Central University of Haryana
Department of Civil Engineering
Course Structure
Semester III (Second Year ODD Semester)

Sl. No.	Course Code	Course Title	L	T	P	C	Internal Mark	External Mark
1	ASH 211 DM 30	Mathematics III	3	0	0	3	30	70
2	CVE 201 DM 30	Strength of Materials Theory	3	0	2	3	30	70
3	CVE 203 DM 30	Building Construction Materials and Testing Theory	3	0	0	3	30	70
4	CVE 205 DM 30	Fluid Mechanics Theory	3	0	0	3	30	70
5	CVE 207 DM 30	Surveying & Geomatics Theory	3	0	0	3	30	70
6	CVE 209 VM 20	Indian Knowledge Systems in Civil Engineering	2	0	0	2	30	70
7	CVE 219 VM 00	Disability, Accessibility and Universal Design	3	0	0	0	30	70
8	CVE 211 DM 10	Strength of Materials Lab	0	0	2	1	30	70
9	CVE 213 DM 10	Building Construction Materials and Testing Lab	0	0	0	1	30	70
10	CVE 215 DM 10	Fluid Mechanics Lab	0	0	2	1	30	70
11	CVE 217 DM 10	Surveying & Geomatics Lab	0	0	2	1	30	70
12	ASH 208 VA 00/ ASH 120 VA 00/ ASH 130 VA 00	Sports & Yoga/ NSS/ NCC/ Extra-Curricular Activities (Value Added Course)	2	0	0	0*		
Contact Hours			**22**	**0**	**8**	**21**		
13	Minor/Honours/Value Added Courses (Optional Through MOOC)		**3**	**0**	**0**	**3**		

8/4/26

Semester IV (Second Year EVEN Semester)

Sl. No.	Course Code	Course Title	L	T	P	C	Internal Mark	External Mark
1	CVE 202 DM 30	Concrete Technology Theory	3	0	0	3	30	70
2	CVE 204 DM 30	Structural Analysis Theory	3	0	0	3	30	70
3	CVE 206 DM 30	Construction Engineering and Management	3	0	0	3	30	70
4	CVE 208 DM 30	Hydraulic Engineering Theory	3	0	0	3	30	70
5	CVE 210 DM 30	Transportation Engineering Theory	3	0	0	3	30	70
6	CVE 212 DM 10	Concrete Technology Lab	0	0	2	1	30	70
7	CVE 214 DM 10	Structural Analysis Lab	0	0	2	1	30	70
8	CVE 218 DM 10	Hydraulic Engineering Lab	0	0	2	1	30	70
9	CVE 220 DM 10	Transportation Engineering Lab	0	0	2	1	30	70
10		Multidisciplinary Open Elective Course-I	4	0	0	4	30	70
11	CVE 224 VA 30	Civil Engineering Societal & Global Impact	3	0	0	0	30	70
			22	**0**	**8**	**23**		
12	Minor/Honors/Value Added Courses (Optional through MOOC)		**3**	**0**	**0**	**3**		

*This course will be offered during the second and third years to foster greater student engagement and participation. Continuous evaluation will be conducted throughout the semesters, with the final assessment taking place in the third year.

8/4/26

Course Code: ASH211DM30	Course Name: Mathematics III	L	T	P	C
		3	0	0	3

Year and Semester	2[t] year -III Semester	Contact hours per week: (3 Hrs) Exam: (3 hrs.)	
Pre-requisite of course	Mathematics I, Mathematics II	Evaluation	
		CIE: 30	TEE: 70

Course Objectives:

1. To develop understanding of Laplace and Fourier transform techniques for solving engineering problems.
2. To introduce analytical and numerical methods for solving ordinary and partial differential equations.
3. To understand matrix theory concepts and quadratic forms for applications in engineering systems.
4. To equip students with problem-solving skills for modeling physical phenomena using mathematical tools.

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

CO ASH 211.1	Apply Laplace and Fourier transforms to solve differential equations and evaluate integrals.
CO ASH 211.2	Analyze and represent periodic functions using Fourier series and transforms.
CO ASH 211.3	Reduce and classify quadratic forms and analyze matrix properties.
CO ASH 211.4	Solve partial differential equations using analytical and numerical techniques for real-world applications.

Module No	Course Contents	Hrs	COs
1	Laplace Transform: Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method	11	**CO ASH 211.1 CO ASH 211.2**
2	Fourier Series: Euler's formulae, Dirichlet's conditions, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series. Fourier Transform: Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem. Fourier transform applications to solve ordinary and partial differential equations.	12	**CO ASH 211.1 CO ASH 211.2**
3	Quadratic Forms: Reduction of real quadratic forms to canonical (normal) form; determination of rank, index, and signature; classification into definite, semi-definite, and indefinite forms. Matrices & Systems: Minimal polynomial and minimal equation of a matrix; derogatory and non-derogatory matrices; solution of linear systems using Gauss elimination, Gauss–Jacobi, and Gauss–Seidel methods.	11	**CO ASH 211.3**
4	Partial Differential Equations (PDE): Introduction, Classifications of second order PDE, second order PDE of mathematical physics (Heat,	11	**CO ASH 211.4**

	wave and Laplace equation, one dimensional with standard boundary conditions), Solution by separation of variable.		

Suggested Books:

(1) Kreyszing E., "Advanced Engineering Mathematics", John Wiley & Sons, Singapore, Int.Student Ed. 1995. (ISBN 8126554231)

(2) Wiley C. R., "Advanced Engineering Mathematics", McGraw Hill Inc., New York Ed.1993.

(3) O'Neel Peter., "Advanced Engg. Mathematics", Thompson, Singapore, Ind. Ed. 2002.

(4) Greenbar Michael D., "Advanced Engg. Mathematics", Pearson, Singapore, Ind. Ed.

(5) Ramana D. V., "Higher Engg. Mathematics", The MaGraw-Hill Inc., New Delhi, 2007. (ISBN 007063419X)

(6) Marsden J. E., Tromba A., Weinstein A., "Basic multivariable calculus", Springer, 1993. (ISBN 354097976X)

(7) A. R. Vasishtha, A. K. Vasishtha, "Matrices", Krishna Prakashan Media, 1991. (ISBN 8182837294)

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO ASH 211.1	**WK1** (Engineering knowledge) **WK2** (Problem analysis)	**PO1** (Engineering knowledge) **PO2** (Problem analysis)	**SDG 4** – Quality Education
CO ASH 211.2	**WK1, WK2, WK3** (Design/development of solutions)	**PO1, PO2, PO3** (Design solutions)	**SDG 4** – Quality Education
CO ASH 211.3	**WK1, WK2, WK4** (Investigation)	**PO1, PO2, PO4** (Investigations of complex problems)	**SDG 4** – Quality Education
CO ASH 211.4	**WK1, WK2, WK3, WK5** (Modern tool usage)	**PO1, PO2, PO3, PO5** (Modern tool usage)	**SDG 9** – Industry, Innovation & Infrastructure **SDG 11** – Sustainable Cities & Communities

Course Code: CVE 201 DM 30	Course Name: STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3
Year and Semester	II[nd] year -III Semester	Contact hours per week: (3 Hrs) Exam: (3 hrs.)			
Pre-requisite of course	i) Engineering Physics ii) Engineering Mathematics	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

The course on **Strength of Materials** aims to develop a fundamental understanding of stress, strain, and material behavior under various loading conditions, and to build analytical skills for evaluating shear forces, bending moments, and stresses in structural members. It equips students with the ability to analyze bending, torsion, and stability of beams, shafts, and columns using classical theories and design principles. The course also focuses on determining slope and deflection of beams through analytical and energy methods, while integrating theoretical knowledge with practical insights through laboratory experiments on material properties and structural behavior.

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

CO CVE 201 DM 30.1	To define different types of stresses and strains
CO CVE 201 DM 30.2	To Understand and analyse the application of Shear Force and Bending Moment.
CO CVE 201 DM 30.3	To Evaluate bending and shear stresses in beams of various cross-sections (rectangular, circular, I, T sections) using bending theory and shear stress distribution concepts.
CO CVE 201 DM 30.4	Apply torsion theory to understand the concept of solid and hollow circular shafts based on strength and stiffness criteria
CO CVE 201 DM 30.5	Understand the concept of columns and struts under axial loading and determine critical buckling loads using Euler's and Rankine formulas, and assess stability of structural members.
CO CVE 201 DM 30.6	Apply different methods like moment area, conjugate beam, Macaulay's method, Strain energy method to determine slope and deflection of the beam.

Module No	Course Contents	Hrs	COs
1	Introduction: Concept of stress and strain, generalized Hooke's law, stress-strain diagram of ductile and brittle materials, thermal stresses, volumetric stresses and strains. Analysis of principal stresses and strains, Mohr's stress circle, relationship of elastic constants. Shear force and bending moment diagrams: Types of loads on beams and frames, classification of beams, statically determinate problems, shear force and bending moment diagrams for simply supported, overhang and cantilever beams subjected to any combination of point loads, uniformly distributed and varying loads and moment, relationship between load, shear force and bending moment.	12	**CO CVE 201 DM 30.1 CO CVE 201 DM 30.2**
2	Theory of pure bending: Flexural stresses, theory of simple	10	

	bending, assumptions, derivation of bending equation M/I=f/y=E/R. Neutral axis and determination of bending stresses. Section modulus of rectangular and circular sections (solid and hollow), I, T and channel sections. Shear stresses in beams: Shear stress formula for beams, shear stress distribution in beams like rectangular, circular, triangular, I, and T- sections.		**CO CVE 201 DM 30.3**
3	Torsion of circular shafts: Basic assumptions, torsion formula, power transmitted by shafts, design of solid and hollow shafts based on strength and stiffness. Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for elastic buckling load, Rankine Gordon formula, secant formula, eccentric stresses in short strut of rectangular & circular sections.	**10**	**CO CVE 201 DM 30.4 CO CVE 201 DM 30.5**
4	Slope & Deflection: Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, conjugate beam method, method of integration, Macaulay's method, calculations for slopes and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, uniformly distributed loads or combination of concentrated and uniformly distributed loads. Strain Energy: Strain energy under axial, bending, shear, torsion, gradual, sudden and impact loading.	**13**	**CO CVE 201 DM 30.6**

Text Books

- Strength of Materials by G.H. Ryder, ELBS Publishers
- Elements of Strength of Materials by Timoshenko & Young, East-West Press, New Delhi
- Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
- Elementary Structural Analysis by Norris & Wilbur, McGraw Hill Publisher
- Strength of Materials by R.K. Bansal, Laxmi Publications
- Strength of Materials by J.C. Hibbeler, Pearson Publications

Reference Books

- Strength of Materials by Sadhu Singh, Khanna Publishers
- Basic Structural Analysis by C.S. Reddy, Tata McGraw Hill
- Fundamentals of Solid Mechanics by L.S. Srinath, Prentice Hall of India
- Strength of Materials by S. Chand & Co.
- Fundamentals of Structural Analysis by B.D. Nautiyal, New Age Publishers

