College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra, Permanently Affiliated to S.P. Pune University)

Department of Civil Engineering

Curriculum Structure & Detailed Syllabus (UG Program)

Third Year B. Tech

(Effective from: A.Y. 2017-18)

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Program Educational Objectives (PEOs):

The Undergraduate students will be able to

I. Have successful career in the diversified sectors of the engineering Industry and / or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.

II. Analyze and design Civil engineering systems with social awareness and responsibility.

III. Exhibit professionalism, ethical approach, communication skills, team work in their profession and adapt to modern trends by engaging in lifelong learning.

Program Outcomes (POs):

The Undergraduate Students will be able to

(a) Apply knowledge of mathematics, science and engineering to civil engineering problems.

(b) Identify, formulate, research literature and solve complex civil engineering problems.

(c) Design various structures or particular system that meets desired specifications and requirements.

(d) Design and conduct experiments, interpret and analyze data, synthesize the information to provide conclusion.

(e) Select and use appropriate engineering techniques and software tools to analyze civil engineering problems with understanding of limitations.

(f) Assess local and global impact of societal issues on civil engineering profession.

(g) Able to understand the impact of engineering solutions on society and demonstrate the knowledge of, and need for sustainable development.

(h) Demonstrate their professional and ethical responsibilities.

(i) Able to function as a member or a leader on engineering and science laboratory teams, as well as on multidisciplinary teams.

(j) Communicate effectively in both verbal and written forms.

(k) Understand engineering and management principles and apply to their work as a member and/ or leader in a team to manage projects.

(l) Adapt transform in industry by understanding the need of independent and lifelong learning.

Correlation between the PEOs and the POs

Program Educational Objectives	Program Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
I	✓	✓			✓						✓	
II		✓	✓	✓	✓				✓			
III						✓	✓	✓	✓	✓	✓	✓

Note: The cells filled in with ✓ indicate the fulfilment/correlation of the concerned PEO with the PO.

List of Abbreviations

Abbreviation	Title
S.P. P.U.	**Savitribai Phule Pune University**
A.Y.	**Academic Year**
BSC	**Basic Science Course**
EFC	**Engineering Foundation Course**
MLC	**Mandatory Learning Course**
ILOE	**Institute Level Open Elective Course**
SLC	**Self-Learning Course**
HSMC	**Humanities/SocialSciences/Management Course**
LLC	**Liberal Learning Course**
SBC	**Skill Based Course**
PCC	**Program Core Course**
DEC	**Department Elective Course**
LC	**Laboratory Course**

Semester V

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Numerical Methods in Civil Engineering	3	0	0	3
2	MLC	Environmental Studies	1	0	0	0
3	PCC	Geotechnical Engineering	3	1	0	4
4	PCC	Transportation Engineering	4	0	0	4
5	PCC	Design of Steel Structures	3	0	0	3
6	PCC	Engineering Geology	3	0	0	3
7	LC	Transportation Engineering Lab	0	0	2	1
8	LC	Design of Steel Structures Lab	0	0	2	1
9	LC	Engineering Geology Lab	0	0	2	1
10	SBC	Geotechnical Engineering Lab	0	0	2	1
11	ILOE in Humanities/ HSMC	• English Proficiency-I • Finance for Engineers-I • Engineering Economics-I • Industrial Psychology-I • Personnel Psychology-I • Japanese Language-I • German Language-I	2	0	0	2
		Total	**19**	**1**	**8**	**23**
		Total Academic Engagement and Credits	**28**			**23**

No.	Semester	Minor Course	Honors Course (Any one in a semester)	Lectures	Credits
1	V	Construction Materials and Building Design	1. Advanced Building Planning and Design 2. Advanced Structural Mechanics	3	3
2	VI	Fundamentals of Geomechanics	1. Advanced Mechanics of Materials 2. Advanced Geotechnical Engineering	3	3
3	VII	Structural Analysis	1. Advanced Structural Design 2. Project Management 3. Any M. Tech Elective Course	3	3
4	VIII	Basics of Transportation Engineering	1. Advanced Transportation Engineering 2. Geotechnical and Structural Design of Foundations 3. Infrastructure Management 4. Any M. Tech Elective Course	3	3

Semester VI

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	MLC	Constitution of India	1	0	0	0
2	HSMC	Entrepreneurship Development	1	0	0	1
3	SLC	MOOC Course /Industry floated course	3	0	0	3
4	PCC	Construction Management	3	0	0	3
5	PCC	Design of RC Structures	3	0	0	3
6	PCC	Water Resources Engineering	3	1	0	4
7	LC	Construction Management Lab	0	0	2	1
8	LC	Design of RC Structures Lab	0	0	2	1
9	LC	Water Resources Engineering Lab	0	0	2	1
10	SBC	Mini project	0	1	4	3
11	ILOE in Humanities /HSMC	• English Proficiency-II • Finance for Engineers-II • Engineering Economics-II • Industrial Psychology-II • Personnel Psychology-II • Japanese Language-II • German Language-II	2	0	0	2
		Total	**16**	**2**	**10**	**22**
		Total Academic Engagement and Credits	**28**			**22**

SEMESTER-V

(CE 17015) Numerical Methods in Civil Engineering

Teaching scheme
Lectures: 3 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

1. Mathematically model a physical system.
2. Identify appropriate numerical method to find solutions of simulated physical system.
3. Apply the numerical methods to solve Civil Engineering problems.
4. Use computer program to get solution of problems in Civil Engineering.

Unit I: Introduction **[6 Hrs]**

Basic concepts of Numerical Methods: Mathematical modeling; accuracy and precision; errors analysis

Unit II: Roots of Equations **[7 Hrs]**

Graphical Methods; Bisection Method; Newton-Raphson Method; Multiple Roots

Unit III: Linear Algebraic Equations **[7 Hrs]**

Numerical Solution of Linear and Nonlinear Simultaneous Equations: Gauss- Elimination, Gauss- Seidal, Gauss- Jordan, Relaxation Technique

Unit IV: Curve Fitting **[7 Hrs]**

Least Square Regressions, Interpolation by Newton's Formulae, Lagrange Interpolating Polynomials, Spline Interpolation

Unit V: Numerical Integration **[7 Hrs]**

Numerical Integration using Newton-Cotes formulae, Gauss-Quadrature, Double Integration

Unit VI: Ordinary Differential Equations **[6 Hrs]**

Taylor's Series method; Euler's method; Modified Euler's method, Runge- Kutta method (Second and Fourth Order)

Reference Books:

- Chapra, Cannale, "Numerical Methods for Engineers", 6th edition, McGraw-Hill Int.,
- Sastry S. S., "Introductory Methods of Numerical Analysis", 5th edition, Prentice Hall of India Delhi.
- N Krishna Raju Ku Muthu, Numerical Methods For Engineering Problems, 2nd edition, Macmillan Children's Books
- Amos Gilat, "Numerical Methods for Engineers and Scientists", 3rd Edition, Wiley International, 2014.

- Ascher, U.M. and Greif, C., "A First Course in the Numerical Methods", SIAM Publication, 2011.
- Khoury, Richard, Harder, Douglas Wilhelm, "Numerical Methods and Modelling for Engineering", Springer International Publishing, 2016.

(ML – 17003) Environmental Studies

Teaching scheme:
ONE interactive session per week (TOTAL – 12 lectures including field work like exposure visit/ interaction/ actual contribution/ small project etc.)

Scheme for evaluation:
T1: Noting the classroom discussions & presentations on selected topics (50 marks)
T2: Report on field work &group activity/ies (50 marks)

Course Outcomes:

1. Students will understand the concept of environment and its importance for the mankind.
2. Students will also become aware of the current issues and environmental problems at local, national and global level
3. Students will be sensitized towards the protection, conservation and sustainable development
4. Students will think seriously about the impact human actions on environment and measures to minimize and mitigate them as an engineer
5. Students will learn about their role as professionals in protecting the environment from degradation

Unit I: The Global environmental issues **[2 Hrs]**
Human population and environment: Population growth, Environment and human health, Women and child welfare.
Social issues and environment: People and environment, Social consequences of development and Environmental changes.

Unit II: Natural resources **[2 Hrs]**
Concept, spheres, Direct & Indirect utilization of natural resources, Types - Renewable and non-renewable, Overexploitation & pollution, Conservation - 3R principle

Unit III: Ecosystem **[4 Hrs]**
Concept, Types – Terrestrial & aquatic with subtypes, Function, Food chain & web, Energy pyramid, Niche, Ecotone

Unit IV: Biodiversity **[4 Hrs]**
Introduction, levels, Types, Distribution & Magnitude, Threats, Conservation

Unit V: Pollution **[4 Hrs]**
Concept, Types & Sources, Direct & indirect Impacts, Prevention, control and mitigation measures, Disaster management

Unit VI: Environmental rules and regulations **[4 Hrs]**
Concepts, Local, national and Global level framework, tools like Environmental Impact Assessment, Environmental Management System, Certifications, Role of an engineer in environmental management

Textbooks:

- Bharucha, E. (2013) Textbook of Environmental Studies for Undergraduate Courses.
- Rajgopalan, R (2011) Environmental Studies: From Crisis to Cure. Oxford University Press
- Wright, RT (2007) Environmental Science. Pearson Education (Low Prise 9th Edition) 712 p.

Reference books:

- Carson, Rachel (1962) The Silent Spring
- Leelakrishnan, P. (2006) Environmental Law Case Book (IInd Edition) LexisNexis Butterworths (Student Serise) 466 p.
- McKibben, Bill (1989) The end of Nature
- Meadows, Donella, Meadows Dennis & Randers Jorgen (1996) Beyond the limits
- Odum, EP (1971) Fundamentals of Ecology, W.B. Saunders (Publi.). 574 p.
- United Nations Environment Program (2005) Atlas of Our Changing Environment
- Weisman, Alan (2007) The World without us
- Important web resources**:** Official websites of UNEP, UNESCO, MoEFCC, various NGO's

(CE 17006) Geotechnical Engineering

Teaching Scheme
Lectures: 3 Hrs / week
Tutorial: 1 Hr / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to

1. Identify type of soils and its various properties.
2. Measure permeability and compute seepage velocity & exit gradient.
3. Draw typical flow net and compute seepage discharge.
4. Identify suitable compaction methods.
5. Determine shear strength of soil.
6. Evaluate stresses within the soil mass.
7. Obtain bearing capacity of foundation.
8. Magnitude of earth pressure.
9. Assess the stability of slopes.

Unit I: Properties of Soil **[7 Hrs]**

Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil. Soil structure: single grained and honey combed, flocculated and dispersed.

Unit II: Permeability and Seepage: **[7 Hrs]**

Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils, Seepage forces, General flow equation. Flow net and its application.

Unit III: Compaction **[7 Hrs]**

Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils.

Unit IV: Shear Strength of Soil **[7 Hrs]**

Mohr's circle, Mohr-coulomb failure criteria, Effective stress concept. Peak and residual shear strength. Factors affecting shear strength. Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test.

Unit V **[7 Hrs]**

a) Stress Distribution in Soils:

Boussinesq theory- point load, pressure distribution due to line load, strip load, pressure bulb, Westergaard's theory, contact pressure, approximate stress distribution method.

b) Bearing Capacity of Foundation:

Types of foundations, Terzaghi's and Meyerhoff bearing capacity analysis, effect of various BC factor on bearing capacity, Shear failure and Settlement criteria, Pile foundation.

Use of field test (SPT and Plate Load) data for bearing capacity determination.

Unit VI **[7 Hrs]**

a) Lateral Earth Pressure:

Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory.

b) Stability of Slopes:

Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.

Note- More emphasis would be given on basic fundamentals in the course work.

