Scheme of Instruction, Evaluation

And

Syllabi of

With effect from Academic Year 2023-24

B.E. [WP] Civil Engineering

III & IV Semesters

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Esd.1917 **Hyderabad – 500 007, TS, INDIA** **Estd. 1929**

SCHEME OF INSTRUCTION AND EVALUATION
B.E. WP (CIVIL ENGINEERING) w.e.f. 2023-24

BE III Semester

S.No	Code	Course Title	Scheme of Instructions			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	BS 301 MT	Engineering Mathematics-III (PDE, Probability & Statistics)	3	0	-	3	3	40	60	3
2	PC 301 CE	Surveying and Geomatics	3	0	-	3	3	40	60	3
3	PC 302 CE	Strength of Materials-I	3	0	-	3	3	40	60	3
4	PC 303 CE	Fluid Mechanics-I	3	0	-	3	3	40	60	3
Practicals										
5	PC 351 CE	Surveying laboratory	-	-	2	2	3	25	50	1
6	PC 352 CE	Fluid Mechanics Laboratory	-	-	2	2	3	25	50	1
		Total	**12**		**4**	**16**	-	**175**	**340**	**14**

SCHEME OF INSTRUCTION AND EVALUATION
B.E. WP (CIVIL ENGINEERING) w.e.f. 2023-24
BE IV SEMESTER

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	PC 401 CE	Strength of Materials-II	3	-	-	3	3	40	60	3
2	PC 402 CE	Engineering Geology	3	-	-	3	3	40	60	3
3	PC 403 CE	Fluid Mechanics-II	3	-	-	3	3	40	60	3
4	PC 404 CE	Hydrology and Water Management	3	-	-	3	3	40	60	3
5	PC 405 CE	Construction Engineering and Management	3	-	-	3	3	40	60	3
Practicals										
6	PC 451 CE	Testing Materials lab	-	-	2	2	3	25	50	1
7	PC 452 CE	Fluid Mechanics Lab-II	-	-	2	2	3	25	50	1
		Total	**15**		**4**	**19**	21	**250**	**400**	**17**

BS 301 MT	ENGINEERING MATHEMATICS – III (PDF & PROBABILITY & STATISTICS)					
Pre-requisites	Mathematical courses of B.E. I year		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1.	Apply general methodology to solve linear first order and secondorder partial differential equations
2.	To study the classification of second order partial differential equations and solve them by using separation of variables methods
3.	To study the types of Random variables
4	To Understand different types of evaluation of statistical Parameters
5	To study the Curve fitting and Rank, Coefficient of Correlation of the data

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Find the solutions of first and second order PDE
CO-2	Find solutions of heat equations, wave equations and subject to the initial boundary conditions
CO-3	To Find Discrete Random Variables and continuous Random Variables and understand their Properties
CO-4	Solve Probability distributions , Normal evaluation of statistical Parameters
CO-5	To find the empirical relations for curve fitting, least square and correlations, regressions

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	2	2	1	1	1	-	-	1	-	-	2	-	-
CO2	3	2	1	2	2	2	-	-	1	-	-	2	-	-
CO3	3	2	2	3	2	2	-	-	1	-	-	2	-	-
CO4	3	2	1	1	1	2	-	-	1	-	-	2	-	-
CO5	3	2	2	3	1	2	-	-	1	-	-	2	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

Unit – I

Definition of Partial Differential Equations, First order partial differential equations, Solutions of first

order linear PDEs , Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

Unit – II

Second-order linear equations and their classification, Initial and boundary conditions, Heat diffusion and vibration problems, Separation of variables method to Solve simple problems in Cartesian coordinates.

Unit – III

Discrete random variables, expectation of discrete random variables, moments, variance of a sum, continuous random variables & their properties.

Unit – IV

Probability distributions: Binomial, Poisson and Normal, evaluation of statistical parameters for these three distributions,

Unit – V

Curve fitting by the method of least squares: fitting of straight lines, second degree parabolas and more general curves, Correlation, regression and rank correlation.

Suggested Readings

1	R. K. Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4th Edition 2014.
2	Erwin Kreyszi, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition, 2014.
4	S. Ross, "A First Course in Probability", Pearson Education India, 2002
5	B.V . Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
6	S.C Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultan chand &sons, New Delhi.
7	H.K. Dass, Er. Rajnish Varma, higher Engineering Mathematics, S.Chand Technical 3rd Edition.