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 201 DM 30.1	WK1,	PO1, PO2,	**SDG 4 – Quality Education** **SDG 9 – Industry, Innovation & Infrastructure**
CO CVE 201 DM 30.2	WK2, WK3	PO1, PO2, PO3,	**SDG 9 – Industry, Innovation & Infrastructure**
CO CVE 201 DM 30.3	WK3, WK4	PO1, PO2, PO3, PO5	**SDG 9 – Industry, Innovation & Infrastructure** **SDG 11 – Sustainable Cities & Communities**
CO CVE 201 DM 30.4	WK4, WK5	PO1, PO2, PO3	**SDG 9 – Industry, Innovation & Infrastructure**
CO CVE 201 DM 30.5	WK5, WK6	PO1, PO2, PO3	**SDG 9 – Industry, Innovation & Infrastructure** **SDG 11 – Sustainable Cities & Communities**
CO CVE 201 DM 30.6	WK6, WK7	PO1, PO2, PO3, PO6	**SDG 4 – Quality Education** **SDG 9 – Industry, Innovation & Infrastructure** **SDG 11 – Sustainable Cities & Communities**

Course Code: CVE 203 DM 30	Course Name: Building Construction Materials and Testing	L	T	P	C
		3	0	0	3
Year and Semester	2nd year -III Semester	Contact hours per week: (3 Hrs) Exam: (3 hrs.)			
Pre-requisite of course	-	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

1. To develop understanding of construction materials including their properties, characteristics, and suitability for various building applications.
2. To impart knowledge of different construction techniques and materials such as masonry, concrete, cement, and foundations used in the building industry.
3. To familiarize students with standard testing procedures for evaluating the quality and performance of construction materials as per relevant specifications.
4. To enable analysis of mechanical behavior of materials and their response under different types of loads and environmental conditions.

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

CO CVE 203 DM 30.1	Identify and classify construction materials based on their properties, composition, and applications in building works.
CO CVE 203 DM 30.2	Manufacturing processes and characteristics of materials such as cement, concrete, bricks, and steel.
CO CVE 203 DM 30.3	Knowledge of masonry techniques and foundation systems used in construction.
CO CVE 203 DM 30.4	Perform and interpret standard tests on construction materials in accordance with relevant specifications and codes.
CO CVE 203 DM 30.5	Analyze the mechanical behavior and performance of materials under various loading and environmental conditions.

Module No	Course Contents	Hrs	COs
1	Building Construction Materials: Building construction materials including: Cement, M-Sand, Concrete, Ready Mix Concrete (RMC), Bricks, Ceramics, Timber, Glass, Plastics, Reinforcement Bars, Structural Steel and other Metals, Paints and Varnishes, Adhesives, Mortar, and Ready Mix Plasters — along with their properties and uses.	12	**CO CVE 203 DM 30.1 CO CVE 203 DM 30.2**
2	Masonry, Cement, and Foundations: Brick masonry; bonds in brick masonry; stones; dressing of stone; stone masonry; cement; grades of cement; supplementary cementitious materials; manufacturing of cement; footings; shallow and deep foundations; putty; granite; Kota stone; and brick bat koba.	12	**CO CVE 203 DM 30.2 CO CVE 203 DM 30.3**
3	Standard Testing and Evaluation Procedures: Standard testing and evaluation procedures including: sampling, mandatory testing, site laboratory setup, frequency of testing, CPWD specifications, non-destructive testing (NDT) equipment, and chemical testing	10	**CO CVE 203 DM 30.4**
4	Testing of Materials and Mechanical Behavior: Testing of	11	**CO CVE 203**

	materials including: i) Tests on bricks ii) Tests on sand iii) Tests on concrete iv) Tests on plaster v) Tests on reinforcement vi) Tests on stone vii) Tests on other special materials		**DM 30.5**

Suggested Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth- Heinemann
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
4. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
5. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
6. American Society for Testing and Materials (ASTM), CPWD Specifications

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	Alignment to SDGs
CO CVE 203 DM 30.1	WK1, WK3, WK5	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**
CO CVE 203 DM 30.2	WK1, WK3, WK4	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production** **SDG 13 – Climate Action**
CO CVE 203 DM 30.3	WK3, WK5, WK6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CVE 203 DM 30.4	WK2, WK6, WK8	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CVE 203 DM 30.5	WK1, WK2, WK4, WK8	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities** **SDG 13 – Climate Action**

Course Code: CVE 205 DM30	Course Name: Fluid Mechanics	L	T	P	C
		3	0	0	3
Year and Semester	2nd year -3rd Semester	Contact hours per week: (3 hrs.) Exam: (3 hrs.)			
Pre-requisite of course	Mathematics I	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

5. To understand the fundamental properties of fluids and principles of fluid statics.
6. To analyze fluid motion using kinematic concepts and flow visualization techniques.
7. To apply fluid dynamics principles and flow measurement methods in engineering problems.
8. To develop understanding of dimensional analysis and similarity for model studies.
9. To evaluate drag, lift, and boundary layer behavior in fluid flow systems.

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

CO CVE 205 .1	Understand fluid properties and analyze hydrostatic forces, pressure measurement, and buoyancy.
CO CVE 205.2	Analyze fluid motion using kinematic concepts such as flow types, continuity, and flow nets.
CO CVE 205.3	Apply fluid dynamics principles including Bernoulli's equation and flow measurement devices.
CO CVE 205.4	Use dimensional analysis and similarity laws for modeling and analysis of fluid systems.
CO CVE 205.5	Evaluate drag and lift forces and analyze boundary layer behavior and flow separation.

Module No	Course Contents	Hrs.	COs
1	**Introduction** Fluid properties, mass density, specific weight, specific volume and specific volume and specific gravity, surface tension, capillarity, pressure inside a droplet and bubble due to surface tension, compressibility viscosity, Newtonian and Non-newtonian fluids, real and ideal fluids. **Fluid Statics** Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers, two liquid manometers, pressure on plane and curved surfaces, center of pressure, Buoyancy, stability of immersed and floating bodies, determination of metacentric height, free and forced vortex.	**12**	**CO CVE 205 .1**
2	**Fluid Kinematics** Steady & unsteady, uniform and non-uniform, laminar & turbulent flows, one, two & three dimensional. flows, stream lines, streak lines and path lines, continuity equation in differential form, rotation and circulation, elementary explanation of stream function and velocity potential, rotational and irrotational flows, graphical and experimental methods of drawing flownets.	**10**	**CO CVE 205 .2**

3	**Dynamic of Fluid Flow:** Euler's equation of motion along a streamline and its integration, limitation of Bernouli's equation, Pitot tubes, venturimeter, Orficemeter, flow through orifices & mouth pieces, sharp crested weirs and notches, aeration of nappe. **Dimensional Analysis and Hydraulic Similude:** Dimensional analysis, Buckinghum theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modeling, similar and distorted models.	**12**	**CO CVE 205 .3** **CO CVE 205 .4**
4	**Drag and Lift:** Types of drag, drag on a sphere, flat plate, cylinder and airfoil, development of lift on immersed bodies like circular cylinder and airfoil. **Boundary layer analysis:** Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, local and average friction coefficient, separation and its control.	**11**	**CO CVE 205 .5**

Note for Paper-setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering e entire syllabus. Students will be required to attempt FIVE questions selecting at least ONE question from each unit.

Books:

1. *"Hydraulics and Fluid Mechanics"*, by P. N. Modi and S. M. Seth.
2. *"Introduction to Fluid Mechanics"*, by Robert W. Fox and Alan T. McDonald.
3. *"Fluid Mechanics Through Problems"*, by R. J. Garde.
4. *"Engineering Fluid Mechanics"*, by R. J. Garde and A. G. Mirajgaoker

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

Course Outcome	WK Alignment	PO Mapping	SDG Alignment
CO CVE 205 .1	WK1, WK3, WK6	PO1, PO2, PO5	**SDG 9 -** Industry, Innovation and Infrastructure
CO CVE 205 .2	WK1, WK2, WK3, WK5	PO1, PO2, PO3, PO5	**SDG 7 -** Affordable and Clean Energy SDG 9 - Industry, Innovation and Infrastructure
CO CVE 205 .3	WK1, WK2, WK5, WK6	PO1, PO2, PO3, PO5	**SDG 7-** Affordable and Clean Energy **SDG 9-** Industry, Innovation and Infrastructure **SDG 11-** Reduced Inequalities
CO CVE 205 .4	WK1, WK2, WK3, WK6	PO1, PO2, PO5	**SDG 9-** Industry, Innovation and Infrastructure
CO CVE 205 .5	WK1, WK3, WK5, WK7	PO1, PO2, PO3	**SDG 9-** Industry, Innovation and Infrastructure **SDG 11-** Reduced Inequalities

Course Code: CVE 207 DM 30	Course Name: Surveying and Geomatics	L	T	P	C
		3	0	0	3
Year and Semester	II[nd] year -III Semester	Contact hours per week: (3 Hrs) Exam:(3 hrs.)			
Pre-requisite of course	-	Evaluation			
		CIE: 30	TEE: 70		

1. **Course Objectives:**
2. **Apply fundamental surveying principles** to perform linear, angular, and graphical measurements, including ranging of survey lines, determining bearings, and conducting levelling operations such as differential, reciprocal, profile, and cross-section levelling using both digital and auto levels.
3. **Interpret and construct contour maps** by applying various contouring methods, and compute areas and volumes from field data for use in engineering design and earthwork estimation.
4. **Execute triangulation and trilateration surveys** using theodolites to measure horizontal and vertical angles, establish horizontal and vertical control networks, and apply trigonometric levelling principles including satellite station corrections and intervisibility analysis.
5. **Set out and calculate elements of horizontal and vertical curves** — including simple, compound, reverse, and transition curves — using appropriate methods for road and railway alignment design.
6. **Operate modern field survey instruments** including EDM, Total Stations, and GPS receivers to collect, process, and transform coordinate data, and evaluate sources of error inherent in these systems to ensure measurement accuracy.
7. **Understand and apply photogrammetric techniques**, including aerial photograph interpretation, relief and tilt displacement correction, flight planning, stereoscopic viewing, aerial triangulation, and the production of photographic maps and mosaics.
8. **Integrate Remote Sensing, GPS, and GIS technologies** to acquire, process, and analyse spatial data — including digital image interpretation, coordinate system transformations, data digitisation, and geo-referencing — for practical applications in civil engineering projects.