Tutorial 1-Based on basic index properties of soil.
Tutorial 2- Permeability of soil
Tutorial 3-Permeability of layered soil and seepage forces
Tutorial 4- Compaction
Tutorial 5- Shear strength of soil
Tutorial 6- Stress distribution of soil
Tutorial 7- Bearing capacity determination of shallow foundation
Tutorial 8- Problems based on earth pressure determination for various condition
Tutorial 9- Slope stability.

Textbooks:

- Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications pvt. Ltd
- V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B.S.Publications (3rd Edition)
- B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi.
- Dr. B. J. Kasmalkar ,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference Books:

- Joseph E Bowles, "Engineering Properties of Soils And Their Measurements", McGraw Hill Publications (2001)
- Lambe and Whitman ,"Soil Mechanics", S. Chand publications(SI Version),(1969).
- Donald P Coduto, Man-chu Ronald Yeung and William A. Kitch "Geotechnical Engineering Principle and practice", McMillan Press (PHI) (2010)
- P Purushothma Raj ,"Geotechnical Engineering", McGraw Hill Publication 4th Edition (2008)
- Compendium of Indian standards on soil engineering part 1 (1980)

(CE 17007) Transportation Engineering

Teaching Scheme
Lectures : 4 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes

1. Students will understand fundamentals of highway, airport, bridge and railway engineering from the syllabus of Transportation Engineering. Students get basic knowledge of highway planning, geometrics, design, materials used and its quality in laboratory and field. (PO-a,e).
2. In bridge engineering students will study components of bridge sub-structure and super-structure, various hydraulics design forces, IRC loadings. (PO-a,e).
3. In airport engineering students will get knowledge of airport planning, layout, components of airport, runway, taxiway, heliport, etc. (PO-a,e).
4. In railway engineering students will achieve knowledge of railway construction, materials used and components, signalling systems, (PO-a,e).

Highway Engineering

Unit I: Introduction **[8 Hrs]**

Role of transportation, scope of road transportation, Highway development in India. Necessity of highway planning and development plans e.g. Nagpur Plan, Bombay plan, Lucknow plan.

Classification of Roads

Star and grid road pattern, planning and preparation of master plan based on saturation system, determination of road length.

Highway alignment and Geometric Design

Basic requirement of an ideal alignment and factors controlling it, Engineering survey for highway location, special requirement for hill roads, Design controls and criteria for geometric design, cross sectional element, sight distance requirements, stopping sight distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of horizontal curves, methods of introduction of extra widening, widening of pavement on horizontal curves, Horizontal transition curves, Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curves, vertical curves, S.S.D. and O.S.D. requirements.

Unit II: Highway materials and Quality Control **[8 Hrs]**

Importance and properties of sub-grade and pavement component materials, Behaviour of materials interaction, tests on aggregate, bituminous materials and bituminous mixes, Marshall stability test. Pavement Design Requirements, factors influencing the flexible and rigid pavement, Flexible pavement

design by Group Index Method and C.B.R. method, rigid pavement design, Westerguards analysis of wheel load stresses and temperature stresses in rigid pavement. I.R.C. recommendations. Pavement failure, Construction and maintenance and Quality control, repairs and maintenance.
Highway Drainage Importance of drainage, Subsurface and surface drainage systems and their design.

Bridge Engineering

Unit III **[7 Hrs]**

Definition of a bridge, basic components of a bridge, selection of bridge site, factors to be considered while deciding upon the type of structure for a particular bridge site, sub-surface investigation, determination of flood discharge, vertical clearance above HFL, scour depth, afflux, approach used to carry out assessment of design discharge at bridge sites, economic span, abutment pier, recommended design discharge, bridge classification, parameters governing choice of superstructure, span ranges for different type of bridge superstructures usually followed in India.

Unit IV **[7 Hrs]**

Importance of bridge economics in selection of a particular type of superstructure, characteristics and design aspects of various types of superstructures, reference codes, scope of various bridge codes used for reference, forces to be accounted for in the analysis for the design of a bridge , IRC Class AA Loading, IRC Class A Loading, IRC Class B Loading, IRC Class 70R Loading, general points to be taken into account during live load analysis for bridge design Bridge substructure and foundation, choice of type of foundation, general design procedure for design of substructure of a bridge, types of piers and their design aspects, general design procedure for the design of abutments , bearings for bridges, types of bearings, types of bearings recommended for various spans lengths and support, expansion joints for bridge superstructures and their types.

Airport Engineering

Unit V: Introduction **[10 Hrs]**

Advantage and limitation of air transportation, Aeroplane component parts and important terms Airport planning
Aircraft characteristics; which influence Judicious and scientific planning of airports selection of site, survey and drawings to be prepared for airport planning, Major Terminal Components**,** Functional Relationships of Terminal Components**,** Objectives in Selecting Terminal Concepts**,** Airport Master Plan, Factors influencing Terminal Configuration and Size, Forecasts, Terminal Apron Areas.
Airport layout: Characteristics of good layout, runway configuration, imaginary surfaces, location of terminal buildings, aprons and hangers, Zoning requirements regarding permissible heights of construction and landing within the airport boundary, planning aspect of important airports in the world.
Runways and Taxiways
Runway Location and orientation, wind coverage, use of wind, rose diagram, Basic runway length, corrections for elevation, temperature and gradient as per I.C.A.O and FAA recommendation, Airport classification by I.C.A.O basic recommendation for geometric design standards regarding length, width, longitudinal and transverse gradients and width of safety area, Taxiway System and Aprons, Exit Taxiways, By Pass Taxiways, sight-distance, turning radius and rate of change of longitudinal gradients, Airport Lighting and Markings, VFR Approach and Departure Paths.
Heliport
Characteristics of helicopter, Nature of helicopter transport, site selection for heliport, Touch Down and Lift off Area, Final Approach and Take off Area, Heliport Markers and Markings

Railway Engineering

Unit VI: Introduction **[10 Hrs]**

History of Indian Railways, Component parts of railway track, recent development in railways specifically w.r.t. track structure, Organizational structure of Indian railways, railway lines classification based on speeds such as A,B,C,D,E,Q,R and S routes.

Permanent way Component Parts

Types of rail sections, Coning of wheels, Rail creep, Rail defects, Rail joints, welding of rails, short welded rail (SWR), long welded rail (LWR) & continuously welded rail (CWR), sleepers requirement, Sleeper density, spacing, and types, Rail fittings, Elastic fastenings, bearing plates, anti-creep devices, check and guard rails, Ballast requirements and specification, Formation, Different cross sections of Track in cutting & embankment, suitability of drainage.

Points, crossing and turnouts

Functions, various types of track junction & their configurations, listing of types of Turnouts.

Signalling & Interlocking

Objects, classification, control of train movements and monitoring, types of signals, principal of interlocking, Modernization in Railways and railway tracks, High speed tracks.

Textbooks:

- S.K.Khanna, C.E.G. Justo, Nem Chand and Bros, Roorkee(U.A), 8th Edition,2
- S.K.Khanna, C.E.G.Justo, Highway Material Testing, Nem Chand and Bros, Roorkee(U.A),
- S.K.Khanna, M.G.Arora,S.S.Jain, Airport Planning And Design, Nem Chand and Bros
- S.P.Bindra, Bridge Engineering.
- S.C. Rangawala, Principals of Railway Engineering - Charotkar Publishing House.

Reference Books:

- O'Flaherty, C.A.:Highways Vol 2, Edward Arnold, London.
- Planning and Design of Airports: 4th Edition, by Robert Horonjeff and Francis McKelvey, McGraw-Hill, 1994.
- Airport Systems: Planning, Design and Management, by Richard DeNeufville and Amedeo Odoni, McGraw-Hill, 2003.
- S. Ponnuswamy (2008) Bridge Engineering, Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
- Yang H. Huang (2008) Pavement Analysis and Design, Pearson Education, Delhi.
- J.S. Mundrey, Railways Track Engineering - Tata McGraw Hill, New Delhi.

(CE 17008) Design of Steel Structures

Teaching scheme
Lectures : 3 Hrs /week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

After learning this course students will be able to

1. Analyse different components of a steel structure
2. Design bolted and welded connections
3. Design tension members
4. Design compression members
5. Design laterally restrained and laterally unrestrained beams
6. Design columns and their foundation

Unit I: **[8 Hrs]**

Introduction to structural design, Structural systems, Role of the designer, Advantages of steel as a structural material, Types of structural steel, Mechanical properties of steel, various rolled steel sections (including cold-formed sections, structural pipe (tubes)) sections and their properties.
Design philosophies: Introduction to working stress method, Limit state method. Introduction to Plastic theory: Plastic hinge concept, Plastic collapse load, Plastic moment, Shape factor, Plastic section modulus.
Types of loads acting on structure, Introduction to IS Codes and specifications: IS 875, IS 800

Unit II: **[8 Hrs]**

Bolted connections: Types of bolts, Behaviour of bolted joints. Strength of joint, efficiency of joint, Analysis and Design of connections, Beam to beam, beam to column.
Welded connections: Types and properties of welds, Types of joints, Design of connections, Beam to beam, beam to column.
Analysis and design of moment resisting bolted and welded connection

Unit III: **[6 Hrs]**

Tension members: Behaviour, Modes of failure, and Design of single and double angle sections.

Unit IV: **[6 Hrs]**

Compression Members: Behaviour, Modes of failure, Classification of cross section, Effective length, slenderness ratio, Design strength, Compression members in trusses.

Unit V: **[6 Hrs]**

Design of beams: Laterally restrained and unrestrained simply-supported beams. Design of compound beams and welded plate girder. Curtailment of flange plates.

Unit VI: **[6 Hrs]**

Design of columns subjected to axial load and biaxial bending, built up column sections, Laced and Battened columns. Column bases: Slab base and Gusseted base.

Textbooks:

- N. Subramanian (2009), “Design of Steel Structures”, Oxford University Press.

- V.L. Shah , V. A. Gore (2015) , "Limit State Design of Steel Structures", Structures Publications
- S.S. Bhavikatti (2012), "Design of Steel Structures by Limit State Method", I.K International Publishing House Pvt. Ltd., 3rd Edition

Reference Books:

- Edwin Gaylord and Charles Gaylord (2010), "Design of steel structures", Tata McGraw Hill Publishing company Ltd., New Delhi (3rd Edition)
- Robert Englekirk (2003), "Steel structures: controlling behaviour through design", John Wiley and Sons.
- Steel designer's manual (1994) : 5th Edition, ELBS Publishers
- SP: 6 (1995) : Handbook for Structural Engineers

I. S. Codes:

- IS 800 (2007) General Construction in Steel — Code of Practice
- IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections

(CE 17009) Engineering Geology

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

1. Know the fundamental concepts leading to formation of the Earth; Rocks and Minerals.
2. Develop the ability to perform basic engineering geological assessments and analysis.
3. Understand the relevance of Engineering Geology in complex projects which will strengthen their practical understanding of the subject.
4. Know the fundamental concepts leading to formation of the Earth; Rocks and Minerals.
5. Develop the ability to perform basic engineering geological assessments and analysis.
6. Understand the relevance of Engineering Geology in complex projects which will strengthen their practical understanding of the subject.

Unit-I : General Geology & Petrology **[8 Hrs]**

Introduction, Object, Scope & Sub-divisions, General Geology, Surface features, External & Internal Agents modifying the earth, weathering, decomposition, earth movements, Rock and minerals. Silicate and non-silicate minerals, rock forming minerals, primary and secondary minerals, essential and accessory minerals. Mineral composition of Igneous Rocks, Textures & textural variation, conditions of cooling of plutonic, hypabyssal and volcanic rocks. Classification of igneous rocks. Secondary Rocks processes and products of decomposition and disintegration. Transport and deposition, Classification of Sedimentary Rocks. Agents of transportation. Welding and cementation. Grain size classification. Agents and types of metamorphism,

Metamorphic textures, Contact cataclastic, dynamothermal and plutonic metamorphism. Study of common rock types of Igneous, Sedimentary, Metamorphic rocks as prescribed in practical work.

