Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:		Course ID :				
03	3		Mathematics III					TMA 302
				Contact Hrs :		L	T	P
Course Components:		DSC		03		3	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Mathematics I and II						

Course Outcomes

CO 1: Formulation and solving engineering problems involving transformations of complex-variable .
CO 2: Identify problems involving use of integral and Fourier transforms and solving them
CO 3: Solve transcendental equations and definite integrals using numerical methods
CO 4: Understand probability distribution functions and evaluating their properties
CO 5: Fit curves of various formulations to given data

UNIT	SYLLABUS	Hrs
I	Integral Transforms: Applications of integral transform in engineering, Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.	9
II	Complex Variable: Applications of complex variable in engineering, Analytic functions, C-R equations and harmonic functions, Complex Integration. Cauchy integral theorem, Cauchy integral formula.	9
III	Numerical Methods: Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Newton-Raphson method, Method of false position, Rate of convergence of Iterative methods. Numerical Integration: Introduction, Newton Quadrature formula, Trapezoidal rule, Simpson's 1/3 and 3/8 rule.	9
IV	Statistics: Random Variable: Discrete and Continuous, Probability mass and Probability density Functions Bayes' Theorem and its applications, Moments, Moment Generating Functions and their properties, Binomial , Poisson and Normal Distributions.	9
V	Curve Fitting and Solution of Equations: Method of least squares and curve fitting of straight line and parabola, Skewness and Kurtosis, Correlation: Linear Regression.	9

Text Book:

TB 1: Higher Engineering Mathematics, B.S. Grewal, Khanna Publication
TB 2: Text Book of Engineering Mathematics, . Bali, N. P, Narayana Iyengar, Laxmi Publication

References:

Ref 1: E. Kreyszing: Advanced Engineering Mathematics, Wiley Eastern
Ref 2: Higher Engineering Mathematics , B.V. Ramana , Tata-McGraw Hill publication

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Fluid Mechanics		Course ID :		TCE 301	
03	4				Contact Hrs :	L	T	P
Course Components:		DSC			04	4	0	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		4	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Applied Sciences						

Course Outcomes

CO 1: ***Interpret*** *fluid Properties and pressure parameters from measuring devices in liquids.*
CO 2: ***Relate*** *flow parameters in different situations.*
CO 3: ***Use*** *different flow measurement devices.*
CO 4: ***Demonstrate*** *the application of Laminar and Turbulent flow concepts to water flow problems.*
CO 5: ***Determine*** *the energy losses in water distribution system.*

UNIT	SYLLABUS	Hrs
I	Scope and importance of the subject, Definition of Fluids, Distinction between solids, liquids & gas, fluid continuum. **Fluid Properties and Classification of Fluid:** Mass density, Specific Volume, Specific Weight, Relative density, Compressibility, Vapour pressure, Surface tension, Capillarity, Viscosity, Shear stress and Newton's law of viscosity, General and rheological classification of fluids. Simple numerical problems. **Fluid Statics:** Measurement of Pressure:Pressure variation in a static fluid, PASCAL's law, Units and scales of pressure measurement. Hydrostatic Paradox., Manometers, Mechanical Pressure Gauges. **Hydrostatic force on plane and curved surface:** Total Pressure and Center of Pressure, on Plane and Curved Surfaces and Pressure Diagram.	12
II	**Buoyancy and Flotation:** Buoyant force, Buoyancy and Center of Buoyancy, Archimedes Principle, Principle of Floatation. Metacentre and Metacentric Height, Equilibrium of Floating bodies and Submerged bodies. **Fluid Kinematics:** Description of Fluid flow - Lagrangian and Eulerian approach, Types of fluid flow, Acceleration of a fluid particle, Continuity equation; Rotational and Irrotational flow, Flow Pattern. Rotation, Circulation and vorticity, Velocity potential and Stream function, Flow net. **Fluid Dynamics:** Concept of Inertia force and other forces causing motion, Derivation of Euler's equation and Bernoulli's equation. Modification of Bernoulli's equation. Application of Bernoulli's equation, Energy correction factor.	12
III	**Flow Measurements:** Flow through Orifices and mouthpiece, classification, Hydraulic co-efficients, Time of emptying a tank with orifice/mouthpiece. **Notches and Weirs** -Discharge over a rectangular notch and a triangular notch, Velocity of approach, End contractions, Cippoletti Notch. Time of emptying a tank with notch/weir. Types of Nappe, ventilation of weirs, Broad crested weirs, Submerged weirs.	12
IV	**Laminar Flow:** Reynolds Experiment; Equation of motion for laminar flow through pipes; Flow between parallel plates; Momentum correction factors; Stokes law; Flow through porous media; Darcy's Law; Fluidization; Measurement of viscosity; Transition from laminar to turbulent flow. Turbulent Flow: Turbulence; Equation for turbulent flow; Reynolds stresses; Eddy viscosity; Mixing length concept and velocity distribution in turbulent flow.	12
V	**Flow Through Pipes:** Major and Minor energy losses; Hydraulic gradient and total energy lines; siphons; Concept of equivalent length; Branched pipes; Pipes in series and parallel; Simple pipe networks. **Water hammer in pipes**; Equation for pressure rise due to gradual and sudden closure of valves, Surge tanks, their functions and types.	12

Text Book:

TB 1: *Hydraulics and Fluid Mechanics, P.N. Modi and S.M. Seth (2019), Standard Book House, New Delhi.*
TB 2: *Fluid Mechanics and Hydraulic Machines, R. K. Bansal (2019), Laxmi Pub., Delhi.*
TB 3: *Fluid Mechanics, y Victor Streeter, E. Benjamin Wylie , K.W. Bedford, (2017), McGraw Hill.*

References:

Ref 1: *Elementary Hydraulics (1st Edition)- James F Cruise, Vijay P. Singh, Mohsan M.Sherif, (2006), Nelson Engineering; New edition .*
Ref 2: *Fluid Mechanics, Hydraulic and Hydraulics - K.R. Arora, (2020), Standard Book House, New Delhi.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Geomatic Engineering	Course ID :		TCE 302	
03	3			Contact Hrs :		L / T / P	
Course Components:		DSC		03		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Applied Sciences						

Course Outcomes

CO 1: ***Understand*** *the principles of linear, angular and direction measurement problems.*
CO 2: ***Conduct*** *survey of an area in form of a polygon and triangles.*
CO 3: ***Determine*** *the ground profile and contours through elevation/depression calculations.*
CO 4: ***Plot*** *and layout the survey results for small engineering projects on a drawing sheet.*
CO 5: ***Incorporate*** *accumulated errors in observations during surveying.*

UNIT	SYLLABUS	Hrs
I	Linear and angular measurments: Introduction to Surveying, Principle of surveying, Introduction to Maps, Types of Maps and their use, Scale of Map, Different methods of linear measurement and their accuracy, Measurement by chain and tape, error and corrections to tape measurements, Angular measurements by Compass surveying and Theodolite Surveying, Temporary and permanent adjustments in theodolite, Accuracy and sources of errors in angle measurement.	9
II	Traversing and Triangulation: Introduction to compass traverse and theodolite traverse, Different methods of Traversing, Field work and checks, Computation of coordinates, Sources of errors in traversing, Checking and adjustment of errors in traversing, Precision of traversing, Problems related to omitted measurements. Triangulation and Trilateration, Principle of Triangulation and Trilateration, Classification of Triangulation stations and signals.	9
III	Levelling Different methods of determining elevation; Definition and terms in Spirit levelling, Levelling instruments, Definitions, Principles of stadia systems, Errors and Precision, Effect of earth curvature and refraction, Reciprocal levelling, Trigonometric levelling, Sources of errors and precision in levelling, Definition and characteristics of contours, Digital Elevation Model.	9
IV	Plane Table Survey and Route Surveys Introduction, Equipment for Plane Table survey and their use, Different methods of Plane Table Surveying, Two point and three point problems, Errors in Plane Table Surveying, Advantages and disadvantages of Plane Table Surveying. General requirements and specifications for Engineering Project surveys, Reconnaissance, Preliminary and Location surveys for highways, railways and canals, Layout of culverts, canals, bridges and buildings.	9
V	Adjustment Computations Treatment of random errors, Normal law of errors, Most Probable Value, Weight of observations, Propagation of errors and variances, Principle of least squares, Observation and correlative Normal Equations, Adjustment of triangulation figures and level nets.	9

Text Book:

TB 1: *Surveying, Vol. I & II ( ), R. Agor,(1980), Khanna Publications, Delhi.*
TB 2: *surveying, Vol. I & II, K.R. Arora, (2019), Standard Book House, Delhi.*
TB 3: *Plane Surveying, David Clark, (2004), CBS Publishers & Distributers, New Delhi.*
TB 4: *Surveying, Vol. I & II, B.C. Punmia, (2016), Laxmi Publications New Delhi.*

References:

Ref 1: *Surveying Vol. I&II, Duggal, S.K., (2017), McGraw Hill Education.*
Ref 2: *Surveying Vol. I&II, Kanetkar T.P. and Kulkarni S.V. (2008), Publisher: Pune Vidyarthi Griha Prakashan.*
Ref 3: *Plane Surveying, Chandra, A.M., (2006), New Age International Publishers, Delhi.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Title:	Mechanics of Solids	Course ID :		TCE 303	
03	3			Contact Hrs :		L / T / P	
Course Components:		DSC		03		2 / 1 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	25	25	50	100
Pre-Requisite		Applied Physics					

Course Outcomes

CO 1: ***Identify*** *basic concepts of system of forces.*
CO 2: ***Determine*** *the member forces in truss and frames.*
CO 3: ***Compute*** *the stresses and strains in axially loaded bars*
CO 4: ***Analyze*** *the reactions, deflections and stresses in beams*
CO 5: ***Evaluate*** *the stresses and strains in circular shafts and stability of columns*

UNIT	SYLLABUS	Hrs
I	**Concurrent Forces in a plane**: Principles of statics, composition and resolution of forces, equilibrium of concurrent forces in a plane,Method of projections, three-force system, Method of moments. **Parallel forces in a plane:** Two parallel forces, general case of parallel forces in a plane, center of parallel forces and center of gravity, Centroids of composite plane figures and curves; Distributed forces in a plane.	9
II	**General case of forces in a plane**: Composition of forces in a plane, equilibrium of forces in a plane, Method of joints and sections for trusses, method of members for plane frames. **Stress, strain and deformation of solids**: Rigid and deformable bodies; Stability, strength and stiffness; Axial and Shear Stresses; Uniaxial stress-strain behavior of steel; Deformation of simple and compound bars; Biaxial state of stress, Elastic constants, thermal stress, strain energy.	9
III	**Stresses on inclined planes**: Principal Stresses, Mohr's circle of stress**.** **Beam statics:** Types of beams, supports and loading, External reactions using equlibrium, SFD and BMD using equilibrium of beam sections.	9
IV	**Deflection of beams**: Double integration method, use of singularity functions for concentrated forces and moments Stresses in beam section: Theory of simple bending; assumptions, relation between bending stress, radius of curvature and moment; Moment of Inertia of sections; bending stress distribution; moment carrying capacity of a section; Shear stress distribution.	9
V	**Torsion:** Pure torsion; Assumptions in the theory of pure torsion; Derivation of torsional equations; polar modulus; Power transmitted; torsional rigidity / stiffness of shafts. **Stresses in Columns**: Behaviour of short and long columns ; Euler's theory of long columns ; Critical loads for prismatic columns; Rankine-Gordon Formula ; Eccentrically loaded long columns and short columns.	9

Text Book:

TB 1: *Strength of Materials, S.S Bhavikatti, IVth edition, (2013), Vikas Publisher, New Delhi.*
TB 2: *Strength of Materials, Rajput R. K., VIth edition, (2018), S. Chand & Co., Dehradun.*
TB 3: *Strength of Materials , Sadhu Singh , VIth edition, (1978), Khanna Publishers, New Delhi.*
TB 4: *Strength of Materials, Bansal R.K, VIth edition,(2018), Laxmi Publisher, New Delhi.*

References:

Ref 1: *Introduction to Solid Mechanics, IIIrd edition,Irwing H. Shames, James M. Pitarresi, (2015), Pearson.*
Ref 2: *Mechanics of Solids, Ist edition,Roger T.Fenner, (2012), Taylor & Francis.*
Ref 3: *The Strength of Materials, IVth edition, Malhotra, D.R. Gupta, H.C., (1963), Satya Prakashan (Tech. India Publications), New Delhi.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Building Materials and Construction Equipment	Course ID :		TCE 304	
03	3			Contact Hrs :		L / T	P
Course Components:		DSC		03		2 / 1	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25 / 50	100
Pre-Requisite		No pre-requisite required					

Course Outcomes

CO 1: ***Apply*** *the knowledge of concrete, as a building material and their types, and applications in Construction*
CO 2: ***Understand*** *the need of sustainable and advanced pavement materials and their types with application*
CO 3: ***Analyze*** *smart materials and Green building material and their applications*
CO 4: ***Evaluate*** *types of earth moving equipments and their use in construction industry*
CO 5: ***Create*** *idea for the use of construction equipments and their applications*

UNIT	SYLLABUS	Hrs
I	Concrete as Building Materals: Normal Strength concrete, Reinforced Cement Concrete, Pre-stressed concrete, Pre-cast concrete, light weight concrete, High Density Concrete, Air entrained Concrete, Ready Mix Concrete, Polymer Concrete, High strength concrete, High Performance concrete, Self Compacting Concrete, Pervious concrete, Pumped concrete, Vaccum Concrete, PQC, Asphalt Concrete, Green Concrete, Fiber Reinforced Concrete, glass concrete, Ductile Concrete, Hydrophobic Concrete, Geopolymer concrete, Sulfur Concrete,	9
II	Sustainability and Availability of Sound Materials, Need for high performance pavement materials, Performance-Specified Cements, Next-Generation Sustainable Cements, Eco-Friendly Cements for Concrete Mixtures, Energetically Modified Cement, Sulfur-Extended Asphalt, Bio-Derived Asphalt Binders, High Modified Asphalt Binders, Warm-Mix Asphalt Concrete, Perpetual Asphalt Pavement Systems, Porous Asphalt Pavement, Recycled Asphalt Shingles, Synthetic Aggregates, Manufactured Aggregate Using Captured CO2, Materials That Allow Internal Concrete Curing, Ultra-Thin Bonded Wearing Course, Concrete Surface Sealers	9
III	Smart and Next Generation building Materials: Piezoelectric materials, Magnetosrictive materials, Electrorheological Fluids, Electrochromic materials, Multiferroic / Electromagnetic Materials Shape Memory Alloys (SMAs), Greeen Materials – earthen materials, engineered wood, Bamboo, insulating materials, composits, Natural Fibers, Polyurethane, Fiberglass, cellulose, cork, Non-VOC paints, Fiber cement	9
IV	Earth Moving Equipments: Dozers, Scrapers, Excavators – Front Shovels, Hoes, Loaders, Trenching Machines; Compactors – Rollers, Vibrocompaction, Dynamic Compaction; Finishing equipments – Graders, Gradalls, Trimmers; Truck and Hauling equipments; Drilling equipments – earth and rock	9
V	Construction Equipments: Aggregate production – crushers, Paving equipments- Asphalt mix, Concrete equipments- ready mix concrete (RMC), Concrete placing, compaction, and curing equipments, Cranes - Mobile cranes, Tower cranes, Rigging; Dragline and Clamshells, Pile driving equipments, equipment for pumping water	9

Text Book:

TB 1: *Building Materials, SK Duggal, (2017), Routledge.*
TB 2: *Building Construction Materials and Techniques, P. Purushothama, (2017) Pearson Education India.*
TB 3: *Construction Equipment and Methods: Planning, Innovation, Leonhard E. Bernold, (2013), Wiley.*
TB 4:

References:

Ref 1: *Construction, Planning, Equipment and Methods, Robert Peurifoy, Clifford J. Schexnayder, Aviad Shapira, (2002), Tata McGraw- Hill.*
Ref 2: *Building Materials in Civil Engineering, Haimei Zhang, (2011), Elsevier Science.*
Ref 3:

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Fluid Mechanics Laboratory	Course ID :		PCE 301	
03	1			Contact Hrs :		L / T / P	
Course Components:		DSC		02		0 / 0	2
Examination Duration (Hrs)		Theory / Practical		CIA	MSE	ESE	Total
		0 / 2	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Applied Sciences					

Course Outcomes

CO 1: ***Obtain*** *fluid properties of various liquids.*
CO 2: ***Verify*** *Law of Conservation of Energy.*
CO 3: ***Use*** *the flow measurement devices in different conditions.*
CO 4: ***Differentiate*** *types of flow.*

UNIT	SYLLABUS	Hrs
	• To measure the surface tension of a liquid. • To determine the metacentric height of a ship model experimentally. • To verify the Bernoulli's theorem. • To find the point velocity in a pipe using Static Pitot Tube and compare it with average velocity. • To calibrate a venturimeter and to study the variation of the coefficient of discharge with the Reynolds number. • To calibrate and to determine the coefficient of discharge for a rectangular notch. • To calibrate and to determine the coefficient of discharge for a triangular notch. • To determine the coefficients of velocity, contraction and discharge for an orifice of a given shape. • To determine the coefficients of velocity and discharge for a mouth piece of a given shape. • To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.	15

Text Book:

TB 1: *Laboratory work in Hydraulic Engineering, G.L Asawa, (2006), New Age International publishers, New Delhi.*

References:

Ref 1: *Laboratory Manual for Fluid Mechanics, Poonia MP and Jakhar O.P, (2016), Standard Publishers Distributors, Delhi.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Geomatic Engineering Laboratory	Course ID :		PCE 302	
03	1			Contact Hrs :		L / T	P
Course Components:		DSC		02		0 / 0	2
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		0	2	Weightage of Evaluation:	25	25 / 50	100
Pre-Requisite		Applied Sciences					

Course Outcomes

CO 1: Obtain the required Information like Length, Area, coordinates, Physical Features on a Map
CO 2: Make Linear Measurements by Using Basic Surveying Instruments.
CO 3: Measure the horizontal and vertical angles using theodolite on ground
CO 4: Determine relative height of various points using Levelling Instruments.

UNIT	SYLLABUS	Hrs
I	1. To study different types of maps published by Survey of India and to determine latitiudes,longitudes, area, heights, lengths of specific points on the map. 2. To study instruments used in conventional chain and compass surveying and to measure distance between two points by ranging. 3. To measure the bearing of sides and length of a given traverse by total station, and plot the traverse on a scale after suitable adjustment. 4. To conduct temporary adjustments of a Vernier Theodolite and measure Horizontal and Vertical angles by Reiteration method 5. To find out the reduced levels of given points using Dumpy/IOP level (Reduction by height of Collimation method and Rise and Fall method) and transfer of bench mark. 6. To determine the Tacheometric constants of a given tacheometric instrument and measurement of distance between two points by Tacheometry 7. To plot details using radiation and intersection methods in plane tabling. 8. Study and use of different types of micro-optic theodolite and total station, and carry out Triangulation and Trilateration of a given area, compute the adjusted coordinates of triangulation stations. 9. Use of GPS for measurement of coordinates and GPS survey of small area. Study of aerial photographs, to find out scale and flying height of a photograph and prepare a base map on a tracing paper.	15

Text Book:

TB 1: Arora, K.R., “surveying” , Vol. I & II, Standard Book House, Delhi
TB 2: Punmia, B.C., “Surveying”, Vol. I &II, Laxmi Publications New Delhi

References:

Ref 1: Agor, R. “Surveying”, Vol. I&II, Khanna Publications, Delhi

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Career Skills-I	Course ID :		XCS 301		
03	2			Contact Hrs :		L	T	P
Course Components:		SEC		02		2	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		2	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Basic English and Mathematics						

Course Outcomes

CO 1: *Improve the logical, analytical and problem-solving skills by practicing various problems on topics like Series, Directions, Coding-Decoding, Blood Relations, Ranking and Number Tests, Seating and Placing Arrangements, Syllogism, Visual Reasoning, Different types of Puzzles, Data Sufficiency etc.*

CO 2: *Apply vocabulary building strategies such as (root word, antonyms & synonyms etc) to enrich their repository of words and determine word meaning by analyzing the textual content*

CO 3: *Identify, understand, and apply different types of prepositions, prepositional phrases as well as articles in drafting meaningful sentences.*

UNIT	SYLLABUS	Hrs
I	Basic concept of series completion using numbers, alphabets, and their combinations based on differences, based on products, based on exponentials. Basic concept of coding-decoding using alphabets, digits, words and their combinations. Basic concept and understanding of directions including the orientation of the 4 basic directions of east, west, north and south and also the cardinal directions. Understanding turns of different degrees towards right, left, clockwise and anticlockwise. Blood relation concepts including basic introduction, making a family tree, standard notations and names for gender and relations. Discussion of different types of questions asked in blood relations, their solutions and practice. Mathematical reasoning-based questions including questions on Number, Ranking and Time Sequence Test.	8
II	Basic concepts and practice of deterministic and non-deterministic arrangement-based questions (linear, vertical, circular and rectangular). Concepts and understanding of deterministic and non-deterministic tabular or grid-based questions including understanding of variables and their entries in the solution table. Understanding the concepts of Syllogism using Venn diagram, types of problems in syllogism (2 statements, 3 statements and 6 statement problems). Various Visual Reasoning and Game based puzzles, Different other types of Puzzles (Selection based on given conditions, Sequential Order of things etc.), Understand and practice the reasoning based on Data Sufficiency	12
III	**Vocabulary Building (Beginner's Level):** Concept of Root Words**,** Synonyms &Antonyms**,** Common Foreign Words and Expressions**,** Idioms and Phrases. **Sentence Completion:** Prepositions**,** Prepositional phrases**,** Articles**,** Cloze test.	10

Text Book:

TB 1: *A Modern Approach to Logical Reasoning All Competitive Exams, R.S.Aggarwal, (2018), S. Chand & co. ltd.*

TB 2: *Unveiling the secrets of verbal Ability, Abhishek Verma & Shweta Bajaj, (2021), Pathak Publication.*

References:

Ref 1: *A new approach to Reasoning Verbal, Non-Verbal & Analytical, BS Sijwali & Indu Sijwali, (2024), Arihant.*

Ref 2: *Logical Reasoning for CAT, Arun Sharma, (2016), McGraw Hill.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Universal Human Values – II	Course ID :		UHV301		
03	2			Contact Hrs :		L	T	P
Course Components:		VAC		02		2	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		2	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Univeral Human Values-I						

Course Outcomes

CO 1: *Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content, and process of value education, explore the meaning of happiness and prosperity, and do a correct appraisal of the current scenario in society.*

CO 2: *Distinguish between the Self and the Body, and understand the meaning of Harmony in the Self and the Co-existence of Self and Body.*

CO 3: *Understand the value of harmonious relationships based on trust, respect, and other naturally acceptable feelings.*

CO 4: *Apply in human-human relationships and explore their role in ensuring a harmonious society.*

CO 5: *Create harmony in nature and existence, and work out their mutually fulfilling participation in nature.*

CO 6: *Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.*

UNIT	SYLLABUS	Hrs
I	Understanding the need, basic guidelines, content, and process for Value Education, Self-exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation –as the mechanism for self-exploration, Continuous Happiness, and Prosperity-A look at basic Human Aspirations, Right understanding, Relationship, and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, the meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya. Harmony in Human: Human Relationship Understanding harmony in the family is the basic unit of human interaction, Understanding values in the human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in a relationship, Understanding the harmony in the society (society being an extension of the family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) – from family to world family!. Whole existence as Co-existence Understanding the harmony in Nature, Interconnectedness, and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	12
II	Harmony in Human-Human Relationship Understanding harmony in the Family-the a basic unit of human interaction, Understanding values in the human-human relationship; the meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in a relationship, Understanding the harmony in the society (society being an extension of the family): Samadhan, Samridhi, Abhay, Sah- astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society: (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) – from family to world family!. Whole existence as Co-existence Understanding the harmony in Nature, Inter connectedness, and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of	10

	mutually self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence.	
III	Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies, and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for the transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b)At the level of society: as mutually enriching institutions and organizations	8