PC301 CE	SURVEYING AND GEOMATICS					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1.	Understand the basic measurement techniques and equipment used in land surveying, levelling and analysis of field data including Triangulation and Tri-lateration methods
2.	Acquire knowledge on methods of setting data horizontal and vertical curves including measurements, methods employed and computation of data.
3.	Acquire the knowledge on working principles of various modern field Surveying equipment such as total station, EDM and GPS including the filed methods applicable for land surveying
4.	Study the modern techniques of surveying by aerial photogrammetry, principles and methods of surveying
5.	Study the modern techniques in surveying with remote sensing, image data interpretation and applications

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Analyze the basic surveying techniques and computations for measurement of distances and angles using various tools and equipment including the Triangulation and Tri-lateration techniques
CO-2	Apply the principles of measurements and analyse the data for setting of horizontal and vertical curves
CO-3	Interpret the principles of measurements made by using various modern surveying equipment's such as total station, EDM, and GPS and solve for omitted measurements in traverse
CO-4	Interpret the principles of Photogrammetric surveying methods and the mapping methods
CO-5	Interpret the principles of remote sensing surveying methods and the visual data interpretations

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	1	1	1	3	1	3	1					1	
CO2	3		1		3								1	
CO3	3	2	3		3							1	1	
CO4	3	1			3								1	
CO5	3	1	1	3									1	

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

Unit I

Introduction to Surveying: Principles, Linear, methods, Leveling: Plane table surveying, Principles of levelling- reducing levels; differential, reciprocal leveling, Digital and Auto Level, contouring: Characteristics, uses; areas and volumes.

Triangulation and Tri-lateration: Theodolite survey: Instruments, Measurement of Horizontal and vertical angle; - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - Satellite station - reduction to centre - Indivisibility of height and distances - Trigonometric leveling.

Unit II

Curves Elements of simple and compound curves – Method of setting out of simple circular and compound curves. Transition curve — Elements of transition curve and Vertical curves - Types.

Unit III

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, , Surveying with GPS.

Unit IV

Photogrammetric Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, flight planning; Stereoscopy, ground control extension for photographic mapping- photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

Unit V

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.

Suggested Reading:

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.

PC302CE	STRENGTH OF MATERIALS-I

Pre-requisites	Basic Knowledge of Engg Mechanics		L	T	P	C
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Understand the basic concept of the stress and strain for different materials.
2	Know the mechanism of development of shear force and bending moments in beams
3	Understand and analyze the stresses for the combined action of direct stress and shear stress
4	Know the concept of bending stresses and shear stresses for different cross sections
5	Understand the concepts of direct and bending, and thick and thin cylinder and their practical applications

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Apply the fundamental concepts of stress and strain in the design of various structural components.
CO-2	Analyze principal stresses and principal planes through numerical and Mohr's circle method
CO-3	Analysis of beams to determine shear forces, bending moments subjected to different type of loads.
CO-4	Determine the bending stresses and shear stresses produced in a beam subjected to system of loads
CO-5	Describe direct & bending concept; and analysis of thin and thick cylinders with their practical applications

Articulation matrix of Course outcomes with PO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	2	-	-	1	-	-	1	-	1	-	1	-	1
CO2	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO3	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO4	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO5	3	1	-	-	1	-	-	1	-	1	-	1	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section –

composite bars – Temperature stresses. Strain Energy – Resilience– Gradual, sudden, impact and shock loadings – simple applications.

UNIT II

Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain

UNIT III

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without over hangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT IV

Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT V

Direct and Bending: Basic concept , Eccentric loading, limit of eccentricity-Core of sections-rectangular and circular, solid and hollow sections-wind pressure on chimneys and water pressure on dams. Thin Cylinders - Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder. Thick Cylinders: Lame's equations, stresses under internal and external fluid pressures- Compound cylinders- Shrink fit pressure

Suggested Reading:

1.	Timoshenko, S. and Young, D. H., Elements of Strength of Materials, DVNC, New York, USA,2003
2.	Kazmi, S. M. A., Solid Mechanics ,TMH, Delhi, India,2017
3.	Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson,Prentice Hall, 2004
4.	Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
5.	D.S. Prakash Rao, Strength of Materials- A Practical approach, Volume 1, Universities Press,1999
6	Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf , Mechanics of Materials - TMH 2002.
7	R. Subramanian ,Strength of Materials, Oxford University Press, New Delhi,2016

PC303CE	FLUID MECHANICS-I					
Pre-requisites	Mathematical Knowledge		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1.	Understand concepts of various fluid properties
2.	Understand the basic concepts of fluid motion
3.	Knowledge of forces due to fluids and energy principles
4.	Study of flow measurement devices
5.	Study of compressible fluid flows for different conditions of expansion

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Analyze and solve problems in the applications of basic principles in Fluid Mechanics
CO-2	Apply of the concepts of Bernoulli's equation to Fluid mechanics related problems
CO-3	Formulate and Fabricate Hydraulic Engineering experiments, interpret and analyze the data
CO-4	Analyze and solve problems related to flow through pipes from practitioners point of view
CO-5	Analyze, design and solve problems pertaining to compressible flows.