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

CO CVE 207 DM 30.1	Understand the Fundamentals of Surveying & Levelling
CO CVE 207 DM 30.2	Execute Control Surveys, Triangulation & Curve Setting
CO CVE 207 DM 30.3	Conceptualize Modern Survey Technologies (EDM, Total Station & GPS)
CO CVE 207 DM 30.4	Interpret the terrestrial and aerial date through Geospatial Data Acquisition & Analysis (Photogrammetry, RS & GIS)

Module No	Course Contents	Hrs	COs
1	**Introduction to Surveying:** Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes. **Triangulation and Trilateration:** Theodolite survey: Instruments, Measurement of horizontal and vertical angle;	**14**	**CO CVE 207 DM 30.1 CO CVE 207 DM 30.2**

	Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric leveling - Axis single corrections.		
2	**Curves :** Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves **Modern Field Survey Systems:** Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations	**14**	**CO CVE 207 DM 30.2** **CO CVE 207 DM 30.3**
3	**Photogrammetry Surveying:** Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.	**7**	**CO CVE 207 DM 30.3** **CO CVE 207 DM 30.4**
4	**Remote Sensing:** Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing. **Global Positioning System (GPS) :** Elements, satellite constellation and signals, GPS measurements, Coordinate System-Map Projection & Projected Coordinate System **Geographical Information System (GIS):** Components, types and characteristics, geo-referencing, digitization, data models, application of GIS in civil engineering.	**10**	**CO CVE 207 DM 30.3** **CO CVE 207 DM 30.4**

Suggested Books:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 207 DM 30.1	WK1, WK2,WK3, WK4	PO1, PO2,PO5	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CVE 207 DM 30.2	WK1, WK2,WK3, WK4, WK6	PO1, PO2, PO3, PO5	**SDG 7 – Affordable and Clean Energy** **SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 207 DM 30.3	WK2,WK3, WK5, WK6	PO1, PO2, PO3, PO5, PO6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CVE 207 DM 30.4	WK4,WK6, WK7, WK8	PO1, PO2, PO3, PO5, PO6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities SDG 13 – Climate Action** **SDG 15 – Life on Land**

Course Code: CVE 209 VA 20	Course Name: Indian Knowledge System in Civil Engineering	L	T	P	C
		2	0	0	2

Year and Semester	II[nd] year -III Semester	Contact hours per week: (2 Hrs) Exam: (3 hrs.)
Pre-requisite of course		Evaluation
		CIE: 30 / TEE: 70

Course Objectives: The course aims to introduce the fundamentals of Indian Knowledge Systems (IKS) and their contributions to traditional engineering, architecture, and construction practices. It develops understanding of ancient and medieval construction techniques, sustainable building methods, and heritage structures. The course also emphasizes the relevance and integration of traditional knowledge with modern construction materials, technologies, and practices, enabling students to analyze sustainability, lifecycle, and environmental aspects of infrastructure development.

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

CVE 209 VA 20.1	Understand the fundamentals of Indian Knowledge Systems and their contributions to ancient science, technology, and construction practices.
CVE 209 VA 20.2	Explain traditional construction techniques, materials, and planning concepts used in ancient civilizations such as the Indus Valley Civilization.
CVE 209 VA 20.3	Analyze traditional engineering systems including water management, transportation networks, and heritage structures in historical contexts.
CVE 209 VA 20.4	Evaluate the application of Indian Knowledge Systems in modern construction practices with respect to sustainability, lifecycle, and environmental considerations.
CVE 209 VA 20.5	Apply knowledge of traditional and modern construction materials and techniques for developing sustainable infrastructure solutions.
CVE 209 VA 20.6	Assess emerging technologies and their integration with traditional knowledge systems for innovative and resilient construction practices.

Module No	Course Contents	Hrs	COs
1	Introduction to Indian Knowledge Systems (IKS) Overview of IKS, Vedic Corpus and Philosophy, Scope and Importance of Traditional Knowledge, Science and Technology development in Early Period, Use of ancient Construction Material, Foundation of Heritage Construction, Harappan and Indus valley Civilization, Design Philosophy, Traditional Water Management system, Road and Bridges development, Modes of Transportations and Reforms, Case study of Ram Setu and other Temples.	12	**CVE 209 VA 20.1, CVE 209 VA 20.2, CVE 209 VA 20.3**
2	Traditional Knowledge in Engineering and Technology: Introduction to History and concept of ancient architecture in terms of light and ventilation, Early Historic Period - Wooden and Cave Architecture, Stone and Bronze Construction, Sustainable Building Practices in Ancient India, Ground improvement works	10	**CVE 209 VA 20.2, CVE 209 VA 20.3**

	take place in ancient construction, Study of Ancient Texts Related to Construction, Analysis of Iconic Structures and Their Construction Techniques, Medieval Construction Era and construction practices, case study of medieval historical buildings. Grand Trunk Road, Silk Route.		
3	**Contemporary Applications of IKS in Construction:** Revival of Traditional Building Techniques, Chemistry and Chemical Engineering for Ancient Period, Indigenous knowledge for rural development, Iron Technology in India, Integration of IKS with Modern Construction Practices, Case Studies of Recent Projects Incorporating IKS, Challenges and Opportunities in Applying IKS today construction practices, Apply traditional geometrical methods for basic layout, Life cycle and cost analysis, Environment, and Economy of the project.	**12**	**CVE 209 VA 20.4, CVE 209 VA 20.5**
4	**Modern Construction Engineering and Material Science:** Clay, Lime, Cement, Concrete and their types, Glass, Bricks, Timber, Steel, Fibers and Geosynthetics. Masonry Construction Works, Reinforced Construction Work, Concept of Earthquake Resistant Building, 3D Printing technology, Application of Machine learning in developing IKS.	**11**	**CVE 209 VA 20.5, CVE 209 VA 20.6**

Suggested Books:

1. Indian Knowledge Systems: Concepts and Applications by Kapil Kapoor – A foundational text for understanding the scope, depth, and interdisciplinary nature of IKS.
2. Introduction To Indian Knowledge System: Concepts and Applications, Mahadevan, B.Bhat, Vinayak Rajat,Nagendra Pavana R.N.PHI, ISBN: 9789391818203
3. Introduction" in Studies in Epics and Purāṇas, (Eds.), KM Munshi and N Chandrashekara Aiyer Bhartiya Vidya Bhavan.
4. Singh, B. R., Jha, G. N., Singh, U. K., & Mishra, D. (2012). Science and technology in ancient Indian texts. D.K. Printworld. ISBN: 9788224606322
5. Srinivasan, S., & Ranganathan, S. (2014). India's legendary Wootz steel: An advanced material of the ancient world. Universities Press. ISBN: 9788173717215.
6. Natural Ventilation of Buildings: Theory, Measurement and Design Print ISBN:9780470660355
7. Duggal, S. K. (n.d.). Building materials. S. K. Kataria & Sons. ISBN: 9788185315361
8. Agarwal, P., & Shrikhande, M. (n.d.). Earthquake resistant design of structures (Latest ed.). Prentice Hall India. (Check edition year and ISBN)
9. Tirthaji, B. K. (1965). Vedic mathematics: Sixteen simple mathematical formulae from the Vedas. Motilal Banarsidass. ISBN: 9788120801646

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CVE 209 VA 20.1	WK1, WK2	PO1, PO2	**SDG 4 – Quality Education** **SDG 9 – Industry, Innovation and Infrastructure**
CVE 209 VA 20.2	WK1, WK2,WK3	PO1, PO2, PO3	**SDG 9 – Industry, Innovation and Infrastructure**
CVE 209 VA 20.3	WK1, WK2, . WK4,WK6	PO1, PO2, PO4, PO6	**SDG 11 – Sustainable Cities and Communities** **SDG 9 – Industry, Innovation and Infrastructure**
CVE 209 VA 20.4	WK2, WK3, WK7	PO2, PO3, PO7	**SDG 11 – Sustainable Cities and Communities** **SDG 12 – Responsible Consumption and Production**
CVE 209 VA 20.5	WK3, WK5, WK7	PO3, PO5, PO7	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CVE 209 VA 20.6	WK2, WK3, WK5, WK7, WK8	PO2, PO3, PO5, PO7, PO8	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**

Course Code: CVE 219 VA 00	Course Name: Disability, Accessibility and Universal Design	L	T	P	C
		3	0	0	0
Year and Semester	IInd year -III Semester	Contact hours per week: (3 Hrs) Exam:(3 hrs.)			
Pre-requisite of course	None	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

Objective 1 — Introduce concepts of human diversity, inclusion, and disability to build sensitivity towards vulnerable groups and their challenges.
Objective 2 — Familiarise students with disability classification, functional limitations, and environmental needs as recognised under the RPWD Act 2016.
Objective 3 — Examine physical, social, and institutional barriers alongside national and international legislative frameworks governing accessible and inclusive environments.
Objective 4 — Equip students with Universal Design philosophy, evolution, principles, and criteria for planning inclusive built environments effectively.
Objective 5 — Expose students to real-world inclusive design case studies enabling evaluation and proposal of Universal Design solutions.

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

CO CVE 219 00.1	Explain diversity, inclusion, disability models, and functional limitations associated with physical, sensory, cognitive, and learning disabilities confidently.
CO CVE 219 00.2	Identify environmental barriers and apply national and international accessibility codes and harmonized guidelines to evaluate built environments.
CO CVE 219 00.3	Interpret UNCRPD, RPWD Act 2016, and SDGs relating legislative policies to inclusive infrastructure planning and design decisions.
CO CVE 219 00.4	Apply Universal Design principles and criteria to analyse built environments and propose inclusive solutions for all users.
CVE 219 00.5	Evaluate built environment case studies recommending context-appropriate Universal Design strategies for urban, peri-urban, and rural infrastructure projects.

Module No	Course Contents	Hrs	COs
1	**Module 1: Diversity, Inclusion & Understanding Disability** Covers foundational concepts of human diversity and inclusion including all vulnerable groups, their need, significance, and impacts; theory of disability; various definitions, concepts, and models of disability; prevalence of disability; disability classification as per international and national frameworks; functional limitations and key coping strategies; physical and movement disabilities; vision impairments; hearing, speech, cognitive, learning, and other disabilities as defined under the Rights of Persons with Disabilities (RPWD) Act, 2016.	12	**CO CVE 219 00.1**
2	**Module 2: Environmental Barriers & Accessibility Frameworks** Covers identification and classification of physical, social, and institutional barriers in diverse national and international contexts; introduction to harmonized guidelines and the National Building Code (NBC); review of exemplary international accessibility codes and guidelines; basics of accessibility standards and their practical application; legislative policies and programmes including the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), RPWD Act 2016, Sustainable Development Goals (SDGs), and urban development programmes in the Indian context alongside other national and international policies.	14	**CO CVE 219 00.2**
3	**Module 3: Universal Design — Theory & Principles** Covers the evolution from barrier-free environment concepts to Universal Design	10	**CO CVE 219 00.3**

	philosophy; definitions, associated myths, terminologies, and perspectives; Universal Design Theory including international and Indian principles, UD goals and their criteria; comparative analysis of Universal Design frameworks across global and Indian contexts; and the application of Universal Design principles to address the diverse needs of all users including persons with disabilities and other vulnerable groups.		**CO CVE 219 00.4**
4	**Module 4: Universal Design — Application & Case Studies** Covers practical application of Universal Design principles through real-world built environment case studies from urban transportation systems, peri-urban settings, and rural contexts; analysis of design solutions that address diverse functional limitations; evaluation of inclusive infrastructure against accessibility codes and Universal Design criteria; and lessons learned from exemplary national and international inclusive design implementations for civil and infrastructure engineering projects.	**9**	**CVE 219 00.5**

