Civil Engineering				
Second Year (Third Semester)				
Sl.No	**Course Code**	**Subject (Theory)**	**Contact Hrs. L-T-P**	**Credit**
1	MA1201	Mathematics–III	3-0-0	3
2	CE1201	Professional Core-1: Mechanics of Material	3-0-0	3
3	CE1202	Professional Core-2: Geotechnical Engineering-I	3-0-0	3
4	CE1203	Professional Core-3: Fluid Mechanics	3-0-0	3
5	CS1204	Advanced Competency Course-1: Programming in Python (PC-4)	3-0-0	2
6	HS1202	Organizational Behaviour	3-0-0	2
Subject (Sessional)				
7	CE1281	Concrete Lab	0-0-3	1.5
8	CE1282	Geotechnical Engineering Lab	0-0-3	1.5
9	CE1283	Fluid Mechanics Lab	0-0-3	1.5
10	CS1286	Programming in Python & Machine Learning Lab	0-0-3	1.5
		Total	**18-0-12**	**22**

Second Year (Fourth Semester)

Sl.No	**Course Code**	**Subject (Theory)**	**Contact Hrs. L-T-P**	**Credit**
1	CE1204	Professional Core-5: Surveying and Geomatics	3-0-0	3
2	CE1205	Professional Core-6: Structural Analysis	3-0-0	3
3	CE1206	Professional Core-7: Geotechnical Engineering-II	3-0-0	3
4	CE1207	Professional Core-8: Transportation Engineering-I	3-0-0	3
5	CS1209	Advanced Competency Course-2: Artificial Intelligence and Machine Learning (PC-9)	3-0-0	2
6	HS1201	Engineering Economics	3-0-0	2
Subject (Sessional)				
7	CE1284	Survey Practice	0-0-3	1.5
8	CE1285	Structural Engineering Lab	0-0-3	1.5
9	CE1286	Building Drawing	0-0-3	1.5
10	CE1287	Transportation Engineering Lab	0-0-3	1.5
	Summer Internship and Research Experience (SIRE- I) *			
		Total	**18-0-12**	**22**

CIVIL ENGINEERING			
Subject Code	**MA1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**Mathematics–III**		
SYLLABUS			
Module-I	Random variables (Discrete and Continuous. Cumulative Distribution Function (CDF). Variance and standard deviation. Moments. Functions of a random variable. Distributions: Binomial, Poisson, normal, Gaussian, uniform (definitions and examples only). Moment generating function.		**6 Hrs**
Module-II	Pairs of random variables. Joint probability density function. Joint probability mass function. Marginal distribution. Functions of two random variables, PDF and expected values of the sum of two random variables		**6 Hrs**
Module-III	Probability Models of n Random Variables. Vector notation. Independence of random variables and random vectors. Functions of random vectors. Expected value vector and correlation matrix.		**6 Hrs**
Module-IV	Stochastic Processes. Definitions and examples. Types of stochastic processes. Random variables from random processes. The Poisson process.		**6 Hrs**
Module-V	Markov Chains. Discrete-time Markov chain. Discrete-Time Markov chain dynamics. Limiting state probabilities for a finite Markov chain. State classification.		**6 Hrs**
Essential Reading	1. Roy D. Yates, Rutgers and David J. Goodman, Stochastic Processes, 2d Edition, John Wiley and Sons, INC. 2. Gregory F Lawler, Introduction to Stochastic Processe, Chapman & Hall/ CRC Press (Taylor Francis Group).		
Course Outcomes	The objective of this course is to familiarize the prospective engineers with techniques in Probability and Statistics. It aims to equip the students to deal with advanced level of Statistics that would be essential for Engineering disciplines. CO1. To apply different distributions in real life problems of industries CO2. To deal with problems that contains multivariable probability distribution. CO3.To enrich knowledge Probability Models of multi-Random Variables CO4. To learn use of stochastic processes in daily life		
Subject Code	**CE1201**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**MECHANICS OF MATERIAL**		
Pre-requisites	**Knowledge in Engineering Mechanics is essential**		
Course Objective	To learn the principles of mechanics applied to different materials and to develop problem solving skills through application of these principles to basic engineering problems		
SYLLABUS			
Module-I	Simple Stresses and Strains:Load, Stress, Principle of St. Venant, Strain, Direct stress, Hooke's Law, Modulus of Elasticity, Shear stress, Complementary shear stress, shear strain, modulus of rigidity, Relationship between elastic constants. Stress and strain diagram of mild steel, Elasticity and plasticity - Types of stresses and strains, Working stress, Factor of safety, Lateral strain, Bars of varying section, statically indeterminate problems, Composite bars, Temperature stresses. Strain Energy, Resilience		**6 Hrs**
Module-II	Compound Stresses and Strains:Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Maximum shear stresses, Mohr's stress circle, Two dimensional stress-strain system Principal strains and principal axis of strain, calculation of principal stresses from principal strains, Analysis of strains, Mohr's strain circle, Strain rosettes, determination of principal strains from strain measurements		**6 Hrs**
Module-III	Shear stress:Derivation of formula for Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections. Flexural Stresses:Theory of simple bending, Assumptions, Derivation of simple bending equation, Neutral axis, Determination of bending stresses, Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections. Distribution of normal stresses. Torsion:Torsion in solid and hollow circular shafts, Twisting moment, strength of solid and hollow circular shafts, strength of shafts in combined bending and twisting, closed coil helical spring.		**6 Hrs**
Module-IV	Thin cylinders and spheres:Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures Buckling of Columns:Short and long columns with axial load, eccentric loading of columns, core of the section, Euler's theory of initially straight columns with various end conditions.Combined bending and direct stress		**6 Hrs**
Module-V	Theories of failure:Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain energy theory, maximum distortion energy theory, maximum octahedral shearing stress theory.		**6 Hrs**
Essential Reading	1. StrengthofMaterialsbyS.P.TimoshenkoandD.H.Young,EastWestPress 2. StrengthofMaterialsby G.H. Ryder,Macmillan India Ltd.		
Supplementary Reading	1. MechanicsofMaterialsbyE.Popov 2. Strength of materials by S S Ratan, Tata McGraw-Hill Education		
Course Outcomes	CO1. Apply the formal theory of mechanics of materials to calculate stresses and strains undervaryingloading conditions CO2. Analyze and design the structural members under tension, compression, torsion, bending andcombinedstressesemployingthefundamentalconceptsofstress,strainandelasticbehaviorofmaterials CO3. Utilizebasicpropertiesofmaterialstosolveisotropicelasticity problemsintwodimension CO4. Solve engineering problems in accordance with ethical and economic constraints on design ofstructures CO5. Use appropriatematerialsin design considering engineering properties, sustainability, costandweight		
Subject Code	**CE1202**	**Total Contact Hour**	**30**
Semester	3rd	**Total Credit**	**3**
Subject Name	**GEOTECHNICAL ENGINEERING-I**		
Pre-requisites	**Engineering Mechanics, Strength of Material**		
Course Objective	This course will enable students to build their strong fundamental knowledge in the behavior of soils and will develop their practical problem-solving capabilities.		
SYLLABUS			