Text Book:

TB 1: *Limits to Growth – Club of Rome's report, Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, (1972), Universe Books.*

TB 2: *Energy & Equity, Ivan Illich, (1974), The Trinity Press, Worcester, and Harper Collins, USA.*

TB 3: *A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, (2019), Excel Books, New Delhi.*

References:

Ref 1: *Jeevan Vidya EkParichay, A Nagraj, (1998), Divya Path Sansthan, Amarkantak.*

Ref 2: *Human Values, A N Tripathy, (2003), New Age International Publishers.*

Ref 3: *Indian Ethos and Modern Management, B L Bajpai, (2004), New Royal Book Co., Lucknow.*

Bachelor of Technology (B.Tech.) in Civil Engineering with specialization in construction management

Semester:	Credits (C)	Course Tittle:	Emerging Technologies in Construction Engineering			Course ID :		TCE 339	
05	3					Contact Hrs :	L	T	P
Course Components:		DSC				03	2	1	0
Examination Duration (Hrs)		Theory	Practical			CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:		25	25	50	100
Pre-Requisite		No pre-reuisite required							

Course Outcomes

CO 1: ***Understand*** *new age challenges and opportunities with construction 4.0 concepts*
CO 2: ***Apply*** *Holistic Building Design Approach for buildings, Landscape and Vegetation*
CO 3: ***Analyze*** *exiting technologies that brought Building Digital Revolution*
CO 4: ***Evaluate*** *Building Modeling and Advanced Digtal Design Tools*
CO 5: ***Create*** *Smart Building and Smart cities with advanced materials, building products and construction*

UNIT	SYLLABUS	Hrs
I	Challenges & Opportunities for construction industry: economic and societal relevance, Energy and Environment Impact of Buildings, Low Carbon and Sustainable cities, Built Environment and Circular economy, Climate positive and smart buildings, Digital Future for construction , construction 4.0 technologies	9
II	Holistic Building Design Approach: Life Cycle Analysis, Design and Costing, Climate and context adaptive design,context and climate analysis, Holistic Design strategies,Building geometry, envelop, systems, Building integrated renewable energy, Landscape and vegetation, Construction and deconstruction design	9
III	Building Digital Revolution – construction 4.0 technology driver, BIM, Cloud and Edge computing, Internet of Things, 5G Network, AI & ML, Big data and Advanced Analytics, Nanotechnology, Digital Building Life Cycle,Augmented Digital Design, Connected construction, smart operations	9
IV	Building Modeling and Advanced Digital Design Tools,Building Information Modeling (BIM), Multidimensional Design, BIM Software Tools, BIM – construction value chain, information requirements, Maturity Level, collaborative practices and standardization	9
V	Advanced Materials and building products – smart materials, Shape Memory Alloys, smart sensors, bio,based materials, High performance insulators, smart coatings, mimetic ptohotvoltaics; Advanced Building Construction – Prefabrication, Robotic Fabrication, Additive Manufacturing – 3D concrete printing, Drones in Construction, Wearable Devices, AR/VR/MR in construction, Building Automation, Smart Homes, Digital Twins, Smart Building and Smart cities	9

Text Book:

TB 1: *Construction 4.0: An Innovation Platform for the Built Environment, 1st edition, Anil Sawhney, (2023). Routledge.*
TB 2: *Sustainable Development of Smart Cities Infrastructure, Arun Goel and Pankaj , Munjal H.K. Sharma, (2023) Allied Publishers Private Limited.*
TB 3: *Construction and Building Automation From Concepts to Implementation, Benny Raphael, (2022) CRC Press.*

References:

Ref 1: *Construction 4.0: Advanced Technology, Tools and Materials for the Digital Transformation of the Construction Industry, Marco Casini, (2021), Elsevier Science.*
Ref 2: *Innovative Production And Construction: Transforming Construction Through Emerging Technologies by Wu Peng, (2019), World Scientific Publishing Company.*

Bachelor of Technology (B.Tech) in Civil Engineering with Specialization in Construction Management

Semester:	Credits (C)	Course Title:	Excel for Civil Engineers Laboratory		Course ID :		PCE 339	
03	1				Contact Hrs :		L / T	P
Course Components:		DSC			03		0 / 0	2
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		0	3	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Basic MS Office						

Course Outcomes

CO 1: ***Understand*** *basic conceps of MS Excel for Engineers*
CO 2: ***Prepare*** *the worksheets and layouts in excel*
CO 3: ***Apply*** *formulas and manage tables in excel*
CO 4: ***Create*** *a excel sheet for a civil engineering problem*

UNIT	SYLLABUS	Hrs
I	**Manage Workbook Options and Settings**: Create Worksheets and Workbooks, Navigate in Worksheets and Workbooks, Customize Options and Views for Worksheets and Workbooks Apply Custom Data Formats and Layouts: Apply Advanced Conditional Formatting and Filtering , Create and Modify Custom Workbook Elements	9
II	**Create Tables:** Create and Manage Tables, Manage Table Styles and Options, Filter and Sort a Table Perform Operations with Formulas and Functions: Summarize Data by using Functions, Perform Conditional Operations by using Functions, Format and Modify Text by using Functions	9
III	**Create Charts and Objects**: Manage Workbook Options and Settings	9
IV	**Apply Custom Data Formats and Layouts :** Apply Advanced Conditional Formatting and Filtering Create Advanced Formulas: Apply Functions in Formulas, Look up data by using Functions, . Apply Advanced Date and Time Functions, Perform Data Analysis and Business Intelligence	9
V	**Create Advanced Charts and Tables**: Create and Manage PivotTables Prepare an basic excel sheet for a civil engineering problem	9

Text Book:

TB 1: *An Introduction to Excel for Civil Engineers: From Engineering Theory to Excel Practice, Gunthar Pangaribuan (2016), Createspace Independent Publishing Platform.*

TB 2: *Excel for Civil Engineers : A Comprehensive Guide: MS Excel Tips and Tricks, Bhaktilata Devi (2023).*

References:

Ref 1: *Engineering with the spreadsheet: structural engineering templates using Excel, Christy, Craig T (2006), ASCE.*

Ref 2: *MS Excel Help tutorials: https://support.microsoft.com/en-us/excel*

Bachelor of Technology (B.Tech) in Civil Engineering with Specialization in GIS & RS

Semester:	Credits (C)	Course Tittle:	Remote Sensing and Its Techniques	Course ID :		TCE 399	
03	3			Contact Hrs :		L / T / P	
Course Components:		DSC		03		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Applied Sciences						

Course Outcomes

CO 1: *Understand the basic concepts of remote sensing.*
CO 2: *Undeerstand the aerial photography and photogrammetry*
CO 3: *Demonstrate satellite remote sensing principles*
CO 4: *Classify different satellites and its applications.*
CO 5: *Understand various types of satellite remote sensing and interpretation Techniques*

UNIT	SYLLABUS	Hrs
I	Introduction of Remote Sensing, Energy sources and Radiation principles, Energy equation, Electro Magnetic Radiation (EMR) and its Spectrum, EMR interaction with Atmosphere, scattering, Absorption, EMR interaction with earth surface features, reflection, emission and transmission, Spectral response pattern, vegetation, soil, water bodies spectral reflectance.	9
II	Introduction of Terrestrial and Aerial photographs , vertical and oblique photographs , height determination contouring , photographic interpretations , stereoscopy, parallax bar, Flight Planning, Photo Interpretation, Applications of aerial Photos, Photo theodolite.	9
III	Data acquisition Procedure, Reflectance and Digital numbers, Intensity, Reference data , Ground truth, Analog to digital conversion, Detector mechanism, Spectroradiometer, Ideal remote sensing system, Characters of real and successful remote sensing system, Platforms and sensors, orbits, types, Resolution.	9
IV	Land observation satellites, characters and applications, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications, Marine observation satellites OCEANSAT.	9
V	Introduction to Active and Passive Optical Remote sensing; Characteristics of visible, infrared and thermal sensors. Microwave remote sensing Sensors, Concept of Microwave remote sensing, SLAR, SAR Scattrometers, Altimeter, Characteristics, Image interpretation characters.	9

Text Book:

TB 1: *Textbook of Remote Sensing and Geographical Information Systems, Anji Reddy .M, (2011), BS Publications, Hyderabad.*
TB 2: *Remote Sensing and GIS, Chandra. A.M and Gosh. S.K, Narosa (2009), Publishing Home, New Delhi.*
TB 3: *Remote Sensing and Image Interpretation, Thomas M. Lilles and, Ralph W. Kiefer, Jonathan W. Chipman, (2008), John Wiley & Sons.*

References:

Ref 1: *Fundamentals of Remote Sensing, George Joseph, (2005), Universities Press, Hyderabad.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Title:	Hydraulics and Hydraulic Machines	Course ID :		TCE 401	
04	4			Contact Hrs :		L / T	P
Course Components:		DSC		4		3 / 1	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre requisite		Applied sciences					

Course Outcomes

CO 1: *Apply dimensional analysis and find the fluid flow parameters in open channels.*
CO 2: *Understand and solve problems in uniform, gradually and rapidly varied flows in open channel in steady state conditions.*
CO 3: *Analyse the problems of Boundary layer, drag and lift in various practical conditions.*
CO 4: *Classify relevent hydraulic pump for different applications.*
CO 5: *Classify relevent hydraulic turbines for different applications.*

UNIT	SYLLABUS	Hrs
I	**Dimensional Analysis and Hydraulic Similitude:** Dimensional homogeneity, Rayleigh & Buckingham‟s Pi method. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem. **Introduction to open channel flow:** Geometrical parameters of a channel, Velocity and pressure distribution in an open channel, Continuity equation. **Uniform Flow:** Chezy's and Manning's equations, Equivalent roughness, most efficient channel section. Energy and Momentum Principles, Critical depth, concepts of specific energy and specific force, Channel Transitions.	12
II	**Non-Uniform flow in Open Channel:** Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods. Hydraulic Jump, Classification of hydraulic jump, Evaluation of the jump elements, Use of jump, End depth in a free over fall, Equation of motion for unsteady flow, open channel surge.	12
III	**Boundary Layer:** Boundary layer thicknesses; Boundary layer over a flat plate; Laminar boundary layer; Application of Von-Kerman Integral Momentum Equation; Turbulent boundary layer; Laminar sub-layer; Hydro-dynamically Smooth and rough boundaries; Local and average friction coefficient; Boundary layer separation and its control. **Flow Past Submerged Bodies:** Drag and lift, Types of drag force, Drag on sphere, Cylinder and air foil; Circulation and Lift on a cylinder and air foil; Magnus effect.	12
IV	**Pump:** Types of pumps. Centrifugal Pump: Definition, Classification, Description & general principle of working, priming & methods, efficiency, Minimum staring speed Specific speed of Pump and characteristics of a centrifugal pump, Cavitation's in pumps. **Impact of jet on vanes:** Force exerted by a jet on a fixed and moving target on flat & curved vanes. Concept of velocity triangles, Equation for work done & efficiency.	12
V	Hydraulic turbines: Classifications, Equation for work done, efficiency and design parameters of impulse and reaction turbines. Draft tube theory, Equation for efficiency, Cavitation's in turbines, Governing of turbines, Specific speed of a turbine, Model studies. Unit quantities of a turbine, definitions, equations, Characteristic curves of a turbine.	12

Text Book:

TB 1: *"Hydraulics and Fluid Mechanics", 22nd edition, 2019, Modi & Seth., Standard Book House, New Delhi.*
TB 2: *"Flow in Open Channels", 05th edition, 2019, Subramanya K., Tata McGRAW HILL.*
TB 3: *"Flow Through Open Channels",02nd edition, 2001, Ranga Raju, Tata McGRAW HILL.*
TB 4: *"Fluid Mechanics and Machinery", 2010, C. S. P. Ojha, Berndtsson and Chandramouli, Oxford University Press.*

References:

Ref 1: *"Fluid Mechanics and Hydraulic Machines", 2006, S.C. Gupta, Pearson Education, India.*
Ref 2: *"Elementary Hydraulics", Ist Edition, 2006, James F Cruise, Vijay P. Singh, Mohsan M. Sherif, Thomson Learning.*
Ref 3: *"Open channel Hydraulics", 2006, V.T.Chow, McGraw Hill International.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Title:	Structural Analysis	Course ID :		TCE 402		
04	3			Contact Hrs :		L	T	P
Course Components:		DSC		3		2	1	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre requisite		Mechanics of Solids						

Course Outcomes

CO 1: ***Identify*** *the stability and determinacy of plane frames.*
CO 2: ***Estimate*** *the deflections and slopes of elastic curves.*
CO 3: ***Analyse*** *indeterminate beams and draw SFD and BMD.*
CO 4: ***Evaluate*** *the effects of moving loads on determinate beams*
CO 5: ***Determine*** *the forces in Determinate Arch.*

UNIT	SYLLABUS	Hrs
I	**Degree of freedoms:** Static and kinematic indeterminacy, Fixed end moments reactions, Theorem of three moments for continuous beams, Shear Force and Bending Moment Diagrams by super position, Effect of sinking and rotation of supports, Moment distribution method (without sway)	9
II	**Deflection In Beams And Energy Principle**s: Deflection in beams-Area moment method, Conjugate beam method Strain energy and strain energy density, Strain energy in axial force shear, flexure and torsion, Castigliano's theorem **Principle of virtual work:** Application of energy theorems for computing deflections in beams, pin jointed frames, Maxwell's reciprocal theorem. slope and deflection for standard cases of loading	9
III	**Analysis of beams and frames:** Concept and application of slope Deflection method, Column Analogy method.	9
IV	**Moving Loads And Influence Lines:** Influence lines for reactions in statically determinate structures Muller Breslau's principle, Influence lines for members forces in pin-jointed frames, Influence lines for shear force and bending moment in beam sections, Calculation of critical stress resultants due to concentrated and distributed moving loads.	9
V	**Arches:** Arches as structural forms, Types of arches, Analysis of three hinged, parabolic and circular arches. Eddy's Theorem, Suspension cable, stiffening girders, Two Hinged and Fixed Arches , Rib shortening and Temp	9

Text Book:

TB 1: *"Comprehensive structural Analysis", Vol. I & II, Ist edition, 2004, 2005, R.Vaidyanathan and P.Perumal , Laxmi Publications, New Delhi.*
TB 2: *"Structural Analysis", S.S BhaviKatti, Vol. I Vol. II", IVth edition, 2013, Vikas Publishing House Pvt. Ltd., New Delhi*
TB 3: *"Structural Analysis", D. Menon, IVth edition, 2010, Narosa publishing house, New Delhi.*
TB 4: *"SMTS-II Theory of Structures", B C Punmia, IXth edition, 2004, Firewall Media.*

References:

Ref 1: *Structural Analysis: A unified classical and Matrix approach, Vth edition, 2003, A. Ghali, A.M.Naville, and T.G. Brown, Spon Press, London and New York.*
Ref 2: *Structural Analysis, IIIrd edition, 1990, R.C. Coates, M.G. Coutie and F.K.Kong, ELBS and Nelson.*
Ref 3: *Structural Analysis – A Matrix Approach, IInd edition, 2008, G.S. Pandit and S.P. Gupta , Tata McGraw Hill.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Soil Mechanics	Course ID :		TCE 403	
04	4			Contact Hrs :		L / T	P
Course Components:		DSC		4		3 / 1	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		4	0	Weightage of Evaluation:	25 / 25	50	100
Pre requisite		Mechanics of Solids					

Course Outcomes

CO 1: ***Understand*** *soil & soil Formation, regional soil deposits, and simple terms and definitions*
CO 2: ***Apply*** *the method of determining engineering and index properties of soil*
CO 3: ***Analyze*** *soil classification system and identification through simple field tests*
CO 4: ***Evaluate*** *effective stress, capillarity and permeability of soil and 1D & 2D seepage flow analysis*
CO 5: ***Create*** *the concept of vertical stress below applied load, shear strength, soil compressibility and time rate of consolidation*

UNIT	SYLLABUS	Hrs
I	Introduction to Soil, Soil Mechanics and Geotechnical Engineering: Civil Engineering problems related to soil, Failure Case studies and remedial measures, Soil Complexity, Historical Development of the field of Soil Mechanics, Major Contributions by researchers, Soil Formation and Soil Types, Regional Soil Deposit of India, Phase Diagram, Simple Definitions, Important Relationships, Problem solvings	12
II	Engineering and index properties of soil and its laboratory determination(theoritical concepts): Water Content (oven drying and pycnometer method), Specific Gravity (pycnometer method), Unit Weight (Insitu) using cone cutter and sand replacement method, Grain shape and Grain Size distribution, Coefficient of Uniformity, Coefficient of Curvature, Sieve Analysis and Hydrometer analysis, Consistency of Clays – Atterberg Limits and its determination through laboratory tests, related defnitions, - Other engineering properties – Permeability, UCS, Activity, Sensitivity, Thixotropy, Relative Density, Problem solvings	12
III	Soil Structure and Clay minerals: Types of rock forming minerals, clay minerals and their properties, clay – water relationship, Diffuse double layer, clay particle interaction, clay structure and fabric, Granular soil fabric Soil classification: Unified Soil Classification System, Indian Standard Soil Classification system, Field identification procedure, i.e., visual examination, Dilatancy test, Toughness, Dry Strength, Organic content and colour, Problem solvings	12
IV	Effective stress, capilarity and Permeability: Principle of effective stress, Capillarity in soil, One dimensional seepage flow, seepage forces, quick sand condition Two Dimensional seepage Flow – Laplace equation, Flow Net – Confined and unconfined flow cases, Seepage in anisotropic soil, Flow through non-homogeneous section, Design of Granular Filters Soil Compaction: Light and Heavy Compaction tests, Factors affecting compaction, Soil structure and Engineering behaviour of compacted soil, Field Compaction, QA/QC in Field compaction, Problem solvings	12
V	Vertical Stress below applied loads: Boussinesq's equation, Vertical stress below point load, line load, strip load, circular load, rectangular load, Approximate stress distribution method, Isobars and zone of influence Shear strength of soil: Mohr Circle of Stress, Mohr-Coulomb Failure hypthesis, Laboratory determination of shear strength of soil – Direct shear test, Triaxal Tests (UU, CU and CD), Field Vane shear test, Elastic properties of soil Compressibility of soil and consolidation: Component of Total settlement, Soil Compressibility, Consolidation settlement, Amount and Time rate of settlement, Consolidation test and related soil parameters, Secondary settlement, Problem solvings	12

Text Book:

TB 1: *Basic and Applied Soil Mechanics, IInd Edition, 2000, Gopal Ranjan, New Age International (P) Ltd., New Delhi.*
TB 2: *Soil Mechanics and Foundation Engineering, 2018, V.N.S. Murthy, UBS Publishers and Distributors.*
TB 3: *Geotechnical Engineering, 3rd edition, 2006, C.Venkatrahmaiah New Age International (P) Ltd., New Delhi.*

References:

Ref 1: *Principles of Geotechnical Engineering, Vth Edition, M. Das Braja, 2002, Thomson Business Information India (P) Ltd.*
Ref 2: *An introduction to Geotechnical Engineering, IInd edition, 2010, Robert D. Holtz and William D. Kovacs Prentice Hall, New Jersey.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Title:	Concrete Technology	Course ID :		TCE 404		
04	3			Contact Hrs :		L	T	P
Course Components:		DSC		3		3	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre requisite		No pre-requisite required						

Course Outcomes

CO 1: ***Analyze*** *the relevance of types of cement for the given site conditions*
CO 2: ***Evaluate*** *the effect of aggregates on the properties of concrete*
CO 3: ***Select*** *the relevant admixtures for given concreting conditions*
CO 4: ***Design*** *concrete mix for the desired mechanical properties as per codal specifications*
CO 5: ***Assess*** *the concrete mix for the given durability parameters and its environmental impact*

UNIT	SYLLABUS	Hrs
I	**Cement:** Grades and different types of cement, Constituents of cements, Water requirement, Physical properties. Chemical constituents of OPC and their effect on properties of OPC, Bogue's compounds and their properties, Hydration of cement. **Testing of OPC:** Field testing, Fineness by sieve analysis and Blaine's air permeability test, Normal consistency, testing time, soundness, compressive strength. Storage of cement and effects of storage on properties of cement. IS specification and field applications of different types of cements.	9
II	**Aggregates and water:** Grading of aggregates – Sieve analysis, specific gravity, Flakiness, and elongation index, crushing, impact and abrasion tests. Aggregates: Fine aggregate – grading, analysis, Specify gravity, bulking, moisture content, and deleterious materials. Coarse aggregate – Importance of size, shape, and texture. Utilisation of waste as partial replacement of natural aggregates as per IS 383. Water: water quality for mixing and curing, Acceptable water, pH value, Seawater chlorides content as per IS 456.	9
III	**Admixtures and type of special concrete:** Additives and admixtures: Types of admixtures. Mineral Admixtures: natural products, diatomaceous earth, calcined clays of shales, volcanic glasses, by-products – pozzolana, fly ash, silica fume, rice husk ash, metakaolin, G.G. blast furnace slag, etc. Chemical admixtures – air entraining, water reducing, accelerators, retarders, plasticizers and superplasticizers, permeability reducer, grouting agents, surface hardeners, etc. Cold and Hot weather concreting and Introduction to Ready mix, pumped, self-compacting concrete, porous concrete, vacuum dewatered concrete, etc..	9
IV	**Concrete Properties and Mix Design:** Concrete: necessity of supervision for concreting operation, different grades of concrete as per IS 456. Significance and selection of w/c ratio as per IS 456 and 10262 specifications based on grade of concrete and exposure conditions. Properties of fresh and Hardened Concrete. **CONCRETE MIX DESIGN:** Process, statistical relation between main and characteristic strength, variance, standard deviation, factors affecting mix properties, grading of aggregates, aggregate/cement ratio etc. Degree of quality control, design of mix by IS 10262 method.	9
V	**Quality control of concrete:** Batching, Mechanical mixers, automatic batching and mixing plants, efficiency of mixing, Conveyance of concrete, placing of concrete, compaction, vibrators, curing of concrete, significance and methods, temperature effects on curing and strength gain, IS provisions, Maturity of concrete. Formwork for concrete- IS provisions. Testing of hardened concrete – compressive strength, split tensile strength, Flexural strength, factors influencing strength test results. Determination of engineering properties of concrete using Non-Destructive testing. Durability – definition, significance, permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Factors contributing to cracks in concrete – plastic shrinkage, settlement cracks, construction joints, Thermal expansion, transition zone, structural design deficiencies. Study the basics of LCA and LCCA to analyse the EIA of concrete to promote sustainability.	9

Text Book:

TB 1: *Concrete Microstructure Properties, 4th edition, 2017, P Kumar Mehta, Monteiro, McGraw Hill Education.*
TB 2: *Properties of Concrete, 5th edition, 2012, A.M. Neville, Pearson Education.*
TB 3: *Concrete Technology,05th edition, 2017, M L Gambhir, Tata McGraw Hill.*

References:

Ref 1: *IS 456-2000.*
Ref 2: *IS 10262-2019*
Ref 3: *IS 383-2016*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Hydraulics and Hydraulic Machines Laboratory	Course ID :		PCE 401	
04	1			Contact Hrs :		L T	P
Course Components:		DSC		2		0 0	2
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		0	3	Weightage of Evaluation:	25	25 50	100
Pre requisite		Fluid Mechanic Lab					

Course Outcomes

CO 1: ***Evaluate*** *the velocity profile and boundary layer, thus to determine the boundary layer thickness*
CO 2: ***Analyse*** *the concepts of open channel for uniform and non uniform flows.*
CO 3: ***Illustrate*** *the concept of Momentum equation.*
CO 4: ***Demonstrate*** *the practical operations of the hydraulic machines.*