Suggested Books:

1. Steinfeld, E., & Maisel, J. (2012). Universal Design: Creating Inclusive Environments. John Wiley & Sons, New Jersey, USA.
2. Preiser, W. F. E., & Smith, K. H. (Eds.). (2011). Universal Design Handbook (2nd ed.). McGraw-Hill Education, New York, USA.
3. Barnes, C., & Mercer, G. (2010). Exploring Disability (2nd ed.). Polity Press, Cambridge, UK.
4. Ghaisas, A., & Kerkar, S. (2015). Accessibility and Universal Design: An Indian Perspective. Rehabilitation Council of India, New Delhi, India.
5. Kumar, J., & Agarwal, R. (2018). Disability Studies and Inclusive Development in India. Rawat Publications, Jaipur, India.
6. Ministry of Housing and Urban Affairs, Government of India. (2021). Harmonized Guidelines and Standards for Universal Accessibility in India (Revised ed.). MOHUA Publications, New Delhi, India.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 219 00.1	WK1, WK3,WK9	PO1, PO3, PO7	SDG 10 – Reduced Inequality SDG 11 – Sustainable Cities and Communities SDG 16 – Peace, Justice, and Strong Institutions
CO CVE 219 00.2	WK1, WK2,WK4,WK5	PO1, PO2, PO3, PO4	SDG 8 - Decent Work and Economic Growth SDG 11 – Sustainable Cities and Communities
CO CVE 219 00.3	WK1, WK2, WK3	PO1, PO2	SDG 3 – Good Health and Well-being SDG 11 – Sustainable Cities and Communities
CO CVE 219 00.4	WK2,WK8,WK7	PO2, PO4, PO6	SDG 8 - Decent Work and Economic Growth SDG 9 – Industry, Innovation and Infrastructure SDG 11 – Sustainable Cities and Communities
CVE 219 00.5	WK2,WK3, WK5	PO2, PO5, PO6	SDG 8 - Decent Work and Economic Growth SDG 9 – Industry, Innovation and Infrastructure SDG 10 – Reduced Inequality SDG 11 – Sustainable Cities and Communities

Course Code: CVE 211 DM 10	Course Name: Strength of Materials Lab	L	T	P	C
		0	0	2	1
Year and Semester	II[nd] year -III Semester	Contact hours per week: (2 Hrs) Exam: (2 hrs.)			
Pre-requisite of course	i) Engineering Physics ii) Engineering Mathematics	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives: This laboratory course aims to provide hands-on understanding of mechanical properties of materials through standard testing methods. It enables students to experimentally evaluate hardness, strength, ductility, brittleness, torsional and flexural behavior of materials. The course also develops the ability to interpret experimental results, understand material response under different loading conditions, and correlate practical observations with theoretical concepts of strength of materials.

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

CO CVE 211 DM 10.1	Determine hardness of materials using Rockwell and Brinell hardness tests.
CO CVE 211 DM 10.2	Assess impact strength of materials using Izod and Charpy impact tests.
CO CVE 211 DM 10.3	Evaluate torsional behavior and determine torsional rigidity of circular shafts.
CO CVE 211 DM 10.4	Analyze stress–strain behavior of ductile and brittle materials under tensile and compressive loading using Universal Testing Machine.
CO CVE 211 DM 10.5	Determine flexural rigidity and understand bending behavior of beams under loading.
CO CVE CVE 211 DM 10.6	Interpret experimental data, prepare technical reports, and correlate laboratory results with theoretical concepts of material mechanics.

Module No	Course Contents Practical / Lab work	Hrs	COs
1	To determine Rockwell hardness number of the specimen of steel/soft metal.	2	**CO CVE 211 DM 10.1 CO CVE 211 DM 10.6**
2	To determine Brinell hardness number of the specimen of steel/soft metal.	2	**CO CVE 211 DM 10.1 CO CVE 211 DM 10.6**
3	To determine the impact strength of M.S./C.I. specimen on Izod impact testing machine.	2	**CO CVE 211 DM 10.2**
4	To determine the impact strength of M.S./C.I. specimen on Charpy impact testing machine.	2	**CO CVE 211 DM 10.2 CO CVE 211 DM 10.6**

5	To determine the torsional rigidity of a shaft on torsion testing machine.	4	**CO CVE 211 DM 10.3** **CO CVE 211 DM 10.6**
6	To study the behavior of ductile material under tension on Universal Testing Machine.	4	**CO CVE 211 DM 10.4**
7	To study the behavior of brittle material under tension on Universal Testing Machine.	2	**CO CVE 211 DM 10.4** **CO CVE 211 DM 10.6**
8	To determine flexural rigidity of a beam simply supported at the ends and carrying a concentrated load at the center.	2	**CO CVE 211 DM 10.5** **CO CVE 211 DM 10.6**

Suggested Books:

1. **Anand A.**, *"Strength of Materials Lab Manual"*, Notion Press / Amazon Publications.
2. **MSBTE Board**, *"Laboratory Manual for Strength of Materials (K Scheme)"*, MSBTE Publications.
3. **Anna University**, *"Strength of Materials Laboratory Manual"*, Anna University, Chennai.
4. **Prof. K. Ramesh**, *"Strength of Materials Laboratory Manual"*, IIT Madras.
5. **Department of Civil Engineering**, *"Strength of Materials Lab Manual"*, Vardhaman College of Engineering, Hyderabad.
6. **Marri Laxman Reddy Institute of Technology**, *"Strength of Materials Laboratory Manual"*, MLRITM, Hyderabad.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 211 DM 10.1	WK1,	PO1, PO2, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 211 DM 10.2	WK1, WK2	PO1, PO2, PO4	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 211 DM 10.3	WK1, WK2, WK3	PO1, PO2, PO3, PO4	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 211 DM 10.4	WK1, WK2, WK4, WK6	PO1, PO2, PO4, PO6	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 211 DM 10.5	WK1, WK2, WK3, WK4	PO1, PO2, PO3, PO4	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 211 DM 10.6	WK4, WK5, WK7	PO4, PO5, PO7, PO8, PO10	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**

Course Code: CVE 213 DM 10	Course Name: Building Construction Materials and Testing Lab	L	T	P	C
		0	0	2	1
Year and Semester	2nd year -III Semester	Contact hours per week: (2 Hrs) Exam: (2 hrs.)			
Pre-requisite of course	-	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

1. To familiarize students with standard laboratory tests on construction materials including bricks, concrete, aggregates, and reinforcement steel.
2. To enable students to perform experiments accurately and interpret results for evaluating material properties and quality.
3. To develop practical skills for non-destructive testing and assessment of concrete and reinforced structures.

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

CVE 213 DM 10.1	Perform standard tests on construction materials such as bricks, concrete, aggregates, and reinforcement steel to determine their properties.
CVE 213 DM 10.2	Analyze and interpret experimental results to assess material strength, durability, and quality.
CVE 213 DM 10.3	Apply non-destructive testing methods like rebound hammer, ultrasonic pulse velocity, and half-cell potentiometer tests for in-situ evaluation of concrete and reinforcement.
CVE 213 DM 10.4	Demonstrate practical understanding of material behavior under different conditions and provide recommendations for safe and sustainable construction.

Module No	Course Contents Practical / Lab work	Hrs	COs
1	Determination of Compressive Strength of Bricks	4	**CVE 213 DM 10.1 CVE 213 DM 10.2**
2	Sieve Analysis and silt content of Fine Aggregates	4	**CVE 213 DM 10.1 CVE 213 DM 10.2**
3	Slump Test and strength on Fresh Concrete	4	**CVE 213 DM 10.1 CVE 213 DM 10.2 CVE 213 DM 10.3**
4	Water Absorption and efflorescence Test on Bricks	4	**CVE 213 DM 10.1 CVE 213 DM 10.2**
5	Tensile Strength Test on Reinforcement Steel	2	**CVE 213 DM 10.1 CVE 213 DM 10.2 CVE 213 DM 10.4**
6	Ultrasonic pulse velocity test on concrete	4	**CVE 213 DM 10.3 CVE 213 DM 10.4**
7	Rebound Hammer Test on concrete	4	**CVE 213 DM 10.3 CVE 213 DM 10.4**
8	Half-cell potentiometer test on reinforced concrete	4	**CVE 213 DM 10.3 CVE 213 DM 10.4**

Suggested Books:

1. Bansal, R.K. – *Building Materials and Construction*
2. Shetty, M.S. – *Concrete Technology: Theory and Practice*
3. Neville, A.M. – *Properties of Concrete*
4. Gambhir, M.L. – *Concrete Technology*
5. IS Codes (Bureau of Indian Standards): IS 3495 – Tests on bricks , IS 2386 – Tests on aggregates, IS 516 – Methods of tests for concrete, IS 4031 – Tests on cement, IS 13311 – Non-destructive testing of concrete
6. CPWD Specifications latest

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	Alignment to SDGs
CVE 213 DM 10.1	WK1, WK3,WK6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CVE 213 DM 10.2	WK2,WK3,WK8	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**
CVE 213 DM 10.3	WK4, WK5,WK6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CVE 213 DM 10.4	WK3,WK5,WK7	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities** **SDG 12 – Responsible Consumption and Production**

Course Code: CVE 215 DM10	Course Name: Fluid Mechanics Lab	L	T	P	C
		0	0	2	1
Year and Semester	2nd year -3rd Semester	Contact hours per week: (2 hrs.) Exam: (2 hrs.)			
Pre-requisite of course	Mathematics	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

1. To develop practical understanding of fundamental fluid properties and behavior through experimental analysis of flow and pressure measurement devices.
2. To enable students to verify fundamental principles of fluid mechanics, including Bernoulli's theorem and Reynolds number, through laboratory experiments.
3. To provide hands-on experience in flow measurement techniques using orifice meter, Venturimeter, notches, and Pitot tube.
4. To impart knowledge of fluid statics and buoyancy concepts, including stability of floating bodies and determination of metacentric height.
5. To develop skills in analyzing fluid flow characteristics, including laminar and turbulent flow, velocity distribution, and flow net construction.

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

CO CVE 215 .1	Analyze fluid statics and buoyancy, including stability of floating bodies and metacentric height.
CO CVE 215.2	Verify fundamental fluid mechanics principles including Bernoulli's theorem and Reynolds number.
CO CVE 215.3	Measure flow parameters using devices such as Venturimeter, orifice meter, notches, and Pitot tube.
CO CVE 215.4	Determine coefficients of velocity, contraction, and discharge for hydraulic devices.
CO CVE 215.5	Evaluate flow behavior including laminar and turbulent flow, velocity distribution, and flow nets.