Module-I	Introduction: Origin of soils, formation of soils, Clay mineralogy, basic terminology and their relations, index properties of soils. Soil classification: Particle size distribution, use of particle size distribution curve, Particle size classification, Unified classification system, Indian standard soil classification system, Stress conditions in soil: Total stress, Pore Pressure and Effective stress	**5 Hrs**
Module-II	Permeability: Darcy's law of permeability, factors affecting permeability, determination of permeability (laboratory and field methods), permeability of stratified soil deposits. Seepage analysis: Seepage pressure, quicksand condition, Laplace equation for two –dimensional flow, flow net, properties and methods of construction of flow net, application of flow net, seepage through anisotropic soil and non-homogenous soil.	**6 Hrs**
Module-III	Soil compaction: Compaction mechanism, factors affecting compaction, effect of compaction on soil properties, density moisture content relationship in compaction test, standard and modified proctor field compaction. Soil consolidation: Introduction, spring analogy, one dimensional consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation	**6 Hrs**
Module-IV	Shear strength of soils: Mohr's stress circle, theory of failure for soils, determination of shear strength (direct shear test, tri-axial compression test, unconfined compression test, van shear test).	**8 Hrs**
Module-V	Stabilization of soil: Introduction, mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization, thermal stabilization, electrical stabilization	**5 Hrs**
Essential Reading	Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.	
Supplementary Reading	1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co. 2. Soil Mechanics, T.W. Lambe& Whiteman, Wiley Eastern Ltd, New Delhi	
Course Outcomes	CO1. Classify soil and solve three phase soil system. CO2. Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram. CO3. Formulate practical problems related to consolidation settlement and time rate of settlement. CO4. Validate problem related to compaction in the field. CO5. Use stabilization techniques for soft and expansive soil by using various methods	

Subject Code	**CE1203**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**3**
Subject Name	**FLUID MECHANICS**		
Pre-requisites	• Knowledge on core Physics • Mathematical Applications • Concepts of Fluid Behaviour		
Course Objective	• To understand the properties of Fluid and Fluid statics • To understand different applications of fluid • Understanding fluid laws and different flow parameters • To introduce flow measurement processes through different devices • Understanding the flow behavior while flowing through pipe		

SYLLABUS

Module-I	Properties of fluids: Introduction, development of fluid mechanics, unit ofmeasurement, mass density, specific weight, specific volume, specific gravity, viscosity, vaporpressure, compressibility and elasticity, surface tension and capillarity. Fluidpressure and its measurement:Fluidpressure at a point,variation ofpressurein a fluid, Pascal'slaw, atmospheric absolute, gauge and vacuum pressure, measurement of pressure	**6 Hrs**
Module-II	Hydrostatic forces on surfaces: Total pressure and center of pressure, total pressure on planesurface (horizontal,vertical,inclined,curved), centerofpressureonverticalandinclinedplanesurface,pressure diagram.Buoyancy and Flotation: Buoyancy, buoyant force and center of buoyancy, metacenter andmetacentric height, stability of submerged and floating body, determination of metacentricheight (experimental and theoretical)	**6 Hrs**
Module-III	Kinematics of fluid flow: Introduction, velocity of fluid particles, types of fluid flow, description offlow pattern, basic principle of fluid flow, continuity equation, acceleration of a fluid particle,rotationalandirrotationalmotion,velocitypotential,streamfunction,streamlines, equipotential lines, flow net, its uses and limitations. Dynamics of fluid flow: Introduction, forces acting on fluid in motion, Euler's equation ofmotion, Bernoulli's equation of motion, Kinetic energy correction factor, Bernoulli's equation for acompressible fluid and its application (venture meter, orificemeter, pitot tube), free liquid jet, vortex motion (free and forced)	**6 Hrs**
Module-IV	Flow through pipes: Introduction, types of flow, laws of fluid friction (laminar flow and turbulentflow), Formulae for head loss due to friction in pipes (Darcy-Weisbach equation, Chezy's formula, Manning's formula, Hazen-William's formula),other energylosses in pipe, Hydraulic grade line and energy grade line, flow through long pipes, flow through pipes(series, and parallel, equivalent, by-pass, branched, syphonic), water hammer in pipe, Orifices and mouthpieces: Introduction, classification of orifices, flow through an orifice, hydrauliccoefficients (velocity, contraction and discharge), flow through large orifices.	**6 Hrs**
Module-V	Laminar flow through pipes: Introduction, steady laminarflow in circular pipe, laminar flowparallel plates (both plates at rest, one plate at rest and other moving), variation of friction factor f forlaminar flow. Turbulent flow through pipes: Introduction, shear stress, hydro dynamically smooth and roughboundaries, velocity distribution for turbulent flow in hydro dynamically smooth and rough pipes,criteria for smooth and rough pipes, velocity distribution for turbulent flow in terms of mean velocityfor smooth and rough pipes.	**6 Hrs**
Essential Reading	Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N.Modi and S.M. Seth, StandardBookHouse.	
Supplementary Reading	1. FluidmechanicsbyA.K.Jain,KhannaPublishers. 2. EngineeringFluidMechanicsbyK.L.Kumar,S.Chand&Co.	
Course Outcomes	CO1. Explainaboutfluidpropertiesandpressuremeasurement. CO2. Analyzehydrostaticforcesonsurfacesandstudyofbuoyancyandflotation. CO3. Revisebasicsofkinematicsanddynamicsoffluidflow. CO4. Observeflowthroughpipesandcomputationofcoefficientsoforificesandmouthpieces. CO5. Differentiatebetweenlaminarandturbulentflowsthroughpipe	