UNIT	SYLLABUS	Hrs
I	• To determine the Manning's coefficient of roughness 'n' for the given channel bed. • To study the velocity distribution in an open channel and to find the energy and momentum correction factors. • To calibrate a broad-crested weir and find the coefficient of discharge of the weir. • To study the flow characteristics through a vertical contraction (hump) in an open channel. • To study the flow through a horizontal contraction in a rectangular channel. • To study the characteristics of free hydraulic jump. • To study the flow over an abrupt drop and to determine the end (brink) depth for a free over fall in an open channel • To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velocity distribution. • To study the impact of jet on flat plate and Hemispherical vanes. • To demonstrate the working and characteristics of a centrifugal pump and Pelton Wheel Turbine.	15

Text Book:

TB 1: *Laboratory work in Hydraulic Engineering, 2006, G.L Asawa, New Age International publishers, New Delhi.*

References:

Ref 1: *Laboratory Manual for Fluid Mechanics, 01st edition, 2016, Poonia MP and Jakhar O.P., Standard Publishers Distributors, Delhi*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Concrete Laboratory		Course ID :		PCE 402	
04	1				Contact Hrs :	L	T	P
Course Components:		DSC			2	0	0	2
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		0	2	Weightage of Evaluation:	25	25	50	100
Pre requisite		No pre-requisite required						

Course Outcomes

CO 1: ***Determine*** *various physical properties of cement.*
CO 2: ***Determine*** *various physical properties of aggregate.*
CO 3: ***Conduct*** *Strength tests on fresh and hardened concrete*
CO 4: ***Illustrate*** *the Non Destructive Tests*

UNIT	SYLLABUS	Hrs
I	**Test on Cement** • Fineness of Cement by Air Permeability (Blaine Fineness) • Standard Consistency, Initial & Final Setting Time • Specific Gravity • Compressive Strength • Soundness of cement by Le-chatelier apparatus **Test on Aggregates:** • Specific gravity of fine aggregate by Pycnometer. • Bulking of fine aggregate • Specific gravity of Coarse aggregate • Sieve Analysis of Coarse and Fine Aggregates. • To design concrete mix without admixture in accordance with IS recommendations along with determination of the workability of given concrete mix by slump test and casting of specimens for properties in hardened state. • To determine the properties of concrete in a fresh state of the given sample. • Workability tests: (Slump cone test or Flow table test or Compaction factor). • To determine the properties of concrete in a hardened state (Compressive Strength, Flexural Strength) of the given sample. • Demonstration of NDT equipment.	15

Text Book:

TB 1: *Properties of Concrete, 05th edition, 2012, A.M. Neville, Pearson Education.*

References:

Ref 1: *Relevant Indian Standards*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Computer Aided Civil Engineering Drawing			Course ID :		PCE 403	
04	1					Contact Hrs :	L	T	P
Course Components:		DSC				2	0	2	0
Examination Duration (Hrs)		Theory	Practical			CIA	MSE	ESE	Total
		0	2	Weightage of Evaluation:		25	25	50	100
Pre requisite		Basic knowledge of computer systems							

Course Outcomes

CO 1: *Learn various commands and getting familiar with AutoCAD*
CO 2: *Create layout design for their own organisation*
CO 3: *Draw various types of staircases*
CO 4: *To design 2D plan of house as per building norms*

UNIT	SYLLABUS	Hrs
I	1. Introduction to AutoCAD and its user interface. Learning various commands related to AutoCAD. 2. To make various geometries by using commands learnt in practical 1 and print them by creating various viewports in a A4 size layout specially designed for your firm. 3. To draw various types of staircases and design a dog legged staircase for an educational building (plan and elevation). 4. To design a 2D-plan for a 2BHK house having special provision for staircase inside. Use layer commands to incorporate various layers like plan layer, dimension layer and blocks layer. Plot size (__X__) make as per the building norms. 5. To design a plan (2D) and elevation (3D) for a 2-floor building showing both floors in one single A3 Size paper along with all the layers. 6. To decide location of various columns and beams for the above two floor building. Showcase reinforcement details for the columns and beams. 7. To draw section of an isolated footing showing reinforcement details.	30

Text Book:

TB 1: *AutoCAD 2024: A Problem-Solving Approach, Basic and Intermediate by Sham Tickoo*

References:

Ref 1: *AutoCAD 2024 Instructor by James A. Leach and Shawna Lockhart*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Career Skills-II	Course ID :		XCS 401	
04	2			Contact Hrs :		L T	P
Course Components:		SEC		2		2 0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		2	0	Weightage of Evaluation:		25 25 50	100
Pre requisite		Career Skills-I					

Course Outcomes

CO 1: *Enhance the Quantitative skills by practicing various Mathematical problems such as Calendars, Clocks, Time, Speed and Distance. Percentage, Ratios and Proportions Simple and Compound Interest, Ages, Chain Rule, Partnerships, Mixtures and allegations, Averages etc.*

CO 2: *Identify, comprehend and analyze the given passage on the basis of central theme, idea and tone.*

CO 3: *Discern an understanding of complex grammatical structures using the Concept of Parallelism and Modifiers (including infinitive, gerund, and participle) in conversations and discussions including academic discourse settings.*

UNIT	SYLLABUS	Hrs
I	Understanding the concept of Clocks and Calendar and practice of various types of questions based on the applications. Concept and understanding of average, weighted average and its application. Practice of problem based on age related concepts. Concept of ratio proportion and its application. Understanding and practice of mixtures and solutions including alligation and replacement of part of a solution. Use the skills of ratios and proportions learned to solve problems of Chain Rule and Partnerships. Concept of percentage and percentage equivalent of fractions, multiplication factor, importance and understanding of the base in calculations, concept and application of the successive percentage change rule. Concept and understanding of simple and compound interest and their difference, understanding CI as an application of the successive percentage change rule, concept of effective rate of interest and practice of all the types of problems in SI and CI. Concepts of time, speed and distance, understanding the direct and inverse relations in the topic, average speed and its application. Understanding the concept and application of relative speed and practice of problems based on trains and boats and streams.	13
II	Reading Comprehension (Level 1 & 2) Techniques of Reading comprehension. Practice of effective reading using concepts of central idea, and tone of the passage. Practicing questions of reading comprehension using contemporary passages. Applied Grammar & Usage a. Concept of Parallelism b. Tenses c. Sentence Completion Double Blank Error Detection on parts of speech	12
III	**Verbal Reasoning:** Introduction to Analogy and Common Relationships, Odd Man out: Letter Classification and Word Classification	5

Text Book:

TB 1: *Quantitative Aptitude for Competitive Examinations All Government and Entrance Exam, R.S. Aggarwal, (2022), S. Chand.*

TB 2: *Unveiling the Secrets of Verbal Ability, Abhishek Verma and Shweta Bajaj, (2021), Pathak Publishers.*

References:

Ref 1: *Verbal Ability and Reading Comprehension, Arun Sharma & Meenakshi Upadhyay, (2023), Mc Graw Hill Edge.*

Ref 2: *How to prepare for Quantitative Aptitude for CAT, Arun Sharma, (2024), McGraw Hill Education.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Constitution of India	Course ID :		HSS 203	
04	1			Contact Hrs :		L / T / P	
Course Components:		VAC/MNG		2		2 / 0 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	2	25	25	50	100
Pre requisite		NA					

Course Outcomes

CO 1: *To develop a comprehensive understanding of the Indian Constitution's historical context.*
CO 2: *To explore the significance of constitutional concepts, such as the Rule of Law, Separation of Powers, and the Basic Structure Theory, in upholding democracy*
CO 3: *To Analyze the interplay between Fundamental Rights, Fundamental Duties, and Directive Principles in ensuring social justice and governance in India.*
CO 4: *To evaluate the key ideas underpinning the Indian Constitution.*
CO 5: *To develop a critical appreciation towards the process and concepts of Constitutionalism.*
CO 6: *To examine the key civic ideas inherent in the Indian Polity.*

UNIT	SYLLABUS	Hrs
I	**Pre-requisites, Key Concepts, and Terminology:** Introduction to the course and its objectives. The State and its significance in constitutional studies. Difference between a "Person" and a "Citizen" in a legal context. Concept of "Citizen" within a constitutional framework. Importance of the "Rule of Law" in a democratic society. Structure of Government and Constitutional Principles. Overview of the Organs of the State and their functions. Concept of "Separation of Powers" and its role in a constitutional democracy. "Basic Structure Theory" and its significance in constitutional interpretation, Introduction to the Preamble and its significance: Detailed analysis of the terms "Secular," "Democratic," and "Socialist."	12
II	**Historical Background and Philosophy of Indian Constitution:** Introduction to constitutional concepts. Defining "Constitution" and "Constitutionalism." Importance of a constitution in governance and democracy. Comparative analysis of various constitutions around the world. The role of constitutionalism in preserving fundamental rights. Introduction to the period from the 1773 Regulating Act to the Mountbatten Plan. Review of salient features of the Indian Constitution.	8
III	**Introduction to Fundamental Rights, Duties and Directive Principles of State Policy:** Overview of Fundamental Rights and their significance in a democratic society. Discussion on Fundamental Duties and their role in promoting civic responsibilities. **Fundamental Rights (Article 12 - 21):** Understanding the Concept of the State (Article 12). Exploring Judicial Review and its role (Article 13). In-depth analysis of Fundamental Rights, including equality, freedom, and protection against discrimination (Articles 14-19). Rights of Accused Persons and the right to a fair trial (Article 20). Right to Life and Personal Liberty, including landmark cases (Article 21). Constitutional Remedies and Directive Principles (Article 32, 36-51). Constitutional Remedies (Writs) and their significance (Article 32). **Directive Principles of State Policy**: understanding the socio-economic objectives (Articles 36-51). The relationship between Fundamental Rights and Directive Principles. **Fundamental Duties (Article 51A) and Landmark Cases**	10

Text Book:

TB 1: *The Indian Constitution: Cornerstone of a nation, Austin, G., (1999), Oxford University Press, India.*
TB 2: *Our Constitution, Kashyap, S. C., (2009), National Book Trust, India.*
TB 3: *Constitutional government in India, Pylee, M. V., (2017), S. Chand Publishing, India.*

References:

Ref 1: *Introduction to the Constitution of India, Basu, D. D., (2020), LexisNexis, India.*
Ref 2: *Constitutional law: Principles and policies, Chemerinsky, E., (2019), Wolters Kluwer, USA.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Title:	Academic Report writing and IPR	Course ID :		GCE 411	
01	0			Contact Hrs :		L / T / P	
Course Components:		GE		2		2 / 0 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	0	0	Weightage of Evaluation:	0	0	100	100
Pre requisite	NA						

Course Outcomes

CO 1: ***Understand*** *the concept of Research and importance of Literature Review.*
CO 2: ***Remember*** *the different types of Research.*
CO 3: ***Identify*** *the data sampling, data collection methods.*
CO 4: ***Document*** *a Research Report.*
CO 5: ***Apply*** *the Research Tools for project evaluation.*

UNIT	SYLLABUS	Hrs
I	**Introduction to Research:** The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, application of Research, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature.	6
II	**Types of Research:** Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative. Research Design: Meaning, need, types of research design, Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design.	6
III	**Sampling, Data Collection and analysis:** Types and sources of data, Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods, sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling, classification and tabulation of data, graphical representation of data, graphs and charts Histograms, frequency polygon and frequency curves, bell shaped curve and its properties. **Statistical Methods for Data Analysis:** Applications of Statistics in Research, measures of central Tendency and dispersion	6
IV	**Research Report:** Research report and its structure, journal articles–Components of journal article. Explanation of various components. Structure of an abstract and keywords. Thesis and dissertations. Components of thesis and dissertations. Referencing styles and bibliography. Ethics in Research,Plagiarism,Definition, different forms, consequences unintentional plagiarism, copyright infringement, collaborative work. Qualities of good Researcher.	6
V	**ICT Tools for Research:** Role of computers in research, maintenance of data using software such as Mendeley, Endnote, Tabulation and graphical presentation of research data and software tools. Web search : Introduction to Internet, use of Internet and WWW, using search engines and advanced Search tools.	6

Text Book:

TB 1: *"Research Methodology", 2nd edition, 2014, Kothari C.R, New Age Publishers, New Delhi.*
TB 2: *"Research Methods for Business", 4th Edition, 2008, Uma Sekaran, John Wiley & Sons.*
TB 3: *"ResearchMethodology", 2nd edition, 2005, Ranjit Kumar, Pearson Education*
TB 4: *"Marketing Research", 07th Edition, 2019, Naresh Malhotra and S Dash, Pearson Prentice Hall.*

References:

Ref 1: *"Business Research Methods", 11th Edition, 2017, Donald Cooper and PS Schindler, , Tata McGraw Hill.*
Ref 2: *"Research Methodology", 2nd edition, 1997, Michael V.P, Himalaya Publishing House, New Delhi*
Ref 3: *"Foundations of Behavioral Research",03th edition, 1986, Fred N.Kerlinger, Surjeet Publications, New Delhi*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Municipal Soild Waste Management	Course ID :		TCE 411	
4	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		3 / 0 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	4	0	Weightage of Evaluation:	25	25	50	100
Pre requisite	NA						

Course Outcomes

CO 1: *Identify the different sources of solid waste.*
CO 2: *Select the relevant method of collection and transportation of solid waste.*
CO 3: *Suggest an action plan for composting of solid waste.*
CO 4: *Devise suitable disposal technique for solid waste.*
CO 5: *Use the relevant method for disposal of Industrial and hazardous waste.*

UNIT	SYLLABUS	Hrs
I	**Introducing Municipal Solid Waste Management:** Definition of solid waste, different solid waste – domestic Waste, commercial waste, indus- trial waste, market waste, agricultural waste, biomedical waste, Ewaste, hazardous waste, institutional waste, etc. Sources of solid waste, Classification of solid waste – hazardous and non- hazardous waste. Physical and chemical characteristics of municipal solid waste.	12
II	**Storage, Collection and Transportation of Municipal Solid Waste:** Collection, segregation, storage and transportation of solid waste. Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable and stationary bin. Transportation vehicles with their working capacity -Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station- meaning, necessity, lo- cation. Role of rag pickers and their utility for society. **Composting of Solid Waste:** Concept of composting of waste, Principles of composting process. Factors affecting the composting process. Methods of composting – Manual Composting – Bangalore method, Indore Method, Mechanical Composting – Dano- Process, Vermi- composting.	12
III	**Disposal of Solid Waste:** Solid waste management techniques- Segregation, recovery and recycle (waste prevention and waste reduction techniques); dumping of solid waste-sanitary waste, solid waste management hierarchy, **Land filling technique**, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste. Landfill closure and environmental monitoring-landfill remediation **Incineration of waste:** Introduction of incineration process, Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste– Definition, Methods. **Municipal solid waste** in Indian conditions, legal aspects of solid waste disposal.	12
IV	**Industrial Solid Waste**: Waste products during manufacturing and packing, operation of pollution control facilities, generation, minimization at source, recycling, disposal. **Hazardous Waste:** Definition, sources, hazardous characteristics, management, Treatment and disposal, mutagenesis, carcinogenesis, Toxicity testing.	12
V	**Biomedical Waste:** Definition, sources, classification, collection, segregation, treatment and disposal. **Electronic Waste:** Waste characteristics, generation, collection, transport and disposal.	12

Text Book:

TB 1: *Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co., Delhi Ed. 2018*
TB 2: *Bhide, A. D., Solid Waste Management, Indian National Scientific Documentation Centre, New Delhi.*
TB 3: *George Techobanoglous, Kreith, Frank., Solid Waste, McGraw Hill Publication, New Delhi.*

References:

Ref 1: *Sasikumar, K., Solid Waste Management, PHI learning, Delhi.*
Ref 2: *Hosetti, B.B., Prospect and Perspectives of Solid Waste Management, New Age International Publisher.*

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-2025 **DEPARTMENT OF CIVIL ENGINEERING** **Program: BTCE**

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Fundamentals of GIS	Course ID :		TCE 412	
04	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		3 / 0 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre requisite	NA						

Course Outcomes

CO 1: *Understand the concept of GIS.*
CO 2: *Differentiate and adopt the right data type for a better data model.*
CO 3: *Understand Database Management System (DBMS) and create the database structure.*
CO 4: *Analyse and Manipulate surface modelling networks.*
CO 5: *Adopt GIS for general implementation in different fields*

UNIT	SYLLABUS	Hrs
I	Introduction, Geographic Information System (GIS) Concepts and Terminology, Utility of GIS, Essential components of a GIS, Hardware and Software requirements for GIS, Conceptual models in GIS. Data Acquisition, Scanners and Digitizers, Method of Digitization, Data Storage, Verification and Editing, Remote Sensing data as input to GIS.	9
II	Data Types, Spatial data and Non spatial data, Spatial Data Models, Raster data model and Vector data model, Data Formats, Raster Vector Data Conversion, Data Compression, Run Length Coding, Quadtree Tessellation, Point Line and Area features, Topology, Data Reduction and Generalization, Map Projection and transformation, Geo referencing, Edge Matching, Rectification and Registration, Data quality and sources of errors.	9
III	Non Spatial Data, Database Structure, Hierarchical Database Structure, Network Data Structure, Rational Database Structure, Data storage and retrieval in GIS, Object Oriented Database, Database Management System (DBMS).	9
IV	Spatial Data Manipulation and Analysis, Reclassification and Aggregation, Geometric and Spatial Operations on Data, Layers, coverage, Overlays, Buffers, Measurement and Statistical Modeling, Raster based analysis, Vector based analysis, Network Analysis, Data Output, Types of Output	9
V	Applications of GIS in Administration, Planning, Management, Monitoring, Engineering, Digital Elevation Model (DEM) and other areas, Various GIS packages and their salient features, Modern trends, Web GIS, Open GIS, Data Mining, GIS Customization, Automated Mapping/Facilities Management(AM/FM).	9

Text Book:

TB 1: *Principles of Geographic Information System, 1998, Burrough, P.A. and McDonnell, R.A., Oxford University Press.*
TB 2: *Remote Sensing and Geographical Information Systems, 2015, Chandra, A.M. and Ghosh, S.K., Narosa Publishing House, New Delhi.*
TB 3: *American Society of Photogrammetry & Remote Sensing, 02nd edition, 1983, Manual of Remote Sensing, ASP, Falls Church, Virginia.*

References:

Ref 1: *Geographic Information Systems- A Management Perspective, 1989, Stan Aromoff WDL Publications.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Case studies in Civil Engineering	Course ID :		TCE 413	
04	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		3 / 0 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:		25 / 25 / 50	100
Pre requisite		NA					

Course Outcomes

CO 1: ***Understand*** *Forensic Engineering and Failures, legal process and dispute resolution*
CO 2: ***Apply*** *the concept of Forensic Geotechnical to solve Foundation problems due to problematic soils*
CO 3: ***Analyze*** *the issues of foundation failure through case studies and learning from such failrues*
CO 4: ***Evaluate*** *the causes of geoenvironmental and bridge failures and learning from such failures*
CO 5: ***Create*** *ideas from building Failure case studies and learning from failures*

UNIT	SYLLABUS	Hrs
I	Definition of Forensic Engineering and Failures, Types of Damage, Legal process, Civil litigation, Impotant Legal Terms, Dispute resolution, Trials, Assignent and Investigation, Confidentiality, Compensation, Agreement with Client, site investigation with destructive and non,destuctive field testing, Monitoring, Proejct report search, Technical documents, Building Codes, Analysis and Conclusion with Case study	9
II	Forensic Geotechnical and Foundation investigation: excessive settlement of structures, Foundation Problems related to expansive soils, collapsible soils, Lateral movements – slope instability and landslides, Earthquake & Liquefaction problem, Ground Water and Moisture problem, Bearing Capacity Failures, Soil erosion, Tree roots stress,	8
III	Foundation Failure Case studies: Tower of Pisa (1173 and ongoing), Transcona Grain Elevator (1913), Fargo Grain Elevator (1956), Embankment dam & Slope Failures: St. Francis Dam (1928), Malpasset Dam (1959), Lower San Fernando Dam (1971), Teton Dam (1976)	8
IV	Geoenvironmental Failures: Love Canal (1978), Kettleman Hills Waste Landfill (1988), North Battleford, Saskatchewan Water Treatment Failure (Cryptosporidium Outbreak) (2001), Bridge Failures: Ashtabula Bridge (1876), Sando Arch (1939), Peace River Bridge (1957), The Second Narrows Bridge (1958), King Street Bridge (1962), Mianus River Bridge (1983), San Francisco,Oakland Bay Bridge (1989), Cypress Viaduct (1989)	10
V	Building Failures: 2000 Commonwealth Avenue (1971), The Skyline Plaza Apartment Building (Bailey's Crossroads) (1973), Hartford Civic Center Coliseum (1978), Imperial County Services Building (1979), Kemper Memorial Arena Roof (1979), Binghamton State Office Building (1981), Pino Suarez Building (1985), L'Ambiance Plaza (1987), Northridge Meadows Apartments (1994), California State University, Northridge, Oviatt Library (1994), Alfred P. Murrah Federal Building (1995), Charles De Gaulle Airport Terminal 2E (2004), Four Times Square Scaffold Collapse (Conde Nast Tower) (1998)	10

Text Book:

TB 1: *Failure Case Studies in Civil Engineering, Structures, Foundations and Geoenvironment", 02nd edition, 2013, Paul A. Bosela (Editor), Pamalee A. Brady*
TB 2: *Forensic Geotechnical and Foundation Engineering, 2nd, 2011, Robert W. Day.*
TB 3: *Guidelines for Forensic Engineering, 2003, L. Lewis Technical Council on Forensic Engineering of ASCE.*

References:

Ref 1: *Beyond Failure: Forensic Case Studies for Civil Engineers , 2008, Norbert J. Delatte, ASCE.*
Ref 2: *Failures in Civil Engineering Structural, Foundation, and Geoenvironmental Case Studies, 1995, J. David Frost, Robin Shepherd, Technical Council on Forensic Engineering (American Society of Civil Engineers).*

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-2025 **DEPARTMENT OF CIVIL ENGINEERING** **Program: BTCE-Sp CM**

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in Construction Management)

Semester:	Credits (C)	Course Title:	Town/Urban Planning and Management	Course ID :		TCE 439	
04	3			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre requisite	NA						

Course Outcomes

CO 1: ***Acquire*** *knowledge of urban planning concepts*
CO 2: ***Formulate*** *plans for urban and rural development*
CO 3: ***Analyse*** *socio economic aspects of urban and rural planning*
CO 4: ***Understand*** *the design of urban development projects.*
CO 5: ***Discuss*** *the management of urban development projects*

UNIT	SYLLABUS	Hrs
I	**BASIC ISSUES**: Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri - urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level	9
II	**PLANNING PROCESS**: Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.	9
III	**DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION:** Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights, Special Economic Zones-Development of small town and smart cities-case studies	9
IV	**PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS**: Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects	9
V	**LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM:** Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.	9

Text Book:

TB 1: *Urban Development and Management, (2002), S.L. Goel, Deep and Deep publications, New Delhi.*
TB 2: *A Systems view of planning, 02nd edition, (1978), George Chadwick, , Pergamon press, Oxford.*
TB 3: *Revitalised Urban Administration in India, (2002), Singh V.B, Kalpaz publication, Delhi.*

References:

Ref 1: *Revitalised Urban Administration in India, (2002), Singh V.B, Kalpaz publication, Delhi.*
Ref 2: *Studies in Urban development, (1986), Edwin S. Mills and Charles M. Becker, A World Bank publication.*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in GIS & RS)