Module No	Course Contents Practical / Lab Work	Hrs.	Cos
1	Determination of Metacentric Height of a Floating Body	2	CO CVE 215.1
2	To draw flow nets for two-dimensional flow conditions by using electrical analogy method.	2	CO CVE 215.2
3	To experimentally verify Bernoulli's theorem for steady flow	2	CO CVE 215.3
4	Experimental study of flow velocity measurement using a Pitot tube.	2	CO CVE 215.3
5	To calibrate a Venturimeter and determine the coefficient of discharge (Cd).	2	CO CVE 215.3
6	To calibrate an orifice meter and determine the coefficient of discharge (Cd).	2	CO CVE 215.3
7	To calibrate a triangular (V-notch) and determine its coefficient of discharge (Cd).	2	CO CVE 215.3
8	To calibrate a rectangular notch and determine its coefficient of discharge (Cd).	2	CO CVE 215.3

9	To determine the coefficients of velocity (Cv), contraction (Cc), and discharge (Cd) for an orifice of given shape.	2	CO CVE 215.3
10	To determine the coefficient of discharge (Cd) for a mouthpiece.	2	CO CVE 215.3
11	Experimental determination of velocity distribution in pipe flow using a current meter or flow probe.	2	CO CVE 215.4
12	To study the transition from laminar to turbulent flow and determine the lower critical Reynolds number.	2	CO CVE 215.5

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

Course Outcome	WK Alignment	PO Mapping	SDG Alignment
CO CVE 215.1	WK1 WK2 WK5	PO1 PO2 PO5	SDG 6 — Clean Water & Sanitation; SDG 9 — Industry, Innovation & Infrastructure
CO CVE 215.2	WK1 WK2 WK3	PO1 PO2 PO3	SDG 9 — Industry, Innovation & Infrastructure; SDG 4 — Quality Education
CO CVE 215.3	WK1 WK2 WK5	PO1 PO2 PO5	SDG 6 — Clean Water & Sanitation; SDG 9 — Industry, Innovation & Infrastructure
CO CVE 215.4	WK1 WK3 WK6	PO1 PO2 PO5	SDG 9 — Industry, Innovation & Infrastructure; SDG 13 — Climate Action
CO CVE 215.5	WK1 WK2 WK6	PO1 PO2 PO3	SDG 6 — Clean Water & Sanitation; SDG 11 — Sustainable Cities & Communities

Course Code: CVE 217 DM 10	Course Name: Surveying and Geomatics Lab	L	T	P	C
		0	0	2	1
Year and Semester	II[nd] year -III Semester	Contact hours per week: (2 Hrs) Exam:(2 hrs.)			
Pre-requisite of course	-	Evaluation			
		CIE: 30		TEE: 70	

Course Objectives

1. Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods
2. Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements
3. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments, EDM, LiDAR, DGPS, etc.
4. Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse
5. Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse. Use appropriate software for calculations and mapping
6. Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system
7. Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities

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

CO CVE 217 DM 10.1	Acquire conventional Field Surveying Skills
CO CVE 217 DM 10.2	Conduct practical field layout applications through Levelling, Angular Measurement & Curve Setting
CO CVE 217 DM 10.3	Conduct data Processing using GIS & Image Analysis enabling extraction of meaningful spatial information from satellite and aerial imagery for civil engineering mapping applications
CO CVE 217 DM 10.4	Able to operate advanced & Digital Survey Instrumentation for diverse civil engineering survey tasks

Module No	Course Contents Practical / Lab work	Hrs	COs
1	Chain surveying: - Chaining a line and recording in the field book, Taking offsets - perpendicular and oblique (with a tape only), Setting out right angle with a tape.	2	CO CVE 217 DM 10.1 CO CVE 217 DM 10.2
2	Compass Surveying: - Study of prismatic compass, Setting the compass and taking observation.	2	CO CVE 217 DM 10.1 CO CVE 217 DM 10.2
3	Plane Tabling: Methods of plane tabling: - Radiation, Intersection, Traversing and Resection.	2	CO CVE 217 DM 10.1 CO CVE 217 DM 10.2
4	Leveling: Profile leveling and plotting of longitudinal section.	2	CO CVE 217 DM 10.1 CO CVE 217 DM 10.2

5	Study of Theodolite, Measurement of horizontal and vertical angles.	4	CO CVE 217 DM 10.4
6	To find the constants of a tachometer and to verify field distances by tacheometric surveying.	4	CO CVE 217 DM 10.1 CO CVE 217 DM 10.2
7	Setting out of simple circular curve by Rankine's method of tangential angle.	2	CO CVE 217 DM 10.1 CO CVE 217 DM 10.2
8	Study of Total Station, Measurement of Horizontal Angle, Measurement of Vertical Angle and Measurement of Horizontal Distance.	2	CO CVE 217 DM 10.4
10	Introduction to ArcGIS/Image Processing Software	2	CO CVE 217 DM 10.3
11	Geo-referencing and On-screen digitization from images	2	CO CVE 217 DM 10.3
12	Area Computation and Simple image enhancement	2	CO CVE 217 DM 10.3
13	Histogram and DN value	2	CO CVE 217 DM 10.3
14	Introduction to EDM and GPS measuring instruments	2	CO CVE 217 DM 10.3
15	Area computation using Digital Planimeter	2	CO CVE 217 DM 10.3
16	Surveying using advanced surveying equipments such as DGPS, LiDAR, Distomat, Drone, etc.	2	CO CVE 217 DM 10.3 CO CVE 217 DM 10.4

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 217 DM 10.1	WK1, WK2,WK3	PO1, PO3,PO4, PO5, PO7, PO8	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 217 DM 10.2	WK3, WK4,WK6	PO1, PO2,PO3, PO5, PO6, PO8	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CVE 207 DM 10.3	WK1, WK2, WK5,WK6	PO1, PO2, PO4, PO5, PO6	**SDG 7 – Affordable and Clean Energy** **SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities** **SDG 13 – Climate Action** **SDG 15 – Life on Land**
CO CVE 217 DM 10.4	WK5,WK6,W K8	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10	**SDG 7 – Affordable and Clean Energy** **SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities** **SDG 13 – Climate Action** **SDG 15 – Life on Land**

Course Code: CVE 202 DM 30	Course Name: Concrete Technology	L	T	P	C
		3	0	0	3
Year and Semester	II[nd] year -IV Semester	Contact hours per week: (3 Hrs) Exam: (3 hrs.)			
Pre-requisite of course	Building Construction and Material	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives: The course aims to provide a comprehensive understanding of the properties, behavior, and performance of concrete and its constituents, including cement, aggregates, sand, and admixtures. It enables students to evaluate fresh and hardened concrete through standard tests, understand factors affecting workability, strength, durability, creep, and shrinkage, and apply concepts such as water-cement ratio and curing methods. The course further develops the ability to design concrete mixes using standard methods such as BIS, ACI, and British Standards, ensuring quality control and compliance. Additionally, it introduces durability issues like sulphate attack, corrosion, and carbonation, along with their prevention, and familiarizes students with special concreting practices and advanced materials such as lightweight and geopolymer concrete.

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

CO CVE 202 DM 30.1	To understand the behavior of fresh & hardened concrete.
CO CVE 202 DM 30.2	To understand & design concrete mix using various design codes
CO CVE 202 DM 30.3	Identify the quality control & durability requirements of concrete
CO CVE 202 DM 30.4	Acquire knowledge of special concrete adopted in industries.
CO CVE 202 DM 30.5	Understand various non-destructive testing techniques & its application

Module No	Course Contents	Hrs	COs
1	**Constituents of Concrete:** Concrete as Engineering Material, Historical Background, Properties of Cement, Various types of cement & their applications, Tests on cement, , Bulking of Sand, properties of good sand and functions of sand in mortar and cement concrete, Classification of Aggregates, Properties of aggregates – specific gravity, bulk density, porosity, adsorption & moisture content of aggregates, deleterious substance in aggregate, Soundness of aggregate, Grading of coarse and fine aggregates, physical requirements of aggregates, and their tests, Admixtures: their purpose, their types, properties, dosages, effects and usages.	10	**CO CVE 202 DM 30.1, CO CVE 202 DM 30.3**
2	**Properties of Fresh and Hardened Concrete:** Overview about Fresh Properties of Concrete, Workability, factors affecting workability, measurement of workability by different tests; Strength of concrete and factors affecting it, Water Cement Ratio – Abram's law, Degree of Compaction and Age of Concrete. Introduction to Strength of Concrete, Fatigue, Elastic Modulus and Poisson ratio, Stress-Strain behavior of Concrete, Methods	11	**CO CVE 202 DM 30, CO CVE 202 DM 30.3**

	of Curing, Influence of Temperature, Steam curing, Durability, shrinkage & Creep of Concrete, Factors influencing Creep; Compression tests and Tension Tests, Flexural Tests & Splitting Tests, Freeze and Thaw in Concrete.		
3	**Concrete Mix Design:** Principles of Concrete Mix Design, Basic Considerations, Factors in the choice of mix design, outline of mix design procedure, Proportioning of Concrete mixes by various methods – BIS Method of Mix Design, American Concrete Institute, British Standard, Quality control and Acceptance Criterion. Grades of Concrete, stress strain curve, permissible stresses.	**12**	**CO CVE 202 DM 30.2**
4	**Durability of Concrete:** Sulphate attack of concrete, Corrosion of rebar wrt chloride and sulphate attack, Alkali Silica Reaction, Freezing and Thawing, Carbonation of Concrete, Corrosion Measurement Techniques, Prevention of Corrosion Special Circumstances of Concreting: Hot weather concreting, Cold weather concreting, Underwater concreting, Heavy Concrete, Lightweight Concrete, Geopolymer concrete.	**12**	**CO CVE 202 DM 30.3, CO CVE 202 DM 30.4, CO CVE 202 DM 30.5**

Suggested Readings:

1. Gambhir, M.L. *Concrete Technology*. Tata McGraw Hill, 2017.
2. *Handbook of Mix Design.* BIS, New Delhi. IS 20262: 2019
3. IS Code on Ordinary Portland Cement IS:383 2016
4. IS Code of RCC, IS 456-2000
5. Neville, A. M. & Brooks, J.J. *Concrete Technology*. Pearson, 2019.
6. Santhakumar, A.R. *Concrete Technology*, Oxford University Press, 2006.
7. Shetty, M.S. *Concrete Technology*. S. Chand & Co., 2006.

Note: Latest edition of books is to be referred.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 202 DM 30.1	WK1, WK2,WK4	PO1, PO2, PO4	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 202 DM 30.2	WK1, WK2,WK3,	PO1, PO2, PO3, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 202 DM 30.3	WK1, WK2, WK6, WK7	PO1, PO2, PO6, PO7	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CVE 201 DM 30.4	WK1, WK3, WK5, WK7	PO1, PO3, PO5, PO7	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**
CO CVE 201 DM 30.5	WK2, WK4, WK5, WK8	PO2, PO4, PO5, PO8	**SDG 9 – Industry, Innovation and Infrastructure**

Course Code: CVE 204 DM 30	Course Name: Structural Analysis	L	T	P	C
		3	0	0	3
Year and Semester	2st year -IV Semester	Contact hours per week: (3 Hrs) Exam: (3 hrs.)			
Pre-requisite of course	Strength of Materials	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

1. Enable students to understand the behavior and analysis of trusses.
2. Develop an understanding for analysis of indeterminate structural members.
3. Enable students to understand Influence Line Diagram and their significance.
4. Enable students to understand the behavior of arches, cables and suspension bridges.