Subject Code	**CS1204**	**Total Contact Hour**	**30**
Semester	**3rd**	**Total Credit**	**2**
Subject Name	**Programming in Python**		

Course Objective	1: Introduction to Python Language and its features. 2: To understand the concept of Python Program using sequence data and Control statements. 3: To be able to understand and create User Defined Function. 4: To understand the concept of OOPs and its implementation. 5: To understand the concept of strings and file handling	
	SYLLABUS	
Module-I	**Beginning Python Basics:** Introduction to Python Features of Python, Application of Python Data Types, Keywords, Identifiers, Literals, Constants. Python Indentation. Operators and expressions. Naming Conventions with examples, Managing Input and Output, Concept of Indentation. Conditional statement, Looping statements, break and continue, pass & return statements, Nesting of loops.	**6 Hrs**
Module-II	**Modules:** Built-in Modules, Import statement, Packages, Date and Time Modules. Array and its operations, Handling Strings and Characters, List: slicing, bound, cloning, nested list, list and methods, Adding Element: append, extend, count, index and insert). Mutability: Sort, reverse, remove, clear and pop. Map, Filter.	**8 Hrs**
Module-III	Tuple and methods, Sets and methods, Dictionary: Basic operation, iterator and methods. **Function:** Introduction to Functions, passing arguments, Anonymous functions (Lambda Function), Recursive Functions.	**6 Hrs**
Module-IV	**Object Oriented Programming:** Classes and Objects, Class methods. Encapsulation, Data Abstraction, Constructor, Destructor and Inheritance. **Exception Handling:** Handling Exceptions: try-except, try-finally	**6 Hrs**
Module-V	**Strings and Regular Expressions :** Methods of String Objects, Escape Sequence, Iterating Strings, String Module, String Formatting, Regular Expressions: Re-Module. **File Handling:** Introduction to File Handling, File Operations, Directories.	**4 Hrs**
Essential Reading	1. Python Programming for Beginners by Adam Stewart 2. Python Cookbook by David Beazley and Brian K. Jones	
Supplementary Reading	1. Introduction to Python Programming By Gowrishankar S. Veena A 2.Python Programming: Using Problem Solving Approach, Oxford University Press by Reema Thareja 3.Python Programming University Press by Ch Satyanarayan, M Radhika, B N Jagadesh	
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.	
Subject Code	**HS1202**	**Total Contact Hour** **30**
Semester	**3rd**	**Total Credit** **2**
Subject Name	**Organizational Behaviour**	
Course Objective	1: To understand the relevance of organizational behavior concepts and theories in real-life organizational settings & to develop skills in critical thinking, decision –making, problem-solving in applying organizational behavior concepts to practical situations. 2: To provide an understanding of individual behavior in the workplace, including personality, motivation, perception, learning, and attitudes. 3: To understand the impact of team composition, diversity, and communication on team performance & to understand the role of motivation and leadership in managing organization. 4: To explore how organisational culture affects behavior, communication and decision making by enhancing creativity and innovation and give an episteme how to cope with change and stress. 5: To Develop intercultural competence, including awareness, knowledge, and skills for effective communication, negotiation, and collaboration across culture	
	SYLLABUS	
Module-I	**Fundamentals of OB & Understanding the Basic Framework of OB:** Evolution of OB through Quality Management movement, Definitions, Scope & Importance of OB,Challenges (Diversity, Globalisation& Ethical Perspective) and opportunities for OB, models of OB, applying OB to solving problems.	**6 Hrs**
Module-II	**Understanding the Determinants of Individual Behavior:** **Personality:** Determinants of personality, Theories of Personality (Type &Psychoanalytic theory), MBTI, Big five personality traits and other major traits influence workplace behavior. **Perception:** Meaning, Perceptual Process, Application of Perception at Workplace. **Motivation:** Motivation Framework, Content theory (Maslow's need hierarchy & Hertzberg's two factors theory), Process theory (Adam's Equity & Vroom's Expectancy theory), Job Design And motivation, Importance of motivation at Workplace. **Learning:** Theories of learning (Classical Conditioning, Operant Conditioning,& Cognitive Theory), Principles of Learning. Bhavioral modification through learning.	**6 Hrs**
Module-III	**Understanding Group and Team Behavior at Workplace:** **Group & Team:** Defining and classifying groups, the five-stage model of group development Group properties: Roles, norms, status, size and cohesiveness, Group decision making. **Leadership:** Meaning, Definition & types of leadership, Traditional theories of leadership: Trait theories, Behavioral theories, Contingency theories, Contemporary approaches to leadership, importance of leader in organisations.	**6 Hrs**
Module-IV	**Understanding Group and Team Behavior at Workplace:** **Organisational Culture:** Meaning, Definition, Cultural dimensions,effect of Organisational culture **Organisational Change & Development:** Nature, Levels & types of Change, Change Agents: Resistance to Change, Force field theory of Change, Managing the Change.	**6 Hrs**
Module-V	**Conflict & International Organisational Behavior:** **Managing Conflict and Negotiations:** Meaning,views, & levels of Conflict, Process of conflict, Conflict resolution techniques. **Transactional Analysis:** Meaning, Importance of TA, Life position, Ego states And their encounters. **IOB:** Internationalisation of Business, Cultural differences and similarities, Understanding Interpersonal behavior across culture through Hofstede's Cultural Dimensions	**6 Hrs**
Essential Reading	1. "Organizational Behavior: Text, Cases, & Games" by K. Aswathappa .Publisher: Himalaya Publishing House 2. "Essentials of Organizational Behavior" by Stephen P. Robbins and Timothy A. Judge. Publisher: Pearson Education.	