Unit-II: Structural Geology [6 Hrs]

Outcrop. Dip and strike. Conformable series. Unconformity and overlap. Different types of Faults and folds in rocks. Inlier and Outlier. Modes of occurrence of igneous rocks. Joints Fractures and their engineering characters. Mountains- Mountain building activity, orogenic and epirogenic processes.

Unit-III: Ground water, Geomorphology and Historical Geology [6Hrs]

Types of Ground water, Water table and depth zones of saturation. Influence of textures and Structures of rocks on groundwater storage and movement, Pervious and impervious rocks. Geological work of groundwater, effects of solution and deposition. Geological action of running water, river valley development, normal cycle of river erosion, Regional cycle of river erosion, waterfalls, ox-bow lakes, flood plain deposits, delta, Rejuvenation and Resulting features such as canyons, river terraces and incised meanders General principles of stratigraphy , Age of the earth and divisions of the Geological time. Physiographic divisions of India and their characteristics. Geological history of Peninsula. Study of formations in Peninsula and the significance of their structural characters in major Civil engineering activities, economic minerals.

Unit-IV: Building Stones and Stability of Slopes [6 Hrs]

Requirements of good building stone. Dependence of strength, durability, Ease of dressing, availability of blocks of suitable size and appearance on mineral composition Textures and field structures. Suitability of common rocks as building stone. Causes, Role of water, stability of slopes in consolidated material, influence of dip and slope, safe and unsafe slopes, Prevention of landslides, keeping slopes free from water , retaining walls Vegetation, slope treatment, Precautions to be taken while aligning roads etc. across hills and making cuts in hill slides. Case histories

Unit-V: Preliminary -Geological Explorations in Engineering Geology [6 Hrs]

Verification of surface data by subsurface exploration- Drill holes, test pits, trenches, exploratory tunnels, shafts, adits, drifts, etc. Compilation and interpretation of information obtained from these, Correlation of surface data with results of subsurface exploration. Limitations of drilling. Comparative reliability of data obtained by drilling and excavation. Engineering significance of Geological structures such as stratification, dips, folds, faults, joints, Fractures, crush zones, fault zones, dykes, etc. Case histories.

Unit-VI: Tunnelling, Dams and Reservoirs [8 Hrs]

Influence of geological conditions on design and construction methods, Preliminary Geological investigations for tunnels. Unlined tunnels. Case histories. Dependence of strength, stability and water tightness of foundation rocks and their physical Characters and Geological structures. Influence of geological condition on the choice of type And design of dams. Preliminary geological work on dam sites. Favourable and unsuitable Geological conditions for locating a dam. Precaution to be taken to counteract unsuitable Condition, Treatment of leaky rocks faults, dykes, crush zones, joints, fractures, unfavourable Dips, etc. Earth quakes in regions of dams. Case histories.

Dependence of water tightness on physical properties and structure of rocks. Geological Conditions suitable and unsuitable for reservoir sites. Conditions likely to cause leakage through reservoir rims. Importance of ground water studies and effects of raising of the water table. Case histories.

Earth movements, Earthquakes, Interior of the Earth, earthquake zones, Geological considerations for choosing sites of building in seismic area.

Textbooks:

- R.B. Gupte : A Text Book of Engineering Geology(New Edition) – P.V.G. Publications, Pune
- M.Anji.Reddy: A Text Book of Remote Sensing and Geographical Information Systems –2nd Edition, BS Publication.
- N.Chenna Kesavulu: A Text book of Engineering Geology.
- Pradeep kumar Guha: Remote Sensing for Beginners, East West Publications.
- Parbin B Singh: Engineering and General Geology. 2013 edition, S K Sons Publication.
- G.B. Mahapatra: Text book of Physical Geology.
- Mukherjee-Text book of Geology-4th Edition .The World Press Pvt. Ltd Calcutta.

Reference Books:

- R.Legget : Geology and Engineering – McGraw Hill Book Co., London
- FGH Blyth, and M.H. De Freitas: Geology for Engineers, ELBS.
- Anne E.Egger: Earth Structure: A Virtual Journey to the Center of the earth, Vol. EAS (1)
- Thomas Lillesand & Rals Kiffer: Remote Sensing & Image Interpretation –John Willey & Sons Publications

(CE 17010) Transportation Engineering Lab

Teaching Scheme | **Examination Scheme**
Practical: 2 Hrs / week | Oral: 25 marks

Course Outcomes:
Students should develop skills in performing experiments related to highway engineering and correlate with the quality standards.

List of Experiment

1. Aggregate impact value
2. Los Angeles abrasion Test
3. Flakiness and elongation index
4. California Bearing Ratio Test
5. Bitumen Penetration
6. Softening Point
7. Centrifuge extraction Test
8. Flash Point & Fire point test
9. Ductility test
10. Viscosity of bitumen
11. Specific gravity of bitumen
12. Marshall stability test
13. Demonstration of Benkelman Beam Apparatus
14. Demonstration of NDT concrete test Hammer
15. Relative Viscosity of Bitumen
16. Demonstration of Core cutting and grinding machine

Note: Perform at least 10 experiments.

(CE 17011) Design of Steel Structures Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

After learning this course students will be able to

1. Analyse the given structure considering practical approach.
2. Design different parts of the given structure using relevant IS codes.
3. Prepare the working drawings suitable for construction.
4. Correlate the practical and theoretical design aspects.

The laboratory work should include the following:

A. Design of any ONE structure as per IS 800- 2007

1. G+1 Industrial building with roof supported by steel trusses (Angle sections / Tubular Sections).
2. Pedestrian bridge

B. Design of continuous beams using plastic analysis as per SP: 6 (1995)
The Report should include

1. Brief Technical design project report involving: Introduction, assumptions, load calculations, analysis, preferably using suitable software and detailed design.
2. Drawings: Structural plan and detailed structural drawings
3. Report of a site visit mentioning structural details with relevant sketches of structural connections.

Reference Books:

- SP: 6 (1995) : Handbook for Structural Engineers
- IS 800 (2007) General Construction in Steel — Code of Practice
- IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections
- IS 875 (Part-I)-1997 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 1 : Dead Loads — Unit Weights of Building Materials and Stored Materials (Reaffirmed 1997)
- IS 875 (Part-II)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 2 : Imposed Loads(Reaffirmed 1997)
- IS 875 (Part-III)-1987 – Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures Part 3 : Wind Loads (Reaffirmed 2003)
- IS 875 (Part-IV)-1987 Code of Practice, for Design Loads (Other Than Earthquake) for Buildings and Structures Part 4 : Snow Loads (Reaffirmed 1997)
- IS 875 (Part-V)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 5 : Special Loads and Combinations (Reaffirmed 1997)

(CE 17012) Engineering Geology Lab

Teaching Scheme
Practical: 2 Hrs / week

Examination Scheme
Term work: 40 Marks
ESE: 60 Marks

Course Outcomes:

After studying this course, students will be able to

1. Identify different types of rocks
2. Carry field investigations based on the identification of Igneous, Sedimentary and Metamorphic rocks.
3. Apply the given Geological knowledge and make its effective use in various projects of Civil Engg in Preliminary Geological Explorations, Tunneling, Dams and Reserviors.

The laboratory work consists of the following experiments which are to be performed in the laboratory.

List of Experiments:

- Megascopic Identification of Rock forming Minerals(Silicates and Non Silicates)
  Quartz and its varieties, common varieties of cryptocrystalline and amorphous silica, orthoclase,plagioclase, muscovite, biotite, zeolites, calcite, icelandspar, gypsum, satinsparfluorite, barites, tourmaline, beryl, graphite, asbestos, talc, kyanite, garnet, galena, magnetite, haematite, limonite, iron pyrites, chromite, bauxite, azurite, malachite, psilomelane.
- Megascopic Identification of Igneous Rocks.Granites, syenites, diorites, gabbros, rhyolites, trachytes, andesites, basalts, varieties of Deccan trap rocks, volcanic breccias, pegmatites, dolerites, graphic granites.
- Megascopic Identification of Sedimentary Rocks.
  Laterites, bauxites, conglomerates, breccias, sandstones, quartzites, grits, arkose, shales, mudstone. Chemical and organic limestones etc. Sedimentary Structures.
- Megascopic Identification of Metamorphic Rocks.
  Marbles, quartzites, varities of gneisses, slates, phyllites and varieties of schists etc.
- Practical Core Logging and Recording of Data.
  Logging of drill cores and interpretation of drilling data. Graphical representation of the core logs as per PWD Handbook.

One site visit is desirable: To study local geology and its engineering applications.
Term work will consist of handwritten journal giving details of the experiments performed.
Practical Exam: The practical exam shall be based on the above practicals performed in the lab

(CE 17014) Geotechnical Engineering Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term-work: 50
Oral: 50 Marks

Course Outcome:
Students will be able to

1. Determine properties of various types of soil.
2. Apply knowledge to various field conditions.
3. Determine shear strength of soil.

Laboratory Experiments to be conducted:

1. Specific gravity determination by voluminometer / pycnometer / density bottle.
2. Sieve analysis, particle size determination and I. S. classification.
3. Determination of consistency limits.
4. Field density test by core cutter, sand replacement method.
5. Determination of co-efficient of permeability by constant head and by variable head method.
6. Direct shear test.
7. Standard proctor test.
8. Unconfined Compression Test

All the tests are to be performed on one type of soil and report is to be submitted for the term- work. A Laboratory Record based on the laboratory experiments would be submitted for the term- work. Oral Examination would be based on the term work and theory covered in the class under the course Geotechnical Engineering. Course Teacher for the Laboratory would decide the breakup to Oral Examination.

[AS(ILE)-17001] English Proficiency-I

Teaching Scheme:
Lectures: 1 Hr/week
each Practical: 4 Hrs/week

Evaluation Scheme:
T1 & T2: 25 Marks
End-Sem Exam: 50 Marks

Course Outcomes:
Students will be able to-

1. Communicate well using meaningful sentences for conversation or speech.
2. reproduce their understanding of concepts of communicating using English language
3. read and comprehend communication well and write an effectively and enhance formal communication
4. better Presentation skills and participate in healthy discussions both formal and informal among peers
5. become more confident in facing interviews, acquiring professional skills and will be industry ready

Unit I: Communication as a skill: **[3 Hrs]**
Review of the basic understanding of communication as a skill and its need for effective business communication for Engineers

Unit II: Conversational Skill Development: **[3 Hrs]**
Formal and informal expressions, general discussions, Vocabulary Building

Unit III: Business Communication: [**4 Hrs]**
Letter Writing, Note making, Minutes, Summarizing

Unit IV: Business Etiquette: **[3 Hrs]**
Basic Mannerisms and Grooming required for professionals

Textbooks:

- Communication Skills for Technical Students by T.M. Farhathullah (Orient Longman)
- Communication for Business: A Practical Approach by Shirley Tailor (Longman)

Reference Books:

- Communication Skills for Engineers by S. MisHra & C. Muralikrishna (Pearson)
- Written Communication in English by Saran Freeman (Orient Longman)
- Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)
- Enhancing Employability at Soft Skills by Shalini Varma (Pearson)

(AS (ILE)-17002) Finance for Engineers –I

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
T1 (Assignment): 20 marks
T2 (Written Test): 20 marks
End Semester Exam: 60 marks

Course Outcomes:
Students will be able to-

1. To understand the importance of financial literacy.
2. To understand the basics of accounting & accounting principles.
3. To analyze & solve the problems based on the above concepts.