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	2	2	2		1							1	2	
CO2	2	2	2	1									2	
CO3	2	2	2	2									2	
CO4	2	2	2	2		1							2	1
CO5	2	2	2	2									2	

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

Unit – I:

Fluid Properties: Basic concepts: Specific weight, specific volume, specific mass, gravity, viscosity, bulk modulus, vapour pressure, capillarity and surface tension, viscosity-Newton's law of viscosity, Newtonian and Non-Newtonian fluids, classification of fluids-ideal and real.

Unit – II:

Fluid Kinematics: Fundamentals of fluid flow-description of flow pattern, stream lines, path lines, streak lines, stream tubes, classification of fluids, steady and unsteady flows, laminar and turbulent flows, uniform and non-unsteady flows, rotational and irrotational flows, laminar and turbulent flows,

uniform and non- uniform flow, one, two and three dimensional flows, stream function, and velocity potential function, flow net- significance and use.

Unit – III:

Fluid Statics: Fluid pressure at a point, variation of pressure in a fluid, measurement of pressure - simple and differential manometers.

Fluid Dynamics: Convective and local acceleration, concept of continuity, three- dimensional continuity equation, body forces and surface forces, body force potential, Euler's equation of motion for 3-D flow, Bernoulli's equation by integration of Euler's equation, significance of Bernoulli's equation and its limitations, applications of Bernoulli's equation- venturimeter, Pitot tube. Impulse-momentum equation and its applications- forces on a pipe bend.

Unit – IV:

Flow Through Pipes: Introduction, types of flows-laminar and turbulent, Reynolds experiment, Darcy-Weisbach equation, and steady laminar flow through circular pipes- Hagen-Poiseuille's equation, hydro-dynamically smooth and rough boundaries- criteria and resistance to flow of fluid in smooth and rough boundaries, variation of friction factor.

Unit – V: Compressible Flow: Compressibility of liquids and gases, differential form of continuity equation, Bernoulli's energy equation for isothermal and adiabatic conditions, velocity of pressure wave, wave velocity for adiabatic and isothermal conditions, Mach Number and Mach cone, stagnation pressure and temperature.

Suggested Reading:

1.	K.Subramanya, '*Theory and Applications of Fluid Mechanics*', Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1993
2.	Vijay Gupta and Santosh K. Gupta, '*Fluid Mechanics and its applications*', Wiley Eastern Ltd., New Delhi,1984
3.	K.L. Kumar, '*Engineering Fluid Mechanics*', Eurasia Publishing House Pvt Ltd.,New Delhi, 2009
4.	Valentine, H.R., '*Applied Hydrodynamics*', Butterworths & Co Ltd., London, 1959
5.	P.N. Modi and S.M.Seth, '*Hydraulics and Fluid Mechanics*', Standard Book House, New Delhi, 2013

PC351CE	SURVEYING LABORATORY					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student	
1.	Know the importance of Theodolite, total station and their practical applications
2.	Study the basic concept of trigonometrical leveling, and field applications
3.	Analyze the horizontal and vertical curves for survey work related to Roads andRailways
4	Know the principles of aerial photogrametry and its applications
5	Study the various concepts of GPS, GIS and remote sensing for field work.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand the basic working principles of theodolite and total station
CO-2	Calculation of applicable corrections to the measured values
CO-3	Computation of omitted measurements areas
CO-4	Computation of setting out data for setting out of horizontal and vertical curves by various methods
CO-5	Learn various applications of the Photogrammetry, GIS and GPS for land surveying

Articulation matrix of Course outcomes with PO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	2	2	1	3	1	1	2	1	3	1	1	1	-	1
CO2	3	2	-	1	2	-	1	1	1	1	1	1	2	-
CO3	2	2	-	1	2	-	1	1	1	1	1	1	2	-
CO4	3	2	2	2	2	2	1	1	2	1	1	2	2	2
CO5	2	2	-	3	3	1	2	1	2	1	1	2	1	2

Correlation rating: Low/ Medium/High:1/2/3respectively.

List of Experiments:

1. Applications of traversing to locate a building and field objects by taking perpendicular and oblique offsets; and recording in the field book.
2. To determine the area of the given site by cross staff survey
3. Closed traverse by chain and compass, plotting and adjustment by graphical method
4. Plane tabling: Radiation and intersection methods
5. Introduction to leveling: Fly leveling using dumpy level
6. Measurement of horizontal angles by repetition and reiteration methods using Vernier Theodolite.
7. Measurement of vertical angle: Application to simple problems of height and distance by measuring angle of elevation and depression
8. Single plane method: Determination of R.L. of an elevated Object using two Instrument Stations which are placed in a same vertical plane- when base of the Object inaccessible.
9. Two plane method: Determination of R.L. of an elevated Object using two Instrument Stations which are not placed in the same vertical plane- when base of the Object inaccessible.
10. Setting out of a simple circular curve by linear method
11. Setting out of a simple circular curve by angular method
12. Setting out of a transition curve by linear method
13. Introduction to Total station and applications: To determine difference in elevation of any two given points. The introduction includes, setting up of the Total station over a station, input values, field measurements, downloading of the data in to a computer.
14. Total station and applications: Application to simple problems of height and distance by measuring angle of elevation and depression and determination of **R.L** of the target object.
15. Total station and applications: Determination of area enclosed in a closed traverse having minimum 5 stations. Plot the measured values by using a software package.