Semester:	Credits (C)	Course Tittle:	Basic Geographical Information Systems	Course ID :		TCE 499	
04	3			Contact Hrs :		L T	P
Course Components:		DSC		3		2 1	0
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre requisite	NA						

Course Outcomes

CO 1: *Understand the fundamental concepts of GIS*
CO 2: *Identify different types of GIS data*
CO 3: *Demonstrate expertise in GIS database management*
CO 4: *Adopt necessary skill for digitization*
CO 5: *Apply Digital Elevation Model (DEM) in GIS*

UNIT	SYLLABUS	Hrs
I	Introduction to Geographical Information Systems: Introduction maps and spatial information. Computer,assisted mapping and map analysis, Map Projections , Usage of Maps Geographic Information Systems. The components of geographical Information System; Future directions and trends in GIS Datadisplay, Data Storage, Spatial Indexes, Data analysis tool,Computer,Assisted Cartography, Advantages, Disadvantages, GIS and Computer, Assisted Cartography,History of GIS,Basic Components of GIS, Hardware, Software, Organizational Context, Comparison of GIS and Hardcopy Maps, GIS Software available in Market.	9
II	Data Files and Databases: Data Types, Non Spatial Data, Nominal, Ordinal, interval, Ratio Spatial Data, Points, Lines and Polygons, Area, File Types, Simple lists, Ordered Sequential Files, Indexed Files , Database, Functions, Database structures such as Hierarchical, Network, Rational.	9
III	Raster Data structures: Raster Data Model , Creating a raster, Cell by cell entry, digital data, Scanner ,Tessellations , Regular, Irregular,Geometry of Regular Tessellations, Shape, Adjacency, Connectivity, Orientation Resolution of Regular Cell,Data Encoding, Rule of dominance, Rule ofimportance, Center of Cell, Space Filling Curves,Run length, Block, Row Order, Prime Row Order, Peano Order, Pi Order,Variable Resolution regular cells, Quadtree data structure, Irregular Tessellations, Theissen polygons, Triangulation, Delaunay triangles.	9
IV	Vector Data Structure: Vector Data Model, Arcs, Storing area, Database Creation, Digitizer, On Screen Digitizing, Topology, Euler Equation, Topological Consistency, Topological Errors, Error identification, Topological Editing, Line weeding, Node matching, Dangle truncation, Fuzzy tolerance, Digital Line Graph, Arc Node Structure, DIME etc.	9
V	Continuous Surface Representation: Digital Elevation Models, Elevation data capture, Interpolation, DEM representation, Altitude matrix, TINstructure, DEM interpretation, Scale, Visualization, Applications	9

Text Book:

TB 1: *Principles of Geographical Information Systems for Land Resources Assessment, (1998), Burrough P.A., Oxford University Press.*
TB 2: *Geographical Information Systems, Volume I and II, (200)5, Paul A Longley, Michael F Goodchild, David J Maguire, David W Rhind, John Wiley and Sons, Inc.*
TB 3: *Remote Sensing and Image Interpretation, (2015), Thomas M. Lilles and, Ralph W. Kiefer, Jonathan W. Chipman, John Wiley & Sons.*
TB 4: *Fundamentals of Remote Sensing, 03rd edition, 2018, George Joseph, , Universities Press, Hyderabad.*

References:

Ref 1: *Geographic informa tion systems: an introduction, (1990), · Star, L. and Estes, JEnglewood Cliffs, NJ: Prentice-Hall.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Advance Structural Analysis	Course ID :		TCE 501	
05	3			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Structural Analysis						

Course Outcomes

CO 1: ***Analyse*** *indeterminate arches and stiffening girders.*
CO 2: ***Check*** *indeterminate frames using energy methods.*
CO 3: ***Develop*** *slope deflection equations and solve indeterminate beams and frames.*
CO 4: ***Formulate*** *stiffness, load and displacement matrix for a given structure.*
CO 5: ***Generate*** *analysis parameters for Plastic Analysis of Structures.*

UNIT	SYLLABUS	Hrs
I	**Arches And Suspension Bridges:** Analysis of two hinged and fixed arches, Settlement and temperature effects. Suspension cables, suspension bridges with two and three hinged stiffening girders	9
II	**Force Method:** Equilibrium and compatibility, Determinate vs Indeterminate structures, Indeterminacy of Primary structure, Compatibility conditions, Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).	9
III	**Slope Deflection Method:** Continuous beams and rigid frames (with and without sway), Symmetry and antisymmetry, Simplification for hinged end, Support displacements **Moment Distribution Method:** Distribution and carryover of moments, Stiffness and carry over factors, Analysis of continuous beams, Plane rigid frames with and without sway.	9
IV	**Stiffness Matrix Method**: Element and global stiffness matrices, Analysis of continuous beams, Co-ordinate transformations, Rotation matrix , Transformations of stiffness matrices, load vectors and displacements vectors, Analysis of pin-jointed plane frames and rigid frames	9
V	**Plastic Analysis Of Structures**: Statically indeterminate axial problems, Beams in pure bending, Plastic moment of resistance, Plastic modulus, Shape factor, Load factor, Plastic hinge and mechanism, Plastic analysis of indeterminate beams and frames, Upper and lower bound theorems	9

Text Book:

TB 1: *Comprehensive structural Analysis– Vol. II, IVth edition, (2017), R. Vaidyanathan, and P.Perumal, Laxmi Publications, New Delhi.*
TB 2: *Structural Analysis, VIrd edition, (2003), L.S. Negi and R.S. Jangid, Tata McGraw-Hill Publications, New Delhi.*
TB 3: *Structural Analysis– Vol. 1 Vol. 2, IVth edition, (2011), BhaviKatti, S.S, IVth edition, Vikas Publishing House Pvt. Ltd., New Delhi.*

References:

Ref 1: *Structural Analysis-A unified classical and Matrix approach–Vth edition, (2003), A. Ghali, A.M. Nebille, and T.G. Brown, Spon Press, London and New York.*
Ref 2: *Structural Analysis, 3rd edition, (1990), R.C. Coates, M.G. Coutie and F.K. Kong, ELBS and Nelson.*
Ref 3: *Structural Analysis – A Matrix Approach", IInd edition, (2008), G.S. Pandit and S.P. Gupta, Tata McGraw Hill.*

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-2025 **DEPARTMENT OF CIVIL ENGINEERING** **Program: BTCE**

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Reinforced Cement Concrete Design	Course ID :		TCE 502	
05	3			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Structural Analysis						

Course Outcomes

CO 1: ***Study*** *RCC behavior against its use in structures.*
CO 2: ***Adapt*** *RCC design philosophies for flexural, shear design and detailing as per IS 456:2000 Design Code.*
CO 3: ***Analyze*** *and give detailing for columns members in structures as per IS 456: 2000 Code standards.*
CO 4: ***Deduce*** *appropriate design of different types of slabs and their structural behavior as per IS 456: 2000 design code.*
CO 5: ***Adapt*** *a suitable Isolated footing for the given site conditions and restrictions applying IS 456:2000 Indian design code..*

UNIT	SYLLABUS	Hrs
I	Importance of RCC in Construction, Basic Components and Behavior of RC Structures. **RCC Material Properties:** Strength, Durability, and Workability aspects. Types, Standards, Specifications, Corrosion Protection and Coatings for Reinforcing Steel. **Concrete Quality Control Measures:** Field Testing and Inspection of Concrete and Reinforcement. Non-Destructive Testing (NDT) Methods for RCC Structures. Equipment and Techniques used for Casting RCC elements.	8
II	Comparative study of RCC Design Philosophies, Working Stress, Ultimate Load and Limit State Philosophies. Strength and Serviceability Limit States, Principles of Ductility and Safety in RCC Design. Basic Flexural Analysis and Design in WSM vs LSM. IS456: 2000 Design Code and Standards for RCC Design. RCC Design and Detailing for Rectangular and Flanged beams for Flexure in Limit state method of design. Shear design Provisions in Design Codes. Importance of Reinforcement Detailing - Standards, Importance, Bar Bending Schedules (BBS) and Detailing Standards for different Structural Elements.	8
III	Axial Load Analysis and Design-Behavior of Columns under Axial Loads. Material Properties, Cross-Sectional Effects, Limit States and Safety Considerations in Column Design. Analysis of Slender and Short Columns. Design for Uniaxial and Eccentric loads in Columns. Design Considerations for Biaxial Bending and Interaction Diagrams. Rectangular and Circular cross sections. Reinforcement Detailing for Columns, Bar Bending Schedules (BBS) for Columns, Development Length and Anchorage Requirements, Lap Splicing and Column Joint Details.	8
IV	Types of Slab Systems in Building Construction. Behavior, Deflection Criteria, Analysis and Design of One-Way, Two-Way Slabs. Moment Coefficients for Slab Systems. Control of Deflection in Slab Design, Remedial Measures for Excessive Deflection. Introduction to Flat Slabs and their Advantages, Column and Drop Panel in Flat Slabs, Punching Shear and Slab-Column Connections. Construction Techniques and Practices for Slabs. Quality Control, and Inspection of Slab Construction. Best Practices for Placing and Curing Concrete in Slabs.	8
V	Types of Foundation Systems: Shallow Foundation Design, Overview of Design Codes and Standards. Isolated Footings: Behavior of Shallow Foundations, Load Distribution, Bearing Capacity, Practical Considerations in Isolated Footing Design. Principles and Design of Rectangular/Square Isolated Footings. Introduction to Combined Footings and Mat Foundations, Design Considerations for Irregular and Multiple Column Arrangements.	8

Text Book:

TB 1: *Reinforced Concrete Design, IVth edition, (2021), Unnikrishnan Pillai and D. Menon, Tata Mc-Graw Hill Book Publishing Company Limited, New Delhi.*
TB 2: *Plain and Reinforced Concrete, VIIIth edition, 2008, O. P. Jain & Jai Krishna, Vol. I & II Nem Chand and Bros.*
TB 3: *Reinforced Concrete – Limit State Design, VIIth edition, (2012), A. K. Jain, Nem Chand & Bros., Roorkee.*

References:

Ref 1: *Reinforced Concrete Structures,* Ist edition, (1975), *R. Park and Pauley, John Wiley and Sons Inc.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Geotechnical and Foundation Engineering	Course ID :		TCE 503	
05	3			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Soil Mechanics					

Course Outcomes

CO 1: ***Understand*** *subsurface exploration program and distructive and non distructive field tests for subsurface investigation*
CO 2: ***Apply*** *earth pressure theories for rigid and flexible earth retaining structure as well as for braced excavation*
CO 3: ***Analyze*** *the way of stability of Infinite and Finite slope through limit equilibrium method under static and earthquake effects*
CO 4: ***Evaluate*** *methods of Bearing Capacity Analysis of Shallow Foundation from theory to practice with IS code provisions*
CO 5: ***Create*** *idea of analyzing Pile capacity (single and Group capacity), as well as, Well Foundation and Machine Foundation*

UNIT	SYLLABUS	Hrs
I	Subsurface Exploration: Methods of exploration, Methods of Boring (Augur Boring, Wash Boring, Percussion Boring, Rotary Boring), Soil Samples- Disturbed, Undisturbed and representative, Sampler Types and Soil Sampling Techniques, IS code provisions of subsurface exploration, Test pits, Field tests Standard Penetration Test (SPT) and Static Cone Penetration test (SCPT), Plate Load Test, Pressure Meter Test, Geophysical Tests (Seismic Refration Method, Electrical Resistivity Method), Borehole Logs, Site Investigation Report, Problem Solvings	7
II	Earth Pressure and Retaining Walls: Active and Passive cases, Earth pressure at rest, Rankine's Earth Pressure Theory, Coulomb's Earth pressure theory, Culmann's Graphical Method, Design considerations of Rataining walls, Introduction to Mechanically Stabilized Earth Wall, Flexibile retaining structures: Sheet pile wall, Anchored Bulkhead, Coffer Dams Arching in soil and Braced Cuts: Theory of Arching, Braced excavation, Earth pressure against bracing in cuts, Strut Loads, Deep excavation support systems, Problem Solvings	8
III	Stability of Slopes: Types of slopes, Factors affeting stability, Factor of safety definition, Stability analysis of infinite slope (cohesionless and cohesive – frictional soil slope), Stability of infinite slope – dry, seepage parallel to slope, and slope under submerged condition), Critical height and stability number, Finite Slope- types of failure, Limit Equilibrium Approach, Total and Effective stress analysis, Method of Slices, Friction Circle Method, Bishop's Method of stability analysis, , strength reduction technique and FEM approach for slope stability (demo), Effect of earthquake force-Pseudostatic Analysis	10
IV	Shallow Foundation: Definition and Types of Shallow foundation, General requirement of foundation, Location and Depth of Foundation, Terminology, Bearing Capacity of Shallow Foundation – Terzaghi's approach, Effect of GWT on bearing capacity of soil, Meyerhof, Hanson and Vesic's approach, Bearing Capacity of footing on layered soils, Bearing Capacity due to eccentric loading, IS:Code provisions IS.1904.1986 & IS.6403.1981 for shallow foundation, Settlement analysis of shallow Foundation, Allowable bearing pressure from field SPT and SCPT tests, Problem solving	10
V	Pile Foundation: Types of Piles, Pile load capacity in Compression – Static Pile load Formulation in sand, clay as well as cohesive-frictional soil, Load test on Pile, Dynamic Pile Formulae, Group action of pile, Effeciency of pile group, Negative Skin Friction, Pile subected to lateral loading and Uplift load Well Foundation: Types of Wells or Caissons's Components of well foundation, shapes of wells, Forces acting on well foundation, Lateral stability and sinking of well Machine Foundation: Terminology, Design criteria for satisfactory action of machine foundation, Block Foundation and soil – spring constants, Damping, Degree of freedom, Vertical, Rocking and Pure sliding of block foundation, IS Code provisions	10

Text Book:

TB 1: *Basic and Applied Soil Mechanics, (2000), Gopal Ranjan, New Age International (P) Ltd., New Delhi.*
TB 2: *Soil Engineering in Theory and Practice, (1994). Alam Singh CBS Publishers and Distributors Ltd., New Delhi*
TB 3: *Geotechnical Engineering, IIrd edition, (2006), C. Venkatrahmaiah New Age International (P) Ltd., Newe Delhi.*

References:

Ref 1: *Foundation Analysis and Design, Vth Edition, (1996), Bowles J.E. McGraw Hill Pub. Co. New York.*
Ref 2: *Foundation Design, (1962), W.C. Teng, PHI Publishers Ltd.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Hydrology and Irrigation	Course ID :		TCE 504	
05	3			Contact Hrs :		L / T / P	
Course Components:		DSC		2		2 / 1 / 0	
Examination Duration (Hrs)		Theory / Practical		CIA	MSE	ESE	Total
		3 / 0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Hydraulics and Hydraulic Machines					

Course Outcomes

CO 1: ***Predict*** *precipitation data for a station.*
CO 2: ***Apply*** *the concept of hydro graph to estimate the magnitude of runoff.*
CO 3: ***Compute*** *the availability of ground water and crop water requirements.*
CO 4: ***Determine*** *the reservoir capacity and general methods of irrigation.*
CO 5: ***Identify*** *various civil structures in water distribution.*

UNIT	SYLLABUS	Hrs
I	**Introduction:** Scope of hydrology, occurrence of water. Hydrological cycle, Scope of Hydrological cycle in civil engineering. **Precipitation:** Definition and forms of precipitation, Types of precipitation, Measurement of precipitation - Non recording and recording type rain gauges, Computation of average depth of precipitation over an area, Optimum number of rain gauges, Estimation of missing precipitation record, Mass curve and consistency of rainfall data, Rain gauges networks, I-D, D-A-D Curves, Frequency and return period **Evaporation:** factors affecting measurement & control of evaporation on reservoirs, Evapotranspiration, definition and measurement. Process of infiltration, factors affecting infiltration, infiltration indices, Application to a practical problem.	9
II	**Surface runoff:** Determination of factors affecting yield calculations. **Hydrograph:** Components of hydrograph, Separation of base flow, flow recession, Unit hydrograph theory, assumptions limitations Derivation and application of unit hydrograph, Computation of unit hydrographs ordinates of different durations, S-Curve and its use. **Floods:** Definition, factors affecting, determination by formulae, Gumble's method, curves, gauging, design flood hydrograph, Recurrence period, Flood Routing.	9
III	**Ground water hydrology and well hydraulics:** Scope and importance of ground water hydrology, Occurrence of ground water, Aquifer parameters, Darcy's law and its validity, Steady radial flow into a well in confined and unconfined aquifers, Safe yield, yield of an open well, recuperation test. Demand for waters, crops - water requirements of different crops, Definition of consumptive use, duty, delta and base period, KOR depth, Factor affecting duty of water, Definition of gross command area, culturable command area, intensity of irrigation, time factor, crop factor, Irrigation efficiencies ,calculation of water required.	9
IV	Definition and necessity of irrigation, Different systems of irrigation, Flow, Lift, Inundation, Storage, Percolation of tank, Sources of water, River, Well, Tank. Methods of lifting water and application of water to soils, sprinkler, drip, basin, furrow. Storage calculation, selection of site, Area capacity curve – preparation and use, Determination of live, dead flood carry – over storage, Determination of control levels in Reservoir, Determination of height of dam, silting of reservoirs, Losses in reservoirs. Lift irrigation, Necessity, general layout, Main components. Simple design of a scheme.	9
V	**Canal Irrigation:** Types of canals, alignment of canals, Design of canals (unlined and lined canal) in non-alluvial and alluvial soils, Kannedy's and Lacey's silt theories. Tractive force theory, canal losses, silt control in canals, typical section of canals in cutting, embankment partial cutting, canal lining purpose types, selection and economics. Canal structures – Necessity, Aqueduct culvert, Super-passage, level crossing, Head regulator, cross regulator, canal siphon, canal fall, canal escape and standing waves flume.	9

Text Book:

TB 1: *Irrigation and water Resources Engineering, (2005), G.L. Asawa, New age International Publishers.*
TB 2: *Irrigation Engineering and Hydraulic Structures 38th edition, (2005), S.K. Garg. Khanna Publishers.*
TB 3: *Irrigation Water Resources and Water Power, XIth edition, (2020), Engineering, P.N.Modi. STANDARD BOOK HOUSE Since 1960 Unit of Rajsons Publications Pvt Ltd*

References:

Ref 1: *Engineering Hydrology, IVth edition, (2017), K. Subramanya. McGraw Hill Education.*
Ref 2: *Hydrology and Water resources engineering, IInd edition, (2008), K.C. Patra. Narosa.*
Ref 3: *Water Resources Engineering, IInd edition, (2010), Larry W. Mays, John Wiley India.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Geotechnical Engineering Laboratory	Course ID :		PCE 501	
05	1			Contact Hrs :		L T	P
Course Components:		DSC		2		0 0	2
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	0	2	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Soil Mechanics						

Course Outcomes

CO 1: ***Determine*** *the basic soil properties, such as, specific gravity, moisture content and its field application*
CO 2: ***Classify*** *the different types of soil based on grain size distribution*
CO 3: ***Estimate*** *the moisture content to achieve maximum compaction*
CO 4: ***Estimate*** *the index properties and its use in classifying the soil*
CO 5: ***Determine*** *the strength parameters of soil sample by simulating field conditions in laboratory.*

UNIT	SYLLABUS	Hrs
I	• Determination of Specific gravity (for coarse and fine grained soils) • Water content (Oven drying method and pycnometer method) • Short notes on field applications of Specific Gravity and Water content • Short note on field method of determination of moisture content	0
II	• Grain size analysis of soil sample (sieve analysis and Hydrometer Analysis) • Relative density of sands • In situ density by core cutter and sand replacement methods. • Short notes on field applications of grain size analysis, Relative density • Short note on field method and advanced method of determination of in-situ density	9
III	• Consistency Limits – Liquid Limit (Casagrande and Cone Penetration Methods) • Plastic limit and shrinkage limit. • Standard Proctor Compaction Test and Modified Proctor Compaction Test • Short notes on field applications of MDD and OMC	9
IV	• Permeability test (constant head method and variable head method) • Short note on field method of determination of permeability as per code • Short notes on field applications of permeability • Solving 2D seepage analysis problems through experimentation in the lab	9
V	• Shear Strength Tests (Direct Shear Test, Tri-axial Compression Test (undrained) – data analysis and interpretation • Demonstration of Standard Penetration Test (SPT) – data analysis and interpretation • Demonstration of Static Cone Penetration Test (SCPT) – data analysis and interpretation • Demonstration of Consolidation Test – data analysis and interpretation	9

Text Book:

TB 1: *Relevant BIS Codes of Practice: IS 2720*
TB 2: *Manual of Geotechnical Laboratory Soil Testing (2021), Bashir Ahmed Mir, CRC Press.*
TB 3: *Manual of Soil Laboratory Testing, Soil Classification and Compaction Testing (1980). K. H. Head.*

References:

Ref 1: *Soil Testing for Engineers, (1966), T. W. Lambe, Wiley Eastern Ltd., New Delhi.*
Ref 2: *Manual of Soil Laboratory Testing, Vol. I, II, III, (1986), K.H. Head, Princeton Press, London.*
Ref 3: *Engineering Properties of Soil and Their Measurements, (1988), J.E. Bowles, McGraw Hill Book Co. New York.*

Graphic Era HILL UNIVERSITY	BOS: 2024-2025 DEPARTMENT OF CIVIL ENGINEERING Program: BTCE

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Structural Analysis Laboratory	Course ID :		PCE 502	
05	1			Contact Hrs :		L / T / P	
Course Components:		DSC		2		0 / 0 / 2	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	0	2	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Applied Sciences						

Course Outcomes

CO 1: ***Demonstrate*** *the deflections and stifnesses in flexural component.*
CO 2: ***Develop*** *Influence Lines for arched components.*
CO 3: ***Distinguish*** *between symmetrical and unsymmetrical bending.*
CO 4: ***Analyze*** *frame and truss structures.*

UNIT	SYLLABUS	Hrs
1	• To find the Flexural Stiffness (E.I) of a given beam and compare it with the theoretical value. • To verify Clark Maxwell's theorem by means of a mild steel beam. • To verify the Maxwell's reciprocal theorem using a two hinged arch. • To determine the forces in the members of a three bar suspension system and the component displacement of the loaded joint D for vertical loads. Comparison of experimental & theoretical results. • To determine the deflection of a truss analytically and graphically and verify the same experimentally. • To determine the horizontal thrust in a three hinged arch for a given system of loads experimentally and verify the same with calculated values. Also, to obtain influence in diagram for horizontal thrust in a three hinged arch experimentally and to compare it with the calculated values. • To determine experimentally the horizontal displacement of the roller end of a two hinged arch for a given load and the influence line for horizontal thrust in a two hinged arch by moving a load along the span • To find the experimental values of deflection of a cantilever beam subjected to symmetrical and unsymmetrical bending and to compare the same with theoretically calculated values. • To calculate experimentally and theoretically the loads in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods under two conditions. • When the suspension rods are attached at their upper ends to rigid supports. • When upper end of the central suspension rod is attached to the centre of a similar elastic beam. • To obtain the influence line diagram for reactions in indeterminate structures by introducing large measurable deformation and using Muller Breslau's principle.	15

Text Book:

TB 1: *Structural Analysis, (2017), R. C. Hibbler, Pearson Education.*
TB 2: *Basic Structural Analysis, IIIrd edition, (2017), C. S.Reddy, Tata Mc Graw Hill Publishing Co., New Delhi.*
TB 3: *Mechanics of solids and Structures, Volume I, (2010), R. Vaidyanathan, P. Perumal and S Lingedwari, Scitech Publication (India) Pvt Ltd.*
TB 4: *Analysis Structures: Strength and behavior, (2005), T. S. Thandavamoorthy, Oxford University Press.*

References:

Ref 1: *Elementary Structural Analysis, (1991), Charles Head Norris and John Benson Wilbur, Tata Mc Graw Hill Publishing Co.*
Ref 2: *Intermediate Structural Analysis, (2017), C K Wang, Tata McGraw Hill.*
Ref 3: *Theory of Structures: Vol. I and II, (2004), B. C. Punmia, Laxmi Publication.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Mini project	Course ID :		MCE 501	
05	01			Contact Hrs :		L / T / P	
Course Components:		PROJ		3		0 / 0 / 2	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		0	2	25	25	50	100
Pre-Requisite		NA					

Course Outcomes

CO 1: **Define** the Preliminary Preparations for a Civil Engineering Project steps.
CO 2: **Develop** a Model of Planned Structure in Staad Pro
CO 3: **Analyse** the Model on Various Parameters
CO 4: **Prepare** the Design Reports and Drawings.
CO 5: **Present** the Project details to a group.