Unit I: Accounting, Cost accounting & Management accounting, Various types of business entities, Accounting principles, postulates & meaning of accounting standards, Accounting cycle, Capital and revenue, Revenue, Expenses, Gains & Losses, Types of accounts & their rules, Journal Entries

Unit II: Create ledger, Preparation of Trial Balance, Finalizations, Preparation of Trading & Profit & Loss account, Understanding of Assets & Liabilities, Concept of Balance Sheet, Preparation of Balance sheet

Textbooks:

- ‘‘Financial Accounting”, Dr. Kaustubh Sontakke [Himalaya Publishing House]

Reference Books:

- Accounting Theory & Practice Prof Jawahar Lal [Himalaya Publishing House]

[AS(ILE)-17003] Engineering Economics-I

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
Field Work/Assignment: 40
End Semester Exam: 60

Course Outcomes:

Students will be able to-

1. understand the nature of markets and competition
2. learn about Basic Concepts of Economics, Micro and Macro
3. understand the importance of how industries behave
4. understand the basis in our day to day life to gain personal financial control
5. learn about start-up culture and economics
6. get to know finance generation and funding rounds

Unit I: Basic Concepts of Economics **[6 Hrs]**

Definitions, Overview of Micro and Macro Economics, Explanation of theories of demand, supply and market equilibrium and Economics Basics – Cost, efficiency and scarcity**,** Opportunity Cost

Unit II: Micro Economics: **[8 Hrs]**

Differences and Comparison, Theories of Utility and Consumers Choice, Competition and Market Structures, Markets and Prices, Market Failures, Income Distribution and Role of Government

Unit III: Macro Economics **[6 Hrs]**

Aggregate Demand and Supply, Economic Growth and Business Cycles, The role of the Nation I economic activity, New Economic Policy in India, Fiscal Policy, GDP and Inflation, Consumption, savings and investments, Commercial and Central banking

Unit IV: Industrial Economics **[8 Hrs]**

Behaviour of firms: Strategies with regard to entry, pricing, advertising, and R & D and innovation. The development of Firms and Market and Industrial Structure: Stochastic models of firm growth, and market structure, inter-industry differences in growth rate variance, economies of scale, technical change, mergers and market concentration. Development of Competitive capabilities: Role of Technology and Skills, FDI and Technology Transfer, Technological Spillovers, Globalization and Technology Intermediation.

Textbooks:

- Baumol, William J., Economic Theory and Operations Analysis, [Prentice Hall India Ltd.] Fourth Edition, 1985.
- Sloman, John H., Economics [Prentice Hall India Ltd.] Second Edition, 1994.
- Varian, Hal, ` Intermediate Microeconomics: A Modern Approach, Fifth Edition [Norton, 1999].
- P.A. Samuelson & W.D. Nordhaus, Economics, McGraw Hill, New York, 1995.
- Koutsoyiannis, Modern Microeconomics, Macmillan, 1975.
- R. Pindyck and D.L. Rubinfeld, Microeconomics, Macmillan Publishing Company, New York, 1989.

Reference Books:

- R.J. Gordon, Macroeconomics 4th Edition, Little Brown & Co., Boston, 1987.
- William F. Shughart II, The Organization of Industry, Richard D. Irwin, Illinois, 1990. (Chapter 3).

[AS(ILE)-17004] Industrial Psychology-I

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme
Fieldwork/Assignment:40
End Semester Exam: 60

Course Outcomes:

Students will be able to-

1. understand the nature, scope, challenges and role of technology in Industrial Psychology
2. learn about major psychological factors that influence individual differences in behaviour at work
3. understand the importance of motivation and involvement in determining satisfaction at work
4. understand the elements of psychometric testing and develop skills to face the same in future
5. learn about physical and psychological aspects related to workplace in terms of environmental conditions, safety and health
6. get to know the stressors of work and learn coping strategies to strike work-life balance
7. understand the role of human factors, especially sensory systems and cognitive abilities, in designs that promote man-machine harmony
8. demonstrate the knowledge gained through practical implementation

Unit I: Introduction to Industrial Psychology **[6 Hrs]**

Nature and Development of Industrial/Work Psychology
Historical background- Time and Motion Study, Hawthorne Studies, World War I & II, Scope & Challenges: Current status, Role of Technology

Unit II: People at Work **[8 Hrs]**

Individual Differences: Personality, Intelligence, Emotional Intelligence, Creativity & Innovation, Perception & Attitudes, Motivation- N-Ach, Expectancy Theory & Equity Theory, Modern Approach to Motivation; Job Satisfaction- Job Diagnostic Model, Measuring Job Satisfaction, Psychometric Testing at Work- Cognitive Abilities, Personality, Emotional Intelligence

Unit III: Characteristics of Workplace **[6 Hrs]**

Working Conditions- Physical (e.g. Work Schedule, etc.) & Psychological (E.g. Fatigue, Boredom, etc.), Safety & Health Practices at Workplace- Accidents, Violence, Harassment, Alcoholism & Drug, Stress at Workplace- Individual Responses to Stress; 3 Cs of Stress- Causes, Consequences & Coping with Work Stress

Unit IV: Engineering Psychology-I **[6Hrs]**

Brief History and Scope, Person-Machine Systems- Basic Human Factors: Sensory systems- Visual (light, color, night vision, depth perception), Auditory (sound, alarms, noise), Tactile & Vestibular senses; Cognition & Decision Making, Displays: Visual & Auditory Control

Textbooks:

- Schultz, D. & Schultz, S. E. (2013). *Psychology and Work Today: An Introduction to Industrial and Organizational Psychology*. 7th Edition. Pearson Education: New Delhi.
- Matthewman, L., Rose, A. & Hetherington, A. (2009). *Work Psychology*. Oxford University Press: India.
- Wickens, C. D.; Lee, J. D., Liu, Y. & Gordon Becker, S. E. (2015). *An Introduction to Human Factors Engineering*. 2nd Edition. Pearson Education: New Delhi.

Reference Books:

- Landy, F. J. & Conte, J. M. (2010). *Work in the 21st Century: An Introduction to Industrial and Organizational Psychology*. 2nd Edition. Wiley India: New Delhi.
- Schultz, D. & Schultz, S. E. (2002). *Psychology and Work Today*. Pearson Education: New Delhi.

[AS(ILE)-17005] Personnel Psychology-I

Teaching Scheme-
2 lectures/week

Examination Scheme
3 Assignments: 60 marks
End semester: 40 marks

Course Outcomes:

Students will be able to-

1. Have understanding of organizational concepts and behavior.
2. Have understanding about their own personality for corporate world.
3. Understand importance of groups and its dynamics.
4. Understand the importance of self-management and development.

Unit I: Introduction **[2 Hrs]**
Basic concepts in organizational set up and its importance

Unit II: Personality and corporate world **[8Hrs]**
Know and accept you, preparing for corporate world, approaches towards work

Unit III: Group behavior and leadership **[8 Hrs]**
Group behavior and effectiveness, effective Leadership and management principles

Unit IV: Self-management & development **[4 Hrs]**
Efficient working habits, self-training and self-development

Textbooks:

- Khana S.S.-(2016) Organizational Behaviour (Text and Cases) Chand and company Pvt. Ltd. Delhi.
- Rae Andr'e:- (2008) organizational behavior. Dorling Kindersley (India) Pvt. Ltd.
- Wallace Hand Masters L. - (2008) Personality development. Cengage Learning India Pvt. Ltd.

Reference books:

- Robbins S, Judge A, VoHra N :- (2013) Organizational behavior. (15th ed.) Pearson Education, Inc.
- Singh Kavita :- (2010) Organizational behavior-Text and cases. Dorling Kindersley (India) Pvt. Ltd

[AS(ILE)-17006] Japanese Language-I

Teaching Scheme: 2 Hrs/week

Evaluation Scheme:
Oral Exam: 20 Marks
Written Exam**:** 80 Marks

Course Outcomes

Students will be able to-

1. know the basic information of japan
2. be familiar with the pronunciation, accent, intonation and Japanese writing system hiragana, katakana and kanji
3. speak daily greetings
4. count the numerals
5. introduce themselves, family members
6. form basic questions
7. understand Colors, Years, Months and Days, Time expressions, Directions to read the city map

Unit I: **[6 Hrs]**

Introduction to Japanese Syllables (phonetic alphabet), greetings & Self introduction, identifying things, point objects and listen to their names, Listen to things and places etc; Creating shopping lists

Unit II: **[6 Hrs]**

Introduction to Time, day of the week, simple inquiries on telephone, Means of transport, Basic conversations of everyday life

Unit III: **[6 Hrs]**

Frame questions in Japanese. Vocabulary of giving and receiving objects, stating impressions/things surrounding us, Expressing likes and dislikes, good/bad, possessions, Talking about the country, town and the environment

Unit IV: **[6 Hrs]**

Quantity, number of people, time, period etc., Stating thoughts and impressions, Conveying movement (e.g. go / come)

Textbooks:

- Minnano no Nihongo 1-1. Goyal Publishers& Distributors Pvt. Ltd. Delhi, India

[AS(ILE)-17007] German Language-I

Teaching Scheme: 2 Hrs/week

Evaluation Scheme:
Oral Exam: 20 Marks
Written Exam**:** 80 Marks

Course Outcomes:

Students will be able to-

1. know the basic information of Germany
2. be familiar with the pronunciation of German letters and greetings
3. count till 100
4. introduce themselves
5. form basic questions
6. to read city maps

Unit I: Start auf Deutsch: (Begin in German) **[8 Hrs]**

Deutschland, Deutsch sehen und hören, erste Kontakte, Texte: Lied, Postkarte, Wortfelder: internationale Wörter, deutsche Namen

Unit II: Café: (Café) **[6 Hrs]**

Gespräche im Café, Texte: Getränkekarte, Telefonbuch, Rechnungen, Wortfelder: Gespräche im Café, Zahlen bis 100, Strukturwörter

Unit III: Städte, Länder, Sprachen: (Cities, Countries, Languages) **[5 Hrs]**

Sehenswürdigkeiten in Europa, Sprachen in Europa, Nachbarsprachen, Texte: Landkarten, ein Statistik, Wortfelder: Himmelsrichtungen, Sprachen

Unit IV: Menschen und Haüser: (People and Houses) **[5 Hrs]**

Wohnwelten, Texte: Möbelkatalog, E-Mail, Wohnungsgrundriss, Wortfelder: Räume und Möbel, Wohnformen

Textbooks:

- Funk, Kuhn, & Demme. Studio d A1. Deutsch als Fremdsprache. 2011. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India

Minors Course

[CE(MI)-17001] Construction Materials and Building Design

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:
Students will be able to

1. Identify different building materials.
2. Demonstrate properties of different material.
3. Apply various principles of building planning.

Unit I: Building materials **[6 Hrs]**
A)Stones :Stones Requirements of good building stones, IS specification and tests on stones ; stone masonry
B)Brick and block masonry:Characteristics of good building bricks, IS specifications and test; Classification of bricks

Unit II: Materials for Doors and windows **[6 Hrs]**
Functional requirements, materials of doors and windows, glazing, method of fixing doors a windows, fixtures and fastenings.
Timber Types and properties, seasoning, testing; Glass – Types and properties;

Unit III: Flooring and Roof material **[7 Hrs]**
(A) Flooring materials, tests and IS specifications:
Ground and upper floors; Flooring functional requirements of flooring material, varieties offloor finishes and their suitability.
(B) Roofing materials:
GI, AC, fibre sheets, Mangalore tiles; Roof construction – types and their suitability.