16. Geographic Position System (GPS),Geographical Information system(GIS) and their applications: Determination of Latitude and Longitude of any four stations and computation of the area. Check trust worthiness of the measured results.

PC352CE	FLUID MACHANICS-I LABORATORY					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student	
1.	Calibration of flow measuring devices
2.	Verification of the Bernoulli's theorem
3.	Demonstration of the various losses in pipes

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Ability to measure flow in closed conduits and flumes
CO-2	Application of Bernoulli's principle in Hydraulics
CO-3	Computation of various losses in pipes and pipe fittings
CO-4	Carry out to experiments independently and conduct investigations
CO-5	Develop oral and written communication and function as team person

Articulation matrix of Course outcomes with PO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	2	2	1	2	1	-	1	1	2	2	-	1	1	1
CO2	2	2	2	3	2	-	1	1	1	1	-	1	-	1
CO3	2	2	-	3	2	-	1	1	1	1	-	1	-	1
CO4	-	2	2	2	1	1	1	1	3	3	-	1	2	1
CO5	-	-	1	-	-	-	-	2	3	3	-	-	-	-

Correlation rating: Low/ Medium/High:1/2/3respectively.

List of Experiments:

1. Determination of C_d and C_v of an orifice
2. Calibration of a mouth piece
3. Determination of C_d of a mouth piece for unsteady flow in a hemi-spherical tank
4. Calibration of a rectangular notch
5. Calibration of a triangular notch
6. Calibration of a broad crested weir
7. Verification of Bernoulli's principle
8. Determination of types of flows
9. Determination of major and minor losses in the pipes
10. Calibration of a Venturi meter

DEMONSTRATION OF EXPERIMENTS

1. Measurement of Water hammer pressure
2. Free and Forced Vortex flow

SCHEME OF INSTRUCTION AND EVALUATION
B.E. Working Professional (CIVIL ENGINEERING) Applicable w.e.f. 2023-24

BE IV – Semester

PC401CE	**STRENGTH OF MATERIALS-II**					
Pre-requisites	Basic Knowledge of Engg Mechanics		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1.	Study the basic concepts of deflections by using various methods and to predict the deformations of a member subjected to various loads and its combination.
2.	Differentiate statically determinate and indeterminate structures and to analyze members by applying the principles of equilibrium and compatibility in deformation.
3.	Understand the concepts of strain energy principle and its applications to beams and frames.
4	Study the nature of stresses developed in shafts, springs, columns for various types of simple loads.
5	Learn the importance of unsymmetrical bending and shear center for equilibrium conditions in a structural member having different axis of symmetry.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	To calculate the deflections of a member due to various loads and its combinations.
CO-2	Analyze statically indeterminate structural members.
CO-3	Apply the concepts of strain energy to evaluate the deflections in beams and analyse statically indeterminate truss.
CO-4	Analyze the stresses developed in shafts, springs, columns for various types of simple loads.
CO-5	To determine unsymmetrical bending and locate the shear center for the structural member having different axis of symmetry.

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO2	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO3	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO4	3	1	-	-	1	-	-	1	-	1	-	1	-	1
CO5	3	1	-	-	1	-	-	1	-	1	-	1	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

Unit – I

Deflection: Slope and deflection by double integration method for cantilever, simply supported beams and overhanging beams carrying one, two point loads, u.d.l. and uniformly varying load over entire span. Moment area and conjugate beam method

Propped Cantilevers: Cantilever beams on elastic and rigid props for point loads and UDL only. Calculation of reactions, B.M. and S.F. diagrams, and deflections.

.

Unit – II

Fixed Beams: Determination of shear force, ·)ending moment slope and deflection in fixed beams with and without sinking of supports for (i) point loads (ii) u.d.l. (iii)uniformly varying load over entire span.

Continuous Beams: Determination of moments in continuous beams with and without sinking of supports by theorem of three moments, S.F. and B.M. diagrams

Column Analogy Method: Application to fixed beams- analogous column- stiffness and carryover factors

Unit – III

Strain Energy: Resilience of beams - Deflections from resilience - Castigliano Theorem - I and its application to beams- Reciprocal theorem. Static indeterminacy and kinematic indeterminacy of structures, Deflections of statically determinate trusses and frames using unit load method.

Redundant trusses and frames: Castigliano Theorem - II - Analysis of plane trusses with one degree of redundancy (internal / external) and plane frames with one degree of redundancy, Lack of fit and temperature effect.

