3RD SEMESTER

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
Theory Papers				L	T	P		
1	BSM	BSM301	Mathematics - III	2	1	0	3	3
2	CSD	CSD015	Data Structure & Algorithm using Python	3	0	0	3	3
3	PCC	CEC301	Surveying-I	3	0	0	3	3
4	PCC	CEC302	Solid Mechanics	3	0	0	3	3
5	PCC	CEC303	Energy Science and Engineering	1	1	0	2	2
6	PCC	CEC304	Engineering Geology	1	0	0	1	1
7	PCC	CEC305	Building Materials and Construction	3	0	0	3	3
8	HSMC	BTHESP301	Essentials Studies for Professionals – III	2	0	0	2	0.5
Practical / Sessional Papers								
9	CSD	CSD095	Data Structure & Algorithm using Python Lab	0	0	2	2	1
10	PCC	CEC391	Surveying-I Lab	0	0	2	2	1
11	PCC	CEC392	Computer Aided Civil Engineering Drawing by AutoCAD Lab	0	0	2	2	1
11	PCC	CEC394	Engineering Geology Lab	0	0	2	2	1
12	PROJ	BTHPWCE381	Mini Project	0	0	0	0	1
13	HSMC	BTHSDP381	Skill Development for Professionals –III	0	0	2	2	0.5
Additional								
14		MAR381	Mandatory Additional Requirement (MAR)	-	-	-	-	1
15		MOOCs	Massive Open Online Course through NPTEL/SWAYAM Portal for Honours Degree					
16		IFC	Industry & Foreign Courses through different online portals					
TOTAL							**30**	**25**

Mathematics- III
BSM301
L-T-P: 3-1-0
Credits: 4

Pre-requisite: Basic Mathematics, Mathematics -II

Introduction: Topics in mathematics that every educated person needs to know to process, evaluate, and understand the statistical and graphical information in our society. Applications of mathematics in problem solving, finance, probability, statistics, geometry, population growth.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Apply integral transform methods to solve engineering problems.

CO2: Learn the basics of complex function, complex integration.

CO3: Learn the ideas of bivariate distributions with their properties and their applications in physical and engineering environments.

CO4: Apply statistical tools for analyzing data samples and drawing inference on a given data set.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

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

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Laplace Transform: Laplace Transform & its Properties, Laplace transform of periodic functions. Inverse Laplace transform, convolution theorem and Solution of ODE by using Laplace transform.

Fourier Transform: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier

Transform: Linearity, Shifting, Change of scale, Modulation. Fourier Transform of Derivatives. Convolution Theorem (statement only), Inverse of Fourier Transform.

Module 2: Fourier series: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of Fourier series. Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier series: Construction of Half Range Sine Series, Construction of Half Range Cosine Series.

Module-3: Complex Variables and Complex functions: Differentiation of complex functions, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series & Laurent's series, zeros of analytic functions, singularities, Poles, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine

Module-4: Bivariate Probability Distributions: Bivariate distributions and their properties (discrete & continuous), marginal distribution, distribution of sums and quotients, conditional densities & independence. Related problems.

Module-5: Correlation and Regression: Correlation, Concept of Regression. Regression Lines. To find the regression equations. Properties of Regression coefficients. Principle of Least Squares, Method of fitting a straight line & a parabola to a given set of observations. Related Problems.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 43 rd Edition
3. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-2B, Cengage Learning
4. Michael Greenberg, Advanced Engineering Mathematics, Pearson
5. Jain & Iyengar, Advanced Engineering Mathematics, Narosa
6. H. K. Dass, Advanced Engineering Mathematics, Sultan Chand
7. S. Ross, A First Course in Probability, Pearson Education India

References

1. Gupta & Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons

2. Miller & Freund's, Probability and Statistics for Engineers, Pearson Education.

3. Spiegel M R., Schiller J.J. and Srinivasan R.A.: Probability and Statistics (Schaum's Outline Series), TMH.

4. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.

Data Structure & Algorithm using Python

CSD015

L-T-P: 3-0-2

Credits: 4

Pre-requisite: Basic concepts in mathematics and programming languages.

Introduction: This course examines data structures and algorithms basics using python. The Topics to be covered (tentatively) include: an introduction to programming and problem solving in Python with basic concepts such as conditionals, loops, functions, lists, strings and tuples; Time and space analysis of algorithms; Linear Data structures like array, linked list, stack, queue; Non-linear Data structures like graph and tree; Sorting; Searching and Hashing.

