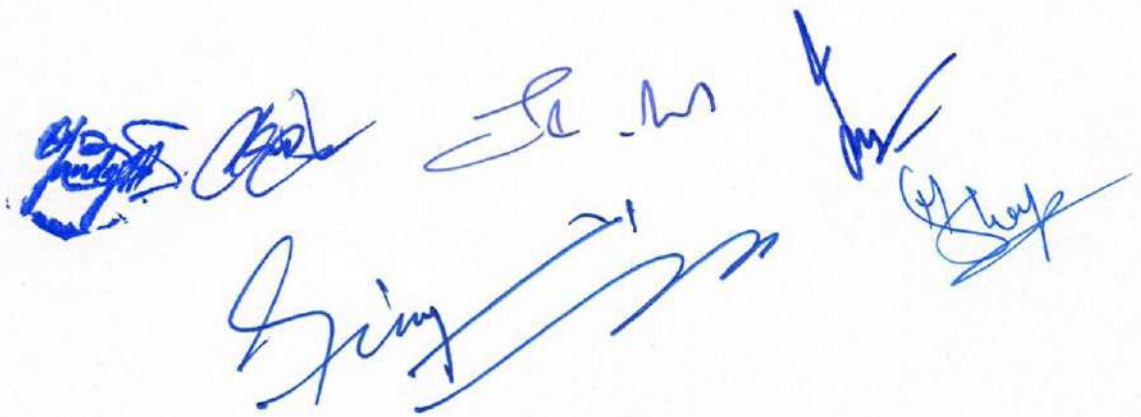
v) **CLO5:** Integrate planning, scheduling, time-cost optimisation, resource management, and risk mitigation techniques for effective project execution

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