Unit – IV

Torsion and Springs- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

Columns and Struts: Euler's theory for long columns- different end conditions- equivalent length- Rankine's theory. Eccentrically loaded columns- Secant and Perry's formulae.

Unit – V

Unsymmetrical bending of beams: Location of neural axis, maximum stresses for rectangular section .Symmetric channel section.

Shear Centre: Shear stress, shear flow, locating shear center for angle section channel section and T- section, with one axis of symmetry.

Suggested Reading:

1.	D.S. Prakash Rao, *Strength of Materials* - A practical Approach, Universities Press,1999.
2.	S.B. Junarkar, *Mechanics of Structures* (Vol. 1 &2), Charotar Publishing House Anand,1992.
3.	R.K. Rajput, *Strength of Materials*, S. Chand & Co., 2003.
4.	B.C. Punmia, *Strength of Materials and Theory of Structures*, Laxmi Publishers,Delhi, 2000.
5.	G.H. Ryder, *Strength of Materials*, Third Edition in SI units, Macmillan IndianLimited, Delhi, 2002.
6	A. Pytel and F. L. Singer, *Strength of Materials*, Harper & Row, Fourth Edition, NewYork, 1987.
7	T.D.Gunneswara Rao and M.Andal ,*Strength of Materials*, Cambridge Publishers.

PC402CE	ENGINEERING GEOLOGY					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Study and identify different types natural materials like rocks & minerals and soil.
2.	know the physical properties of rocks & minerals
3.	Understand the various natural dynamic processes their influence on the surficial features, natural material and their consequences.
4.	Know the importance of geological maps and language helpful for Civil Engineering projects.
5.	Gain knowledge of various geological processes influencing the stability and maintenance of civil structures

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	appreciate the importance of geological science in Civil Engineering applications
CO-2	evaluate geological aspects influencing the stability of Civil structures
CO-3	select appropriate construction material and methods of site investigation
CO-4	understand the significance of geological aspects in designing and planning
CO-5	learn about the suitability of geological strata and areas for specific infrastructure projects

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	2	1	1	1	-	1	2	1	-	1	-	2	-	-
CO2	2	2	2	2	-	2	2	1	1	1	-	2	-	-
CO3	2	1	2	2	2	1	2	1	1	1	-	2	-	-
CO4	2	2	2	1	1	1	2	1	1	1	-	2	-	-
CO5	2	2	2	2	1	1	2	1	1	1	-	2	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

Unit I: Geology and Civil Engineering

Introduction: Definition of engineering geology, role and tasks of an Engineering Geologist. Various branches of geology and their applications in Civil Engineering.

Basic Reviews of the Earth: Earth's origin. History of the Earth: Geological time scale, origin and evolution of life. Major geological formations of India, their distribution, and associated construction material.

Geological Hazards: Internal structure of the Earth. Plate tectonics and mountain building process. Geological aspects of Earthquakes, Tsunamis and Landslides. Brief on failure of some Civil Engineering constructions due to geological drawbacks.

Unit II: Minerals and Rocks

Mineralogy: Minerals and their classification, Determinative properties of minerals, common rock-forming minerals.

Petrology: Types of rocks, their origin, distribution, and classification. Rock Cycle.

Distinguishing features of igneous, sedimentary and metamorphic rocks.

Geological description and Indian occurrence of Granite, Basalt, Dolerite, Gabbro, Laterite,

Sandstone Shale, Limestone Slate, Gneiss, Quartzite, Marble, Khondalite and Chamockite.

Rock Mechanics: Engineering properties of rocks. Stress - Strain behavior of rocks under uniaxial compression.

Unit III: Structural and Morphological Aspects

Primary and Secondary Structure: Physical features of the earth surface.

Elementary knowledge of rock deformation and structural characteristics of deformed rocks: Folds-definition and associated terminology and classification. Fractures & Joints- definition and classification; Faults-mechanism of formation, elements, terminology, geometric and genetic classification

Strike and Dip: Attitude of strata, strike, true and apparent dip.

Geomorphology: Evolution, characteristics features and engineering considerations of Fluviatile, Aeolian, Glacial and Marine landforms.

Unit IV:Site Investigation

Weathering and soil formation: Weathering of rocks – controls and scale. Soil forming processes. Soils of India.

Surface and Subsurface Investigation: Remote Sensing for civil engineering applications. Geophysical methods of site investigation – Seismic and electrical resistivity for subsurface investigations.

Hydrogeology: Ground water, Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration.

Unit IV: Application of Geological Site Investigation

Geology of Dams and Reservoirs: Types of Dams, Problems associated with dam foundations and reservoirs. Geological investigations for a dam site. Analysis of dam failure. Geology of major dam sites of India.