Course Outcomes (CO):

In this course we will study the basic components of data structure and algorithm. Students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in python, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Students would be able to design & implement any data structure properly.

CO2: Students would be able to implement any problem by writing their own algorithm.

CO3: To understand basic concepts about stacks, queues, lists, trees and graphs.

CO4: To enable them to write algorithms for solving problems with the help of fundamental data structures

C O5: Fora given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3	3	3		3							3		
CO2	3			3								3		
CO3	2	3	3									2		
CO4	3	3	3		3							3		
CO5	3	3	1		3							3		

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space tradeoff.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module 2: Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation –corresponding algorithms and complexity analysis. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Module 3: Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4: Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Books

1. Data Structures and Algorithms in Python: Michael H. Goldwasser, Roberto Tamassia, Michael T. Goodrich, Publisher: John Wiley & Sons
2. Data Structure and Algorithmic Thinking with Python: Narasimha Karumanchi; Career monk publication.
3. Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
4. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-

freed.

5. Data Structures in C" by Aaron M. Tenenbaum.

References

1. Problem Solving in Data Structures & Algorithms Using Python: Programming Interview Guide: Hemant Jain; Create space Independent Pub
2. Data Structures and Algorithms Using Python: Necaise Rance D; Wiley publish

Data Structure & Algorithm using Python Lab

CSD095

Course Contents: Exercises that must be done in this course are listed below:

Exercise No.1: Implementation of array operations

Exercise No. 2: Stacks and Queues: adding, deleting elements

Exercise No. 3: Circular Queue: Adding & deleting elements

ExerciseNo.4: Merging Problem: Evaluation of expressions operations on multiple stacks &queues ExerciseNo.5: Implementation of linked lists: inserting, deleting, and inverting a linked list.

Exercise No. 6: Implementation of stacks & queues using linked lists, Polynomial addition, and Polynomial multiplication

Exercise No. 7: Sparse Matrices: Multiplication, addition. Exercise No. 8: Recursive and Non-recursive traversal of Trees

Exercise No. 9: Threaded binary tree traversal. AVL tree implementation

Exercise No. 10: Application of Trees. Application of sorting and searching algorithms

1.

Surveying-I

CEC409

L-T-P: 1-1-2

Credits: 3

Pre-requisite: Fundamental knowledge of Physics and Mathematics XII level.

Introduction: The concepts developed in this course will help in building the concept of surveying and leveling in civil engineering.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Understand the concepts of surveying and measurement of angles and direction.

CO2: Gain knowledge on instruments used in leveling.

CO3: Understand the methods and instruments used in different methods of traversing and contouring.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1														
CO2														
CO3														

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Chain surveying: Preparing index plans, Location sketches, Ranging, Preparation of map, Heights of objects using chain and ranging rods, Getting outline of the structures by enclosing them in triangles/quadrilaterals, Distance between inaccessible points, Obstacles in chain survey.

Module 2: Compass surveying: Measurement of bearings, Preparation of map, Distance between two inaccessible points by chain and compass, Chain and compass traverse.

Module 3: Plane Table survey: Temporary adjustments of plane table and Radiation method, Intersection, Traversing and Resection methods of plane tabling, Three-point problem

Module 4: Leveling: Temporary adjustment of Dumpy level, Differential leveling, Profile leveling and plotting the profile, Longitudinal and cross sectioning, Gradient of line and setting out grades, Sensitiveness of Bubble tube 4.

Module 5: Contouring Direct contouring, Indirect contouring – Block leveling, Indirect contouring – Radial contouring, Demonstration of minor instruments

Textbooks:

1. Basak, N. N. (1994). Surveying & Levelling. McGraw-Hill Education.

Surveying-I Lab

CEC499

Lists of Experiments:

1. Chain surveying

Preparing index plans, Location sketches, Ranging, Preparation of map, Heights of objects using chain and ranging rods, getting outline of the structures by enclosing them in triangles/quadrilaterals, Distance between inaccessible points, Obstacles in chain survey.

2. Compass surveying

Measurement of bearings, Preparation of map, Distance between two inaccessible points by chain and compass, Chain and compass traverse.

3. Plane Table survey

Temporary adjustments of plane table and Radiation method, Intersection, Traversing and Resection methods of plane tabling, Three-point problem.