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

CO CVE 204 DM.1	Analyze determinate trusses and to determine degree of indeterminacy in structures.
CO CVE 204 DM.2	Analyze indeterminate structures by using force method.
CO CVE 204 DM.3	Apply concept of Influence Line Diagram to statically determinate structures.
CO CVE 204 DM.4	Apply concepts of structural mechanics for the analysis of arches and stiffened suspension bridges.

Module No	Course Contents	Hrs	COs
1	Analysis of Determinate Trusses: Introduction, various types, stability, determination of forces in members of trusses by method of joints, method of sections, zero force members. Fixed and Continuous Beams: Degree of static and kinematic indeterminacies	10	**CO CVE 204 DM.1**
2	Analysis of fixed beams, continuous beams and propped cantilevers by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, effects of sinking and rotation of supports, bending moment and shear force diagrams for fixed beams and propped cantilevers, slope and deflection of fixed beams, analysis of continuous beams by the three moment theorem (Clapeyron's theorem) due to different types of loadings.	11	**CO CVE 204 DM.2**
3	Moving loads, Variable loads, Influence lines, Influence line diagram 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, Muller-Breslau Principle.	12	**CO CVE 204 DM.3**
4	Elastic arches: Analysis of three and two hinge arches, Normal thrust, shear force and bending moment for parabolic and segmental three hinged arches. Suspension bridges: Cables carrying point load and udl, Suspension cable with three hinged stiffening girder.	12	**CO CVE 204 DM.4**

Suggested Books:

1. S.B Junnarkar, Structural Mechanics Volume I, and II Charotar Publishers, 2016. (ISBN:978-9385039270).
2. D. Menon, Structural Analysis Volume – I and II Narosa Publication, 2010. (ISBN- 978-1842653371/1842653377).
3. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2010. (ISBN-1283187140/978-1283187145).

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 204 DM.1	WK3,WK6	PO1, PO2, PO3, PO4, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 204 DM.2	WK4, WK6	PO1, PO2, PO3, PO4, PO5	**SDG 4 – Quality Education** **SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 204 DM.3	WK4, WK5,WK6	PO1, PO2, PO3, PO4, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 204 DM.4	WK4,WK5, WK7	PO1, PO2, PO3, PO4, PO5	**SDG 9 – Industry, Innovation and Infrastructure**

Course Code: CVE 206 DM 30	Course Name: Construction Engineering and Management	L	T	P	C
		3	0	0	3
Year and Semester	IInd year -IV Semester	Contact hours per week: (3 Hrs) Exam: (3 hrs.)			
Pre-requisite of course	NIL	Evaluation			
		CIE: 30		TEE: 70	

Course Objectives:

. Introduce the fundamentals of road design and construction.
. Enable students to understand and design different geometric elements of road, investigate quality of materials and design different pavements with the incorporations of above concepts.
. Develop an understanding of traffic behavior and road safety concepts.

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

CO CVE 206 30.1	To learn the various stages of a project, project life cycle and the role of project stakeholders.
CO CVE 206 30.2	To schedule, design, check and analyse a construction project via network.
CO CVE 206 30.3	To understand various equipment used in construction and to organize site wrt various resources involved in construction project.
CO CVE 206 30.4	To understand the cash flow behaviour for a construction project.
CO CVE 206 30.5	To monitor and ensure quality control for a construction project.

Module No	Course Contents	Hrs	COs
1	Basics of Construction- Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution. Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts.	**10**	**CO CVE 206 30.1**
2	Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion.	**15**	**CO CVE 206 30.2**
3	Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for	**13**	**CO CVE 206 30.3 & CO CVE 206**

	lifting; Equipment for transportation of materials. Equipment Productivities. Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation. Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value. Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and levelling. Common Good Practices in Construction.		**30.4**
4	Project Monitoring & Control- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management. Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.	7	**CO CVE 206 30.5**

Suggested Books:

1. Varghese, P.C., "*Building Construction*", Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	Alignment to SDGs
CO CVE 206 30.1	WK1, WK3,WK6	**SDG 4 – Quality Education** **SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 206 30.2	WK1, WK2,WK3,WK5	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 10 – Reduced Inequalities**
CO CVE 206 30.3	WK1, WK2, WK5,WK6	**SDG 11 – Sustainable Cities and Communities** **SDG 12 – Responsible Consumption and production** **SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 206 30.4	WK1,WK2,WK3,W K6	**SDG 12 – Industry, Innovation and Infrastructure**
CO CVE 206 30.5	WK1,WK3, WK5	**SDG 3 – Good Health and Well Being** **SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**

Course Code: CVE 208 DM30	Course Name: Hydraulics Engineering	L	T	P	C
		3	0	0	3
Year and Semester	2nd year -4th Semester	Contact hours per week: (3 hrs.) Exam: (3 hrs.)			
Pre-requisite of course	Fluid Mechanics	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

1. To develop understanding of open channel flow characteristics, including classification of flows, velocity distribution, and design of efficient channel sections.
2. To enable students to analyze specific energy, specific force, hydraulic jump, and gradually varied flow for practical channel flow problems.
3. To impart knowledge of flow through pipes, including laminar and turbulent flow behavior, energy losses, and pipe network analysis.
4. To provide understanding of canal engineering including types, alignment, regime concepts, lining, and canal outlets for efficient irrigation water management.

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

CO CVE 208 .1	Apply principles of open channel flow to classify flow regimes, analyze velocity distribution, and design efficient channel sections.
CO CVE 208 .2	Analyze specific energy, specific force, hydraulic jump, and gradually varied flow to solve open channel flow problems.
CO CVE 208 .3	Apply principles of pipe flow to evaluate head losses, flow behavior, and analyze pipe systems including series, parallel, and network configurations.
CO CVE 208 .4	Understand canal types, design principles, regime theories, lining, and canal outlets.

Module No	Course Contents	Hrs.	COs
1	**Flow in Open Channels:** Difference between pipe flow and channel flow, Types of channels, Classification of flows, Sub Critical and Supercritical Flows, Velocity distribution in channel, Design of Channels, Most efficient channel sections **Concepts of Specific energy and specific Force:** Specific energy and specific curve, Momentum Equation in open channels, Specific force.	12	**CO CVE 208 .1**
2	**Hydraulic jump:** Froude number and types of hydraulic jump, Applications Jumps in channels. Unsteady flow equation, Pre jump and post jump depths, length of Hydraulic Jump and energy dissipation, Surges. **Gradually Varied Flow:** Channel transitions, Non-uniform flow in open channels, Dynamic equation for GVF, Water surface profiles, GVF flow computations.	11	**CO CVE 208 .2**

3	**Flow through pipes:** Types of flows-Reynold's experiment, laminar flow through pipes-Hagen Poiseuille law, loss due to friction (Darcy's weisbach equation), sudden expansion and sudden contraction, other energy losses in pipes, hydraulic gradient and total energy lines, pipes in series and in parallel, equivalent pipe, branched pipe, pipe networks, Hardy Cross method. Shear stress on turbulent flow, boundary layer in pipes-Establishment of flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Stanton and Moody's diagram.	**12**	**CO CVE 208 .3**
4	**Canals** Types of canals (perennial and non-perennial), canal alignment and selection of route, classification of canals (main canal, branch canal, distributary, minors), silting and scouring in canals, regime channels and regime conditions, Kennedy's theory, Lacey's theory, canal lining and types of lining, advantages of canal lining, canal outlets: requirements of a good outlet, classification of outlets, performance and flexibility of outlets, proportionality and sensitivity, selection and maintenance of outlets.	**10**	**CO CVE 208 .4**

Note for Paper-setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least ONE question from each unit.

Books:

1. *Fluid Mechanics, by P. N. Modi and S. M. Seth, Standard Book House, New Delhi, Latest Edition.*
2. *Engineering Fluid Mechanics, by R. J. Garde and A. G. Mirajgaoker, New Age International Publishers, Latest Edition.*
3. *Open Channel Hydraulics, by Ven Te Chow, McGraw Hill Education, Latest Edition.*
4. *Flow in Open Channels, by K. Subramanya, McGraw Hill Education, Latest Edition.*
5. *Irrigation Engineering and Hydraulic Structures, by B. C. Punmia, Laxmi Publications, Latest Edition.*
6. *Irrigation Engineering and Hydraulic Structures, by G. L. Asawa, New Age International Publishers, Latest Edition.*
7. *Irrigation and Water Resources Engineering, by S. K. Garg, Khanna Publishers, Latest Edition.*

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

Course Outcome	Course Outcome Statement	WK Alignment	PO Mapping	SDG Alignment
CO CVE 208 .1	Apply principles of open channel flow to classify flow regimes, analyze velocity distribution, and design efficient channel sections.	WK1, WK2, WK3	PO1, PO2, PO3	**SDG 6-** Clean Water and Sanitation **SDG 9-** Industry, Innovation and Infrastructure **SDG 11 -** Sustainable Cities and Communities
CO CVE 208 .2	Analyze specific energy, specific force, hydraulic jump, and gradually varied flow to solve open channel flow problems.	WK1, WK2, WK3, WK5	PO1, PO2, PO3, PO5	**SDG 6 -** Clean Water and Sanitation **SDG 9 -** Industry, Innovation and Infrastructure **SDG 11 -** Sustainable Cities and Communities
CO CVE 208 .3	Apply principles of pipe flow to evaluate head losses, flow behavior, and analyze pipe systems including series, parallel, and network configurations.	WK1, WK2, WK3, WK5	PO1, PO2, PO3, PO5	**SDG 6-** Clean Water and Sanitation **SDG 9 -** Industry, Innovation and Infrastructure **SDG 11 -** Sustainable Cities and Communities
CO CVE 208 .4	Understand canal types, design principles, regime theories, lining, and canal outlets.	WK1, WK2, WK3, WK7	PO1, PO2, PO3, PO6	**SDG 6:** Clean Water and Sanitation **SDG 2**: Zero Hunger Improved agricultural productivity **SDG 9**: Industry, Innovation and Infrastructure Sustainable canal infrastructure

Course Code: CVE 210 DM 30	Course Name: Transportation Engineering	L	T	P	C
		3	0	0	3
Year and Semester	IInd year -IV Semester	Contact hours per week: (5 Hrs) Exam: (3 hrs.)			
Pre-requisite of course	-	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

. Introduce the fundamentals of road design and construction.
. Enable students to understand and design different geometric elements of road, investigate quality of materials and design different pavements with the incorporations of above concepts.
. Develop an understanding of traffic behavior and road safety concepts.