Supplementary Reading	1. "Organizational Behavior: Improving Performance and Commitment in the Workplace" by Jason A. Colquitt, Jeffery A. LePine, and Michael J. Wesson. Publisher: McGraw-Hill Education. 2. "Organizational Behavior: Human Behavior at Work" by John W. Newstrom and Keith Davis. Publisher: McGraw-Hill Education. 3. "Organizational Behavior: An Evidence-Based Approach" by Fred Luthans. Publisher: McGraw-Hill Education. 4. "Organizational Behavior: Emerging Knowledge, Global Reality" by Steven L. McShane and Mary Ann Von Glinow. Publisher: McGraw-Hill Education. 5. "Organizational Behavior and Management" by Ivancevich, Konopaske, and Matteson. Publisher: McGraw-Hill Education. 6. "Organizational Behavior: Theory, Research, and Practice" by John R. Schermerhorn Jr., James G. Hunt, and Richard N. Osborn. Publisher: Wiley		
Course Outcomes	CO1. Explain the importance of organizational behavior in improving individual and organizational effectiveness with Ethical practices. CO2. Evaluate the effectiveness of different leadership styles and their application in different situations. CO3.Develop critical thinking, Creativity& Innovation, problem-solving, and communication skills necessary for success in organisational settings. CO4. Develop strategies for managing organisational change effectively and maintainingsustainability. CO5. Apply organistional behavior concepts and theories to practical organisational situations.		
	SESSIONAL		
Subject Code	**CE1281**	**Total Contact Hour**	**32**
Semester	3rd	**Total Credit**	**1.5**
Subject Name	**CONCRETE LAB**		
Pre-requisites	Knowledge about building material behavior and properties		
Course Objective	Knowledge about building material behavior and properties		
	List of Experiments		
1	Standard Consistency of Cement		
2	Initial and Final setting time of Cement		
3	Soundness of Cement		
4	Fineness (sieve analysis) of Cement		
5	Compressive strength of Cement		
6	Grain size distribution (coarse and fine aggregate)		
7	Specific gravity (coarse and fine aggregate)		
8	Bulk density and Voids of aggregates		
9	Bulking of fine aggregate		
10	Workability (slump test, compaction factor test) of Concrete		
11	Compressive strength of Concrete		
12	Tensile strength (split tensile strength, mod. of rupture) of Concrete		
13	Stress strain curve for concrete to find its Modulus of elasticity and Poission's ratio		
14	Shape and size determination of brick		
15	Water absorption of brick		
16	Compressive strength of brick		
Course Outcomes	CO1. To understand about various cement property tests CO2. To understand about various fine aggregate property tests CO3. To understand about various course aggregate property tests CO4. To understand about various Concrete property tests CO5. To understand about various brick property tests		
	SESSIONAL		
Subject Code	**CE1282**	**Total Contact Hour**	**20**
Semester	3rd	**Total Credit**	**1.5**
Subject Name	**GEOTECHNICAL ENGINEERING LAB**		
Pre-requisites	Building material, geotechnical engineering		
Course Objective	This course will enable students to determine various soil properties to identify soil type.		
	List of Experiments		
1	Determination of specific gravity of soil grains		
2	Determination of water content of soil sample.		
3	Determination of grain size distribution of soil: a) Sieve analysis b) Hydrometer/pipette test		
4	Determination of liquid limit of soil sample.		
5	Determination of plastic of soil sample.		
6	Determination of shrinkage of soil sample.		
7	Determination of bulk density of sand by pore cylinder method.		
8	Measurement of unit weight of soil in the field by core cutter method		
9	Measurement of unit weight of soil in the field by sand replacement method.		
10	Determination of Density-water content relationship of soil: Proctor compaction tests.		
Course Outcomes	CO1. Classify soil by physical observation of the soils. CO2. Observe soil based on estimated index and engineering characteristics of soils CO3. Examine soil properties in field CO4. Estimate density water content relationship CO5. Measure consolidation and shear parameter to design foundation		
	SESSIONAL		
Subject Code	**CE1283**	**Total Contact Hour**	**20**
Semester	3rd	**Total Credit**	**1.5**
Subject Name	**FLUID MECHANICS LAB**		
Pre-requisites	Core Physics, Fluid Properties and Behaviour		
Course Objective	This course will enable students to be acquainted with different flow properties, its measurement and scope for real time applications.		
	List of Experiments		
1	Study of Discharge Measuring, Pressure measuring, Depth measuring and Velocity measuring equipment.		
2	Verification of Bernoulli's Theorem		
3	Determination of metacentric height for a ship model		
4	Determination of metacentric height for a ship model		
5	Study of Moody's chart for a pipe flow		

6	Study of flow pattern using Reynold's apparatus		
7	Study of free and forced vortex.		
8	Determination of Co-efficient of discharge for a Venture meter		
9	Determination of Co-efficient of discharge for an Orifice meter		
10	Determination of Co-efficient of discharge for a Nozzle meter.		
Course Outcomes	CO1. Conversant with the basic flow measuring equipment CO2. Validating the Bernoulli's theorem corresponding to different energy heads. CO3. Understanding effect of friction in pipe flow CO4. Determining flow patterns through experiments CO5. Measurement of discharge through different instruments		
	SESSIONAL		
Subject Code	**CS1284**	**Total Contact Hour**	**20**
Semester	3rd	**Total Credit**	**1.5**
Subject Name	**Programming in Python Lab**		
	List of Experiments		
1	Program on basics of python Programming Language.		
2	Program on basic Data Structures in Python.		
3	Program on Conversion from on data type to another.		
4	Program on Functions in Python.		
5	Program using Object Oriented Programming in Python.		
6	Program using Inheritance in Python.		
7	Program using String in Python.		
8	Program using Regular expression in Python.		
9	Program using File Handling in Python.		
10	Program using basics of Pandas and Matplotlib module in Python.		
Course Outcomes	CO1: Understand the Python Language and its features. CO2: Apply sequence data and control statements to solve problem CO3: Able to create user defined functions to solve problems. CO4: Analyze the concept of OOPs and its implementation. CO5: Create the python program using strings and files.		