UNIT	SYLLABUS	Hrs
I	**Planning a Civil Engineering Structural Project:** **Real World Structure:** Take any Real World Structure. (Residential, Industrial, Transportation Structures. Water Tanks, etc.,) Define the ***Project Scope*** and the ***Objectives*** and ***Outcomes of the Project*.** Prepare the ***Schedule of the Mini project*** and **Time Line)**	
II	**Project Execution:** Creating the structural model in STAAD.Pro. Applying loads and performing analysis.	
III	**Analyzing and designing** the structure for various materials and load combinations.	
IV	Preparing a **detailed project report.** Presenting the **project findings.**	
V	Discussion and **peer review.**	

Text Book:

TB 1: "Structural Analysis and Design with STAAD.Pro" by V. L. Shah and S. R. Karve
TB 2: "STAAD Pro V8i for Beginners" by T.S. Sarma
TB 3: "Design of Steel Structures with STAAD Pro" by M. D. Rajendra
TB 4: "Practical Analysis and Design using STAAD Pro" by Shyam Chapagain

References:

Ref 1: "Design of Steel Structures" by S. K. Duggal
Ref 2: "Reinforced Concrete Design" by S. Unnikrishna Pillai and Devdas Menon
Ref 3: "Structural Analysis" by R. C. Hibbeler`
Ref 4: "Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)", by Dr. S.R. Karve Dr. V. L. Shah (Author), Standard Book House, Jan 2021.

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Career Skills-III	Course ID :		XCS 501	
05	2			Contact Hrs :		L / T / P	
Course Components:		SEC		2		2 / 0 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		2	0	25	25	50	100
Pre-Requisite		Career Skills-I					

Course Outcomes

CO 1: *Apply the properties of numbers and the other concepts to solve different problems on number theory, Data Interpretation, Time and Work including efficiency-based problems, Mensuration and Algebra*

CO 2: *Discern an understanding of grammatical structures using the Concept of Subject Verb Agreement, Pronouns and conditionals in conversations and discussions including academic discourse settings.*

CO 3: *Demonstrate the ability to critically assess the statements & and draw inferences after critical analysis and evaluation of the text.*

UNIT	SYLLABUS	Hrs
I	• Classification of numbers, rules of divisibility, properties of remainders, LCM-HCF and their applications, concept of the last digit and last two digits, concept of alpha numerals, Calculations of Remainder, Highest Power in a factorial, Factors of a number and associated problems. Practice of questions based on number system concepts.To verify Clark Maxwell's theorem by means of a mild steel beam. • Logarithm with its different properties and applications. • Introduction to Data Interpretation (DI), understanding different methods of data representation including tabular, bar graph, pie chart, line graph and caselet. Techniques of quick arithmetic calculations, concepts of percentage as applicable in DI, growth and growth rate and practice of various DI sets	07
II	• Concepts of time and work and its application-based problems using the LCM method for individual efficiencies and practice of problems based on group efficiencies. • Mensuration, Basic Algebra and practice of various types of questions based on the applications.	08
III	• Applied Grammar & Usage PART (I) a. Subject Verb Agreement b. Pronoun and Antecedent based errors c. Conditionals d. Sentence Completion Triple Blank • Verbal Reasoning PART (II) a. Introduction to Parajumbles, techniques to solve, types of questions and practice of parajumble questions. (Include 4 statement Parajumbles and 6 statement parajumbles). b. Introduction to critical reasoning using statement assumption, statement conclusion, strengthen, weaken and drawing inference.	15

Text Book:

TB 1: *How to prepare for Quantitative Aptitude for CAT,Eleventh, (2024), Arun Sharma, McGraw Hill EducationE.*

TB 2: *Unveiling the Secrets of Verbal Ability, IInd edition, (2024), Abhishek Verma and Shweta Bajaj,Pathak Publishers.*

References:

Ref 1: *Wiley Quantitative Aptitude, First Edition, (2015), P.A.Anand, Wiley.*

Ref 2: *Quantitative Aptitude for Competitive Examinations All Government and Entrance Exams Third edition, (2022), Dr. R.S. Aggarwal, S. Chand..*

Ref 3: *Quantitative Aptitude, first edition, (2016), Rawat and Rawat, Savera, India.*

Ref 4: *Verbal Ability and Reading Comprehension, Eleventh edition, (2023), Arun sharma, Mc Graw Hill edge.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	CIVIL ENGINEERING WONDERS AND CHALLENGES	Course ID :		VAC 501	
05	00			Contact Hrs :		L / T / P	
Course Components:		VAC		2		2 / 0 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	2	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	No pre-requisite required						

Course Outcomes

CO 1: Appreciate the historical developments in civil engineering perspective.
CO 2: Compare the notable ancient and modern civil engineering developments
CO 3: Understand the developments of the civil engineering practices
CO 4: Appreciate the real world challenges in civil engineering projects.
CO 5: Study the case of a world famous civil engineering project
CO 6: Develop an appraisal on the civil engineering professionals.

UNIT	SYLLABUS	Hrs
I	• Introduction to Civil Engineering and its historical developments, understanding the importance of civil engineering in shaping and impacting the world.	6
II	• The ancient and modern Marvels. Ancient, medieval and modern wonders in the field of civil Engineering, scope of work involved in various branches of civil engineering and future vision, recent civil engineering breakthrough and innovations.	6
III	• Understanding the past to look into the future -Pre industrial revolution days, agricultural revolution, first and second industrial revolution and IT revolution and how these eras' helped civil engineering to grow.	6
IV	• Challenges faced while tunneling, bridges over deep ravines, construction of high rise structures, smart cities, metros, military structures like bunkers, silos	6
V	• Various challenges in typical construction practices i.e. BurjKhalifa, Taipei 101, Petronas twin Towers etc.	6

Text Book:

TB 1: *Sandler, T. (1997). Global challenges: an approach to environmental, political, and economic problems. Cambridge University Press*
TB 2: *Williams, A. (Ed.). (1910). Engineering wonders of the world (Vol. 1). Thomas Nelson.*
TB 3: *Hansen, K., & Zenobia, K. (2011). Civil engineer's handbook of professional practice. John Wiley & Sons.*

References:

Ref 1: *De Wekker, S. F., & Snyder, B. J. (2013). Mountain weather research and forecasting: recent progress and current challenges. F. K. Chow (Ed.). Dordrecht Heidelberg New York London: Springer.*
Ref 2: *Soong, T. T., &Costantinou, M. C. (Eds.). (2014). Passive and active structural vibration control in civil engineering (Vol. 345). Springer*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Indian Knowledge System	Course ID :		HSS 304		
05	02			Contact Hrs :		L	T	P
Course Components:		MNG		2		2	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		2	0	Weightage of Evaluation:		Qualified/ Not Qualified		
Pre-Requisite		No pre-requisite required						

Course Outcomes

CO 1: To introduce the Indian knowledge system and its significance across various fields such as philosophy, astronomy, mathematics, health wellness, science, technology, and psychology.

CO 2: To familiarize students with the scientific, yet timeless ideas, embraced and promoted by different scholars, saints, and ideas highlighting their relevance in today's world.

CO 3: To illuminate the governance, economy, and physical architecture of ancient India, emphasizing their importance for fostering peace, humanity, and unselfishness.

CO 4: To cultivate a profound sense of pride in learners for Indian knowledge, fostering a commitment to universal human rights, well-being, and sustainable development.

CO 5: To analyse the Indian Knowledge System and apply its insights within the framework of modern scientific paradigms.

CO 6: To cultivate a profound sense of pride in learners for Indian Knowledge, fostering a commitment to universal human rights, well-being and sustainable development.

UNIT	SYLLABUS	Hrs
I	**Unit I: Foundation and Philosophy of Indian Knowledge System** • Indian Knowledge System – Meaning, Scope, and Overview. • Sources of Indian Knowledge System – Four Vedas, Six Vedangas, Puranas, Smritis, and Itihasa. • Orthodox (Vedic) Indian Philosophy: Introduction and Typology • Un-orthodox (Non-Vedic) Indian Philosophy: Introduction and Typology • Notable Scholars – Veda Vyasa, Patanjali, Gargi, Nagarjuna • Key Concepts – Dharma, Rta, Brahman, Jnana, Atma, Vidya-Avidya, Purushartha.	12
II	**Unit II: Ancient Education System, Science, Mathematics and Health in India-** • Ancient Education System – Overview, role of Universities (Takshila, Nalanda). • Indian Mathematics: Numerical system and Vedic mathematics. • Irrigation System, Metallurgy. • Tri-Dosha system, Prakruti, Ojas, Tejas.	08
III	**Unit III: Governance, Economy, and Architecture** • The Administrative setups in the Ancient Times • Mahabharata – Shanti Parva • Kautilya – Saptanga Theory. • Temple Economy. • Role of Shilpasastra , Important Architecture and Towns – Jantar Mantar, Harappa, Mohenjo-Daro.	10

Text Book:

TB 1: *Dasgupta, S. (1975). A History of Indian Philosophy – First edition, Motilal Banarasidass, New Delhi*

TB 2: *Kapoor, Kapil, Singh Avadhesh (2021). Indian Knowledge Systems Vol - I & II, Indian Institute of Advanced Study, Shimla, H.P..*

TB 3: *Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), Introduction to Indian Knowledge System: Concepts and Applications., – First edition, PHI Learning Private Ltd., Delhi*

TB 4: *Vivekananda (2019). The Complete Book of Yoga: Karma Yoga, Bhakti Yoga, Raja Yoga, Jnana Yoga, first edition, Rupa Publications India Pvt. Ltd.*

References:

Ref 1: *Upanishads with the Commentary of Sankaracharya, First Edition, (2002), Gambirananda, Swami, Advaita Ashrama Publication Department, Kolkata.*

Ref 2: *Daily Life in Ancient India from Approximately 200 BC to AD 700, First Edition, (1994), J Auboyer, Munshiram Manoharlal Publishers*

Ref 3: *The Message of the Upanishads, First Edition, (1985), Ranganathananda, Swami, Bharatiya Vidya Bhavan, Mumbai.*

Ref 4: *Teachings of Swami Vivekananda, Fifth Edition, (1917), Vivekananda, Vedanta Press*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Air and Noise pollution		Course ID :		TCE 511	
05	3				Contact Hrs :		L / T / P	
Course Components:		DSE			3		3 / 0 / 0	
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		No pre-requisite required						

Course Outcomes

CO 1: ***Understand*** *sources of air pollution, air pollution problems*
CO 2: ***Analyse*** *Environment legislation and regulations for air and noise pollution*
CO 3: ***Calculate*** *efficiency of various air pollution control devices used for particulate removal*
CO 4: ***Understand*** *sources of noise pollution and problems related to it.*
CO 5: ***Analyse****, operate and control the devices used for gaseous emission control and noise emission control*

UNIT	SYLLABUS	Hrs
I	Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects, Smoke, smog and ozone layer disturbance, Greenhouse effect.	9
II	Air sampling and pollution measurement methods, principles and instruments, ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations	9
III	Control principles, Removal of gaseous pollutants by adsorption, absorption, reaction, and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.	9
IV	Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria.	9
V	Effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods	9

Text Book:

TB 1: *Environmental Pollution Control Engineering, (2000), C. S. Rao, Wiley Eastern Limited.*
TB 2: *Noise Pollution,* (1999), *G.K. Nagi, M.K. Dhillon, G.S. Dhaliwal, Commonwealth Publishers.*
TB 3: *Sewage Disposal and Air Pollution Engineering, 35th edition, (2016),* S.K. *Garg, S. Kumar, Khanna publishers.*

References:

Ref 1: *Environmental pollution analysis, (2020), S.M. Khopkar, New Age International Publications*.
Ref 2: *Air pollution, (1993), M. N. Rao and H. V. N. Rao, Tata McGraw Hill Pvt. Ltd, New Delhi.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Design of Masonry Structure		Course ID :		TCE 512	
05	3				Contact Hrs :	L	T	P
Course Components:		DSE			3	3	0	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Structural Analysis						

Course Outcomes

CO 1: ***Categorize*** *masonry defects, applying methods to avoid cracks, and understanding material properties*
CO 2: ***Study*** *masonry design principles and assess structural stability through strength formula analysis.*
CO 3: ***Practice*** *masonry design principles.*
CO 4: ***Apply*** *masonry design principles to solve eccentric loadings.*
CO 5: ***Apply*** *reinforced masonry principles effectively.*

UNIT	SYLLABUS	Hrs
I	Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry unitsstrength, modulus of elasticity and water absorption of masonry materials–classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason f o r cracking, methods of avoiding cracks. Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.	8
II	Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses. Design Considerations: Effective height of wall sand columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.	8
III	Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers. Design of solid walls subjected to concentrated axial loads: Solid walls, solid wall supported at the ends by cross wall, walls with piers, wall with openings.	8
IV	Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads –Problems on eccentrically loaded solid walls, walls with piers.	8
V	Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under lateral loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels, and slabs. In,filled frames: Types – modes of failures – Design criteria of masonry retaining walls.	8

Text Book:

TB 1: *Masonry Structural Design, (2021), Prabir S. Sharma and Nagesh R. Iyer* , Springer.
TB 2: *Design of Masonry Structures, (2004), A. W. Hendry and B. P.* Sinha, CRC Press.

References:

Ref 1: *Brick and Reinforced Brick Structures, (2018), Dayaratnam P, Scientific International Pvt. Ltd.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Advance Concrete Technology		Course ID :		TCE 513	
05	3				Contact Hrs :	L	T	P
Course Components:		DSE			03	3	0	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Concrete Technology						

Course Outcomes

CO 1: ***Recall*** *the properties and testing procedure of concrete materials as per IS code*
CO 2: ***Assess*** *advanced concrete mix design using IS Code Methods.*
CO 3: ***Describe*** *the procedure of determining the properties of fresh and hardened concrete*
CO 4: ***Explain*** *nondestructive testing of concrete*
CO 5: ***Describe*** *the various special types of concretes*

UNIT	SYLLABUS	Hrs
I	**Concrete materials** : Cement ,Review of manufacturing process, chemical composition, Bogue's compounds, mechanism of hydration,heat of hydration,Aggregate,Review of types, sampling and testing, artificial aggregates , Chemical Admixtures, types, uses, mechanism of action , effects on properties of concrete , Mineral admixtures, types, chemical composition , physical characteristics , effects on properties of concrete , Rheology – basic concepts, Bingham model.	
II	**Mix proportioning** : Mix design , nominal mix, design mix – concept of mix design , variables of proportioning , general considerations , factors considered in the design of concrete mix, various methods of mix design , design of advanced concrete mix as per IS 10262: 2019 , Statistical quality control of concrete – mean strength , standard deviation, coefficient of variation, sampling , testing , acceptance criteria.	
III	**Properties of fresh and hardened Concrete**: Properties of fresh concrete, workability,factors affecting workability , slump test, compaction factor test, Vee Bee consistometer test, Properties of hardened concrete , modulus of elasticity, compressive strength, split tensile strength, flexural strength, effect of water cement ratio – maturity concept, Creep , factors affecting creep , effect of creep, Shrinkage, factors affecting shrinkage , plastic shrinkage, drying shrinkage, autogenous shrinkage, carbonation shrinkage.	
IV	**Durability & NDT of concrete:** Durability of concrete, Factors affecting durability , permeability, cracking,reinforcement corrosion; carbonation, chloride penetration, sulphate attack, acid attack, fire resistance; frost damage, alkali silica reaction, concrete in sea water , Non,destructive testing of concrete, surface hardness test, ultrasonic pulse velocity method , penetration resistance, pull,out test, core cutting , measuring reinforcement cover.	
V	**Special Topics in Concrete Technology :** Special concretes , lightweight concrete,heavy weight concrete , high strength concrete – high performance concrete , self compacting concrete ,roller compacted concrete– fibre reinforced concrete , polymer concrete,pumped concrete , ready mix concrete , green concrete. Special processes and technology , sprayed concrete; underwater concrete, mass concrete; slip form construction, prefabrication technology, 3D concrete printing Study the analysis of concrete based on LCA and LCCA to analyse the EIA of it to promote sustainability.	

Text Book:

TB 1: *Concrete Microstructure Properties, IVth edition, (2017),P Kumar Mehta, Monteiro, , McGraw Hill Education*
TB 2: *Properties of Concrete, Vth edition, (2012), A.M. Neville, Pearson Education.*
TB 3: *Concrete Technology: Theory And Practice, Vth edition, (2017), M. L. Gambhir, Tata McGraw Hill*
TB 4:

References:

Ref 1: *IS 456-2000.*
Ref 2: *IS 10262-2019*
Ref 3: *IS 383-2016*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in Construction Management)

Semester:	Credits (C)	Course Tittle:	Building Information Modeling			Course ID :		TCE 539	
05	03					Contact Hrs :	L	T	P
Course Components:		DSC				3	2	1	0
Examination Duration (Hrs)		Theory	Practical			CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:		25	25	50	100
Pre-Requisite		No pre-requisite required							

Course Outcomes

CO 1: ***Understand*** *the concepts of various buidling systems*
CO 2: ***Describe*** *the concepts of BIM*
CO 3: ***Demostrate*** *the application of Autodesk Revit*
CO 4: ***Apply*** *BIM concepts for cost estimation*
CO 5: ***Document*** *the applications of BIM for architectural renderings, interference checking, and modeling of energy consumption*

UNIT	SYLLABUS	Hrs
I	**Introduction to/Review of Buildings & Systems**, Building components and systems (architectural, MEP, structural), Building vocabulary, Building drawings, specifications, Building design process and roles of owners, managers, designers, engineers and contractors/subcontractors	9
II	**Introduction to BIM and BIM Concepts**, What is BIM?; How can BIM be a part of the building design process?; BIM vs. 3D CAD; Evolution and development of BIM & object-based parametric modeling; BIM platforms	9
III	**Autodesk Revit**- Mass and concept modeling, Detailed modeling, Creating, importing and modifying families of objects and elements, Architecture, MEP and Structural applications, Creating plans, sections, details, schedules, cover page	9
IV	**Miscellaneous Applications of BIM** : Cost Estimating	9
V	**Miscellaneous Applications of BIM** : Energy Modeling; Conflicts/Interference checking	9

Text Book:

TB 1: *BIM Handbook: A guide to building information modeling for owners, (2008), John Wiley & Sons.*
TB 2: *Revit 2016 (help: http://help.autodesk.com/view/RVT/2016/ENU/)*
TB 3: *Building Information Modeling: Technology Foundations and Industry Practice, (2018), Borrmann; Konig; Koch; Beetz.*

References:

Ref 1: *BIM Handbook: A Guide to Building Information Eastman, (2011), C.; Teicholz, P.; Sacks, R.; Liston, K. Modeling for Owners, Managers, Designers, Engineers and Contractors. New York: Wiley. 626 pp.*
Ref 2: *ISO 19650-1, ISO 19650-2 (Organization and digitization of information about buildings and civil engineering works, including BIM).*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in Construction Management)

Semester:	Credits (C)	Course Tittle:	Building Information Modeling (BIM) using Autodesk Revit Laboratory	Course ID :		PCE 539	
05	01			Contact Hrs :		L T	P
Course Components:		DSC		2		0 0	2
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	0	2	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Computer Aided Civil Engineering Drawing						

Course Outcomes

CO 1: ***Understand*** *basic conceps of BIM and Autodesk Revit*
CO 2: ***Prepare*** *drawings with details like levels, walls with elements, etc.*
CO 3: ***Produce*** *drawings with various views and details of various components like floors, stairs, ramps, etc.*
CO 4: ***Create*** *construction douments with working schedules*

UNIT	SYLLABUS	Hrs
I	Introduction to BIM and Autodesk Revit, Basic Sketching and Modify Tools Setting Up Levels and Grids.	9
II	Modeling Walls, Working with Doors and Windows Working with Curtain Walls	9
III	Working with Views Adding Components, Modeling Floors, Ceilings and roofs	9
IV	Modeling Stairs, Railings, and Ramps Creating Construction Documents, Annotating Construction Documents- Working with Dimensions, Working With Text, Adding Detail Lines and Symbols	9
V	Adding Tags and Schedules: Adding Tags, Adding Rooms and Room Tags and Working with Schedules Creating Details: Setting Up Detail Views Adding Detail Components, Annotating Details, Keynoting and Keynote Legends	9

Text Book:

TB 1: *BIM Handbook: A guide to building information modeling for owners, (2008), John Wiley & Sons.*

References:

Ref 1: *Revit 2016 (help: http://help.autodesk.com/view/RVT/2016/ENU/)*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in GIS & RS)

Semester:	Credits (C)	Course Tittle:	Advance Geographical Information systems	Course ID :		TCE 599	
05	03			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory / Practical		CIA	MSE	ESE	Total
		03 / 0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Fundamentals of GIS					

Course Outcomes

CO 1: *Manipulate and transform spatial data.*
CO 2: *Analyze spatial and non-spatial data analysis.*
CO 3: *Demonstrate spatial modeling and various other models*
CO 4: *Impliment data quality in GIS and error propagation.*
CO 5: *Illustrate the recent trends in GIS*

UNIT	SYLLABUS	Hrs
I	Spatial Data Manipulation and Transformation: Line intersections, Point in line, Point in segment, Point in polygon, line intersection with polygons, Union and Intersections of Polygons, shape measures of polygons, buffer zones,Data Transformation,Change in Dimensionality, Change in position,Rubber Sheeting, Tin Sheeting,Vector to Raster, Raster to Vector Conversion	9
II	Spatial and Non, Spatial Data Analysis, Raster and Vector: Display of raster data ,Local operators ,recoding, overlaying–Local Neighborhood operators, Filtering, Slopes and Aspects, Extended Neighborhood operators–Distance, Buffer zones, Visible area or Viewshed –Zonal operations–Zone identification, Zone area, Zone Perimeter, Distance from Zone boundary –Vector data–Polygon overlay, polygon statistics, Network Analysis, Non spatial data analysis, Structured Query Language.	9
III	Spatial Modeling: Modeling,Definition,Spatial Modeling,External Model, Conceptual Model, Logical Model, Internal Model,GIS applications in Resource Management, AM / FM studies.	9
IV	Data Quality and Error Data Propagation in GIS: Data Quality–Accuracy –Spatial Accuracy, Temporal Accuracy, Thematic Accuracy– Resolution –Spatial resolution, thematic Resolution, Temporal resolution–Consistency– Completeness– Data Quality in Spatial Data Transfer Standards– Lineage, Positional, Attribute accuracy, Logical Consistency, Completeness–Error Propagation.	9
V	Multi Criteria Evaluation in GIS, Data capture using GPS for GIS FM studies, Object Oriented Database Models. Recent trends in GIS.	9

Text Book:

TB 1: *Principles of Geographical Information System for Land Resources Assessment, (1998), P.A.Burrough, , Oxford ; New York : Oxford University Press.*
TB 2: *Geographical Information Systems, Volume I and II, John Wiley and Sons, Inc., (1999).Paul A Longley, Michael F Goodchild, David J Maguire, David W Rhind,*

References:

Ref 1: *Geographic informa tion systems: an introduction, (1990), L. Star, and J.E.Estes, , Englewood Cliffs, NJ: Prentice-Hall.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Water and Wastewater Engineering	Course ID:		TCE 601	
06	3			Contact Hrs:		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory / Practical		CIA	MSE	ESE	Total
		3 / 0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Fluid mechanics and Hydrology and Irrigation					

Course Outcomes

CO 1: ***Understand*** *the way to calculate water demand, population forecasting and discharge*
CO 2: ***Analyse*** *physical and chemical properties of water and wastewater samples*
CO 3: ***Appraise*** *the appropriate technique for the treatment of water and wastewater*
CO 4: ***Sketch*** *the different components of sewerage system for a given area/ city*
CO 5: ***Describe*** *the different disposal methods of sewage and sludge disposal*

UNIT	SYLLABUS	Hrs
I	**Introduction**: Necessity of protected water supply and sanitation, Water demand and per capita consumption, factors affecting population forecasts. Water Supply: Sources of water and quality parameters, standards of potable water, infiltration pipes & galleries, intake structures pipes, joints, valves & pumps. Water distribution systems.	9
II	**Treatment of Water**: Clarification sedimentation –Principles. Design of sedimentation tanks, coagulation and flocculation, design of a clariflocculator. Filtration – Types of filters and filter media. Design principles of slow and rapid sand filters. Backwash mechanisms. Pressure filters. Disinfections – Necessity and methods, Chlorination of water supplied, action of chlorine, break point chlorination. Ozone and U-V radiations, Removal of hardness, tastes & odor control.	9
III	**Domestic Sewage**: Quantity estimation, quality parameters – BOD, COD and TOC. Sewerage systems, ultimate disposal of sewage, Land and water bodies, Sewage conveyance – Sewer types and appurtenances, Velocity in sewers, Design of a simple sewerage system. Storm water sewers – Storm water estimation by rational method.	9
IV	**Waste Water Treatment:** Preliminary treatment, screens, grit chambers. Primary treatment – Sedimentation – rectangular and circular sedimentation tanks, Secondary treatment – sewage filtration – trickling design. Activated sludge process – design parameters, secondary clarifier. Design aspects of a sewage treatment facility.	9
V	**Sludge Disposal**: Sludge digestion and disposal methods – Standards for Disposal, Methods dilution Self-purification of surface water bodies. Oxygen sag curve Land disposal Sewage farming, Deep well injection Soil dispersion system - Sludge characterization and Thickening Sludge digestion.	9

Text Book:

TB 1: *Water Supply Engineering Garg S. K., 37 th Edition (2024), Khanna Publishers, New Delhi.*
TB 2: *Environmental Engineering Vol. II Garg, S.K, 43 Edition (2024) Khanna Publishers, New Delhi.*
TB 3: *Water Supply & Sanitary Engineering Birdi J. S. and Birdi G. S., DhanpatRai (2010), Pub. Company, 8th edition, New Delhi.*
TB 4: *Environmental Engineering Peavy and Rowe, (2017), McGraw Hill Publications .*

References:

Ref 1: *Environmental Engineering, Stern, Vol. I to IV, (2017), McGraw Hill Publications.*
Ref 2: *Wastewater Engg; Treatment, Disposal Reuse, Metcalf & Eddy, (2002), Tata McGraw-Hill Publishing Company Limited, New Delhi.*
Ref 3: *Wastewater Engineering, White. J.B., 2 nd Edition, (1978), Edward Arnold. London .*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Advance Reinforced Cement Concrete Design		Course ID :		TCE 602	
06	3				Contact Hrs :	L	T	P
Course Components:		DSC			3	2	1	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Reinforced Cement Concrete Design.						