Tunnels: Geological investigations of tunnels in rock. Stand - up time of different rocks. Problems in tunneling. Pay line and over break. Logging of tunnels. Geology of some well-known Indian tunnels.

Rock as a Construction Material: Geological considerations for the selection of concrete aggregate, highway and runway aggregates. Building stones, Decorative stones, Roofing and facing stones. Building stones of India.

Suggested Reading:

1.	NC Kesavulu. Textbook of Engineering Geology. Macmillan Publishers India Limited. Edition 2009.
2.	P. C. VARGHESE. ENGINEERING GEOLOGY FOR CIVIL ENGINEERS. PHI Learning. Edition 2011.
3.	C. Gribble, and A. McLean. Geology for Civil Engineers. CRC Press. Edition 2017.
4.	Parbin Singh. A Textbook of Engineering and General Geology. S.K. Kataria & Sons. Edition 2008.
5.	Gokhale K V G K. Principles of Engineering Geology. BS Publications. Edition 2008
6.	B.S. Sathya, Narayanaswami. Engineering Geology. Dhanpat Rai Publishing Co Pvt Ltd.

PC 403CE	FLUID MECHANICS-II					
Pre-requisites	Fluid Mechanics -I		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand the boundary layer theory, concept of drag, lift of streamlinedbodies
2.	Understand the basics of dimensional analysis and development of non-dimensional equations
3.	To understand the basic principles of the hydraulic turbines, pumps and their hydraulic design.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Ability to solve open channel flow problems through the selection and use of appropriate Equations
CO-2	Knowledge of Boundary layer thickness and applications of Drag and lift onsome case studies
CO-3	Ability to perform dimensional analysis for problems in fluid mechanics anddevelop model studies.
CO-4	Understanding of basics of the hydro-machinery and the components, functionsand use of different types of turbines and pumps.
CO-5	Able to prepare the characteristic curves and Assimilation of turbine/pump laws and constants for the hydraulic design

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	1	-	-	1	-	-	1	1
CO2	3	2	2	1	1	1	1	-	-	1	-	-	1	1
CO3	3	3	1	2	1	-	1	1	1	-	-	1	2	1
CO4	3	3	1	2	1	-	1	1	1	-	-	1	2	1
CO5	3	3	1	2	1	-	1	1	1	-	-	1	2	1

Correlation rating: Low/ Medium/High: 1/2/3 respectively

Unit – I

Steady uniform flow through open channels: Descriptions and definitions, difference between pipe flow and channel flow, velocity and pressure distributions in a channel cross-section, energy and

momentum correction coefficients, friction to flow in open channels, uniform flow, Manning and Chezy formulae, most efficient channel sections, specific energy, concept and applications of critical depth. Gradually varied flow:

Significance of Froude number, dynamic equation of gradually varied flow, classification of gradually varied flow profiles

Unit – II

Boundary layer: Definition, laminar and turbulent boundary layers, boundary layer thickness, displacement thickness, momentum thickness, and energy thickness, hydro- dynamically smooth and rough boundaries, and boundary layer separation.

Drag and Lift: fundamental concepts of drag and lift forces, drag on a sphere, cylinder, flat plate, and aerofoil.

Unit – III

Dimension analysis and model studies: Dimensional analysis and a tool in experimental hydraulics, Buckingham's Pie theorem, applications, geometric, kinematic and dynamic similarity, similarity laws, significance of Reynolds, Froude and Mach similarity laws, different types of models and their scale ratios.

Unit – IV

Hydraulic turbines: Classification, specific speed, velocity triangles, power developed, efficiencies, principles of design of impulse and reaction turbines, turbine laws and constants, characteristic curves, selection of turbines.

Unit – V

Centrifugal pumps: Components, work done and efficiency, minimum starting speed, Euler head equation, specific speed and characteristic curves of centrifugal pump, pumps in series and parallel.

Suggested Reading:

1	K. Som, and Biswas, G, 'Fluid Mechanics and Fluid Machines', Tata McGraw-Hil Publishing Co.,New Delhi, 1998
2.	Yuan, S. W., 'Foundation of Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi, 1976.
3.	C.S.P. Ojha, R.Berndtsson, P.N. Chandramouli, 'Fluid Mechanics & Machinery', Oxford University Press, New Delhi, 2010
4.	A.K.Mohanty, 'Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi,1994.
5.	Subrahmanya , K, Fluid Mechanics and Hydraulic Machines Tata McGraw-Hill Publishing Co., New Delhi, 2001

PC 404CE	HYDROLOGY AND WATER MANAGEMENT					
Pre-requisites	Fluid Mechanics -I		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understanding the importance of Hydrology and its applications
2.	Introduction to Hydrological processes and estimation of Design flood
3.	Basic concepts and assessment of groundwater flows
4	Applications of statistical models in Hydrology

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Compute mean Rainfall, Develop Intensity-Duration-Duration curves
CO-2	Estimate Design flood for Water Resources structures
CO-3	Compute drawdown and yield in aquifers
CO-4	Apply Principles of probability to hydrological problems and develop Rainfall – Runoff relationship
CO-5	Analyze the soil-water-plant relationship

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2		1						2	1
CO2	2	2	3	2	2		1					2	2	2
CO3	2	2	2	2	2		1					2	2	2
CO4	3	2	3	2	2		1					2	2	3
CO5	2	2	2	1	1		2						2	

Correlation rating: Low/ Medium/High: 1/2/3 respectively

Unit – I

General: Definition, relation to engineering design, hydrological cycle, importance ofhydrology and its application in engineering.