4TH SEMESTER

Subject Code	**CE1204**	**Total Contact Hour**	**30**
Semester	4th	**Total Credit**	**3**
Subject Name	**SURVEYING AND GEOMATICS**		
Pre-requisites	Building drawing, Engineering drawing		
Course Objective	Enable students to plot contour map and setting of geometrical curves		
	SYLLABUS		
Module-I	Geo-informatics – (Definition & Importance, Concept of Geoid and reference spheroids, Coordinate Systems), Basic Surveying – (Definition & Objective, Plane and Geodetic Surveys, General Classification of Surveys and its Principles), Surveying Errors – (Sources, Types of errors and their treatment, Accuracy), Maps- (Types, importance, scales, conventional symbols, and generalization; topographic maps, map projection systems), Idea about measuring Instruments.		**5 Hrs**
Module-II	Linear Measurements – (Direct and indirect methods, Error and Correction of linear measurement, Optical methods Levelling and trigonometric levelling;Levelling: Types of levelling and their uses, permanent adjustment, curvature and refraction effects		**6 Hrs**
Module-III	Angular Measurement – (Principle, Instrument - Compass and Theodolite, Meridian, Bearing & Bearing System, Local attraction, Theodolite traversing, Concept of Latitude and Departure) Triangulation and Trilateration. Electronic methods- EDMs, total stations		**6 Hrs**
Module-IV	Curve Survey – (Curve – types & elements, setting out work) Photogrammetric - Principle, Scale, flying height, Number of Photographs, Deduction of distance & height scale.		**8 Hrs**
Module-V	Remote sensing - basics, platform and sensors,visual image interpretation. Basics of Geographical information system (GIS) andGeographical positioning system (GPS).		**5 Hrs**
Essential Reading	1. Surveying – Punmia, Vol. – I, Laxmi Publication. 2. Surveying – Vol –II – By B.C. Punmia, A K Jain and A K Jain, Laxmi Publishers		
Supplementary Reading	1.Surveying (Vol -1 & 2) By S.K. Duggal, Tata McGraw Hill Publishing Co. Ltd. New Delhi 2.Surveying and Levelling by R. Agor, Khanna Publishers 3. Higher Surveying – Vol –II By B.C. Punmia, A K Jain, Laxmi Publishers.		
Course Outcomes	CO1. Comprehend the definitions, importance, and concepts of Geo-informatics including the Geoid and reference spheroids, and coordinate systems. CO2. Application of the principles and objectives of basic surveying methods. CO3. Interpretation of different types of maps to understand their importance. CO4. Perform and evaluate linear and angular measurements using appropriate methods and instruments, understand errors and corrections, and conduct various types of levelling. CO5. Utilize advanced surveying methods, including triangulation, trilateration, EDMs, total stations, and apply principles of curve surveying, photogrammetry, remote sensing, GIS, and GPS in civil engineering projects.		
Subject Code	**CE1205**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**STRUCTURAL ANALYSIS**		
Pre-requisites	**Knowledge in Engineering and Solid Mechanics is essential**		
Course Objective	To determine the reactions, internal forces, such as axial, shear, bending and torsional, and deformations at any point of a given structure caused by the applied loads and forces.		
	SYLLABUS		

Module-I	General Introduction on Concept of Analysis, Concept of Force Method of Analysis, Statically Determinate vs. Indeterminate Structures, Static Indeterminacy, External and Internal Static Indeterminacy, Introduction to kinematically determinate/indeterminate structures. Degree of Indeterminacy estimation for rigid joint frame and Pin Joint Truss (both for 2D and 3D structures)	**6 Hrs**
Module-II	Bending moment and Shear Force Diagrams for statically determinate beams like cantilevers, simply supported with or without overhangs under different types of loadings. Relationship between B.M, S.F and loading. B.M. shear and normal thrust of three hinged arches. Suspension Cables: Three hinged stiffening girders.	**6 Hrs**
Module-III	Moment Curvature Relation, Elastic Curve, Deflection calculation of Statically Determinate Beams by geometrical methods like Double Integration Method, Macaulay's Method, Moment Area Method, and Conjugate Beam Method. Concepts of Strain Energy, Strain Energy Due to Axial, Bending, Shear and Torsion Effects, Castigliano's Theorem, Deflection calculation of Statically Determinate Beams by Strain Energy Method, Castigliano's Method, virtual work and Unit Load Deflection of pin-jointed trusses using strain energy method, unit load method.	**6 Hrs**
Module-IV	Bending Moment and Shear Force Diagrams for statically indeterminate beams like propped cantilever, fixed beam and continuous beam. Use consistent deformation method, moment area method and three moment theorems.	**6 Hrs**
Module-V	Introduction to Rolling Loads, Concept of Influence Lines, Influence Line diagram (ILD) for determinate beams for reactions at supports, S.F. at given section, B.M. at a given section, Maximum shear and maximum bending moment at given section.	**6 Hrs**
Essential Reading	1. Structural Analysis – Norris & Wilber 2.Structural Analysis – R. C. Hibbeler	
Supplementary Reading	1. Reddy, Basic Structural Analysis, Tata McGraw Hill, Third Edition 2. Indeterminate Structures – J.S. Kenney	
Course Outcomes	1. Ability to understand various internal forces like axial force, shear force and bending moment in structures. 2. Ability to determine internal forces in statically determinate structures like beams, arches, cables and stiffening girders. 3. Ability to determine deformation of statically determinate beams and in pin-jointed plane trusses using appropriate methods. 4. Ability to determine internal forces in the statically indeterminate beams like propped cantilever beam, fixed beam and continuous beam. 5. Ability to determine various internal forces due to rolling or moving loads and their maximum influence on determinate beams, arches, cables with stiffening girders.	