4. Levelling

Temporary adjustment of Dumpy level, Differential levelling, Profile levelling and plotting the

profile, Longitudinal and cross sectioning, Gradient of line and setting out grades, Sensitiveness of Bubble tube.

5. Contouring

Direct contouring, Indirect contouring – Block levelling, Indirect contouring – Radial contouring, Demonstration of minor instruments.

Solid Mechanics

CEC408
L-T-P: 2-1-0
Credits: 3

Pre-requisite: Fundamental knowledge of Physics and Mathematics XII level.

Introduction: The concepts developed in this course will help in understanding the concept of stress-strain behavior in solids, bending moment and shear forces, flexural stresses etc.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Understand the basic concepts of both simple and compound stresses and strains in solids

CO2: Gain knowledge on bending moments and shear forces and construction of SFD and BMD

CO3: Understand the concept of flexural stress, shear stress and Torsion

CO4: Understand the concept of Slope and deflection and using the same to find slope and deflection of the determinant beam.

CO5: Understand the concept of Euler critical buckling load the in column

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3			3		3				3	
CO2	3	3	3	3					3				3	
CO3		3	3	3			3		3				3	
CO4		3	3	3					3				3	2
CO5		3	3	3			3		3				3	2

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience Gradual, sudden, impact and shock loadings – simple applications.

Module 2: Compound Stresses and Strains- Two-dimensional system, stress at a point on a plane,

principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. The two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.
Module 3: Bending Moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, a combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.
Module 4: Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.
Module 5: Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.
Module 6: Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.
Module 7: Theory of Columns – long column and short column – Euler's formula – Rankine's formula – Secant formula – beam column.
Module 8: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.
Module 9: Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

Textbooks:

1. Richards Jr, R. (2001). SOLID MECHANICS.
2. Karasudhi, P. (1991). Foundations of solid mechanics (Vol. 3). Taylor & Francis.

Energy Science and Engineering

CEC303
L-T-P: 1-1-0
Credits: 2
Pre-requisite: Fundamental knowledge of Chemistry XII level.
Introduction: The concepts developed in this course will help understanding the energy systems and resources; sustainability & the environment. It also provides understanding of the Civil Engineering Projects connected with the Energy Sources along with the concept of Green Building and Green Architecture.
Course Outcomes (CO): Upon successful completion of this course, students should be able to:
CO1: Understand basic concepts of energy systems and resources; sustainability & the environment.

CO2: Gain knowledge on clean energy technologies and its importance in sustainable development.
CO3: Understand how future energy use can be influenced by economic, environmental, trade, and research policy.
CO4: Know different Civil Engineering Projects connected with the Energy Sources.
CO5: Understand the basics concept of Green Building and Green Architecture.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

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

3 – High; 2 – Medium; 1 – Low

Course Contents:
Module 1: Introduction to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment.
Module 2: Energy Sources: Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries).
Module 3: Introduction to Energy Efficient Buildings: Need for Building Energy Efficiency, Introduction to Energy Efficient Buildings, Definitions and Components, Historical overview, Building Energy Performance Benchmarks, Heat Exchange & Building Energy Consumption, Building Energy Use Performance Analysis, Energy Performance Metrics, Indicators & Measures.
Module 4: Energy Efficiency in New Buildings: Passive Energy Efficiency Systems θ Micro Climate & Thermal Comfort θ Energy Performance Based Building Design.
Module 5: Energy Retrofit of Existing Buildings: Energy Conservation in Buildings-Moving Towards Net Zero, Energy Efficient Building Envelope Retrofit, Active Energy Retrofit Systems.
Module 6: Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.

Textbooks:

1. Baker, N., & Steemers, K. (2003). Energy and environment in architecture: a technical design guide. Taylor & Francis.
2. Twidell, J., & Weir, T. (2015). Renewable energy resources. Routledge.
3. José Manuel Andújar and Sergio Gómez Melgar , Eds. (2020) Energy Efficiency in Buildings (Both New and Rehabilitated). MDPI

Engineering Geology

CEC304
L-T-P: 1-0-2
Credits: 2

Pre-requisite: Fundamental knowledge of Chemistry XII level.