Rainfall: Definition, types of rainfall, measurement of rain fall, types of rain gauges, network design, presentation of precipitation data, mean aerial rainfall; thiessen polygon, isohyetal methods., depth-

area- duration curve, dependable rainfall.
Infiltration: Evaporation, transpiration-definitions and processes.

Unit – II
Runoff: Definition, runoff process, factors affecting runoff, determination of runoff, importance of stream gauging, runoff formulae and runoff tables, dependable yield of a basin.
Floods: Definition, causes, importance of flood studies, flood peak and flood hydrograph, methods of computing flood peak, empirical methods, rational formula, unit hydrograph method, flood frequency studies, Weibul's and Gumble's extreme value methods.

Unit – III
Ground water: Types of aquifers, aquifer parameters, specific yield, storage coefficient, coefficients of permeability and transmissivity, Darcy's law, types of well, steady radial flow to wells in confined and unconfined aquifers, yield of open wells, safe yield, constant level pumping test and recuperation test.

Unit – IV
Statistics in Hydrology: Introduction, Statistical parameters; central tendency parameters, dispersion characteristics, Skewness., probability distribution; discrete and continuous distribution., frequency analysis; log Pearson type III distribution., regression and correlation; standard forms of bivariate equations., multivariate linear regression and correlation., analysis of time series., selection of a design return period, determination of permissible risk.

Unit – V
Irrigation: Definition, necessity of irrigation, types of irrigation, advantages and ill- effects of irrigation.
Soil-water-plant relationship: Vertical distribution of soil moisture, soil moisture tension, soil moisture stress, soil moisture constants, plant water relationship, moisture stress and plant response, consumptive use, crop factor, duty, factors affecting duty, types of crops and their water requirements, crop rotation.

Suggested Reading:

1.	K. Subramanya, *Engineering Hydrology*, Tata McGraw Hill Publishing Co.Ltd.1996.
2.	H.M. Raghunath, *Hydrology – Principles, Analysis and Design*, New Age International Publishers, 1996.
3.	Michael, A.M, *Irrigation Theory & Practice*, Vikas Publishing House, New Delhi, 1978
4.	Ray K.Linsley, Jr, Max A. Kohler, Joseph L.H.Paulhus, *Hydrology for Engineers*, McGraw-Hill Book Company, 1980
5.	Ven Te Chow, Hand book of Applied Hydrology, McGraw-Hill Book Company, New York, 1964

PC405CE	CONSTRUCTION ENGINEERING AND MANAGEMENT					
Pre-requisites		**L**	**T**	**P**	**C**	
		3	-	-	3	
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student :	
1.	To Describe different techniques of construction management projects
2.	To Illustrate economics, resource allocation & basic concepts of optimization for construction projects
3.	To Understand the basics of MIS techniques and works measurement standards.
4.	To introduce the concepts of safety and safety engineering practices for construction management projects
5.	To comprehend the preparation of contracts and its laws

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Propensity to plan and schedule various phases in construction industry
CO-2	Ability to optimize the cost and construction time of various projects
CO-3	Application of MIS and work measurement techniques to cater for construction industry needs.
CO-4	Acquaintance with various safety measures and safety management practices
CO-5	Capability to manage and provide viable solutions for various construction projects

Articulation matrix of Course outcomes with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	2	-	1	3	3	1	1	-	1	1	1
CO2	1	1	2	3	3	2	3	3	-	2	1	1	1	1
CO3	2	3	3	3	3	2	1	3	2	1	1	1	2	1
CO4	1	-	1	1	-	3	2	2	-	1	2	2	-	-
CO5	2	1	3	1	1	3	3	2	1	2	2	3	-	1

Correlation rating: Low/ Medium/High : 1/2/3 respectively.