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

CO CVE 210 DM 30.1	To design highway pavement geometrics.
CO CVE 210 DM 30.2	To understand the procedure to collect the traffic data for design and traffic management.
CO CVE 210 DM 30.3	To understand the need for traffic management.
CO CVE 210 DM 30.4	To test the quality of highway materials as per recommendation.
CO CVE 210 DM 30.5	To understand different aspects of highway construction and maintenance.
CO CVE 210 DM 30.6	To do structural design for flexible and rigid pavements.

Module No	Course Contents	Hrs	COs
1	Highways development Planning: Introduction, Different modes of transport, Development of Transport System, Phased development of Roads in India. Highway Surveys & Alignment, Geometric Design of Highways: Introduction, Highways Classification, Right of way, Land width, width of formation, width of pavement, Sight Distances, camber, horizontal and vertical Road Curves, Transition Curves.	10	CO CVE 210 DM 30.1
2	Traffic Studies: Road user characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Vehicular flow models. Stream variables: Spacing and concentration, headway and flow, mean speed. Time distance diagram of flow. Traffic operations and control devices, intelligent transport systems.	8	CO CVE 210 DM 30.2 & CO CVE 210 DM 30.3
3	Highway construction: Road types--earth roads, gravel roads, water bound macadam, bituminous pavement including surface treatment, premix carpet, mastic asphalt, bituminous macadam, bituminous concrete and cement concrete roads. Construction of earth, gravel and water bound macadam roads, Construction Equipment. Design, Drawings, Estimates & Project Report.	13	CO CVE 210 DM 30.4 & CO CVE 210 DM 30.5

	Highway materials and testing: sub grade, sub base and base course materials, bituminous materials, testing of soil, aggregate and bitumen. Maintenance: Introduction, Maintenance of Earth, gravel, WBM, GSB, WMM Roads, Bituminous Roads, Maintenance of berms, Side Slopes, Pavement edge and draining work. Failures of flexible and rigid pavements: Maintenance, evaluation and its strengthening		
4	Design of Pavements: Types of pavements, Factors affecting design of pavements, wheel load factor, Climatic Factors, Structure of Flexible pavement, Function of various components of Flexible pavement, design of flexible pavements by G.I. & CBR methods, stresses in rigid pavements, design of rigid pavements by IRC method. Road Safety Audits: Road Safety Audits: Safety concerns in highway projects, Systems approach, various stages of Safety Audit, Preparation of Audit Reports.	**14**	**CO CVE 210 DM 30.6**

Suggested Books:

1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Highway Engincering by L.R. Kadyali, Nem Chand & Brothers, Roorkee

Reference Books

1 Highway Engineering by Oglesby and Hews
2 Transportation Engineering by G V. Rao, Tata McGraw Hill Publisher, New Dethi

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CVE 210 DM 30.1	WK1, WK3,WK6	PO1, PO2, PO5	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CVE 210 DM 30.2	WK1, WK2,WK3,WK5	PO1, PO2, PO3, PO6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CVE 210 DM 30.3	WK1, WK2, WK5,WK6	PO1, PO2, PO3, PO5, PO6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 10 – Reduced Inequalities** **SDG 11 – Sustainable Cities and Communities**
CVE 210 DM 30.4	WK1,WK2,WK3, WK6	PO1, PO2, PO3, PO5	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**
CVE 210 DM 30.5	WK1,WK3, WK5	PO1, PO2, PO6	**SDG 9 – Industry, Innovation and Infrastructure**

			SDG 11 – Sustainable Cities and Communities **SDG 12 – Responsible Consumption and Production**
CVE 210 DM 30.6	WK1, WK2, WK3,WK7	PO1, PO2, PO3, PO6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**

Course Code: CVE 212 DM 10	Course Name: CONCRETE TECHNOLOGY LAB	L	T	P	C
		0	0	2	1
Year and Semester	**II[nd] year -IV Semester**	**Contact hours per week:** (2 Hrs) **Exam:** (2 hrs.)			
Pre-requisite of course	Building Construction and Material	**Evaluation**			
		CIE: 30	**TEE: 70**		

Course Objectives: The course aims to develop practical knowledge of concrete materials and their properties through standard laboratory tests on cement, aggregates, and concrete. It enables students to evaluate workability, strength, and durability characteristics using appropriate testing methods and equipment. The course also provides hands-on experience in concrete mix design as per IS guidelines and introduces modern techniques such as non-destructive testing. Additionally, it enhances students' ability to analyze experimental results and relate laboratory findings to real-world construction practices.

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

CVE 212 DM 10.1	To develop practical understanding of the properties of cement, aggregates, and concrete through standard laboratory testing methods.
CVE 212 DM 10.2	To enable students to evaluate workability, strength, and other characteristics of concrete using appropriate testing procedures and equipment.
CVE 212 DM 10.3	To provide hands-on experience in concrete mix design as per relevant IS code guidelines.
CVE 212 DM 10.4	To introduce modern testing techniques, including non-destructive testing methods for assessing concrete quality.
CVE 212 DM 10.5	To enhance analytical and reporting skills for interpreting experimental results and correlating them with theoretical concepts and field applications.

Module No	Course Contents Practical / Lab work	Hrs	COs
1	Determination of Fineness and Specific Gravity of cement.	2	**CO CVE 212 DM 10.1, CO CVE 212 DM 10.5**
2	Determination of consistency of standard Cement Paste.	2	**CO CVE 212 DM 10.1**
3	Determination of initial and Final Setting times of Cement.	2	**CO CVE 22 DM 10.1**
4	Determination of Compressive Strength of Cement.	2	**CO CVE 212 DM 10.2**
5	Determination of Fineness modulus of Coarse and Fine Aggregates	4	**CO CVE 212 DM 10.1**
6	Workability Tests: Slump Cone Test, Compaction factor test, Vee-Bee consistometer Test.	4	**CO CVE 212 DM 10.2, CO CVE 212 DM 10.5**
7	Determination of tensile strength of concrete.	2	**CO CVE 212 DM 10.2**

8	Determination of flexural strength of concrete.	2	**CO CVE 212 DM 10.2**
9	Mix Design: As per Guidelines of IS Code method.	2	**CO CVE 212 DM 10.3, CO CVE 212 DM 10.5**
10	Experiments to demonstrate the use of non-destructive test equipment.	2	**CO CVE 212 DM 10.4, CO CVE 212 DM 10.5**

Suggested Books:

- M.S. Shetty., "Concrete Technology: Theory and Practice", S. Chand & Company Pvt. Ltd.
- M.L. Gambhir., "Concrete Technology", Tata McGraw Hill Education Pvt. Ltd.
- A.M. Neville and J.J. Brooks., "Concrete Technology", Pearson Education India.
- Bureau of Indian Standards., "IS 20262: 2019 – Concrete Mix Proportioning Guidelines", BIS Publications, New Delhi.
- Bureau of Indian Standards., "IS 456: 2000 – Plain and Reinforced Concrete Code of Practice", BIS Publications, New Delhi.
- A.R. Santhakumar., "Concrete Technology", Oxford University Press.
- K.K. Choi and M. Asce., "Non-Destructive Testing of Concrete: Methods and Applications", CRC Press.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CVE 212 DM 10.1	WK1, WK4	PO1, PO4	**SDG 9 – Industry, Innovation and Infrastructure**
CVE 212 DM 10.2	WK1, WK2,WK4	PO1, PO2, PO4	**SDG 9 – Industry, Innovation and Infrastructure**
CVE 212 DM 10.3	WK1, WK2, WK3	PO1, PO2, PO3	**SDG 9 – Industry, Innovation and Infrastructure**
CVE 212 DM 10.4	WK2, WK4, WK5	PO2, PO4, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CVE 212 DM 10.5	WK4, WK5, WK8 WK9, WK10	PO4, PO5, PO8, PO9, PO10	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 12 – Responsible Consumption and Production**

Course Code: CVE 214 DM 10	Course Name: Structural Analysis Lab	L	T	P	C
		0	0	2	1
Year and Semester	2nd year, IV Semester	Contact hours per week: (2 Hrs) Exam: (2 hrs.)			
Pre-requisite of course	Strength of materials	Evaluation			
		CIE: 30		TEE: 70	

Course Objectives:

1. To understand and experimentally verify fundamental principles of structural analysis such as Betti's Law and Moment-Area Theorems.
2. To determine structural properties like flexural rigidity (EI) and study the behavior of beams, struts, and curved members under loading.
3. To develop skills in measuring deflection and displacement and validating results with theoretical and computational methods.

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

CO CVE 214 DM 10.1	Apply structural analysis concepts to determine slope and deflection in beams and structural members.
CO CVE 214 DM 10.2	Experimentally verify classical theorems such as Betti's Law and Moment-Area Theorems.
CO CVE 214 DM 10.3	Evaluate structural properties like flexural rigidity (EI) and analyze behavior of different structural elements.
CO CVE 214 DM 10.4	Compare experimental results with theoretical predictions and use basic computational tools for validation.

Module No	Course Contents Practical / Lab work	Hrs	COs
1	To verify Betti's Law	4	**CO CVE 214 DM 10.2 CO CVE 214 DM 10.4**
2	To determine the flexural rigidity (EI) of a given beam.	4	**CO CVE 214 DM 10.3 CO CVE 214 DM 10.4**
3	To verify Moment-Area Theorems for slope and deflection of a beam.	4	**CO CVE 214 DM 10.1 CO CVE 214 DM 10.2 CO CVE 214 DM 10.4**
4	To study the behavior of different types of struts.	4	**CO CVE 214 DM 10.3**
5	To determine the elastic displacement of curved members	4	**CO CVE 214 DM 10.1 CO CVE 214 DM 10.3**
6	To determine the horizontal displacement of the roller end in a curved beam.	4	**CO CVE 214 DM 10.1 CO CVE 214 DM 10.3**

			CO CVE 214 DM 10.4
7	To analyses a structural member in STADD Pro/Computer program	**6**	**CO CVE 214 DM 10.4**

Suggested Books:

1. S.B Junnarkar, Structural Mechanics Volume I, and II Charotar Publishers, 2016. (ISBN:978-9385039270).
2. D. Menon, Structural Analysis Volume – I and II Narosa Publication, 2010. (ISBN- 978-1842653371/1842653377).
3. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2010. (ISBN-1283187140/978-1283187145).

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 214 DM 10.1	WK3, WK2	PO1, PO2, PO3, PO4, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 214 DM 10.2	WK4, WK6	PO1, PO2, PO3, PO4, PO5	**SDG 4 – Quality Education**
CO CVE 214 DM 10.3	WK2, WK4	PO1, PO2, PO3, PO4, PO5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CVE 214 DM 10.4	WK4, WK 5, WK6	PO1, PO2, PO3, PO4, PO5	**SDG 4 – Quality Education** **SDG 9 – Industry, Innovation and Infrastructure**

Course Code: CVE 218 DM10	Course Name: Hydraulic Engineering Lab	L	T	P	C
		0	0	2	1
Year and Semester	2nd year -4th Semester	Contact hours per week: (2 hrs.) Exam: (2 hrs.)			
Pre-requisite of course	Fluid Mechanics I	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

1. To develop practical understanding of open channel flow behavior, including velocity distribution, energy concepts, and flow transitions.
2. To enable students to perform flow measurement and calibration experiments, such as weirs, current meters, and hydraulic devices.
3. To impart knowledge of pipe flow and energy losses, including frictional and minor losses using standard equations.
4. To provide hands-on experience in analyzing hydraulic phenomena, such as hydraulic jump, vortices, and flow over structures.
5. To understand principles of fluid mechanics through experiments, including Reynolds number, Stokes' law, and jet impact.