Introduction: The concepts developed in this course will help in understanding the usefulness of geology to civil engineering, scope of geological studies in various civil engineering projects along with Petrology, Strength Behavior of Rocks, Geological Hazards and basics of Rock Mechanics etc.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Understand the scope of geology in civil engineering.
CO2: Gain knowledge on physical properties of minerals, rock forming processes etc.
CO3: Understand the strength behavior of rocks and concept of rock deformation & tectonics.
CO4: Know different geological hazards, rock instability and slope movement, concept of sliding blocks etc.
CO5: Understand the geology of dam and reservoir site.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

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

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

Module 2: Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology- Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

Module 3: Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits.

Module 4: Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

Module 5: Geological Hazards-Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslides. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

Module 6: Rock masses as construction material- Definition of Rock masses. Main features constituting rock mass. Main features that affect the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging. Rock Quality Designation. Rock mass description.

Module 7: Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable

conditions, significance of discontinuities on the dam site and treatment giving to such structures. **Module 8: Rock Mechanics**- Sub surface investigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks, Bearing capacity of rocks.

Textbooks:

1. Attewell, P. B., & Farmer, I. W. (2012). Principles of engineering geology. Springer Science & Business Media.
2. Price, D. G. (2008). Engineering geology: principles and practice. Springer Science & Business Media.

Engineering Geology Lab

CEC394

List of Experiments:

Exercise No.1: To study of Physical properties of minerals
Exercise No.2: To Study various rock forming minerals.
Exercise No.3: Study of crystals with the help of crystal models
Exercise No.4: Identification of Rocks and Minerals [Hand Specimens]
Exercise No.5: Microscopic study of Rocks and minerals
Exercise No.6: Study of Geological maps, interpretation of geological structures.

Building Materials & Construction

CEC305
L-T-P: 3-0-0
Credits: 2

Pre-requisite: Fundamental knowledge of Chemistry XII level.
Introduction: The concepts developed in this course will help in understanding the knowledge of different building materials used in the construction sector.
Course Outcomes (CO): Upon successful completion of this course, students should be able to:
CO1: Gain knowledge on the classification and characteristics of good bricks, aggregates, their ingredients, harmful substances etc., Brick Masonry.
CO2: Understand the strength and behavior of binding materials like cement and lime, etc and different types of mortar
CO3: Gain knowledge on stones and paints, enamels, varnish, Bitumen.
CO4: Know various types of foundations, their requirements and uses
CO5: Know types of doors and window, understand the requirements of good stairs, dimension of steps, classification, geometric design along with various roofing materials.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3		3				3	
CO2	3	3	3	3	3	3			3				3	
CO3		3	3	3	3	3	3		3					
CO4		3	3	3	3	3			3					
CO5		3	3	3	3	3	3		3					2

3 – High; 2 – Medium; 1 – Low

Course Contents:

Module 1: **Bricks:** Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick Earth, Different forms of bricks, testing of bricks as per BIS. Defects of bricks. Brick masonry: Definitions, Rules for bonding, Type of bonds – stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall).

Module 2: Cement: Manufacturing of cement, Composition, Hydration of cement, Types of cement, Setting time of cement, Test on cement.

Module 3: Lime: Impurities in limestone, Classification, Slaking and hydration, Hardening, Testing, Storage.

Module 4: Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars

Module 5: Stone: Classification, sources, properties, applications.

Module 6: Wood and Wood Products: Classification of Timber, Structure, Characteristics of good timber, Seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Preservation of Timber Testing of Timber, Veneers, Plywood, Fiber Boards, Particle Boards, Chip Boards, Black Boards, Button Board and Laminated Boards, Applications of wood and wood products.

Module 7: Paints, Enamels and Varnishes: Composition of oil paint, characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and color wash, Varnish, French polish, and Wax Polish Miscellaneous Materials: Gypsum: Classification, Plaster of Paris, Gypsum wall Plasters, Gypsum Plaster Boards, Adhesives, Heat and sound insulating materials, Geo-synthetics.

Module 8: Foundations: Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations Wall, Doors and Windows: Load bearing wall, Partition wall, Reinforced brick wall Common types of doors and windows of timber and metal.

Module 9: Stairs: Technical Terms, Requirements of good stair, Dimension of steps,

Classification, Geometric design of a dog legged stair case Flooring: Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing Plastering and Pointing: Plastering with cement mortar, Defects in plastering, pointing, whitewashing, color washing, Distempering, Roofs: Types, Pitched roofs and their sketches, Lean – to roof, King Post – Truss, Queen post truss and Simple steel Truss , Roof Covering materials: AC sheets GI sheet.