Unit I

Basics of Construction: Features of construction, Construction project planning - Stages of project

planning, Construction Schedule, work break-down structure.
Development of management techniques, Bar charts, Gantt charts, CPM, PERT techniques, and Network analysis example

Unit II

Cost analysis: Cost reduction in construction management. Cost time analysis, Crashing the Network. Resource allocation and levelling: Various allocation methods, economical manner of resource allocation. Optimization: application of LP for solving simple networks

Unit III

Construction management: Nature and purpose of construction management, Principles of construction management, functions and responsibilities of construction manager, application of MIS to construction.
Method study Definition, Objective, and Procedure for selecting the work, recording facts, symbols and flow process charts. Time study - Concept of standard time and various allowances, time study, equipment performance rating

Unit IV

Safety Engineering: Basic construction safety regulations, Safety program, Construction accidents and causes, Direct and Indirect loss due to accident. Location hazards and elimination, Safety in demolition of buildings, Safety in storage and handling of materials and equipments.

Unit V

Contracts Management – Basics, Importance of contracts, Types of Contracts, parties to a contract. 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 lifting; Equipment for transportation of materials.

Suggested Reading:

1.	Robert L. Peurifoy and William B. Ledbetter, Construction Planning, equipment, and methods, McGraw-Hill International Editions, New Delhi, 1985
2.	Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.
3.	Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company Pvt. Ltd., New Delhi, 1994.
4.	H. N. Ahuja, Construction performance control by networks, John willey & sons, New York, 1976.
5.	Frank Harris and Ronald Mc. Caffer, Modern Construction Management. Blook well science L1d, 2001.
6.	Punmia, B C, Ashok K Jain and Arun K Jain. Building Construction, Eleventh Edition, Laxmi Publications Ltd, New Delhi, 2016
7.	Arora, S P, and S P Bindra. A textbook of Building construction. Fifth Edition, New Delhi, Dhanpatrai publications, 2010.

LABORATORY COURSES

PC451CE	TESTING MATERIALS LAB					
Pre-requisites	Strength of Materials		**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand the experiments on various materials to assess their behavior and limitations
2.	Learn the brittle and ductile material failure patterns
3.	Understand the shear force, bending moment and deflection for different types ofbeams
4.	Know the rigidity modulus by conducting spring and torsion test

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Evaluate Young's modulus, rigidity modulus, hardness number, flexural rigidity and impact strength of given specimens
CO-2	Find the cracking stress and compressive strength of bricks
CO-3	Determine the stiffness of close coiled helical springs
CO-4	Find the deflection of a beam
CO-5	Evaluate torsion phenomenon of shaft

Articulation matrix of Course outcomes with PO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	2	2	-	3	2	-	1	1	1	1	-	1	-	1
CO2	2	2	-	3	2	-	1	1	1	1	-	1	-	1
CO3	2	2	-	3	2	-	1	1	1	1	-	1	-	1
CO4	2	2	-	3	2	-	1	1	1	1	-	1	-	1
CO5	2	2	-	3	2	-	1	1	1	1	-	1	-	1

Correlation rating: Low/ Medium/High:1/2/3respectively.

Cycle - I

1. Tension –I Uni-Axial tension test on a specimen of ductile material
2. Tension II Stress-Strain characteristics of a ductile material
3. Brinell's hardness test
4. Compressive strength test on bricks
5. Bending test on simply supported beam of timber

Cycle - II

6. Torsion test on a specimen of ductile material
7. Compression test on close coiled helical spring
8. Bending test on simply supported beam of steel
9. Bending test on fixed beam of steel
10. Izod impact test

C 452CE	**FLUID MACHANICS-II LABORATORY**					
Pre-requisites	Fluid Mechanics		**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student	
1.	Practical applications of open and curved channels
2.	Application of force concepts on jets and hydraulic machines
3.	Determination of characteristic curves of turbines and pumps

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Competence in understanding flow phenomenon in open channels
CO-2	Ability to analyze the force acting due to jets concept and it's application in hydraulic machines.
CO-3	Competence in working principles of hydraulic pumps and turbines
CO-4	Ability to develop the characteristic curves for turbines and pumps
CO-5	Develop oral and written communication and function as team person,

Articulation matrix of Course outcomes with PO's:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
CO1	3	2	-	2	1	-	-	1	2	3	-	1	2	1
CO2	3	2	-	2	1	-	-	1	2	3	-	1	2	2
CO3	3	2	-	2	1	-	-	1	2	3	-	1	2	2
CO4	3	2	-	2	1	-	-	1	2	3	-	1	2	2
CO5	-	-	1	-	-	-	-	2	3	3	-	-	-	-

Correlation rating: Low/ Medium/High:1/2/3respectively.

List of Experiments:

1. Determination of roughness coefficient in an open channel
2. Determination of a vane coefficient
3. Study of universal characteristic curves of a Pelton wheel
4. Study of universal characteristic curves of a Francis turbine
5. Determination of super elevation in an open channel
6. Determination of basic characteristics of a hydraulic jump
7. Verification of Froude's Model law in an open channel
8. Determination of critical slope of an open channel
9. Study of main characteristic curves of a Centrifugal pump
10. Study of universal characteristic curves of a Kaplan turbine