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

CO CVE 218 .1	Analyze open channel flow characteristics, including velocity distribution, Manning's coefficient, and flow over humps and weirs
CO CVE 218 .2	Evaluate hydraulic phenomena in open channel flow, including hydraulic jump and vortex motion.
CO CVE 218 .3	Determine head losses and flow behavior in pipes using fundamental equations such as the Darcy–Weisbach equation.
CO CVE 218 .4	Analyze fluid flow principles and forces, including jet impact, Reynolds number, and viscous effects (Stokes' law).
CO CVE 218 .5	Evaluate performance of hydraulic devices and flow measurement systems through experimental analysis.

Module No	Course Contents Practical / Lab Work	Hrs.	Cos
1	To determine Manning's coefficient of roughness (n) for a given channel bed.	2	CO CVE 218.1
2	To measure velocity distribution in an open channel using a current meter/flow meter, plot the velocity profile, and determine mean velocity and discharge using the velocity–area method.	2	CO CVE 218.5
3	To study the flow characteristics over a hump in an open channel.	2	CO CVE 218.2

4	To calibrate a broad-crested weir and determine its coefficient of discharge (Cd).	2	**CO CVE 218.5**
5	To study the characteristics of a free hydraulic jump.	2	**CO CVE 218.2**
6	To determine friction factor and head losses in a pipe using the Darcy–Weisbach equation, including major and minor losses due to sudden expansion, contraction, and bends.	2	**CO CVE 218.3**
7	To study free and forced vortices and determine surface profile, angular velocity, and verify theoretical relations using a rotating cylinder apparatus.	2	**CO CVE 218.4**
8	To determine the force exerted by a jet of water on flat, inclined, and curved vanes and verify the impulse–momentum principle	2	**CO CVE 218.4**
9	To study the working and performance of a hydraulic ram, including delivery heaD.	2	**CO CVE 218.4**
10	To determine Reynolds number and study laminar, transitional, and turbulent flow.	2	**CO CVE 218.4**
11	To verify Stokes' law and determine the coefficient of viscosity of a viscous fluid.	2	**CO CVE 218.4**

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

Course Outcome	Course Outcome Statement	WK Alignment	PO Mapping	SDG Alignment
CO CVE 218 .1	Apply principles of open channel flow to classify flow regimes, analyze velocity distribution, and design efficient channel sections.	WK1, WK2, WK3	PO1, PO2, PO3	**SDG 6-** Clean Water and Sanitation **SDG 9-** Industry, Innovation and Infrastructure **SDG 11** - Sustainable Cities and Communities
CO CVE 218 .2	Analyze specific energy, specific force, hydraulic jump, and gradually varied flow to solve open channel flow problems.	WK1, WK2, WK3, WK5	PO1, PO2, PO3, PO5	**SDG 6** - Clean Water and Sanitation **SDG 9** - Industry, Innovation and Infrastructure **SDG 11** - Sustainable Cities and Communities
CO CVE 218 .3	Apply principles of pipe flow to evaluate head losses, flow behavior, and analyze pipe systems including series, parallel, and network configurations.	WK1, WK2, WK3, WK5	PO1, PO2, PO3, PO5	**SDG 6-** Clean Water and Sanitation **SDG 9** - Industry, Innovation and Infrastructure **SDG 11** - Sustainable Cities and Communities
CO CVE 218 .4	Understand canal types, design principles, regime theories, lining, and canal outlets.	WK1, WK2, WK3, WK7	PO1, PO2, PO3, PO6	**SDG 6:** Clean Water and Sanitation **SDG 2**: Zero Hunger Improved agricultural productivity **SDG 9**: Industry, Innovation and Infrastructure Sustainable canal infrastructure

Course Code: CVE 220 DM 10	Course Name: Transportation Engineering Lab	L	T	P	C
		0	0	2	1
Year and Semester	II[nd] year -IV Semester	Contact hours per week: (2 Hrs) Exam: (2 hrs.)			
Pre-requisite of course	Building Construction Material and Testing	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

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

CO CE 220.1	Identify and Investigate engineering properties of aggregate
CO CE 220.2	Identify the grade & properties of bitumen.
CO CE 220.3	Determine CBR for subgrade soil.
CO CE 220.4	Calculate Spot speed of a location through speed surveys.
CO CE 220.5	Calculate traffic volume for a road section.

Module No	Course Contents Practical / Lab work	Hrs	COs
1	To test toughness of road Aggregates by Impact Test	2	CO CE 220.1
2	To test hardness of aggregates by Los Angles Abrasion Test	2	CO CE 220.1
3	To perform Crushing Strength Test on Aggregates	2	CO CE 220.1
4	To identify grade of bitumen using Penetration Test.	2	CO CE 220.2
5	To test the ductility of bitumen using Ductility test.	4	CO CE 220.2
6	To test water absorption and specific gravity of road aggregates using density basket.	4	COCE220.1
7	To find out Softening Point of Bitumen.	2	CO CE 220.2
8	To find out Flash & fire point of bitumen	2	CO CE 220.2
9	To determine spot speed of traffic by radar speedometer and endoscope.	4	CO CE 220.4
10	To conduct CBR test on samples of subgrade.	4	CO CE 220.3
11	To perform classified traffic Volume count on a road section.	4	COCE220.5

Suggested Books:

1. S. K. Khanna, C. E. J. Justo and A. Veeraghavan., "*Highway Materials and Pavement Testing*",Neem Chand & Bros.Pvt. Ltd.
2. S. K. Khanna, C. E. J. Justo and A. Veeraghavan., "*Highway Engineering*",Neem Chand & Bros.Pvt. Ltd.
3. L.R. Kadyali "*Highway Engineering*",Neem Chand & Bros.Pvt. Ltd.

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	Alignment to SDGs
CO CE 220.1	WK1, WK2, WK3,WK4, Wk5	**SDG 9 – Industry, Innovation and Infrastructure**
CO CE 220.2	WK1, WK2,WK3,	**SDG 9 – Industry, Innovation and Infrastructure**
CO CE 220.3	WK1, WK2, WK5,WK6	**SDG 9 – Industry, Innovation and Infrastructure**
CO CE 220.4	WK1,WK2,WK3,WK6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**
CO CE 220.5	WK1, WK3,WK5, WK6	**SDG 9 – Industry, Innovation and Infrastructure** **SDG 11 – Sustainable Cities and Communities**

Course Code: CVE 224 VA 00	Course Name: Civil Engineering Societal and Global Impacts	L	T	P	C
		3	0	0	0
Year and Semester	IInd year -III Semester	Contact hours per week: (3 Hrs) Exam:(3 hrs.)			
Pre-requisite of course	NA	Evaluation			
		CIE: 30	TEE: 70		

Course Objectives:

Objective 1 — Build Historical & Contextual Awareness

Objective 2 — Explore Civil Engineering's Role in Infrastructure Development

Objective 3 — Develop Environmental Awareness & Sustainability Competence

Objective 4 — Understand the Built Environment & Smart Technologies.

Objective 5 — Instil Responsible & Innovative Project Development Practices

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

CO CVE 224 00.1	Analyze civil engineering's evolution linking historical, sustainability, and societal responsibilities.
CO CVE 224 00.2	Assess civil engineering marvels and infrastructure systems for future sustainability.
CO CVE 224 00.3	Evaluate environmental management methods addressing pollution, waste, and sustainability challenges.
CO CVE 224 00.4	Assess energy-efficient smart buildings, LEED ratings, and heritage conservation principles.
CVE 224 00.5	Apply lean construction techniques evaluating civil engineering's socio-economic and sustainability contributions.

Module No	Course Contents	Hrs	COs
1	**Evolution, Global Context & Civil Engineering Significance** Traces civilisation's evolution from pre-industrial to IT revolution, exploring civil engineering breakthroughs, global sustainability challenges, global warming, ecological footprint, Human Development Index, GIS applications, and the profession's transformative role through ancient and modern marvels shaping the world's future.	**12**	**CO CVE 224 00.1**
2	**Infrastructure Systems & Energy** Explores infrastructure systems encompassing smart cities, multimodal transportation, renewable energy technologies, water provisioning, and telecommunication networks, while emphasizing applicable codes, standards, and innovative methodologies ensuring long-term sustainability across diverse civil engineering infrastructure development contexts.	**14**	**CO CVE 224 00.2**
3	**Environment, Sustainability & Built Environment** Addresses environmental management, waste treatment, flood control, and pollution mitigation alongside built environment concepts including energy-efficient buildings, LEED ratings, smart systems, urban aesthetics, and conservation and rehabilitation of structures and heritage buildings ensuring comprehensive sustainability.	**10**	**CO CVE 224 00.3 CO CVE 224 00.4**

4	**Civil Engineering Projects, Sustainability & Societal Impact** Examines Environmental Impact Analysis, waste reduction, greenhouse gas mitigation, and advanced construction techniques, alongside Lean Construction paradigms, civil engineering's contribution to GDP and employment, and health, safety, and quality innovations ensuring sustainability throughout project development.	**9**	**CVE 224 00.5**

Suggested Books:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition.
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
6. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130

COURSE ARTICULATION MATRIX

CO-WK-PO-SDG Mapping Table

CO	WK Alignment	PO Mapping	Alignment to SDGs
CO CVE 224 00.1	WK1, WK3,WK6	PO2, PO6, PO11	SDG 9 – Industry, Innovation and Infrastructure SDG 11 – Sustainable Cities and Communities
CO CVE 224 00.2	WK1, WK2,WK3,W K5	PO2, PO4, PO10,	SDG 8 - Decent Work and Economic Growth SDG 9 – Industry, Innovation and Infrastructure SDG 11 – Sustainable Cities and Communities
CO CVE 224 00.3	WK1, WK2, WK5,WK6	PO2, PO3, PO4, PO10	SDG 3 – Good Health and Well-being SDG 6 - Clean Water and Sanitation SDG 11 – Sustainable Cities and Communities SDG 14 - Life Below Water SDG 15 - Life on Land
CO CVE 224 00.4	WK1,WK2,W K3,WK6	PO2, PO3, PO4, PO10	SDG 7 - Affordable and Clean Energy SDG 8 - Decent Work and Economic Growth SDG 9 – Industry, Innovation and Infrastructure SDG 11 – Sustainable Cities and Communities
CVE 224 00.5	WK1,WK3, WK5	PO5, PO6, PO10	SDG 8 - Decent Work and Economic Growth SDG 9 – Industry, Innovation and Infrastructure SDG 11 – Sustainable Cities and Communities SDG 12 - Responsible Consumption and Production