Textbooks:

1. Rangwala, S. C., Rangwala, K. S., & Rangwala, P. S. (1992). Engineering materials. Charotar Publ..
2. Duggal, S. K. (2017). Building materials. Routledge.

Essential Studies for Professionals-III
BTHESP301
L-T-P: 0-0-1
Credits: 0.5

Pre-requisite: Basic concepts in mathematics and Basic English languages.

Introduction: This course examines economy, governance. The Topics to be covered, (tentatively): Economic Affairs, Quantitative Aptitude, Reasoning, Ancient & Medieval History.

Course Outcomes (CO): In this course we will study the basic components of Indian economy and Reasoning. Students are expected to be capable of understanding their advantages and drawbacks, how to implement them it all over the country, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Understand the values of the exam like Gate, IAS etc.
CO2: Understand the values of tax payment and mutual Fund
CO3: Understand the values of literature, languages etc.
CO4: Understand Working & Policies, Money Market & Capital Market.
CO5: Know about different short cut techniques to solve any kind of aptitudes.
CO6: Know about different short cut techniques to solve any kind of reasoning.
CO7: Know about different short cut techniques to solve any kind of communicating problems.
CO8: Know about different short cut techniques to solve any kind of societal problems.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

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

CO5	3	3	3		3							3		
CO6	3			3								3		
CO7	3	3	3									3		
CO8	3	3	3		3							3		

3 – High; 2 – Medium; 1 – Low

Course Contents:

Section A: Employment Enhancement Skills-III

Module-1: GK & CA, National income: Concept of GDP, GNP, NNP both in FC & MP, PCI

Tax: Concept of TAX, objective of TAX, Direct & Indirect Tax, Progressive, Regressive & Proportional tax.

Module-2: Market structure: Perfect competition, monopoly, oligopoly, duopoly, monophony, duopoly, Oligopoly. SEBI, IRDA, NHB –Working & Policies, Money Market & Capital Market, functions of Banks & Types of accounts, cheques & loans, Mutual Fund, Banking Terminologies.

Module-3: Science, Technology, Literature (with current updates): Monuments, sculptures, Literature, Languages, Visual arts – paintings etc. Performing arts – classical and folk dances, puppetry etc., religious diversity, Satellite, GPS, SIM, GSM, CDMA, Indian Regional Navigation Satellite System (IRNSS), NAVIC, WIFI, SIM, GPRS, ISRO, NASA.

Module-4: Ancient & Medieval History at a glance: From Indus valley civilization to Pre-Foreign (British, Dutch, French) Invasion. Current Affairs.

Section B: Skill Development for Professional – III

Module-1: Quantitative Aptitude: Basic concept of SI &CI, different formulas & their applications, concept of Growth & Contraction of Business. Data Interpretation- Tables, pie chart, histogram, Bar chart, solution tricks & techniques. Quant Review-Miscellaneous problems from different chapters & short cuts. Indices & Surds- Basic concept, Formulae & their applications, finding out the square roots, Elimination of Surds, Equation solve. Quadratic Equation- Polynomials, degree, powers, Equation & factors Solution. Progression-Concept of AP, GP &HP

Module-2: Reasoning:

Syllogism: a) Logical Venn diagram b) The If Else Statement **Puzzles** a) Seating Arrangement b) Classification c) Seating Arrangement with Blood relations **Machine Input-Output:** a) Pattern Based I/O **Inequality:** a) Coded Inequality, b) Jumbled Inequality, c) Conditional inequality **Sentence:** a) Sentence Corrections b) Fill the blanks with appropriate words/articles/ preposition/ verbs/adverbs/conjunction. **d**) Reading Comprehension (Advance Level) d) Vocabulary

Module-3: Advanced Data Interpretation level-III Newspaper reading: The Hindu & Economic Times

Text Books

1. Quantitative Aptitude for Competitive Examinations by R S Aggarwal
2. The Indian Economy, An Analysis of Economic Survey 2019-20 & Budget 2020-21 by Sanjiv Verma
3. Indian Financial System by Sujatra Bhattacharyya

References

1. Indian Economy for Civil Services, Universities and Other Examinations by Ramesh Singh
2. Indian Financial System, by Pathak PEARSON publisher.