Unit IV: Miscellaneous materials **[6 Hrs]**
Properties, types and uses of following materials, Lime, Ferrous metals, Polymers, Plastics types, Mastic, Gypsum, Ferro Crete, Clay Tiles and glazed ware, Plaster of Paris. Artificial stone; Aluminium and alloys– Properties.

Unit V: Building planning **[8 Hrs]**
Principle of Building planning, Integrated approach in Built Environment, Building Rules and Byelaws, Necessity of laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), marginal distance,building line control line, height regulation, Built-up area, floor area, carpet area, Landscape elements and elements of interior decoration.

Unit VI: Building Design **[7 Hrs]**
Introduction, Types of load, thermal insulation of roofs and walls. Ventilation: Necessity of ventilation, stack effect, wind effect, Mechanical ventilation, objectives, selection of ventilation system, ventilation rate,
Lighting**:** Principles, Day lighting, design of windows, sky component, E.R.C, Orientation, artificial illumination, supplementary illumination

Textbooks:

- Shah M.G., Kale C.M. and Patki S.Y., "Building drawing an Integrated approach to Built environment", Tata McGraw Hill (Fifth edition).
- Mentt, "Building Design and Constructions", Tata McGraw Hill (Second edition)

Reference Books:

- National Building Code of India 2016, Bureau of Indian Standard, New Delhi
- Ghosh,"Materials of Construction" Tata McGraw Hill
- M. S. Mamlouk and J. P. Zaniewski, Materials for Civil and Construction Engineers, 3rd Ed., Prentice Hall, USA, 2010.
- P. C. Varghese, Building Materials, PHI Learning Pvt. Ltd., India, 2005.
- TTTI Chandigrah, "Civil Engineering Materials", Tata McGraw Publication

[CE (HO)-17001] Advanced Building Planning and Design

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem Exam: 60 Marks

(For T-I and T-II Examinations various format can be used with prior intimation to the students concerned.)

Pre-requisites: Building Planning, design and Construction

Course Outcomes:

Students will be able to:

1. understand the statutory framework for building design
2. understand the design of multifunction public building
3. understand the design of green building
4. understand the design of intelligent building concept
5. understand the design of high rise building

Unit-I: Study of Statutory Framework for Building Design [7 Hrs]
Study of National Building Code, Development Control Regulations, Byelaws pertaining to Development Activities, Restriction on development by various agencies, such as, Airport Authority of India, Archaeological Survey of India, Highway Authorities, Irrigation Department, Pollution Control Board, Coastal Regulation Zone Management Authority, Tree Authority, National Green Tribunal, etc.

Unit-II: Design of Multifunction Public Building [7 Hrs]
Study Multifunctional Public Building, Requirements of Multifunctional Public Buildings, Estimation of Parking Requirements, Mass Horizontal & Vertical Circulation, Universal Accessibility, Flexibility in Internal Design, Integrated Sanitary System, Water Supply System, Power Supply System, Fire Fighting System, Air Conditioning System, Garbage Management System, Safety and Security Measures, etc.

Unit-III: Design of Green Building **[7 Hrs]**

Principles and Planning Concepts of Green Buildings: salient features of a Green Building, Site Integration, Benefits of Green Buildings, Environmentally Friendly - Ecohousing, Use of Insulating Materials, Energy & Water Conservation in Buildings, Storm Water Harvesting and Management, Methods of Rain Water Harvesting, Green Construction Materials, Non-Toxic Paint, Green Roofing, Economics of Green Buildings, etc.

Unit-IV: Intelligent Building Concept **[7 Hrs]**

Introduction to Intelligent Buildings - High Performance Buildings - basic concepts of Intelligent Buildings - Intelligent Building Automation, Cost Analysis of Intelligent Buildings, Introduction to Smart Materials and Embedded Sensor Technology – Building Management System (BMS) and Energy Savings, BMS Benefits, External Skin Systems, Intelligent Flooring, Raised Floor System, etc.

Unit-V: Intelligent Comfort Systems **[6 Hrs]**

Introduction - HVAC System - Human Comfort - Artificial Intelligent Systems – Occupancy Sensors – Temperature Sensors; Energy Efficient HVAC Systems –Thermal Energy Storage – Under Floor Air Distribution Chilled Beams – Other Emerging HVAC Technologies for High Performance Buildings - Automated Car Parking Management, etc.

Unit-VI: Planning of High Rise Building **[6 Hrs]**

Design Criteria: Design Philosophy, Classification of High Rise Building Structural System - Types - Shear Frames, Interacting Systems, Partial Tubular Systems, and Tubular Systems, Composite Steel Floor Systems, Braced Frames and Moment Resisting Frame Systems, Shear Wall Systems, Core and Outrigger Systems, Tubular Systems, Hybrid Systems, etc.

Textbooks:

- Jain, V. K., Designing and Installation of Services in Building Complexes and High Rise Buildings, Khanna Publishers, New Delhi.
- Kibert C. J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Ed., John Wiley, Hoboken, New Jersey
- Jan F. Kreider, Handbook of Heating, Ventilation, and Air Conditioning" Taylor & Francis, 2001
- Derek Clements-Croome, "Intelligent Buildings: An Introduction" Routledge; 1st Edition (December 14, 2013)

Reference Books:

- Proceedings of the Council for Tall buildings - Vol 1 to 10
- National Building Code, 2005 & 2016
- BIM Handbook / Eastman, Teicholz, Sacks, Liston / Wiley
- A Handbook of Planning of Office Buildings published by Directorate General, Central Public Works Department

[CE (HO)-17002] Advanced Structural Mechanics

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

At the end of this course the student will be able to

1. analyse frames by displacement methods
2. analyse structures by matrix methods
3. analyse two hinged and three hinged arches
4. perform approximate analysis of multi-bay and multi-storey frames
5. analyse structures using commercial software

Unit I: **[7 Hrs]**

Analysis of indeterminate Structures by displacement methods
A) Slope deflection method
B) Moment distribution method
Applications to non-sway and sway frames

Unit II: **[7 Hrs]**

Flexibility method of analysis: Formulation of flexibility matrix.
A) Application to beams and rigid jointed rectangular plane frames, Settlement and rotation of supports.
B) Application to pin jointed Plane trusses, Lack of fit, Temperature change

Unit III: **[6 Hrs]**

Stiffness method of analysis: Formulation of stiffness matrix
A) Application to beams and rigid jointed rectangular plane frames, Settlement and rotation of supports.
B) Application to pin jointed Plane trusses, Lack of fit, Temperature change

Unit IV: **[7 Hrs]**

Arches –Three hinged and two hinged arches. Parabolic and Semi Circular arches. Influence lines

Unit V: **[7 Hrs]**

Approximate methods of analysis of multi-storeyed, multi-bay rigid jointed frames.
(i) Portal frame method (ii) Cantilever method (iii) Substitute frame method

Unit VI: **[6 Hrs]**

Analysis of structures (2D and 3D Frames) using commercial software

Textbooks:

- R. C. Hibbeler, “Structural Analysis”, Pearson Education Publication
- R. C. Hibbeler (2005), “Mechanics of materials”, Pearson Education Publication, 6th Edition
- Pandit and Gupta (1999), “Theory of Structures”, Vol. I, Tata McGraw Hill Publication

Reference Books:

- Wilbur and Norris ,"Elementary Structural Analysis", Tata McGraw Hill Publication
- Gere and Weaver (1998),"Matrix Analysis of Framed Structures", CBS Publication Delhi, 2nd Edition
- C. K. Wang (1983) , "Intermediate structural analysis", Tata McGraw Hill Publication
- Pandit and Gupta (1997), "Structural analysis: A matrix approach", Tata McGraw Hill Publication
- C. S. Reddy (1996), " Basic structural analysis", Tata McGraw Hill Publication, 2nd Edition

SEMESTER-VI

(ML 17001) Constitution of India

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme
Assignments/Quiz -40 marks
End-Sem Exam- 60 Marks

Course Outcomes

1. Student will be able to understand how India has come up with a Constitution which is the combination of the positive aspects of other Constitutions.
2. Student will be able to understand the interpretation of the Preamble.
3. Student will be able to understand the basics of governance of our nation.
4. It helps in understanding the different aspects covered under the different important Articles.
5. Student will be able to understand the basic law and its interpretation. Understand the important amendments which took place and their effects.
6. Student will be able to understand our Union and State Executive better.
7. Student will be able to understand the basic that along with enjoying the rights one needs to fulfill one's duties.
8. Student will be able to understand and Gain confidence on our Constitution by knowing it better.

Unit I **[3 Hrs]**
Meaning and history of Constitution. Understanding the concept of Human Rights and Fundamental Rights.

Unit II **[6 Hrs]**
Introduction to The Constitution of India, understanding its objects. Preamble to the constitution of India. Fundamental rights under Part – III, exercise of rights, limitations and important cases. Prerogative Writs.

Unit III **[4 Hrs]**
Relevance of Directive principles of State Policy under Part – IV, Fundamental duties & their significance.

Unit IV **[3 Hrs]**
Union Executive – President, Prime Minister, Parliament & the Supreme Court of India.

Unit V **[3 Hrs]**
State executive – Governors, Chief Minister, State Legislature and High Courts

Unit VI **[4 Hrs]**
Constitutional Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes. Emergency Provisions.

Unit VII **[3 Hrs]**
Electoral process.
Amendment procedure, 42^{nd}, 44^{th}, 73^{rd},74^{th}, 76^{th} , 86^{th} , 91^{st} , 98^{th} and latest amendment.
Constitutional amendments.

Textbooks

- Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice – Hall EEE, 19th/20th Edn., 2001.
- Engineering Ethics by Charles E.Haries, Michael. S.Pritchard and Michael J.Robins Thompson Asia, 2003-08-05.

Reference Books

- An Introduction to Constitution of India by M.V. Pylee, Vikas Publishing.

(HS-17001) Entrepreneurship Development

Teaching Scheme
Lectures: 1 Hrs/week

Examination Scheme
Fieldwork/Assignment: 40
End Semester Exam: 60

Course Outcomes

1. Students would understand different types of Entrepreneurial ventures and would be able to discover, develop, and assess opportunities
2. Students would learn about opportunity and risk analysis
3. Students would understand the strategies for valuing your own company, and how venture capitalist and angel investors use valuations in negotiating milestones, influence and control
4. Students would understand to pick correct marketing mix and how to position the company in the market by using analytical tools
5. Students would learn how to sale themselves and the product/service and to handle objections
6. Students would get to know how organizations operates and their process matrices
7. Students will learn how start new ventures
8. Students will learn how to write winning business plans

Unit I: Market Research **[2 Hrs]**
Introduction to Entrepreneurship, Profile of the Entrepreneur, Market Gap / Opportunity Analysis, Market Research Methods, Defining the Focal Market: Market Segmentation, Industry analyzing – Research / Competitive Analysis

Unit II: Types of Companies and Organizations **[1 Hr]**
Company/ Organization Types, Legal Aspects, Taxation, Government Liaison, Building the Team, Mergers and Acquisitions

Unit III: Business Finance **[2 Hrs]**
Shares and Stakes, Valuation, Finance Creation (Investors / Financers), Revenue Plans and Projections, Financial Ratios, Business Lifecycle, Break Even

Unit IV: Marketing **[2 Hrs]**
Marketing Basics, Marketing Strategy and Brand Positioning, Plans and Execution Techniques, Marketing Analytics, Online Marketing

Unit V: Sales **[2 Hrs]**
Understanding Sales, Pitching Techniques, Sales strategies, Inside Sales v/s Outside Sales, RFP

Unit VI: Operations Management **[1 Hrs]**

Operational Basics, Process Analysis, Productivity, Quality

Unit VII: Start-ups **[2 Hrs]**

Start-up Basics, Terms, Start-up Financing, Start-up Incubation, Start-up Incubation, Getting Listed

Textbooks:

- The Startup Playbook: Secrets of the Fastest-Growing Startups From Their Founding Entrepreneurs by David Kidder
- Creativity, Inc.: Overcoming the Unseen Forces That Stand in the Way of True Inspiration by Ed Catmull
- True North by Bill George and Peter Sims
- Bhargava, S. (2003). Transformational leadership: Value based management for Indian Organizations (Ed.). New Delhi: Response-Sage.
- Cardullo, M. W. P. E. (1999). Technological entrepreneurism: Enterprise formation, financing, and growyh. England: Research Studies press Ltd.
- Hisrich, R. D. & Peters, M. P. (2001). Entrepreneurship: Starting, developing, and managing a new enterprise (5th Ed.). New York: McGraw-Hill.