Course Outcomes

CO 1: ***Demonstrate*** *analysis of continuous beams, circular beams and frames.*
CO 2: ***Understand*** *the Earthquake/Wind Resistant reinforced concrete design aspects in compliance with IS codes.*
CO 3: ***Demonstrate*** *staircase design principles of straight flight staircase.*
CO 4: ***Analyze*** *a water tank as per design principles.*
CO 5: ***Investigate*** *a suitable retaining wall as per design principles.*

UNIT	SYLLABUS	Hrs
I	Overview of Continuous Beam Systems, Real-World Examples of Continuous R.C. Beam Design, Design Challenges and Analytical applications. Concept of Moment Redistribution, Analysis and Design of Continuous Beams with Redistribution. Bending, Torsional Behavior and Analysis of Circular Beams. Design Principles for Circular Beams, Design Considerations for Torsion Resistance.	9
II	Introduction to Seismic Analysis, Seismic Hazard Assessment, Response Spectrum Analysis, Seismic Design Concepts of RCC Buildings as per Design Code IS 1893. Wind Load Estimation, Wind Force Distribution, Wind-Resistant Design of RCC Buildings, and Practical Applications as per Wind Analysis and Design code IS 875. Reinforced Concrete Design Principles for Earthquake Resistance as per IS 456 and IS 13920. Seismic Detailing Requirements, Ductility and Overstrength Considerations, Special Detailing for Earthquake-Prone Zones.	9
III	Importance of staircase design in architecture and construction, Overview of different types of staircases. Structural and ergonomic considerations for safe and efficient staircases. Balustrades, handrails, and balusters specific to staircase design. Analysis and design of Straight Flight staircase slabs and beams for various load conditions. Structural integrity, reinforcement, and support systems. Design of individual steps, including riser and tread dimensions, Safety features and compliance with codes.	9
IV	Types and Purposes of Tanks, Design Considerations for Water Storage, Safety and Environmental Aspects. Design of Underground Rectangular Tanks. Site Selection and Soil Investigation, Structural Design of Tank Walls and Base Slab, Waterproofing and Corrosion Protection. Design of Circular Overhead Tanks: Design of Tank Shell and Roof, Staging Systems and Supports. Design Aspects of Intze Tanks.	9
V	Overview of retaining walls and their importance in civil engineering. Cantilever and Counterfort retaining walls. Fundamentals of structural mechanics related to retaining wall design, Load analysis, stability, and safety considerations. Design and construction principles specific to cantilever retaining walls, Factors influencing the design, including soil properties and wall height. Design and construction principles specific to counterfort retaining walls, Comparative analysis with cantilever walls and when to use each type. Construction methods, including reinforcement and drainage systems. Real-world case studies of successful and failed retaining wall projects.	9

Text Book:

TB 1: *Reinforced Concrete Design S. Unnikrishnan Pillai & D. Menon, (2021), Tata Mc-Graw Hill Book Publishing Company Limited, New Delhi.*
TB 2: *Plain and Reinforced Concrete O. P. Jain & Jai Krishna, Vol. I & II Nem, (2008), Chand & Bros.*
TB 3: *Reinforced Concrete – Limit State Design A. K. Jain, (2012), Nem Chand & Bros., Roorkee.*

References:

Ref 1: *Reinforced Concrete Structures R. Park and Pauley, 1st edition (1978), John Wiley & Sons Inc.*

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-2025 **DEPARTMENT OF CIVIL ENGINEERING** **Program: BTCE**

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Construction Planning and Management	Course ID :		TCE 603	
06	3			Contact Hrs :		L T P	
Course Components:		DSC		3		2 1 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		No Pre-Requisite required					

Course Outcomes

CO 1: ***Understand*** *the fundamental principles of construction planning and management.*
CO 2: ***Prepare*** *a schedule of construction planning and management to a construction project.*
CO 3: ***Evaluate*** *cost and time plan for construction projects.*
CO 4: ***Employ*** *a satisfactory contract management plan for construction projects.*
CO 5: ***Understand*** *the documentation and safety aspects of project Work.*

UNIT	SYLLABUS	Hrs
I	Introduction to Construction Planning and Management- Fundamental principles of construction planning and management. Importance of construction planning and management, Stages and steps involved in project planning, objectives of construction project management. different phases of a construction project, different roles and responsibilities of construction professional's significance and impact of management principles on the success of construction projects. Financial Evaluation of Projects and Project Planning: Capital investment proposals, criterions to judge the worth whileness of capital projects viz. net present value, benefit cost ratio, internal rate of return, Risk cost management, main causes of project failure.	9
II	Construction Scheduling - Importance of project scheduling, scheduling techniques and tools used in construction project, determining activities involved, work breakdown structure, assessing activity duration, duration estimate procedure, Project work scheduling, Project management techniques – CPM and PERT, networks analysis, concept of precedence network analysis.	9
III	Project cost and time control- The Time Progress And Cost Controlling Measures In A Construction Project, Time Cost Trade-Off Process: Direct And Indirect Project Costs, Cost Slope, Process Of Crashing Of Activities, Determination Of The Optimum Duration Of A Project, Updating Of Project Networks, Resources Allocation.	9
IV	Contract Management: Elements of tender operation, Types of tenders and contracts, Contract document, Legal aspects of contracts, Contract negotiation & award of work, breach of contract, determination of a contract, arbitration. Management Information System – Concept, frame work, benefits of computerized information System (PMIS)	9
V	Safety and Other Aspects of Construction Management- Causes and prevention of accidents at construction sites, Safety measures to be followed in various construction works like excavation, demolition of structures, explosive handling, hot bitumen work. Project Environmental and social aspects of various types of construction projects.	9

Text Book:

TB 1: *Construction Project Management, K.K. Chitkara*, (2010), McGraw Hill Education.
TB 2: *Project Management with CPM /PERT, B.C. Punmia,, (2023), Laxmi Publication (P) Ltd*

References:

Ref 1: *Construction Management: Subcontractor Scopes of Work, Jason G Smith* (2009), CRC Press.
Ref 2: *Project Management by Modder & Phillph, (2011),PHI Learning Pvt. Ltd.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Estimation and Costing		Course ID :		TCE 604	
06	3				Contact Hrs :	L	T	P
Course Components:		DSC			3	2	1	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	No Pre-Requisite required							

Course Outcomes

CO 1: ***Understand*** *general terms of estimates and reports.*
CO 2: ***Acquire*** *knowledge of rate analysis .*
CO 3: ***Prepare*** *detailed estimates for civil engineering works.*
CO 4: ***Determine*** *cost of work considering influential factor.*
CO 5: ***Perform*** *valuation of items to evaluate the cost of property and rent fixation.*

UNIT	SYLLABUS	Hrs
I	Introduction: Introduction to estimate ,Objects & general principles for estimating &costing ,types of estimate in civil engineering works, General considerations for preparing report. Purpose and importance of estimates, principles of estimating. Various items of work in building construction. General considerations for preparing report. Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities..	9
II	Rate Analysis: Concepts of rate analysis. Requirements of an item for analysis of rate , Data analysis of rates for various items of works .Task for average artisan (task of labour as per N.B.O.), various factors involved in the rate of an item, material and labor requirement for various trades. preparation for rates of important items of work. Current schedule of rates. (C.S.R.)	9
III	Estimates: Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roadwork for level . Use of L-section & cross-section for earthwork. Cocept of MS Project in estimation.	9
IV	Specification and Cost of Works: Specification, types of specification Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building Muster Roll Form,Peace work agreement ,Measurement book, earnest money, security money & measurement book. General discussion of a works department	9
V	Valuation: Purposes, depreciation, Annuity capitalized value ,sinking fund, scrap value, Market value, Book value year's purchase, gross and net income, dual rate interest, Methods of calculating depreciation, rent fixation of buildings. Introduction to GST in India, relevant to construction industry.	9

Text Book:

TB 1: *Estimating and Costing in Civil Engineering, Theory and Practice B.N. Dutta, (2020), Publishers & Distributors Pvt Ltd.*
TB 2: *Costing & Specifications in Civil Engineering, M. Chakroborti, Estimating, (2007*), Chakraborti.
TB 3: *S. C. Rangawala - Valuation of Real Properties, (2024), Charotar Publishing House.*
TB 4:

References:

Ref 1: *Construction project management, K. K. Chitkara, (2010),Tata Mc Graw –Hill.*

Graphic Era HILL UNIVERSITY	BOS: 2024-2025 DEPARTMENT OF CIVIL ENGINEERING Program: BTCE

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Mini Project (Survey Camp)	Course ID :		MCE 601	
06	01			Contact Hrs :		L / T / P	
Course Components:		PROJ		2		0 / 0 / 1	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		0	1	25	25	50	100
Pre-Requisite		Geomatic Engineering.					

Course Outcomes

CO 1: Understand the basic fundamentals of plane table surveying
CO 2: Conduct reconnaissance and to adopt an appropriate methodology for surveying an area
CO 3: Carry out necessary field measurements and calculations.
CO 4: Establish control points and plot the details on a drawing sheet by plane table survey.
CO 5: Prepare the final maps for future reference.

UNIT	SYLLABUS	Hrs
I	Introduction	9
II	(i) Triangulation - 1 day (ii) Trilateration - 1 day	9
III	(iii) GPS observation to determine latitude, longitude and azimuth – 1-2 days (iv) Plotting the details by plane table survey - 1-2 days	9
IV	PREPARATION OF TOPOGRAPHIC MAP: - 2 days Reconnaissance, establishment of control points, computation/determination of coordinates of stations, surveying the details using total station, data transfer and map compilation using appropriate software.	9
V	Area selected should be such that important features such as agriculture land, orchards, roads, water bodies etc. exist. Students shall submit a map (with appropriate symbols and colours) of the area showing topographic features.	9

Text Book:

TB 1: Punmia, B.C., “Surveying”, Vol. I &II, Laxmi Publications New Delhi

References:

Ref 1: Agor, R. “Surveying”, Vol. I&II, Khanna Publications, Delhi
Ref 2: Arora, K.R., “surveying” , Vol. I & II, Standard Book House, Delhi

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-2025 DEPARTMENT OF CIVIL ENGINEERING Program: BTCE

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Career Skills-IV	Course ID :		XCS 601	
06	02			Contact Hrs :		L	T	P
Course Components:		SEC		2		2	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		2	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Career Skills-III					

Course Outcomes

CO 1: ***Understand the conceptual difference between Combination and Permutation and logically solve the different questions asked on these topics and also on Probability***

CO 2: ***Apply the quantitative skills learnt on various types of problems of Profit, Loss and Discounts also enhance the skill set of mathematical simplifications and Arithmetic Reasoning and solve various data sufficiency problems.***

CO 3: ***Apply the intricacies of verbal communication to augment comprehension***

UNIT	SYLLABUS	Hrs
I	Concept, understanding and practice of questions based on permutation and combination, difference in the approach for different things and identical things. Concept, understanding and practice of questions based on probability	08
II	Concept of profit, loss and discount and its application. Understanding and practice of questions based on addition of impurity and unequal quantity buying and selling concept Simplifications and Arithmetical Reasoning and practice of various types of questions Data Sufficiency with problems of all the Quantitative Aptitude topics in detail.	09
III	Applied grammar/Error Detection and Usage a. Frequently committed grammar errors b. Practice of advanced level placement-oriented questions based on Tenses, Pronoun and Antecedents, SVA, Parallelism, Conditionals and comparison-based errors. c. Application of vocabulary (Pure and Contextual) (Note: Inclusion of all types of questions based on vocabulary based on synonyms, antonyms, root words, usage of idioms and phrases etc. in pure and contextual forms) Verbal Ability: Reading Comprehension Practice to advanced level Reading Comprehension with respect to: a. Central Idea b. Tone c. Types of Passages (Descriptive, Narrative etc.) d. Drawing Inference e. Drawing Conclusions	13

Text Book:

TB 1: *Quantitative Aptitude, Theory and Practice Rawat and Rawa, (2016), Savera, India*

TB 2: *Verbal Ability and Reading Comprehension for CAT, Nishit K. Sinha, (2024*), Pearson Education, India

References:

Ref 1: *Quantitative Aptitude for CAT, Nishit K. Sinha, fifth edition, (2022), Pearson Education, India.*

Ref 2: *Quantum CAT, S.K.Verma, Fourteenth edition, (2024), ARIHANT PUBLICATIONS INDIA PRIVATE LIMITED*

Ref 3: *Wiley Quantitative Aptitude, P.A.Anand, first edition, (2015), Wiley.*

Ref 4: *Verbal Ability and Reading Comprehension for CAT, Capt. AK Kalia (Retd), first edition, (2020), Wiley.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Rivers and Civilization	Course ID :		VAC 601	
06	00			Contact Hrs :		L	T	P
Course Components:		VAC		2		2	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		2	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Applied Sciences					

Course Outcomes

CO 1: Understand the role of rivers in civilization
CO 2: Note the developments of early riverside civilization.
CO 3: Understand the river role in development of a kingdom.
CO 4 Understand the Indian scenario of river civilization
CO 5 Understand the world most populated country's scenario.

UNIT	SYLLABUS	Hrs
I	**Rise of early river valley civilizations:** Development of early river civilizations, characteristics of early river valley civilizations, Farming and construction methods	06
II	**Mesopotamia, the cradle of civilization:** Tigris and Euphrates rivers, Neolithic Revolution-12000 BCE, Sumerian, Assyrian, Akkadian, and Babylonian civilizations, use of technology, literature, legal codes, philosophy, religion, and architecture in these societies.	06
III	**Ancient Egypt, the gift of Nile:** Early Egypt, Old Kingdom Egypt: 2686-2181 BCE, Middle Kingdom: 2000-1700 BCE, New Kingdom: 1550-1077 BCE, Third Intermediate Period: 1069-664 BCE, Flooding of Nile, Construction of Pyramids and tunnels.	06
IV	**Indus valley, the cradle of Indian civilization:** Harappan civilization, Discovery and history of excavation, Pre-Harappan era- Mehargarh, Trade and transportation practices, Aryan invasion.	06
V	**Yellow river, the cradle of Chinese civilization:** Development of Yellow River Civilization, Neolithic Yellow River Civilization (6000–800 BC), Bronze Age Yellow River Civilization, Feudal Age China and construction practices	06

Text Book:

TB 1: Cotterell, A. (Ed.). (1980). The encyclopedia of ancient civilizations (p. 14). Mayflower Books.
TB 2: Manik, S. Decline of Indus Civilization and Vedic Upheaval.
TB 3: Johnson, P. (1999). The civilization of ancient Egypt. HarperCollins.

References:

Ref 1: Rector, R. K. (2016). *The Early River Valley Civilizations*. The Rosen Publishing Group, Inc.
Ref 2: Chang, K. C. (1986). The archaeology of ancient China. Yale University Press.

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Finite element Methods (FEM) in Civil Engineering	Course ID :		TCE 611	
06	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	25	25	50	100
Pre-Requisite		Advance Structural Analysis.					

Course Outcomes

CO 1: ***Understand*** *General Description and Steps in Finite Element Method.*
CO 2: ***Demonstrate*** *concept of element definition and stiffness matrix for 1D and 2D element (bar and Truss elements).*
CO 3: ***Derive*** *shape Functions for one dimensional and 2 dimensional elements.*
CO 4: ***Determine*** *stiffness Matrix and Nodal Force Vector for two and three noded beam and frame element.*
CO 5: ***Choose*** *a suitable Finite Element Modeling Technique for a simple civil structure.*

UNIT	SYLLABUS	Hrs
I	General Description and Steps in Finite Element Method, Matrix Displacement Method vs. Finite Element Method, Applications of FEM, Element characteristics – Principle of Minimum Potential Engergy (strain Energy and Work done by External Forces)	9
II	Element Definition, Stiffness Matrix and Load Vector for an Element, (Principle of Minimum Potential Energy and Principle of Virtual Work) Stiffness Matrix for Two nodded bar element, Equivalent nodal Force vector, Analysis of Trusses – Global and Local coordinate system, Transformation or Rotation Matrix, Force in Member	9
III	**2-Dimensional Problems:** – plane stress and Plane strain problems, Constant Strain Triangle (CST) – stiffness matrix and Equivalent Nodal Force Vector, Shape Function – for one dimensional element (cartesian coordinate and Natural coordinate), Shape Functions – for 2D elements (rectangular and triangular element)	9
IV	Beam and Frame Problems – Two nodded beam element (stiffness matrix and Nodal force vector), Three nodded beam element (stiffness matrix and Nodal force vector), Analysis of Frames – stiffness matrix for plane frame member	9
V	Modeling Techniques, guidelines for discretization (Meshing), Mesh Density, Element Distortion, Location of nodes / Joints, Modeling of offsets, Structure of a finite element program, Computer program, educational program and Commercial Program	9

Text Book:

TB 1: *Introduction to Finite Element Method, P N Godbole, (2016), IK International Publishing House Pvt. Ltd.*
TB 2: *Finite Element Analysis in Engineering Design, S. Rajasekaran, (2013), Chand & Company Pvt. Ltd.*
TB 3: *Finite Element Analysis by S. S. Bhavikatti, (2005), New Age International.*

References:

Ref 1: *Finite Elements in Civil Engineering Applications, Justin Beil, (2023), Willford Press.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Geotechnical Earthquake Engineering		Course ID :		TCE 612	
06	3				Contact Hrs :		L / T	P
Course Components:		DSE			3		2 / 1	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Geotechnical and Foundation Engineering.							