Subject Code	**CH1206**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**GEOTECHNICAL ENGINEERING-II**		
Pre-requisites	**Geotechnical Engineering-I**		
Course Objective	This course will enable students to design foundations and earthen structures,with attaining knowledge regarding the sub soil exploration.		
	SYLLABUS		
Module-I	Stress distribution in soil: Boussinesq's equations, Stress isobar and pressure bulb concept, pressure distribution on horizontal and vertical planes, stresses due to point load, line load, strip load, uniformly loaded circular and rectangular areas. Use of Newmark's chart. Westergaard's solution		**5 Hrs**
Module-II	Lateral earth pressure and retaining structures: Earth pressure at rest, active and passive earth pressure. Earth pressure theories, Rankine's theory, Coloumb's wedge theory, stability conditions for retaining walls.		**7 Hrs**
Module-III	Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Contact pressure; Settlement analysis in sands and clays. Deep foundations – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile group efficiency, negative skin friction.		**8 Hrs**
Module-IV	Subsoil exploration: Methods, direct (test pits, trenches), semi-direct (borings soil sampling, types of samples, standard penetration test, cone penetration test.		**4 Hrs**
Module-V	Stability of earth slopes: Stability of infinite slopes, stability analysis of finite slopes, Swedish method of slices, fiction circle method, Bishop's method. Use of Taylor stability number.		**6 Hrs**
Essential Reading	1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers. 2. Soil Mechanics and Foundations, B.C.Punmia, A.K.Jain&Jain, Laxmi Publication		
Supplementary Reading	1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co. 2. Soil Mechanics, T.W. Lambe& Whiteman, Wiley Eastern Ltd, New Delhi. 3. Foundation Engineering, P.C. Verghese, Prentice Hall of India 4. Principle of Geotechnical Engineering, Braja M. Das, Cengage		
Course Outcomes	CO1. Analysis of stress distribution in soil using Boussinesq's equations and related concepts. CO2. Evaluation of lateral earth pressure and design retaining structures using relevant theories. CO3. Estimation of bearing capacity of soils and analysis of settlement using Terzaghi's and Meyerhoff's theories. CO4. Assessment of the load capacity of deep foundations and evaluate pile group efficiency. CO5. Preparation of Subsoil exploration and analysis of stability of earth slopes using various methods.		

Subject Code	**CE1207**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Transportation Engineering - I**		
Pre-requisites	• Basic knowledge of civil engineering principles andengineering survey techniques. • Understanding of geometry, trigonometry, and road design principles. • Familiarity with statistics, data analysis, and traffic flow theories. • Knowledge of materials science and laboratory testing methods for construction materials. • Background in mechanics of materials		