References Books:

- Kanungo, R. N. (1998). Entrepreneurship and innovation: Models for development (Ed., Vol.2). New Delhi: Sage.
- McClelland, D. C. (1961). Achieving society. Princeton
- Van Nostrand. Verma, J. C., & Singh, G. (2002). Small business and industry: A handbook for entrepreneurs. New Delhi: Response-Sage.
- Richard A Brealy & Steward C Myres. Principles of Corporate Finance, McGraw Hills, 7th Edn,2004
- Prasanna Chandra, Financial Management: Theory and Practice, Tata McGraw Hills, 6th Edn, 2004
- I M Pandey, Financial Management, Vikas Publishing, 9th Edn, 2004
- Aswath Damodaran, Corporate Finance-Theory and Practice, John Wiley & Sons, 1997
- I.M. Pandey & Ramesh Bhat, "Cases in Financial Management", Tata McGraw-Hill, New Delhi.
- Horowitch (ED), Technology in the modern Corporation: A Strategic perspective, Pergamon Press, 1986.
- M. Dodgson (ED), Technology and the firm: Strategies, management 7 Public Policy, Longman, Harlow, 1989

MOOC Course/Industry floated Course

The department will be floating a set of MOOC courses and/or courses in association with industry based on the latest technology trends and available courses.

(CE-17019) Construction Management

Teaching scheme
Lectures: 3Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

1. Learn various basic concepts like safety, laws, site layout related to Construction Management.
2. Understand important aspect of managing the construction project with the help of various networking techniques like Bar Chart / Milestone Chart, CPM, PERT, LOB, and Precedence networks.
3. Apply various material management theories like ABC, EOQ, HML, VED, SDE, etc. MUSIC-3d role.
4. Understand economic analysis and financial management concepts to know economic feasibility of construction projects.

Unit I: Time Management **[7 Hrs]**

Introduction, steps in Project Management – work break down structure, Bar Chart, Mile stonechart, Gantt Chart, Activity On Arrow and Activity On node.
Introduction to PERT: Concept of probability, normal and Beta Distribution, Central limit theorem. Time estimates and calculations of project duration, critical path, slack, probability of project completion.

Unit II: Network Analysis **[7 Hrs]**

Precedence network, Critical Path Method (CPM): Introduction, Time estimates, floats, critical path, Network compression – Least Cost and optimum duration, Updating of networks– needs, steps, project duration, calculation for updated network.

Unit III: Resource Management **[7Hrs]**

Human Resource allocation – smoothening and levelling, Material Management- definition by international federation of purchasing and material management. Objectives, Role Functions, Qualities of material manager Material forecasting. Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE, etc. MUSIC-3drole, lead-time, safety stocks, Material Evaluation using differential indices.

Unit IV: Financial Management **[7 Hrs]**

Introduction to Engineering economics, importance, demand and supply, types of costs, Types of interest such as – simple, compound, continuous, effective. Value of Money – time and equivalence, tangible and intangible factors, introduction to inflation. Interest factors – Uniform series factors – derivations.

Unit V: Economic Analysis **[6 Hrs]**

Economic comparisons, Discounting methods: Present worth method, equivalent annual cost method, capitalized cost method, net present value, and internal rate of return.

Unit VI: Miscellaneous **[6 Hrs]**

Site layout, Factors affecting, Typical layout, few major construction projects, Safety Engineering, Accident cost, IFR, ISR, injury sources and causes, Effective safety programmes occupational health hazards,

Personal protective equipment, Preparation of safety programmes for construction works, Laws related to construction industry.

Textbooks:

- Jha K. N. "Construction Project Management" Pearsons publication.
- Sengupta,B. and Guha H."Construction Management and Planning", Tata McGraw Hill Publication.
- SrinathL.S. "PERT &CPM: Principles and Applications", Affiliated East West Press, Delhi
- B.C.Punmia, "Project Planning and Control with PERT and CPM", Laxmi Publications (P) Ltd.

Reference Books:

- S. Seetharaman, "Construction Engineering and Management", Umesh Publications
- K KChitkara, "Construction Project Management," Tata McGraw-Hill Education
- K.S. Menon, "Purchasing and Inventory Control", A. H. Wheeler Publishing Company Limited
- Gopalkrishnan and Sundaresan," Materials Management: An Integrated Approach", PHI Learning Pvt. Ltd.
- L.C. Jhamb, "Inventory management", Everest Pub. House, Pune, 1987
- Riggs, J., Bedworth, D. D., and Randhawa S. U., "Engineering Economics" Tata McGraw-Hill Education
- M. K. Rustogi, "Production and Operation Management", University Science Press

(CE-17020) Design of Reinforced Concrete Structures (DRCS)

Teaching Scheme
Lectures: 3 Hrs /week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

1. Analyze RC sections using Limit State Theory.
2. Design and detail RC slabs and beams using IS code provisions.
3. Design and detail RC columns and column footings using IS code provisions.
4. Design and detail cantilever retaining walls using IS code provisions and learn the concept of building frame design

Unit I: Design Philosophies and Analysis: **[7 Hrs]**
Design philosophies of RC structures (WSM, LSM), Structural elements, Loads on structures, and Structural properties of concrete, Role of structural engineer. RC sections in flexure - theory & analysis - singly and doubly reinforced - rectangular and flanged sections.

Unit II: Slabs **[7 Hrs]**
Slabs - one way and two way - simply supported, cantilever and continuous. Design of staircase - Dog legged and open well.

Unit III: Beams **[7 Hrs]**
Design of beams for flexure, shear, bond and torsion: simply supported, continuous & cantilever, redistribution of moments.

Unit IV: Columns **[7 Hrs]**

Design of Columns - short & long - axially loaded, uniaxial & biaxial moments.

Unit V: Column Footings **[7 Hrs]**

Isolated column footings - axial load, uniaxial and biaxial moments, eccentric footing. Footings in difficult soil conditions

Unit VI: Cantilever Retaining Walls **[7 Hrs]**

Design of cantilever Retaining wall, Concept of building frame design.

Textbooks:

- Shah V. L. and Karve S. R., "Limit State Theory and Design of Reinforced Concrete", Structures Publications, Pune, 2005.
- Punmia B. C., Jain A. K. and Jain A. K., "Limit State Design of R.C. Structures", Laxmi Publications Pvt. Ltd., 2008.
- Vergese P. C., "Limit State Design of Reinforced Concrete", PHI Learning Pvt. Ltd., 2008.
- IS: 456, IS: 875, SP16, SP34 - relevant IS codes and Explanatory handbooks to be used.

Reference Books:

- Dayaratnram, "Design of Reinforced Concrete Structures" Oxford and IBH, New Delhi, 2011.
- Sinha N. C., Roy S. K., "Fundamentals of Reinforced Concrete", S. Chand and Co., New Delhi, 2010.

(CE-17021) Water Resources Engineering

Teaching Scheme
Lectures: 3 Hrs / week
Tutorial: 1 Hr/week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to

1. Demonstrate the features of the primary hydrological processes and various hydraulic structures; and explain various terms related to irrigation engineering. (Po-c, e)
2. Evaluate average rainfall, runoff, evaporation loss and other losses from a reservoir/ watershed, crop water requirement, reservoir capacity, canal capacity, and capacity of well. (Po-c, e)
3. Design the gravity dam, canal and spillway. (Po-c, e)
4. Analyse stability of earth dam and gravity dam. (Po-c, e)

Unit I: Surface Water Hydrology: Hydrological Process **[6 Hrs]**

Introduction to Hydrology, Hydrological cycle and application of hydrology. Precipitation, Types of Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves, and concept of depth area duration analysis, frequency analysis. Elementary concepts of evaporation, transpiration, evapotranspiration and infiltration.

Unit II: Surface Water Hydrology: Hydrometery **[6 Hrs]**

Selection of site, various methods of discharge measurements, Runoff- Factors affecting runoff, rainfall-

runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph
Floods- Estimation of peak flow, rational formula and other methods, flood frequency analysis, Gumbells method, Design floods

Unit III: Ground water hydrology: [7 Hrs]
Occurrence and distribution of ground water, specific yield of aquifers, movements of ground water, Darcy's law, permeability, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers, specific capacity of a well, well irrigation: tube wells, open wells.

Unit IV: Irrigation Engineering [6 Hrs]
Definition, functions, advantages and necessity. Water requirement of crops, Soil classification, soil moisture and crop water relationship, factors governing consumptive use of water, principal Indian crops, their season and water requirement, agriculture practices. Cropping pattern, Determination of canal capacities, design of canal.
Causes of water logging, preventive and curative measures, Lift irrigation schemes - Various components and their design principles (Only concepts)

Unit V: Dams and Reservoirs [8 Hrs]
Types of Dam, Choice of dam, various components of dam Forces acting on gravity dam, design of gravity Dams, low and high gravity dams, construction of gravity dam.
Earth dam: Causes of failure of earth dam, stability analysis by Swedish Slip Circle Method
Reservoir: Types, selection of site, dependability calculations, estimation of required storage and safe yield, mass curve, reservoir sedimentation, reservoir and channel routing

Unit VI: Introduction to Hydraulic structures [8 Hrs]
Types, Design and drawing of spillways and energy dissipaters, weirs and barrages, Cross drainage works: need, types, design considerations, General features of Hydro-power, general layouts of different types, Assessment of power potential, main components of Hydro-power schemes.

Textbooks:

- K.Subramanya, "Engineering hydrology", Tata McGraw-Hill, New Delhi, (4th Edition)
- Garg, S.K., "Irrigation Engineering and Hydraulic Structures", Khanna Publications (2009)
- P. N. Modi, "Irrigation, water resources and water power Engineering", Standard book House (2008)
- Asawa, G.L., "Irrigation Engineering", New Age International Publishers (2nd Edition).

Reference Book:

- Ven Te Chow,David R. Maidment, Larry W. Mays " Applied Hydrology" Tata McGraw-Hill, New Delhi (2010)
- Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India (P), Ltd (2000).
- Basak, N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co (1999)
- Ralph A. Wurbs, Wesley P. James, " Water Resources Engineering", Prentice Hall of India,(2012)

Tutorials on:

1. Average rainfall
2. DAD and IDF curves, Evaporation, Infiltration

3. Discharge measurements
4. Hydrograph
5. Determination of canal capacities
6. Dependability and Storage capacity
7. Gravity dam
8. Earth Dam
9. Ground water hydrology
10. Spillway and hydropower plant

(CE-17022) Construction Management Lab

Teaching Scheme
Practical: 2 Hrs / week

Examination Scheme
CCE: 50 Marks
Oral: 50 Marks

Course Outcomes:

Students will be able to:

1. Determine the practical application of construction management.
2. Determine the time duration, material management, and resource allocation of construction project.
3. Perform economic analysis of different projects and equipment.
4. Students will be able to understand safety of worker, laws related the construction organization.