Course Outcomes

CO 1: ***Understand*** *seismic hazard analysis and strong ground motion parameters and their estimation*
CO 2: ***Apply*** *concept of wave propagation in unbound and semi,infinite body, layered body and dynamic soil properties*
CO 3: ***Analyze*** *one dimensional and Two dimensional ground response for solving soil –structure interaction*
CO 4: ***Evaluate*** *liquefaction pheenomenon and it impact as well as mitigation measures*
CO 5: ***Create*** *concept of seismic slope stability and seismic design of retaining walls*

UNIT	SYLLABUS	Hrs
I	Seismic Hazards and Mitigation, Significant Historical earthquakes; seismology and earthquakes – internal structure of earth, Continental drift and plate tectonics, Faults, Sources of seismic activity, Locaton and size of earthquakes, Strong ground motion parameters and their measurements, Deterministic seismic hazard analysis,	9
II	Wave propagation in unbound media, Waves in semi,infinite body, Waves in layered body, Attenuation of stress waves – Material damping and radiation damping, Dynamic soil properties and its measurement through field and laboratory tests, stress,strain behaviour of cyclically loaded soils	9
III	Ground Response Analysis – one dimensional and two dimensional, Soil,structure interaction; Local site effects and design of ground motions, Design parameters, Ground motion time history	9
IV	Liquefaction – Flow liquefaction and cyclic mobility, Liquefaction hazards, Liquefaction susceptibility, initiation of liquefaction, effect of liquefaction, liquefaction mitigation approach	9
V	Seismic Slope stability analysis – types of earthquake induced landslides, evaluation of slope stability – limit equilibrium analysis; Seismic Design of Retaining wall, seismic pressure on retaining wall, Seismic design considerations	9

Text Book:

TB 1: *Geotechnical Earthquake Engineerin, Steven L. Kramer (1996) Pearson Education.*
TB 2: *Soil Dynamics and Liquefaction, A.S. Cakma, (2014) Elsevier Science.*
TB 3: *Earthquake Geotechnical Engineering Design, Claudio Soccodato, (2014) Springer.*
TB 4:

References:

Ref 1: *Geotechnical Earthquake Engineering Handbook, Robert Day, (2001), McGraw-Hill Education.*
Ref 2: *Developments in Earthquake Geotechnics, Susumu Iai, (2017), Springer International Publishing.*
Ref 3:

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Design of Hydraulic Structures	Course ID :		TCE 613	
06	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Hydrology and Irrigation and Hydraulics and Hydraulic Machines						

Course Outcomes

CO 1: ***Perform*** *the stability analysis of gravity dams.*
CO 2: ***Illustrate*** *earth dam components and design aspects.*
CO 3: ***Compare*** *various types of spillways and their suitability..*
CO 4: ***Distinguish*** *the component parts of a storage and diversion head works.*
CO 5: ***Identify*** *River training works, Navigation and water logging problems.*

UNIT	SYLLABUS	Hrs
I	**Dams:** introduction, necessity and types of dams. Selection of site and types for dams,. Masonry & concrete dams, forces acting on dams. Design criteria. Theoretical and practical profile of high and low dam. Stability calculations, openings in masonry & concrete dams, methods of construction, joints in dams.	9
II	Earth dam, components and their functions, check list for design, failure of earth dam and its design criterea, control of seepage through earth dam and foundation ,stability of slopes. Slip circle methods, filters in earth dam and their design. Drainage of earth dam. Construction of earth dam. Introduction to Arch dam, thin cylinder theory method.	9
III	Spillway, necessity & function components of spillway, different types of spillways i.e. ogee, chute side channel siphon, shaft factors affecting choice of type of spillway, Elementary hydraulic design for ogee spillway, Energy dissipation below spillway, Jump height curve & tail water rating curve, types of energy dissipation arrangements & factors affecting their selection. Gates for spillway.	9
IV	**Diversion works:** Definition, Layout, components and their functions, Design of impermeable floors – Bligh's Methods and Khosla's theory, Slit control works – silt ejectors and silt excluder	9
V	River & river training works, characteristics of alluvial rivers. River training works purpose different types, advantages & disadvantages, River navigation. Water logging and drainage causes, effects Preventive & curative measures Alkaline soils. Soil efflorescence. Drainage arrangements.Tile drains and its spacing.	9

Text Book:

TB 1: *Irrigation Engineering, Bharat Singh, (2005), Nem Chand.*
TB 2: *Irrigation Engineering, S.K. Garg, (2023), Khanna Publishers.*
TB 3: *Irrigation Engineering, P.N.Modi, (2020), Standard Book House.*
TB 4: *Irrigation Engineerin, B.C. Punmia, (2021), Laxmi Publications.*

References:

Ref 1: *Water Resources Engg, Larry W. Mays, (2010), John Wiley India.*
Ref 2: *Water Resources Engg, Wurbs and James, John (2011), Wiley India.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Watershed Management	Course ID :		TCE 621	
06	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Hydraulics and Hydraulic Machines						

Course Outcomes

CO 1: *Understand the characteristics of watershed, watershed development problems, soil characteristics and land use practices and socio, economic factors.*

CO 2: *Understand the concept, objective, factor effecting in watershed planning and hydrological data also prioritization of watershed.*

CO 3: *Describes the rain water conservation technologies, and understand the integrated watershed management.*

CO 4: *Analyze the effect on watershed hydrology, and understand the watershed programme.*

CO 5: *Remember and understand the Participatory watershed management, and formulation of project proposal for watershed management.*

UNIT	SYLLABUS	Hrs
I	Watershed, introduction and characteristics. Watershed development, problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio,economic factors.	9
II	Watershed management , concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds sediment yield index. Water budgeting in a watershed.	9
III	Management measures , rainwater conservation technologies , in,situ and ex,situ storage, water harvesting and recycling. Dry farming techniques , inter,terrace and inter,bund land management. Integrated watershed management , concept, components, arable lands , agriculture and horticulture, non,arable lands , forestry, fishery and animal husbandry.	9
IV	Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme , execution, follow,up practices, maintenance, monitoring and evaluation.	9
V	Participatory watershed management , role of watershed associations, user groups and self,help groups. Planning and formulation of project proposal for watershed management programme including cost,benefit analysis.	9

Text Book:

TB 1: *Hydrology and Soil Conservation Engineering: Including Watershed Management, Ghanshyam Das, ii[nd] Edition, (2008), Prentice-Hall of India Learning Pvt. Ltd., New Delhi.*

TB 2: *Watershed Management: Design and Practices Singh, P.K. (2000), E-media Publications, Udaipur .*

TB 3: *Fundamentals of Watershed Management Technology Singh, G.D. and T.C. Poonia (2003), Yash Publishing House, Bikaner.*

TB 4: *Hydrology and Soil Conservation Engineering: Including Watershed Management ,Ghanshyam Das, ii [nd] Edition, (2008), Prentice-Hall of India Learning Pvt. Ltd., New Delhi.*

References:

Ref 1: *Watershed Management Guidelines for Indian Conditions, E M Tideman , (1996), Omega Scientific Publishers, New Delhi.*

Ref 2: *Participatory Integrated Watershed Management: A Field Manual, Sharda, V.N., A.K. Sikka and G.P. Juyal, (2006), Central Soil and Water Conservation Research and Training Institute, Dehradun.*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Pre-Stressed Concrete		Course ID :		TCE 622	
06	3				Contact Hrs :	L	T	P
Course Components:		DSE			3	2	1	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Advance Reinforced Cement Concrete Design.						

Course Outcomes

CO 1: ***Understand*** *the principles and various concepts of prestressing.*
CO 2: ***Analyze*** *the flexural section for the resultant stresses considering the losses in prestressing.*
CO 3: ***Determine*** *the member parameters for flexure and deflection limits.*
CO 4: ***Examine*** *for a suitable flexural Prestressed member cross section for a given site situation.*
CO 5: ***Apply*** *knowledge of the design principles to symmetrical/Unsymmetrical cross sections.*

UNIT	SYLLABUS	Hrs
I	Basic Principles of Prestressing. High strength concrete and steel, Stress, Strain characteristics and properties. Comparitive understanding of RCC and PSC. Fundamentals of Prestressed concrete member analysis. Stress concept, Load balancing concept, Thrust line methods. Pretensioning and post tensioning systems, tensioning methods and end anchorages.	9
II	Analysis of Sections for Flexure. Losses of Prestress, Various losses encountered in pre,tensioning and post tensioning methods. Stresses in concrete due to pre,stress and loads, stresses in steel due to loads, Cable profiles.	9
III	Flexure , IS Code recommendations Ultimate flexural Strength of sections, Shear, IS Code recommendations, shear reinforcement. Limit state of serviceability , control of deflections and cracking. Deflection of a prestressed member , short term and long term deflections.	9
IV	Permissible stresses, design of prestressing force and eccentricity, limiting zone of pre,stressing cable profile. Graphical method to determine the preliminary section.	9
V	Design Principles of pre tensioned and post tensioned symmetrical and unsymmetrical sections.	9

Text Book:

TB 1: *Pre-stressed Concrete, N. Krishna Raju, (2010), Tata mc. Graw Publishers.*
TB 2: *Pre-stressed Concrete, P. Dayarathnam, (1996), Oxford and IBH Publishing Co.*
TB 3: *Pre-stressed Concrete, Rajagopalan, (2008), Narosa Publishing House.*

References:

Ref 1: *Fundamental of pre-stressed concrete, N.C. Sinha & S.K. Roy, (2011), S Chand Publishing.*
Ref 2:

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Rock mechanics and foundation on rocks			Course ID :			TCE 623
06	3					Contact Hrs :		L	T	P
Course Components:		DSE				3		2	1	0
Examination Duration (Hrs)		Theory	Practical			CIA	MSE	ESE		Total
		3	0	Weightage of Evaluation:		25	25	50		100
Pre-Requisite		Geotechnical and Foundation Engineering								

Course Outcomes

CO 1: ***Understand*** *the rock as geomaterial and its basic properties*
CO 2: ***Apply*** *rock mass classification system for assessing the strength, deformability etc.*
CO 3: ***Analyze*** *the stress and strain behaviour for assessing the insitu stresses and deformations*
CO 4: ***Evaluate*** *types of rock foundation and displacement and stress monitoring devices*
CO 5: ***Create*** *idea for assessing the bearing capacity, settlement of foundation on rocks for dams*

UNIT	SYLLABUS	Hrs
I	Rock as Geomaterial – Rock Types, Rock vs. Soil, Discontinuities in rocks – Fracture and Joints, Faults, Folds, Bedding Planes, Strike, Dip, Dip Direction, stereonets, Weight – Volume relationship , Phase Diagram, weight, volume relationship, porosity and grain density, Hydraulic conductivity and Permeability, Linear Flow, Radial Flow, Laboratory measurement of hydraulic conductivity	9
II	Rock Mass Classification – RQD, Rock Mass Rating, Rock Tunneling Quality Index (Q, index), Geological Strength Index (GSI), Coal Mine Roof Rating (CMRR), Application of Rock Mass Classification System – rock mass strength, Deformation Modulus, Stand up time, support selection	9
III	Analysis of stresses and strain, Mohr Circle of Stress, Analysis of strain, stress equilibrium equation, strain compatibility condition, stress – strain relationship, linear, non, linear, elasto, plastic behavior, Measurement of in situ stress, Displacement and Stress monitoring devices, stresses around underground opening	9
IV	Types of rock foundations – spread, socketed and tension; Performance of foundation on rocks – settlement and bearing capacity, block failure, geological structure influence, reinforcement, structural loads, allowable settlement, ground water effect on foundation performance, factor of safety and reliability	9
V	Bearing capacity, settlement and stress distribution, stability of foundation, Foundation of gravity and earth dams, foundation rehabilitation, grouting and drainage, construction methods – drilling, blasting and non, explosive explosions, contracts and specifications	9

Text Book:

TB 1: *Introduction to Rock Mechanics, Richard E. Goodman , (1988),* John Wiley & Sons Inc.
TB 2: *Engineering in Rocks for Slopes, Foundations and Tunnels, T. Ramamurthy, (2010), PHI Learning Private Limited.*
TB 3: *Fundamentals and Applications of Rock Mechanics, Deb Debasis, (2016), PHI Learning Pvt. Ltd.*
TB 4:

References:

Ref 1: *Engineering Rock Mechanics: An Introduction to the Principles by John A Hudson, John P Harrison, (2000), Elsevier.*
Ref 2: *Rock Mechanics- An Introduction by Nagaratnam Sivakugan, Sanjay Kumar Shukla, Braja M. Das, (2013), Taylor & Francis.*
Ref 3: *Foundations on Rock by Duncan C. Wyllie, (2003), CRC Press.*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in Construction Management)

Semester:	Credits (C)	Course Tittle:	Safety and Health in Construction	Course ID :		TCE 639	
06	3			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	25	25	50	100
Pre-Requisite		No pre-requisite required					

Course Outcomes

CO 1: ***Understand*** *the concept of Construction safety & Health*
CO 2: ***Discuss*** *the concept of regulations and codes pertaining to safety*
CO 3: ***Analyse*** *the safety provisions in typical civil structures*
CO 4: ***Describe*** *the Construction Safety Management*
CO 5: ***Characterize*** *the methods of Accident Prevention at sites*

UNIT	SYLLABUS	Hrs
I	**Introduction to Construction Safety And Safety Technology**--Introduction to construction safety; historical background and current perspective; Government's policy in industrial safety; safety & health legislation in India,	9
II	**Construction Sites (Safety) Regulations**; Codes of practice; Potential hazards/risks associated with construction sites and high risk activities such as the use of hoist, Working at height and working in confined space.	9
III	**Safety in typical civil structures** – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitations – Merits and demerits – Steel structures –Concrete structure.	9
IV	**Workplace ergonomics** including display screen equipment and manual handling, personal protective equipment, first aid and emergency preparedness, fire safety, electrical hazards.	9
V	**Construction Safety Management and Accident Prevention** Safety training; safety policy; safety committees; safety inspection; safety audit; reporting accidents and dangerous occurrences.Accident Prevention: Principles of accident prevention; job safety analysis; fault tree analysis; accident management	9

Text Book:

TB 1: *Accident Prevention Manual for Industrial Operations, (1974), National Safety Council, Chicago.*
TB 2: *Construction Safety, Security, and Loss Prevention, Fulman, J.B., (1984), John Wiley & Sons Inc.*

References:

Ref 1: *Construction Safety and Health (2nd ed) David L. Goetsch (2012), Pearson.*
Ref 2: *OSHA Standards (CFR 1926) at www.osha.gov/readingroom.html.*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in Construction Management)

Semester:	Credits (C)	Course Tittle:	Basics of Project Management and Primavera Laboratory		Course ID :		PCE 639	
06	1				Contact Hrs :		L / T	P
Course Components:		DSC			2		0 / 0	2
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		0	3	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Building Information Modeling						

Course Outcomes

CO 1: ***Understand*** *basic conceps of Project Managementa and Primavera*
CO 2: ***Analyse*** *the type of activites, critical path, etc in a network*
CO 3: ***Compute*** *the cost and resourses allocation in a project*
CO 4: ***Create*** *a construction project using Primavera*
CO 5: ***Understand*** *basic conceps of Project Managementa and Primavera*

UNIT	SYLLABUS	Hrs
I	Introduction to Project Management Body of Knowledge (PMBOK) and - Fundamentals of Project Management. Introduction to Primavera Systems and Oracle Primavera P6 PPM	9
II	An overview of Project Schedule Management, Organizational Breakdown Structure, Enterprise Project Structure and - Work Breakdown Structure. Understanding a Sample Project, Creating a New Project in Primavera P6, Project Window Options	9
III	Understanding Project Must Finish and Total Float, Role of Calendars in Scheduling, Project and Database Default Calendar and Creating WBS in Primavera P6. Understanding Percentage Complete Types, Adding Activities, Estimating Duration of Activities and Adding Relationships and Scheduling	9
IV	Formatting Bars, Columns and Timescale, Printing, Exporting and Importing & - Reporting in Primavera P6. Understanding and Adding Baseline, Updating a Project, Understanding Roles, Resources and Expenses and Adding Resources	9
V	Planning and Managing Projects with PRIMAVERA (P6) Project Planner by P. Vinayagam , A. Vimala	9

Text Book:

TB 1: *Planning and Managing Projects with PRIMAVERA (P6) Project Planner, P. Vinayagam , A. Vimala(2016), I K International Publishing House.*
TB 2: *Planning and Control Using Oracle Primavera P6 Versions 8 to 21 PPM Professional, Paul E Harris, (2022), Eastwood Harris Pty Ltd.*

References:

Ref 1: *Primavera P6 Professional Project Management: Release 19 [P6 R19], Dibyaranjan Maharana, (2020), (PMP).*
Ref 2: *Oracle Primavera P6 Course: Project Portfolio Management, (2018), NIBT Education.*

Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in GIS & RS)

Semester:	Credits (C)	Course Tittle:	RS & GIS for Hydrology and Water Resources	Course ID :		TCE 699	
06	3			Contact Hrs :		L / T / P	
Course Components:		DSC		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Advance Geographical Information systems					

Course Outcomes

CO 1: *Recall basic knowledge of hydrological Componants*
CO 2: *Understand GIS applications for watershed analysis*
CO 3: *Interpret the role of remote sensing & GIS for hydrological disaster*
CO 4: *Demonstrate the ground water resources mapping by remote sensing & GIS*
CO 5: *Demonstrate the surface water resources mapping by remote sensing & GIS*

UNIT	SYLLABUS	Hrs
I	Hydrological Componenets, Hydrological cycle, Estimation of various components of hydrological cycle, rainfall, runoff, evaporation, transpiration, evapotranspiration, crop evapotranspiration, depression and interception loss, infiltration and percolation losses.	9
II	Watershed Characters: Watershed, types, divide, catchment , command area, stream types, influent, effluent, ephemeral, non perennial. Drainage network, different pattern, morphometric analysis, linear, area, relief aspects. GIS applications for watershed analysis	9
III	Hydrological Stidies: Hydrological aspects, mapping and monitoring, management Mapping of snow covered area and glacial outburst, soil moisture estimation, Optical and microwave remote sensing techniques , drought zonations, Agricultural, meteorological and hydrological, flood mapping pre and post flood area estimation and control measures – GIS applications for hydrological disaster studies	9
IV	Ground Water Resources Applications: Types of Aquifers formations confined and unconfined aquifers Assessment of Groundwater potential zones and Groundwater mapping. Site selection for recharge structures, Hydrogeological Mapping GIS applications to ground water studies	9
V	Surface Water Resources Applications: Surface water bodies, lakes, reservoirs, ponds, rivers , channels ,mapping, change detection , Water harvesting structures, in,situ and Ex,situ , Mapping and monitoring of catchment and command area, Water logging and salt affected area mapping, Reservoir Sedimentation, sedimentation control. GIS applications to surface water studies.	9

Text Book:

TB 1: *Hydrology – Principles – Analysis – Design, Raghunath .H.M, (2006), New Age International Publishers, New Delhi.*
TB 2: *Remote sensing in water resources, Ramasamy .S.M, (2005), Rawat publications, New Delhi.*
TB 3: *Land and Water Management Engineering, Murty.V.V.N, (2002), Kalyani Publishers, New DelhI.*

References:

Ref 1: *Text Book on Remote Sensing in Natural Resources, Monitoring and Management, Agarwal C.S and Garg.P.K, (2010), Wheeler publishing Co & Ltd., New Delhi.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Highway and Airfield	Course ID :		TCE 701	
07	3			Contact Hrs :		L T	P
Course Components:		DSC		3		3 0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25 50	100
Pre-Requisite		Building Materials and Construction equipment					

Course Outcomes

CO 1: ***Discuss*** *the development and classification of roads.*
CO 2: ***Compute*** *the geometric design of highway.*
CO 3: ***Conduct*** *traffic studies to design traffic signals and intersections.*
CO 4: ***Design*** *the flexible and rigid pavement.*
CO 5: ***Examine*** *and plan of airport components.*

UNIT	SYLLABUS	Hrs
I	**Introduction:** Role of Transportation, Modes of Transportation, History of road development, Nagpur road plan, Bombay road plan & Three 20 Year Road Plan, Road types and pattern, classifications of roads, utility factor system, engineering survey for highway alignment.	9
II	Geometric Design of highway: cross sectional elements, horizontal alignment, vertical alignment, sight distances consideration ,super elevation, extra widening, transition curves	9
III	**Traffic Engineering:** Traffic characteristic, volume studies, speed study, capacity, density, traffic control devices, signs, signals, , Intersection at grade and grade separated intersections, Rotary intersection. **Highway Materials:** properties of subgrade and pavement component materials, Test on subgrade soil, Aggregates and Bituminous materials.	9
IV	**Design of Highway Pavement:** Types of Pavements, Design factors, Design of Flexible Pavement by CBR method (IRC: 37-2001), Design of rigid pavement, Westergaard's theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC: 58 - 2002).	9
V	**Airport Engineering:** Aircraft characteristics, types of airports, layout of airports, airport planning & design, runway orientation, wind-rose diagram, estimation of runway length & correction, Taxiway.	9

Text Book:

TB 1: *Highway Engineering, S. K. Khanna and C.E.G. Justo, 10 th Edition, (1990), Nem Chand & Bros, Roorkee.*
TB 2: *Transportation Engineering (Vol I & II), L. R. Kadiyali, (2019) Khanna Publishig.*
TB 3: *Principles of Pavement Design, E.J. Yoder and M.W. Witczak, (2011), Wiley India Pvt Ltd.*
TB 4: *Airport Planning and Design, S. K. Khanna, M. G. Arora and S. S. Jain,(1999), Nem Chand and Bros.*

References:

Ref 1: *Principles of Transportation Engineering". P. Chakraborty and A. Das, 2nd edition (2017), PHI Learning.*
Ref 2:
Ref 3:

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Industrial Summer Training	Course ID :		PCE 701	
07	2			Contact Hrs :		L / T / P	
Course Components:		PROJ		-		- / - / -	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		0	2	-	-	-	100
Pre-Requisite		No pre-requisite required					

Course Outcomes

CO 1: *Appreciate the practical implementation of concepts in industry*
CO 2: *Participate and Contribute hands on to a project/process.*
CO 3: *Develop ideas for future academic and career project selection.*
CO 4: *Improve the chances of employment through developed contacts and skill set.*
CO 5: *Consolidate and present self contribution in a practical work involved in.*

UNIT	SYLLABUS	Hrs
I	The Student has to submit a report on the Industrial Based Internship. And present a seminar to the panel of faculty.	9

Text Book:
TB 1: *NA*

References:
Ref 1: *NA*

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Major Project – I	Course ID :		CEP 701	
07	4			Contact Hrs :		L / T / P	
Course Components:		PROJ		2		- / - / 2	
Examination Duration (Hrs)		Theory / Practical		CIA	MSE	ESE	Total
		0 / 2	Weightage of Evaluation:	-	-	-	100
Pre-Requisite		Knowledge of basic civil engg. subjects					

Course Outcomes

CO 1: *Retrospect and set to direction of the project progress*
CO 2: *identify and search for Innovative solutions*
CO 3: *Presentation and Documentation tools usage*
CO 4: *Raise and identify the flaws in planning and execution of a project.*
CO 5: *Summarise the then stage of the project.*

UNIT	SYLLABUS	Hrs
I	The objective of the project work is to enable the students to work in convenient groups of not more than five/six members in a group on a project involving theoretical and experimental studies related to Civil Engineering. Every Project Work shall have a Guide who is a member of the faculty of Civil Engineering of the university where the student is registered. The hours allotted for this course shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work and also to present in periodical seminars the progress made in the project. Each student shall finally produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions. This experience of project work shall help the student in expanding his / her knowledge base and also provide opportunity to utilize the creative ability and inference capability.	-

Text Book:
TB 1: *NA*

References:
Ref 1: *NA*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Building planning and Vaastu	Course ID :		VAC 701	
07	0			Contact Hrs :		L / T / P	
Course Components:		GE		2		2 / 0 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	2	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	No pre-requisite required						

Course Outcomes

CO 1: ***Understand*** *the fundamental principles of Vastu Shastra*
CO 2: ***Discuss*** *the cultural and historical significance of Vastu Shastra.*
CO 3: ***Apply*** *the principles of Vastu Shastra in contemporary architectural design*
CO 4: ***Elaborate*** *the sustainability aspects of natural materials*
CO 5: ***Analyse*** *the potential environmental and energy benefits of using Vastu Shastra in green building*

UNIT	SYLLABUS	Hrs
I	**Introduction to Vastu Shastra** Introduction to Vastu, History of Vastu, Vedas and other ancient books, Growth of Vastu, Vastu and today, Scientific definition of Vastu, Solar Passage & Buildings referencing, Solar Energy, Humans & Buildings, Cosmic Energy & Flow. Concept of Vedic Vastu, Vastu Purush, Mandalas, Five Elements Theory, Planets & Directions.	5
II	**Planning as per Vastu** Direction and Corners, Eight directions, Importance of directions, Slope & Loading Pattern, Open space & balconies, Shapes, Vedic opinion on entries, Alternative opinion on entries, Main Door & Main Gate. Planning for Bedroom, Kitchen, Puja room, Bathroom, Children's room, Drawing Room, Living Room, Office Room.	5
III	**Land and Location as per Vastu:** Angles in a Plot & Building, Veedhi Shoola, Angles & Extensions, Shermukhi & Gaumkhi plot, Good & Bad Location. Selection of land & soil test, Examination of the land as per Mayamata & Brahit Samhita, Types of Land as per Vedic books, auspicious land &Inauspicious land, Obstructions.	5
IV	**Natural Materials and Sustainability** – Use of local materials, Energy efficiency, Relationship with nature Building with Natural, Non,Toxic Materials, Using the Latest Green Technologies Sustainable Technologies. Green Building: A science behind Vastu: Green Building concepts, Different ratings systems like LEED, GRIHA, IGBC, GEM, etc., Correlation between concepts of Vastu and Green Building	5
V	**Case Studies on the Practical Applications and Research Opportunities** Practical examples and case studies of real,world projects that have successfully combined Vastu principles with modern sustainability practices. Research on the benefits and limitations of applying Vastu principles in green building projects in the form of term projects, research papers, and field studies	5

Text Book:

TB 1: *Vastu Architecture: Design Theory and Application for Everyday Life, Michael Borden, (2012), Createspace Independent Pub.*
TB 2: *Applied Vastu Shastra in Modern Architecture, B.B. Puri, (2022), Motilal Banarsidass Publishing House, New Delhi.*
TB 3: *The spirit of Indian architecture: Vedantic Wisdoms of Architecture for Building Harmnious Space and Life, D. K. Bubbar, (2005), Rupa.*
TB 4:

References:

Ref 1: *Masterpieces of Traditional Indian Architectur, Satish Grover, (2009), Lustre.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Earthquake Resistant Design of Structures	Course ID :		TCE 711	
07	3			Contact Hrs :		L	T	P
Course Components:		DSE		3		2	1	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Advance Structural Analysis					

Course Outcomes

CO 1: ***Understand*** *SDOF systems and their equations of motion.*
CO 2: ***Elaborate*** *MDOF systems and their equations of motion.*
CO 3: ***Characterize*** *the basics of seismology.*
CO 4: ***Estimate*** *the response and design spectra for various Reinforced Concrete.*
CO 5: ***Apply*** *the IS codal provisions for design of Earthquake resistant Reinforced Concrete structures.*

UNIT	SYLLABUS	Hrs
I	**Theory Of Vibrations:** Concept of inertia and damping, Types of Damping, Difference between static forces and dynamic excitation, Degrees of freedom, SDOF idealization, Equations of motion of SDOF system for mass as well as base excitation, Free vibration of SDOF system, Response to harmonic excitation, impulse response	9
II	**Multiple Degree Of Freedom System:** Introduction to MDOF systems, Two degree of freedom system, Normal modes of vibration, Natural frequencies, Mode shapes, Decoupling of equations of motion, Concept of mode superposition (No derivations).	9
III	**Elements Of Seismology**: Causes of Earthquake, Geological faults, Tectonic plate theory, Elastic rebound, Epicentre, Hypocentre, Primary, shear and Raleigh waves, Seismogram, Magnitude and intensity of earthquakes, Magnitude and Intensity scales, Spectral Acceleration	9
IV	**Response Of Structures To Earthquake**: Response and design spectra, Design earthquake, concept of peak acceleration, Effect of soil properties and damping, Importance of ductility, Methods of introducing ductility into RC structures..	9
V	**Design Methodology:** IS 1893, IS 13920 and IS 4326, Code provisions, Design as per the codes, Calculation of base shear distribution to various floors, Base isolation techniques, Vibration control measures, Important points in mitigating effects of earthquake on structures.	9

Text Book:

TB 1: *Dynamics of Structures, Theory and Applications to Earthquake Engineering, 5th edition, Chopra, A.K (2019), Pearson Education.*
TB 2: *Earthquake resistance design, 5th edition, Agarwal Pankaj, (2011), PHI Publishers.*
TB 3:
TB 4:

References:

Ref 1: *Introduction to Structural Dynamics, Biggs, J.M, (1964), McGraw–Hill Book Co., N.Y., USA.*
Ref 2: *Earthquake Resistant Design, 2nd edition, Dowrick, D.J., John , (2009), Wiley & Sons, London.*
Ref 3: *Structural Dynamics, Theory & Computation, 2nd edition, Paz, M, (2004), CSB Publishers & Distributors, Shahdara, Delhi.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Bridge Engineering	Course ID :		TCE 712	
07	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Advance Structural Analysis						

Course Outcomes

CO 1: ***Enlist*** *design considerations of a bridge.*
CO 2: ***Demonstrate*** *the main components of slab bridges.*
CO 3: ***Demonstrate*** *the main components of other bridge types.*
CO 4: ***Understand*** *the terminology of cable bridges and construction methods*
CO 5: ***Discuss*** *the bridge bearings and substructure design aspects.*

UNIT	SYLLABUS	Hrs
I	**General Considerations:** Types of Bridges, Economic Spans, Aesthetics, Selection of suitable type of bridge. Design Loads and their Distribution: Design loads for highway and railway bridges.	9
II	**Slab Bridges:** Analysis of deck slabs using effective width method and Pigeaud's method, T-Beam Bridges Live Load distribution in multi,beam bridges by courbons method, henry jaega, morice, little method	9
III	**Design of Superstructure:** Design of balanced cantilever concrete bridge, Design of lattice grider railway bridges. Design priciples of arch bridge, prestressed concrete bridge, and box grider bridge.	9
IV	**Introduction to cable bridges**: Various types of bridge bearings and their design. & Terminology	9
V	**Introduction to Design of Substructure:** Introduction to Construction/Erection Methods. **Foundations and Bearings:** Types of bridge foundations and general design criteria, shallow foundations, deep foundations, piles, wells and pneumatic caissons, river training works. Bearings: functions and types of bearings, necessity of bearings, design of elastomeric bearings, expansion joints, necessity and types of expansion joints, design considerations.	9

Text Book:

TB 1: *Essential of Bridges, 6th edition, Victor, D.J, (2019), Oxford and IBH Publishing Co. Pvt. Ltd.*
TB 2: *Design of Bridges, 5th edition, Krishna Raju, N, (2019), Oxford and IBH Publishing Co. Pvt. Ltd .*
TB 3: *Bridge Engineering, 2nd edition, Ponnuswamy, S, (2008),Tata McGraw Hill Book Co. Ltd., New Delhi*
TB 4:

References:

Ref 1: *Concrete Bridge Practice, 2nd edition, Raina, V.K, (2018), Tata McGraw Hill Book Co. Ltd., New Delhi.*
Ref 2: *Bridge Deck Analysis, 1st edition, Pama, R.P and Cusens, A.R, (1975), John Wiley & Sons.*
Ref 3: *Essential of Bridge Engineering, 6th edition, Victor, D.J, (2019), Oxford & IBH Publishing Co., New Delhi.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Tunnel Engineering	Course ID :		TCE 713	
07	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		2 / 1 / 0	
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE	Total
	3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite	Advance Structural Analysis						

Course Outcomes

CO 1: ***Understand*** *the types and classification of tunnel with special emphasis on navigation tunnel*
CO 2: ***Apply*** *various concepts for the design of tunnel including design of tunnel lining*
CO 3: ***Analyze*** *survey requirements for fixing the tunnel alignment, on curves and transitions*
CO 4: ***Evaluate*** *tunneling operations in rocks, soft ground, soil through various techniques*
CO 5: ***Create*** *comprehensive approach for tunneling of metro tunnel work through TBM*

UNIT	SYLLABUS	Hrs
I	Tunnel classification and Types, Route Selection and Preliminary Investigation, Geological Investigation, Hydrological Investigation, Gases and Rock Temperature, Tunnel Requirements – operational requirements, structural requirements, construction and maintenance, Canal/ Navigation Tunnel and their additional requirements	9
II	Design of tunnels, alignment, gradient, curvature, cross-section determination, geometric shape of tunnel, Rock pressures, Design of Tunnel lining, Design of Box Tunnel, Circular Tunnel, Horse Shoe shape Tunnel	9
III	Survey and Setting out – setting out on surface, use of EDM, Levelling, Setting out inside the tunnel, Transfer of alignment below GI, Setting out curves – circular and transition curves,	9
IV	Tunneling Operations – Tunneling methodologies, Tunneling in rocks, Tunnel support, Tunneling in soft rocks and soil, soft ground tuneling – shield tunneling, freezing, chemical grouting, slung wall, cut and cover tunnel, shield tunneling, Drilling, Blasting and Mucking, case studies,	9
V	Metro Tunnels – Route Selection and construction methodology, alignment and track design, vertical profile, cover/ over burden, investigation, cut and cover construction, construction joints and Water proofing, Shield Tuneling and Tunnel Boring Machine (TBM), Ventilation, Lighting and Drainage, Instrumentation in Tunneling, Inspection and Maintenance	9

Text Book:

TB 1: *Harbour, Dock And Tunnel Engineering, R. Srinivasan, (2009) Charotar Publishing House Pvt.*
TB 2: *"Transportation Tunnels, S. Ponnuswamy, (2016.CRC Pres).*
TB 3: *Tunnelling in Weak Rocks, Bhawani Singh (2011), Elsevier Science.*
TB 4:

References:

Ref 1: *Tunnel Engineering Handbook by John O. Bickel,(2012), Springer US.*
Ref 2: *Handbook of Tunnel Engineering, Volumes I and II by Bernhard Maidl, Markus Thewes, Ulrich Maidl, (2014), Willey.*

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Bachelor of Technology (B.Tech.) in Civil Engineering (Specialization in Construction Management)

Semester:	Credits (C)	Course Tittle:	Total Quality Management(TQM) in Construction		Course ID :		TCE 739	
07	3				Contact Hrs :		L / T	P
Course Components:		DSC			3		2 / 1	0
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE	Total
		3	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Safety and Health in construction						

Course Outcomes

CO 1: ***Understand*** *the concept of quality in construction*
CO 2: ***Demonstrate*** *the tools of quality control*
CO 3: ***Expose*** *to the importarnce of training and development of Human Resources*
CO 4: ***Apply*** *the concpets of ISO standards on quality control*
CO 5: ***Establish*** *the concepts of six sigma*

UNIT	SYLLABUS	Hrs
I	**Concept of Quality**: Definition of quality as given by Deming, Juran, Crosby, difference between Quality control, Quality Assurance (QA/QC). Total quality control (TQC) and Total Quality Management (TQM), Need for TQM in construction industry. Organization necessary for implementation of quality, Quality manual-Contents, data required, preparation, responsibility matrix, monitoring for quality- PDCA Cycle. Quality aspects in every phase in the life cycle of Construction project.	9
II	**Quality Control tools and statistical quality Control:** (A) Histogram, Pareto diagram, Fishbone diagram, Quality control chart-Testing required for quality control of construction material used in RCC Work- destructive and Non destructive Test (NDT) (B) Statistical Quality Control- Necessity, Benchmarking, Application of dispersion methods in quality control of construction activity.	9
III	**Training and development of Human Resources:** Training needs assessment, technical and managerial competencies necessary for achieving quality, preparation for training. Training on Project Rework Reduction Tool (PRRT) software- training for preparation of checklist necessary for RCC work, for commonly used formats.	9
IV	**Development of quality circles**, quality inspection team, inspection reports, monitoring and control, 360‘ feedback for quality. Study of ISO 9004- Quality System Standards. Purpose of ISO Standards. Difference between ISO 9001 and ISO 9004.Certification process for ISO 9001. Certification bodies involved. Eight Principles of ISO-Basic meaning, applying these principles for an effective quality process in the organization. Management support and commitment necessary for achieving implementation for quality system standards.	9
V	**Achieving TQM on Construction Projects:** Advantages, barriers, principles, steps in implementation, seven types of construction defects. Determining cost of poor quality including hidden cost. Quality functions deployment (QFD). Importance of third party quality audits. CIDC- CQRA quality rating systems, customers satisfaction surveys, Non Conformity reports (NCR), remedial strategy for reducing NCR‘s. Six Sigma: Definition of six sigma, evolution – Historical aspects, probability distribution Six sigma ratings, Six sigma training, six sigma as an effective tool in TQM.	9

Text Book:

TB 1: *International Standards Organization – ISO 9001 and ISO 9004 .*
TB 2: *Mantri Handbook – A to Z of Construction, Sandeep Mantri, (2020), Satya Prakashan.*
TB 3:
TB 4:

References:

Ref 1: *Juran‘s Quality Handbook – Joseph M. Juran, A. Blanton. Godfrey, (1998), Mcgraw Hill International Edition.*
Ref 2: *Miller and Freund's - Probability and Statistics for Engineers, Richard J, (2011), Prentice Hall India Learning Private Limited.*
Ref 3:

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Bachelor of Technology (B.Tech) in Civil Engineering (Specialization in GIS & RS)

Semester:	Credits (C)	Course Tittle:	Remote Sensing and GIS in Environmental Science	Course ID :		TCE 799	
07	3			Contact Hrs :		L / T / P	
Course Components:		DSE		3		2 / 1 / 0	
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE	Total
		3	0	25	25	50	100
Pre-Requisite		RS & GIS for Hydrology and Water Resources					

Course Outcomes

CO 1: *Understand the significance of Land Resource Mapping*
CO 2: *Monitor the quality of water through RS & GIS*
CO 3: *Apply RS and GIS for EIA Study*
CO 4: *Map the natural disasters using RS and GIS*
CO 5: *Assess the mana made disasters using RS and GIS*

UNIT	SYLLABUS	Hrs
I	Land Resources mapping and Management– Significance of Land Use and Land Cover Information, Land Use classification, Land evaluation and suitability studies by Remote sensing and GIS. Land use / land cover mapping and planning. land use change, Land Resources Action plan.	9
II	Water quality and RS – Water quality mapping and monitoring, Remote sensing in water quality mapping monitoring and management, Solid waste management– introduction classification and environmental problems, Remote sensing and GIS in solid waste management & waste water management	9
III	Impact assessment – basic concepts, environmental impact assessment (EIA) methods, Environmental analysis and environmental monitoring for sustainable development through RS & GIS, EIA of mining areas and river valley project through remote sensing, Environmental management plan (EMP), its importance and role of GIS in preparation of EMP	9
IV	Natural disasters – introduction and types, Disaster management cycle and role of remote sensing and GIS in disasters management, Remote sensing and GIS application in hazard zonation mapping, Remote sensing and GIS application in post disasters	9
V	Man made disasters: introduction and types, Application of remote sensing & GIS in management of man made disasters, Nuclear fuel, power plants, nuclear waste management, global and Indian scenario. Forest fire and fire risk assessment and management using RS &GIS	9

Text Book:

TB 1: *Geoinformatics for environmental management, Anji Reddy,M, (2004), B.S. Publications.*
TB 2: *Remote Sensing Geology, R.P.Gupta, (1990), Springer Verlag.*
TB 3: *Remote Sensing of the Environment: An Earth resource Perspective, J.R. Jensen, (2000), Prentice Hall.*
TB 4:

References:

Ref 1: *Remote Sensing and Image Interpretation, T.M.Lillesand, , and R.M. Kieffer, (1987), John Wiley.*

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Design of Steel Structures	Course ID :		TCE 801		
08	4			Contact Hrs :		L	T	P
Course Components:		DSC		4		3	1	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		4	0	Weightage of Evaluation:	25	25	50	100
Pre-Requisite		Advance Structural Analysis						

Course Outcomes

CO 1: *Appreciate the use of IS Codes in the design of steel structures.*
CO 2: *Can submit economical designs for various simple structural steel members.*
CO 3: *Appreciate economization and conservation of material without compromise of safety.*
CO 4: *Produce the drawings pertaining to different components of steel structures based on the design.*
CO 5: *Design the industrial elements like plate girder, gantry girder and Foundation bases.*

UNIT	SYLLABUS	Hrs
I	INTRODUCTION: Properties of steel , Structural steel sections, Limit State Design Concepts , Loads on Structures – Metal joining methods using rivets, welding, bolting – Design of bolted, riveted and welded joints – Eccentric connections , Efficiency of joints – High Tension bolts	12
II	TENSION MEMBERS: Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag	12
III	COMPRESSION MEMBERS: Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base, Slab base.	12
IV	BEAMS: Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders riveted and welded – Intermediate and bearing stiffeners – Web splices.	12
V	ROOF TRUSSES AND INDUSTRIAL STRUCTURES: Elements of Roof trusses – Roof and side coverings – Design loads, design of purlin.	12

Text Book:

TB 1: *"Design of Steel Structures – Vol. I & II", 2007, Ramachandra, S. and Virendra Gehlot, Standard Publication, New Delhi,*
TB 2: *"Design of steel structure", 2018, Bhavikatti, New age international.*
TB 3: *"Limit State Design of Steel Structures", IIIrd Edition, 2019, Duggal S. K., McGraw-Hill Publication.*
TB 4:

References:

Ref 1: *"Teaching Resources for Structural Steel Design – Vol. I & II", INSDAG, Kolkatta.*
Ref 2: *"Design of Steel Structures", 3rd edition, 1992 E.H. Gaylord, N.C. Gaylord, and J.E. Stallmeyer, McGraw-Hill Publications.*
Ref 3: *IS 800-2007 Indian Standard - General Construction in Steel – code of practice (3rd Revision).*

Major Project

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Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:		Major Project -II	Course ID :		CEP 801		
08	04				Contact Hrs :		L	T	P
Course Components:		PROJ			08		0	0	8
Examination Duration (Hrs)		Theory	Practical		CIA	MSE	ESE		Total
		0	8	Weightage of Evaluation:	50	-	50		100
Pre-Requisite		Knowledge of basic civil engg. subjects							

Course Outcomes

CO 1: *Application of fundamental knowledge of civil engineering in solving engineering problems*
CO 2: *Use conventional as well as advanced tool application*
CO 3: *Design and draw the necessary drawings as per the detailing's.*
CO 4: *Planning and execution skills as an individual and team member.*
CO 5: *Get the presentation skills of the work done and submission of a Technical Report.*
CO 6: *Become confident in planning, partitioning and solving a simple project through team work.*

UNIT	SYLLABUS	Hrs
I	The objective of the project work is to enable the students to work in convenient groups of not more than five/six members in a group on a project involving theoretical and experimental studies related to Civil Engineering. Every Project Work shall have a Guide who is a member of the faculty of Civil Engineering of the university where the student is registered. The hours allotted for this course shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work and also to present in periodical seminars the progress made in the project. Each student shall finally produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions. This experience of project work shall help the student in expanding his / her knowledge base and also provide opportunity to utilize the creative ability and inference capability.	

Text Book:
TB 1: *NA*

References:
Ref 1: *NA*

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-25 **DEPARTMENT OF CIVIL ENGINEERING** **Program: BTCE**

Bachelor of Technology (B.Tech.) in Civil Engineering.

Semester:	Credits (C)	Course Tittle:	Disaster Management	Course ID :		DM 001		
08	02			Contact Hrs :		L	T	P
Course Components:		SEC		2		2	0	0
Examination Duration (Hrs)		Theory	Practical	CIA	MSE	ESE		Total
		2	0	Weightage of Evaluation:		25	25	50	100
Pre-Requisite								

Course Outcomes

CO 1: *Understand the foundations of hazards, disasters, and associated natural/social phenomena in India.*
CO 2: *Study the various natural disasters.*
CO 3: *Study the various manmade disasters.*
CO 4: *Understand the disaster management principles.*
CO 5: *Study the modern techniques used in disaster mitigation and management.*
CO 6: *Formulate Technological innovations in Disaster Risk Reduction.*

UNIT	SYLLABUS	Hrs
I	Introduction, Definitions, and Classification: Concepts and definitions - Disaster, Hazard, Vulnerability, Resilience, Risks Natural disasters: Cloud bursts, earthquakes, Tsunami, snow, avalanches, landslides, forest fires, diversion of river routes (ex. Kosi river), Floods, Droughts Cyclones, volcanic hazards/ disasters (Mud volcanoes): causes and distribution Hazardous effects and environmental impacts of natural disasters: mitigation measures, natural disaster-prone areas in India, major natural disasters in India with special reference to Uttarakhand. Man-induced disasters: water logging, subsidence, groundwater depletion, soil erosion, the release of toxic gases and hazardous chemicals into the environment, and nuclear explosions.	8
II	Inter-relationship between Disasters and Development: Factors affecting vulnerabilities: differential impacts, impacts of development projects such as dams, embankments, changes in land use, etc. climate change adaption, the relevance of indigenous knowledge, appropriate technology and local resources, sustainable development, and its role in disaster mitigation. Roles and responsibilities of the community: Panchayat Raj institutions/urban local bodies, state, center, and other stakeholders in disaster mitigation.	8
III	Disaster Management (Pre-disaster stage, Emergency stage, and Post Disaster Stage) Pre-disaster stage (preparedness): Preparing hazard zonation maps, predictably/forecasting and warning, preparing disaster preparedness plans, land use zoning, preparedness through information, education and communication (IEC), disaster resistant house construction, population reduction in vulnerable areas, awareness Emergency Stage: Rescue training for search & operation at national & regional level, immediate relief, assessment surveys Post Disaster stage: Rehabilitation and reconstruction of disaster-affected areas; urban disaster mitigation: Political and administrative aspects, social aspects, economic aspects, environmental aspects.	8
IV	Disaster Management Laws and Policies in India: Environmental legislations related to disaster management in India: Disaster Management Act,2005 Environmental policies & programs in India- Institutions & national centers for natural disaster mitigation: National Disaster Management Authority (NDMA): structure and functional responsibilities, National Disaster Response Force (NDRF): Rule and responsibilities, National Institute of Disaster Management (NIDM): Rule and responsibilities	6
V		

Text Book:

TB 1: *"Disaster Management", Ist Edition, 2017, M M. Sulphey, PHI, India.*

References:

Ref 1: *"Disaster Management", 2nd Edition, 2022, S C Sharma, Khanna Book Publishing, India.*

Graphic Era HILL UNIVERSITY Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011) University under section 2(f) of UGC Act, 1956	BOS: 2024-25 **DEPARTMENT OF CIVIL ENGINEERING** **Program: BTCE- Sp GIS & RS**

Bachelor of Technology (B.Tech.) in Civil Engineering (Specialization in GIS & RS)

Semester:	Credits (C)	Course Tittle:	Concepts and Applications of Geospatial Technology in Natural Resources Management (only for specialization in GIS and Remote Sensing and Minor)	Course ID :		TCE 899		
08	3			Contact Hrs :		L	T	P
Course Components:		SEC		3		2	1	0
Examination Duration (Hrs)	Theory	Practical		CIA	MSE	ESE		Total
	03	0	Weightage of Evaluation:	25	25	50		100
Pre-Requisite	Advance Geographical Information systems							

Course Outcomes

CO 1: *Explain the common methods of Space Inputs for Natural Resources Management.*
CO 2: *Design common methods land and soil resource mapping.*
CO 3: *Compute common methods forest cover assessment.*
CO 4: *Identify common methods for water quality monitoring.*
CO 5: *Identify common methods for air Pollution assessment.*

UNIT	SYLLABUS	Hrs
I	Space Inputs for Natural Resources Management: Earth Resources satellites and sensors, IRS and Geostationary environmental satellites, image products and characteristics.	09
II	*Land and Soil Applications:* Land Use Land Cover Mapping, Land Resources Census, Land/soil Resources Information System, National land/soil Resources Management Systems, Wetland Mapping, Wasteland Mapping, Soil Erosion Modeling, Land capability Maps, Soil Conservation Measures.	09
III	*Forest Applications:* Mapping and inventorying of forest resources, Forest biomass estimation, carbon sequestration, mapping and monitoring of afforestation, deforestation, encroachment, forest depletion and degradation, , Forest Information System, Forest Management Plans, and Working Plans and conservation plans.	09
IV	*Water Pollution Applications:* Mapping and inventorying of surface water bodies, siltation estimation and mapping, water colour, turbidity, and transparency monitoring, water quality index mapping, eutrophication and water vegetation mapping, methane production area mapping and modeling, Groundwater-pollution hazard assessment and protection planning, evaluation of groundwater vulnerability using GIS techniques; groundwater quality index mapping. RS and GIS technologies for sustainable groundwater management.	09
V	*Air and Atmospheric Pollution Applications: Introduction and Impacts of air pollution on human health, vegetation, animals, building materials, structures, and atmosphere, soil and water bodies.* *Aerosol remote sensing, air quality indexing and mapping, dynamic air pollution modeling, mapping and measuring troposphere pollutants. RS and GIS Applications in noise pollution and light pollution monitoring.*	09

Text Book:

TB 1: *Air Pollution, Tata Mc Graw Hill Publishing Company Ltd., 2007, ISBN-13: 9780074518717.*
TB 2: *Environmental Studies, 3rd Edition, Khanna Publishing House (2021), ISBN: 978-93-90779-02-4.*
TB 3: *Industrial Water Pollution Control, McGrawHill, 2001, 1e, ISBN: 9780070393646.*
TB 4:

References:

Ref 1: Barrett E.C., Curtis, I.F., Chapman and Hall, "Introduction to Environmental Remote Sensing", New York, (1982).
Ref 2: Sabins, F.F., (Ed) W.H. Freeman and Co.,"Remote Sensing principles and Interpretations", New York, (1986).
Ref 3: Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc.,"Remote sensing and Image interpretation", New York, (1994).