Course Objective	To equip students with the knowledge and skills to analyze transportation systems and modes, apply geometric design principles for highways, conduct traffic engineering studies, evaluate pavement materials, and design flexible and rigid pavements in accordance with IRC specifications, thereby fostering a comprehensive understanding of highway development and planning.		
SYLLABUS			
Module-I	Transportation System, Modes of transportation – their importance & limitation, Historical Development of road construction.Highway Development & Planning in India: Classification of roads and road patterns, Highway alignment: Requirements, factors controlling alignment & Engineering surveys for Highway alignment.		**4 Hrs**
Module-II	Geometric Design of Highways: Cross-sectional elements, Sight Distances, Horizontal alignments: Horizontal Curves, Super elevation design, Attainment of Super elevation, Radius of horizontal Curve, Extra Widening, Transition Curve and Setback Distance. Vertical alignments-Gradients, Types and Length of Vertical Curves, Grade Compensation on Horizontal Curve		**8 Hrs**
Module-III	Traffic Engineering: Traffic Studies- Volume studies, Speed Studies, O-D Studies, Capacity Studies and Level of service, Peak hour factor, parking study, accident study and analysis, Statistical analysis of traffic data, Microscopic and macroscopic parameters of traffic flow, fundamental relationships, Operations and Traffic Control devices, Signal design by Webster's method. Types of intersections and channelization.		**6 Hrs**
Module-IV	Highway Pavements materials: Aggregate - desirable properties & quality control tests of Aggregates, Bitumen-Types, Source, desirable properties & quality control tests of bitumen. CBR Test of Soil, Design of bituminous paving mixes by Marshall Method.		**6 Hrs**
Module-V	Highway Pavement Design: Requirements, types & Design Factors. Design of flexible pavement using IRC: 37, Design of rigid pavements using IRC: 58, Stress analysis, Design of Joints in Rigid Pavement.		**6 Hrs**
Essential Reading	Highway Engineering-By Khanna & Justo (Nemchand & Bros., Roorkee (U. A)		
Supplementary Reading	1. Principles & Practice of Highway Engineering – By Dr. L.R. Kadiyalli (Khanna publisher) 2. Relevant IRC codes/ Specifications.		
Course Outcomes	CO1. Analyze transportation modes for their significance in urban and rural development, recognizing their limitations and historical contexts. CO2. Demonstrate geometric highway design** skills, focusing on cross-sectional elements, sight distances, horizontal/vertical alignments, and curve calculations. CO3. Conduct traffic studies (volume, speed, O-D) and statistical analyses to assess traffic flow and create effective traffic control devices and signal designs. CO4. Evaluate properties and quality control tests for highway pavement materials, including aggregates, bitumen, and CBR testing of soil. CO5. Design flexible and rigid pavements per IRC specifications, incorporating stress analysis, joint design, and relevant design factors		
Subject Code	**CS1209**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**3**
Subject Name	**Artificial Intelligence and Machine Learning**		
Course Objective	1.To familiarize students with the fundamental concepts, theories, and applications of Artificial intelligence& Machine learning. Students will gain insight into the various subfields of AI& ML. 2.Students will have a clear understanding of the fundamental concepts and terminology of Artificial intelligence& Machine learning, enabling them to discuss and comprehend AI-related topics. 3. Students will have a clear understanding about neural networks, Fuzzy logic. 4. Students will have a clear understanding about Clustering and related techniques. 5. Students will have a clear understanding about Classification and related techniques.		
SYLLABUS			
Module-I	Introduction to Artificial Intelligence, Applications of AI, State-space problem, Problem solving by Intelligent search: BFE, DFS, Iterative Deepening Search, Hill climbing, Heuristic search: A*, AO*, MIN_MAX Algorithm, Alpha-beta cutoff		**8 Hrs**
Module-II	Knowledge representation and reasoning: Formalized symbolic logic, propositional logic, First-order predicate logic, wff conversion to clausal form, inference rules, resolution principle.		**5 Hrs**
Module-III	Unsupervised Learning: K-means, K-Medoids, Hierarchical clustering, Density based clustering, Validation Method: LOO, K-fold cross validation.		**5 Hrs**
Module-IV	Supervised Learning: Decision Tree, Naïve Bayes classifier, K-NN, Introduction to regression. Performance matrix: Confusion matrix, Precision, Recall, Sensitivity, Specificity, MAE, MSE		**6 Hrs**
Module-V	Neural Network Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks, Training of ANN, Back propagation, RBFNN.		**6 Hrs**
Essential Reading	1.E.Rich and K. Knight, Artificial Intelligence-TMH 2.Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI		
Supplementary Reading	1.Artificial Intelligence, Dan W Patterson, Prentice Hall of India 2.Computational Intelligence Principles, Techniques and Applications, Amit Konar, Springer publication. 3. M. Gopal, Applied Machine Learning, McGraw Hill Education, 2018		
Course Outcomes	CO1:Understand the basics of Search techniques, Knowledge representation and reasoning in Artificial Intelligence. CO2:Understand the Supervised machine learning and Unsupervised machine learning. CO3:Analyzevarious machine learning models. CO4:Implement various Supervised machine learning techniques and analyze them. CO5:Implement various Unsupervised machine learning techniques and analyze them.		
Subject Code	**HS1201**	**Total Contact Hour**	**30**
Semester	**4th**	**Total Credit**	**2**
Subject Name	**Engineering Economics**		
SYLLABUS			
Module-I	**Basic Principles of Economics:** Definition, Nature, Scope and significance of economics for Engineers. Demand & Supply and their Determinants,Elasticity-Government policies and application. Basic Macro economics concept: National income accounting (GDP/GNP/NI/Disposable Income etc) and identities for both closed and open economies.		**6 Hrs**

Module-II	**Utility Analysis:** Cardinal and ordinal measurability of utility, Assumptions of cardinal utility analysis, law of diminishing marginal utility, Consumer's equilibrium: Principle of equi-marginal utility; Indifference curve-Concepts, properties, Budget line, Equilibrium of the consumer, Revealed preference hypothesis, Individual choice under Risk and Uncertainty: St. Petersburg paradox and Bernoulli's hypothesis, Neumann-Morgenstern method of constructing utility index, Friedman-Savage hypothesis	**6 Hrs**
Module-III	**Production, Cost and Market Structure:** Production function: short run production function and law of variable proportion; Long run production function: Isoquants, isocost line, returns to scale, Optimum factor combinations, Cost Analysis: Concepts, Classification- Short run and Long run cost curves, Analytical and accounting cost concepts; Market structure: Market classifications, Perfect competition: Characteristics, price and output determination in Short run and long run, Monopoly market: Price and output determination, price discrimination Modern theories of firms: Baumol's theory of sales revenue maximisation, Bain's limit pricing model.	**6 Hrs**
Module-IV	**Money and Banking:** Money-Function of Money, Demand for Money Theory. Quantity theory of money; Banking: Commercial Banks and their Functions, Central bank's Functions. Role of the Banks in Economic Development, Monetary and Fiscal Policy Tools and their impact on the economy.	**6 Hrs**
Module-V	**Capital Budgeting and Investment Analysis:** Time value of money: use of cash flow diagram, Annual economic worth, present worth, future worth, Internal Rate of Return (IRR), Net Present Value (NPV), Payback period method, Analysis of public projects: Cost-Benefit analysis, Cost effectiveness	**6 Hrs**
Essential Reading	1. Koutsoyiannis, A. (1979). Modern Microeconomics. The Macmillan Press Ltd., London 2. Pindyck, R. S., D. N. Rubinfeld and P. L. Meheta (2009). Microeconomics, Pearson India, New Delhi 3. Panneerselvam, R. (2007). Engineering Economics, Prentice-Hall of India, New Delhi 4. Mankiw Gregory N. (2002). Principles of Economics, Thomson Asia	
Course Outcomes	CO1- Utilise economics principles in consumption process CO2- Describe the utility measurement and measure the utility associated with risk CO3- Efficient use of resources in production and take decision regarding optimum output CO4- Describe market mechanism and analyse product market to take proper decisions CO5- Implement economic principles in company related decision making	