Term work shall be based on the following:

a) Term Work Based on Course Work

- Theories of Management
- Functions of management
- Time Management
- Resource Management
- Financial Management
- Site Layout
- Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE
- Laws related to construction Industry
- One assignment in MSP / PRIMAVERA / Any construction Management software.

b) Site Visit to Project Site

- A report would be presented as a part of course work and shall form the part of term work Course Teacher will arrange all the visits to suit the course work.
- A Laboratory Journal based on the practical work would be prepared for the term-work.
- Oral Examination would be based on the term work. Course Teacher for the Laboratory would decide the breakup of marks for the Oral Examination. An Objective Multiple-Choice Test based on the theory for the Course Work can be conducted as a part of the oral examination.

(CE-17023) Design of RC Structures Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

Students will be able to

1. Design simple RC structures using Limit State Theory and related IS code provisions (PO-a, b, c, d, e)
2. Prepare a general structural drawing showing detailing of a simple RC structure which includes Slabs, Beams, Columns, Footings etc. (PO - a, b, c, d, e)
3. Refer relevant IS codes and Explanatory handbooks such as IS: 456, IS: 875, IS: 13920, SP 16, SP 22, SP 26, SP 34 for design of RC structures.

Design Assignments Shall Consist of Following:

- Design of multi-storeyed RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group)
- Report of a site visit related to building structure under construction.
- To the scale sketching would be done in the sketch book by hand and then the drawings would be drafted using Drafting Package/ Auto Cad. Four full size drawing sheets would be drawn using drafting software/ Auto CAD
- Bar bending schedule & detailing of reinforcements as per standard professional practice and relevant IS codes.
- Emphasis would be given on structural detailing of reinforcement taking in to account earthquake effects.

For the architectural layouts necessary for the RCC design assignments, buildings designed for the Term Work on Building Design and Drawing and Building Planning would be taken as basis.

(CE-17024) Water Resources Engineering Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

Course Outcomes:

Students will be able to

1. Select the appropriate hydraulic structure/dam. (po-a)
2. Determine the trial section of earth dam/ gravity dam, and check stability of it. (po-a, c, e)
3. Design spillway, energy dissipation structures, canal and vertical drop weir. (po-a, c, d, e)
4. Plan catchment area on a toposheet, and compute average rainfall and runoff of a catchment. (po-a)
5. Demonstrate basics of hydropower plant.

A. List of Assignments:

1. Marking Catchments area on a toposheet and determination of average annual rainfall and runoff.
2. Stability analysis of Gravity dam
3. Design of an ogee spillway and stilling Basin.

4. To develop a unit hydrograph and to draw a flood hydrograph for given 2 or 3 successive storms of a water resources project.
5. A typical layout of a hydropower plant and functions of the components
6. Determination of reservoir capacity
7. Design of canal
8. Stability analysis of an Earth dam by Swedish slip circle method
9. Design of a vertical drop weir

B. Report on Site Visit

A report based on visit to any irrigation project during the academic term

Note:

1. The term work shall consist of record of the above assignments in Journal.
2. Oral examinations will be based on the above exercises.

(CE-17025) Mini Project

Teaching Scheme	**Examination Scheme**
Tutorial: 1Hr/week	Continuous Assessment: 30 Marks
Practical: 4Hrs/ week	End Semester Examination: 70 Marks

Course Outcomes:

At the end of the course, students will be able to:

1. Formulate a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Analyse, design, and test the models in order to solve the identified problem.
3. Write comprehensive report on mini project work.

Guidelines:

1. Mini-project is an individual activity.
2. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
3. Student is expected to detail out methodology, software required, critical issues involved in analysis /design and implementation and submit the proposal within one week of the semester.
4. Use of relevant software is preferred.
5. The student is expected to exert on the proposed work as per the schedule.
6. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
7. The tutorial sessions should be used for discussion on their topic and guidelines for documentation /report writing.
8. The final presentation will be in front of the committee of examiners in presence of the group of students to be assessed by the committee.

[AS(ILE)-17008] English Proficiency-II

Teaching Scheme:
Lectures: 1 Hr/week
Practical: 4 Hrs/week

Evaluation Scheme:
T1 & T2: 25 Marks each
End-Sem Exam: 50 Marks

Course Outcomes:

Students will be able to-

1. Communicate well using meaningful sentences for conversation or speech.
2. Reproduce their understanding of concepts of communicating using English language
3. Read and comprehend communication well and write an effectively and enhance formal communication
4. Better Presentation skills and participate in healthy discussions both formal and informal among peers
5. Be more confident in facing interviews, acquiring professional skills and will be industry ready

Unit I: Linguistic Competence Building: **[3 Hrs]**
Enhancement of Word Power, Formal and Group Discussion

Unit II: Presentation Skills Development: **[3 Hrs]**
Oral and Written Presentations

Unit III: Business Writing: **[4 Hrs]**
Business Reports, CV, Resume, Statement of Purpose

Unit IV: Job Readiness: **[4 Hrs]**
Interview Skills and Mock Interviews

Textbooks:

- Communication Skills for Technical Students by T. M. Farhathullah (Orient Longman)
- Communication for Business: A Practical Approach by Shirley Tailor (Longman)

Reference Books:

- Corporate Communication by Jaishri Jethwaney (Oxford University Press)
- Written Communication in English by Saran Freeman (Orient Longman)
- Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)

[AS (ILE)-17009] Finance for Engineers –II

Teaching Scheme:
Lectures: 2 Hrs/week

Examination Scheme:
T1 (Assignment): 20 marks
T2 (Written Test): 20 marks
End Semester Exam: 60 marks

Course Outcomes:

Students will be able to-

1. To understand the importance of financial literacy.
2. To understand the basics of accounting & accounting principles.

3. To analyze & solve the problems based on the above concepts.

Unit I: Introduction, Corporate Financial Objectives Ownership Structure and Control

Unit II: Financial Statement Analysis – Ratio Analysis

Unit III: Preparation of Cash Flow statement

Unit IV: Introduction to Break even analysis – Decision Making

Unit V: Return and Risk, Time Value of Money, Annuities and Accumulation, Discounted Payback period, Net Present Value, IRR.

Textbooks:

- Chandra, Prasanna (2004). Financial Management: Theory and Practice. New Delhi: TATA McGraw Hill

Reference Books:

- Brearley, Richard A. and Myers, Stewart C. (1988). "Principles of Corporate Finance", New Delhi: McGraw-Hill

[AS(ILE)-17010] Engineering Economics-II

Teaching Scheme: **Examination Scheme**
Lectures: 2 Hrs/week **Field Work/Assignment: 40**
End Semester Exam: 60

Course Outcomes:

Students will be able to-

1. understand how managerial decisions are based on economics
2. learn about capital budgeting and planning
3. understand the importance balance trade, monetary policies and exchange rates
4. understand the importance of day to day budgeting and personal finances at early stage
5. learn about start-up culture and economics
6. get to know funding rounds which would help them to run their own start-ups

Unit I: Managerial Economics **[10 Hrs]**

Nature and scope of Managerial Decisions, Objectives of firms, Techniques of analyses with special reference to econometric method, Analysis of demand pattern, demand forecasting, Production function and production planning, cost and product relationships, cost function, Break-even-point analysis, Pricing and price related policies, Labour productivities and wages, Optimization problems, Introductory aspects of capital budgeting, Selected case studies under Indian conditions.

Unit II: International Economics **[7 Hrs]**

Balance of Trade and Balance of Payments, Barriers to Trade, Benefits of Trade/Comparative Advantage, Foreign Currency Markets/Exchange Rates, Monetary, Fiscal and Exchange rate policies, Economic Development

Unit III: Personal Economics **[5 Hrs]**

Compound Interest and Credit, Financial Markets, Human Capital and Insurance, Money Management/Budgeting, Risk and Return, Saving and Investing

Unit IV: Start-up Economics **[6 Hrs]**

Introduction to Start-up Finance, Introduction to Financial Terms, Financial Ratios, Capital Funding, VC's , Funding Rounds, Series A, B.

Textbooks:

- Carton, D. and J.Perloff. Modern Industrial Organization (Reading, Massachusetts: Addison-Wesley), 1999.
- Hay, Donald A. and Derek J. Morris. Industrial Economics and Organization: Theory and Evidence, 2nd Edition (Oxford: Oxford University Press), 1991.
- Lall, Sanjaya. Competitiveness, Technology and Skills (Cheltenham: Edward Elgar), 2001.
- Scherer, F. M. and D. Ross. Industrial Market Structure and Economic Performance, 3rd Edition (Houghton: Mifflin), 1990.

Reference Books:

- Schmalensee, R., Inter-industry studies of Structure and Performance, in Schmalensee, R. and R. D. Willig (eds.): Handbook of Industrial Organization [Amsterdam: North-Holland] Vols. 2 Chapter 16, pp. 951-1009, 1989.
- Siddharthan, N. S. and Y.S. Rajan. Global Business, Technology and Knowledge Sharing: Lessons for Developing Country Enterprises (New Delhi: Macmillan), 2002.

[AS(ILE)-17011] Industrial Psychology-II

Teaching Scheme:
Lectures: 2Hrs/week

Examination Scheme:
Field Work/Assignment: 40
End Semester Exam: 60

Course Outcomes:

Students will be able to-

1. learn about major psychological factors involved in the process of employment
2. acquire psychological skills required to sustain employability
3. understand the elements of organizational culture for enhancing group/team behaviour
4. understand the role of diversity in workforce and acknowledge the multicultural factors influencing workplace behaviour
5. learn to apply the concepts of Engineering Psychology with respect to their disciplines
6. learn about the impact of Psychological factors in consumer behaviour and role of conscious efforts needed in designing products
7. demonstrate the knowledge gained tHrough practical implementation

Unit I: Managing People at Work **[8 Hrs]**

Employee Selection- Techniques, Fair Employment Practices, Biographical Information, Interviews, References & Letters of Recommendation, Job Analysis- Types; Newer Developments, Performance Assessment: Evaluation & Appraisal- Objective & Subjective Techniques, Bias, Post Appraisal Interviews,

Organizational Training- Types of Training, Psychological Issues; Career Development & Planning

Unit II: Groups at Work **[6 Hrs]**

Relationships- At workplace, Issues, Developing Effective Relationships, Groups & Teams- Stages of Group Development, Group Behaviour, Social Identity Theory, Leadership- New Approaches- Leader-Member Exchange, Transactional, Transformational & Charismatic Leaderships, Diversity at Workplace- Cultural Differences (Multiculturalism, Psychometric Testing, Motivation, Work-related Attitude, Leadership, Team work, etc.)

Unit III: Engineering Psychology-II **[8 Hrs]**

Workspace Designs- General Principles, Design of Standing & Seating Work Areas; Human Anthropometry- Structural & Functional Data, Use of Anthropometric Data in Design, Human Computer Interaction- Software Design Cycle, System & User Characteristics, Principles & Guidelines for Design, Automation- Problems, Function Allocation; Transportation- Visibility, Hazards & Collisions, Characteristics of Impaired Driver, Safety Improvements, Industrial Robots

Unit IV: Consumer Psychology **[6 Hrs]**

Scope & Research Methods- Surveys, Public Opinion Polls, Focus Groups, Observations of Shopping Behaviour, Neuromarketing, Advertising- Nature, Scope & Types, Consumer Behaviour & Motivation- Buying Habits, Product Pricing, Targeted Advertising, Visual Merchandising- Psychological Perspective- Techniques, Impulse Buying, Online Visual Merchandising

Textbooks:

- Schultz, D. & Schultz, S. E. (2013). Psychology and Work Today: An Introduction to Industrial and Organizational Psychology. 7th Edition. Pearson Education: New Delhi.
- Matthewman, L., Rose, A. & Hetherington, A. (2009). Work Psychology. Oxford University Press: India.
- Wickens, C. D.; Lee, J. D., Liu, Y. & Gordon Becker, S. E. (2015). An Introduction to Human Factors Engineering. 2nd Edition. Pearson Education: New Delhi.