	SESSIONAL		
Subject Code	**CE1284**	**Total Contact Hour**	**22**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**Survey Practice**		
Pre-requisites	• Basic surveying principles and traditional land measurement methods • Foundation in mathematics (particularly geometry and trigonometry) • Understanding of engineering principles, basic computer literacy for data handling and software usage		
Course Objective	To equip students with a comprehensive understanding of advanced surveying techniques and equipment, such as digital theodolites, total stations, and DGPS, while developing practical skills in applications like height and distance determination, profile leveling, and stakeout operations for effective use in engineering projects.		
	List of Experiments		
1	Study of Digital Theodolite		
2	Determination of Tacheometric Constant		
3	Solution for Height and Distance		
4	Study of Auto level, Profile Levelling and Contouring		
5	Land Surveying using Digital Theodolite		
6	Study of Total Station		
7	Land Surveying using Total Station		
8	Stake out operation using Total Station		
9	Setting out of Simple Circular using Total Station		
10	Setting out of Transition Curve using Total Station		
11	Land Surveying using DGPS		
Course Outcomes	CO1. Proficiency in operating digital theodolites, total stations, and auto levels for diverse surveying applications. CO2. Ability to determine and apply tacheometric principles for solving height and distance measurement problems effectively. CO3. Ability to Conduct profile leveling and contouring surveys for interpretation and creation of detailedtopographic features of the terrain. CO4. Capability to perform stakeout operations and accurately set out geometric features, including simple circular curves and transition curves, utilizing total station technology. CO5. Utilize DGPS technology for precise land surveying practices.		
	SESSIONAL		
Subject Code	**CE1285**	**Total Contact Hour**	**22**
Semester	**4th**	**Total Credit**	**1.5**
Subject Name	**STRUCTURAL ENGINEERING LAB**		
Pre-requisites	Knowledge about behaviour of steel, concrete and RCC		
Course Objective	To understand the building material characterization process		
	List of Experiments		
1	Determination of Tensile strength of Steel (mild steel and tor steel)		
2	Determination of Percentage elongation for steel		
3	Determination of Stress- strain curve of steel		
4	Determination of Modulus of Elasticity of Steel		
5	Experiment on bend and re-bend test of steel reinforcement		
6	Experiment on Mix design of Concrete		
7	Experiment on Non-destructive tests of concrete: Ultrasonic Pulse Velocity		
8	Experiment on Non-destructive tests of concrete: Rebound Hammer		
9	Testing of RCC beam in flexure		
10	Influence line diagram for two hinged arch		
11	Finding reactions and forces for three hinged arch		
Course Outcomes	CO1. Connecttheory withpractice andapplication bydemonstration CO2. Practicetogetexposureonequipmentsandmachineslike UTM,reboundhammer,threeand two hinged arch, concretemixer etc CO3. Facilitateallinputsrequiredtohelptoattainprofessionalexpertisetoanalyzedata,interpretresults, and write technicalreports CO4. Understanding concrete mix design for different field conditions CO5. Summarizetheknowledgeandapplicationofsafetyregulations		
	SESSIONAL		
Subject Code	**CE1286**	**Total Contact Hour**	**16**
Semester	**4th**	**Total Credit**	**1.5**

Subject Name	**BUILDING DRAWING**		
Pre-requisites	Knowledge about building material & construction, engineering drawing		
Course Objective	To understand the plan and elevation for different types of buildings.		
	List of Experiments		
1	Plan, elevation, side view of residential/office building		
2	Detailing of doors/windows		
3	Drawing of several types of footing, brick work, floor staircase, masonry, arches and lintels.		
4	Types of steel roof trusses		
5	Drawing of 2 bedroom/3 bedroom houses (single and two storied), ground and first floor plans, elevation and section for load bearing and framed structures		
6	Project on establishment like Bank building/Post.		
7	Office/Hostel/Library/Auditorium/Factory building etc		
8	Introduction to Auto-CAD: Use of Auto-CAD in building drawing		
Course Outcomes	CO1. Apply the principles of planning and bylaws used for building planning CO2. Use Drawing for plan, section and elevation for various structures. CO3. Evaluate several types of footing. CO4. Explain staircase. CO5.Building drawing by Auto-CAD		
	SESSIONAL		
Subject Code	**CE1286**	**Total Contact Hour**	**20**
Semester	4th	**Total Credit**	**1.5**
Subject Name	**Transportation Engineering Lab**		
Pre-requisites	Knowledge about soil properties and behavior under load. Knowledge of aggregate characteristics. Familiarity with bitumen properties. Basic concepts of stress, strain, and material strength.		
Course Objective	To equip students with practical knowledge and skills in material testing methods essential for transportation engineering. To conduct standardized tests on soil, aggregates, bitumen, and bituminous mixes to evaluate their properties for pavement design and construction, ensuring quality, durability, and performance of road infrastructure.		
	List of Experiments		
1	Determination of subgrade soil strength for pavement design – California Bearing Ratio (CBR) Test.		
2	Determination of aggregate strength under compressive loads – Crushing Value Test.		
3	Assessment of aggregate toughness and resistance to impact forces – Impact Value Test.		
4	Measurement of aggregate resistance to surface wear and degradation – Los Angeles Abrasion Test.		
5	Evaluation of aggregate shape factors, including flakiness and elongation indices – Shape Test.		
6	Determination of bitumen consistency under varying temperature conditions – Penetration Test.		
7	Identification of the temperature value at which bitumen softens – Softening Point Test.		
8	Measurement of bitumen's elongation property before breaking – Ductility Test		
9	Determination of bitumen density and purity – Specific Gravity Test.		
10	Evaluation of the strength and stability of bituminous mixes under loading conditions – Marshall Stability Test.		
Course Outcomes	CO1. Evaluate subgrade strength through CBR testing for pavement design suitability. CO2. Conduct and interpret aggregate tests (crushing, impact, abrasion, shape) to assess material quality for pavements. CO3. Perform bitumen tests (penetration, softening point, ductility, specific gravity) to determine its suitability in road construction. CO4. Assess bituminous mix properties using the Marshall Stability Test for pavement performance. CO5. Apply standard testing protocols and demonstrate teamwork in laboratory settings		