Reference Books:

- Landy, F. J. & Conte, J. M. (2010). Work in the 21st Century: An Introduction to Industrial and Organizational Psychology. 2nd Edition. Wiley India: New Delhi.
- Schultz, D. & Schultz, S. E. (2002). Psychology and Work Today. Pearson Education: New Delhi.

[AS(ILE)-17012] Personnel Psychology-II

Teaching Scheme-
2 lectures/week

Examination Scheme
3 Assignments for 60 marks
End-sem Exam of 40 marks

Course Outcomes:

Students will be able to-

1. Understand the importance of motivation.
2. Realize the importance of standards of behavior at work place.
3. Get guidelines to achieve workplace success.
4. Manage stress and conflict in their personal life and at a workplace.

Unit I: **[4 Hrs]**
Motivation: Self-motivation and motivating others in their job

Unit II: **[4 Hrs]**
Emotional Intelligence & values: Emotional intelligence and Standards of conducts

Unit III: **[8 Hrs]**
Work place success: Setting goals, performance appraisal and moving ahead

Unit IV: **[6 Hrs]**
Stress & conflict management at a workplace: Occupational stress and conflict, strategies For stress and conflict management

Textbooks:

- Khana S.S.- (2016) Organizational Behaviour(Text and Cases) Chand and company Pvt. Ltd. Delhi.
- Rae Andr'e :- (2008) organizational behavior. Dorling Kindersley (India) Pvt. Ltd.
- Wallace H.and Masters L.- (2008) Personality development.Cengage Learning India Pvt. Ltd.

Reference Books:

- Robbins S, Judge A, VoHra N: - (2013)Organizational behavior.(15th ed) Pearson Education, Inc.
- Singh Kavita: - (2010) Organizational behavior-Text and cases. Dorling Kindersley (India) Pvt. Ltd.

[AS(ILE)-17013] Japanese Language-II

Teaching Scheme: **Evaluation Scheme**
2 hours/week Oral Exam: 20 Marks
Written Exam: 80 Marks

Course Outcomes:
Students will be able to-

1. Acquire target phrases and expressions
2. Master elementary Japanese grammar
3. Converse about professions at work
4. Get familiar with the customs, work culture & society of Japan

Unit I: **[6 Hrs]**
Formation of requests, asking for permission/prohibition, speaking conversations of everyday life.

Unit II: **[6 Hrs]**
Rules and prohibitions, expressing potential and hobbies, sharing experiences.

Unit III: **[6 Hrs]**
Informal Conversations with friends, Expression of opinions, expectations, Utilization of modifying forms

Unit IV: **[6 Hrs]**
Vocabulary of Machines, Directions, Forms of verbs (give/take/receive), Description of condition and coming to decision

Textbooks:

- Minnano no Nihongo 1-2. Goyal Publishers& Distributors Pvt. Ltd. Delhi, India

[AS(ILE)-17014] German Language -II

Teaching Scheme:
2 hours/week

Evaluation Scheme:
Oral Exam: 20 Marks
Written Exam: 80 Marks

Course Outcomes:

Students will be able to-

1. understand conversations of time and appointments
2. get familiar with the place orientation and directions
3. converse about professions and schedules at work
4. get familiar with the tourism and culture of German

Unit I: Termine: (Appointments) **[7 Hrs]**
Termine und Verabredungen, Pünktlichkeit interkulturell,Texte: Meldebestätigung Veranstaltungsangebote Arztchild, Gedicht, Wortfelder: UHrzeiten, Wochentage, Tageszeiten

Unit II: Orientierung: (Orientation) **[6 Hrs]**
Orientierung am Arbeitsplatz, Der Weg zur Arbeit, Die Stadt Leipzig/ Quiz online, Texte: Stadtplan, Etagenplan, Terminkalender, Prospekt, Wortfelder: Stadt, VerkeHrsmittel, Büro und Computer

Unit III: Berufe: (Professions) **[5 Hrs]**
Beruf und Alltag, Texte: Visitenkarten, Wörterbuchauszüge, Wortfelder: Berufe und Tätigkeiten

Unit IV: Berlin sehen: (To see Berlin) **[6 Hrs]**
Eine Exkursion durch Berlin, Orientierung in der Stadt, Projekt "Internetrally'', Texte: Busplan, Stadtplan, Postkarte, Exkursionsprogramm, Wortfelder: Tourismus, Kultur

Textbooks:

- Funk, Kuhn & Demme. Studio d A1. Deutsch als Fremdsprache. 2011. Goyal Publishers & Distributors Pvt. Ltd. Delhi, India

[CE(MI)-17002] Fundamentals of Geomechanics

Teaching Scheme
Lectures: 3 Hrs / week

Examination Scheme
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to

1. Identify type of soil.
2. Understand and apply basic soil mechanics principle to identify various properties of soil.
3. Suggest suitable compaction method.
4. Identify lateral force and slope stability problems.

Unit I: Properties of Soil **[7 Hrs]**
Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils,

lateritic soils, alluvial deposits and desert soils. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. clssification of soil.

Unit II: Permeability and Seepage [7 Hrs]

Darcy's law. Factors affecting permeability. Determination of permeability by constant head and falling head method as per IS - 2720, field permeability tests.

Unit III: Compaction [7 Hrs]

Soil compaction phenomenon. Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line. Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction.

Unit IV: Shear Strength of Soil [7 Hrs]

Mohr circle of stress, Mohr-coulomb failure criteria, pore pressure, total and effective stress Factor affecting shear strength. Laboratory measurement of shear strength by direct, unconfined test,triaxial tests and Vane shear test.

Unit V: Stress Distribution in Soils [7 Hrs]

Boussinesq theory- point load, pressure distribution due to line load, strip load, pressure bulb, approximate stress distribution method.

Unit VI: [7 Hrs]

a) Lateral Earth Pressure:

Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge.

b) Stability of Slopes:

Slope failure, Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.

Textbooks

- Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications Pvt. ltd
- V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B. S. Publications (3rd Edition)
- B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi.
- Dr. B. J. Kasmalkar ,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference Books

- Joseph E Bowles, "Engineering Properties of Soils And Their Measurements", McGraw Hill Publications (2001)
- Lambe and Whitman ,"Soil Mechanics", S. Chand publications(SI Version),(1969).
- Donald P Coduto, Man-chu Ronald Yeung and William A. Kitch "Geotechnical Engineering Principle and practice", McMillan Press (PHI) (2010)
- Purushothma Raj ,"Geotechnical Engineering", McGraw Hill Publication 4th Edition (2008)
- Compendium of Indian standards on soil engineering part 1 (1980)

[CE(HO)-17003] Advanced Mechanics of Materials

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 mark

Course Outcomes:

Students will be able to:

1. Analyse simple continuum problems using principles of Solid Mechanics.
2. Idealise continuum problems in structural engineering.
3. Solve simple elasticity problems using computer programs.

Unit I: Introduction **[6 Hrs]**

Stress at a Point, Stress on an Arbitrarily oriented Plane, Transformation of Stress, Deformation of a Body Strain Theory, Transformation of Strain, Small-Displacement Theory.

Unit II: Linear Stress-Strain Relations **[7 Hrs]**

Hooke's Law for Anisotropic and Isotropic Elasticity, Equations of Elasticity for Isotropic Materials, Hooke's Law for Orthotropic Materials.

Unit III: Torsion **[6 Hrs]**

Saint-Venant's Semi-inverse Method, Linear Elastic Solution, Prandtl Analogy, Numerical solution of the Torsion Problem.

Unit IV: Shear Center **[7 Hrs]**

Approximations for Shear in Thin-wall Beam , Shear Flow in Thin-Wall Beam Cross Sections, Shear Center for a channel Section, Shear Center of Composite Beams and Box Beams.

Unit V: Thin Plates **[7 Hrs]**

Stress Resultant in a Thin Plate, Strain-Displacement Relations for plates, Equilibrium equations for small-Displacement Theory, Stress-Strain Relations for Isotropic Elastic Plates, Boundary Conditions for plates, solution of Rectangular and Circular Plate Problems

Unit VI: Computer Applications **[7 Hrs]**

Solution of Simple Elasticity Problems using computer programs for Plane Stress and Plane Strain Problems.

Reference Books:

- Srinath L. S., “Advanced Mechanics of Solids”, Tata Mc-Graw Hill,2008.
- Hearn E. J., “Mechanics of Materials-2”, Butterworth Heinemann, 1997.
- Boresi A. P., and Schmidt R. J., “Advanced Mechanics of Materials”, Wiley, 2003.
- Ugural A. C., and Fenster S.K., "Advanced Strength and Applied Elasticity", Prentice Hall, 2003

[CE(HO)-17004] Advanced Geotechnical Engineering

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course outcome:

Student will be able to

1. Identify the type of soil and accordingly choose the required shear strength parameters (po-a, b, c, e, h, j)
1. Compute consolidation settlement. (PO- a, b, c, d, e, j)
3. Carry out geotechnical design of retaining structures and assess the stability of soil slopes (PO- a, b, c, e, j)
4. Select effective soil stabilisation and ground improvement technique.

Unit I: Clay mineralogy and clay structures [6 Hrs]
Composition of clay minerals, Atoms and Atomic Bonds, Types of Clay Minerals and their Structure, Clay Water Relations, Clay Particle Interaction, Soil Structure and Fabric, Black Cotton Soil: Swelling Pressure.

Unit II: Compressibility of Soil and Consolidation [8 Hrs]
Components of total settlement, Compressibility: Effects of Soil Types; Role of stress History; Role of Effective Stress, Time Rate of Consolidation: Mechanics; Terzaghi's Theory of One Dimensional Consolidation, Consolidation Test, Determination of Coefficient of Consolidation, Computation of Settlement, Extrapolation of Field Consolidation Curve, Settlement Analysis, Vertical Sand Drains, PVD

Unit III Shear Strength behaviour of soil [7 Hrs]
Shear strength of clayey and sandy soils under different drainage conditions, Selection of appropriate shear strength parameters for different field conditions, Skempton's pore pressure parameters, Stress path method and its use, Stress-Strain behaviour of soil, Elastic Properties of Soils.

Unit IV:Soil Retaining Structures [7 Hrs]
Design Considerations for Retaining Walls, Design of retaining walls, and Introduction to reinforced earth wall

Unit V:Stability of Slopes [7 Hrs]
Total Stress and Effective Stress Methods of Analysis, Methods of Slices, Location of the most critical slip circle, Stability of Earth Dam Slopes, Stability analysis –Modified Bishops method, Taylors Stability Number and stability curves, Effect of Earthquake Force: Pseudo Static Analysis

Unit VI:Soil Stabilisation and Ground Improvement [6 Hrs]
Need of the Soil Stabilisation, Cement-Lime Stabilisation, Use of geosynthetics in ground improvement.

Textbooks:

- Basic and Applied Soil Mechanics by Gopal Ranjan and Rao, New Age International Publishers
- Principles of geotechnical engineering by B. M. Das, Cengage Learning (Thompson)
- Soil Mechanics and foundation Engineering, Dr. K.R. Arora, Standard Publishers Distributors.

Reference Books:

- Soil Mechanics and Foundations, Muni Budhu, John Wiley and Sons Inc
- Foundation Analysis and Design, J.E.Bowles, McGraw Hill International
- Advanced Soil Mechanics, B.M.Das, Tata McGraw Hill.

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