## Semester I

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 67**
# LIST OF ELECTIVES

## SEMESTER I (Elective -I)

<table>
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<tr>
<th>SL. NO.</th>
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<td>7.</td>
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OBJECTIVES:
- To familiarize the students in the field of differential equations to solve boundary value problems associated with engineering applications.
- To expose the students to variational formulation and conformal mapping and their applications to obtain solutions for buckling, dynamic response, heat and flow problems of one and two dimensional conditions.

UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3
Laplace transform, Definitions, properties – Transform error function, Bessel's function, Dirac Delta function, Unit Step functions – Convolution theorem – Inverse Laplace Transform: Complex inversion formula – Solutions to partial differential equations: Heat equation, Wave equation.

UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

UNIT III CALCULUS OF VARIATIONS 9+3
Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Problems with constraints – Direct methods – Ritz and Kantorovich methods.

UNIT IV CONFORMAL MAPPING AND APPLICATIONS 9+3

UNIT V TENSOR ANALYSIS 9+3
Summation convention – Contravariant and covaraiant vectors – Contraction of tensors – Innerproduct – Quotient law – Metric tensor – Chrirstoffel symbols – Covariant differentiation – Gradient, divergence and curl.

OUTCOME:
- On completion of the course the students will enable to solve boundary value problems using Laplace and Fourier transform techniques. They will also solve Fluid flow and heat flow problems using conformal mapping.

REFERENCES:
OBJECTIVES:
• To impart knowledge required for computing stress and settlement at any point in the semi-infinite elastic soil medium, anisotropic medium and layered deposits due to foundation loads and evaluation of stability of foundations, slopes, cuts and retaining structures both for the conditions of undrained and drained loading through theorems of plastic collapses.

UNIT I THEORY OF ELASTICITY 12

UNIT II STRESS AND DISPLACEMENT IN ELASTIC – HALF SPACE MEDIUM 14

UNIT III THEOREMS OF PLASTIC COLLAPSE AND THEIR APPLICATIONS 10

UNIT IV STABILITY OF SOIL STRUCTURE BY SLIP LINE METHOD AND LIMIT EQUILIBRIUM ANALYSIS 14

UNIT V FLOW THROUGH POROUS MEDIA 10

TOTAL : 60 PERIODS

OUTCOME:
• At the end of the course students will have the capacity to estimate the stresses in soil medium of any type due to foundation load and settlement of foundation. Further they will be in a position to evaluate bound and true collapse loads of soil structures.

REFERENCES:
OBJECTIVES:
- To impart knowledge to characterize stress-strain behaviour of soils, the failure criteria and to evaluate the shear strength and compressibility parameters of soils.

UNIT I SHEAR STRENGTH OF COHESIONLESS SOILS
Introduction-Shear strength of soil-cohesion-angle of internal friction-Shear strength of granular soils - Direct shear - Triaxial Testing- Drained and undrained Stress-strain behaviour - Dilation, contraction and critical states - Liquefaction and cyclic mobility of saturated sands. Factors influencing shear strength.

UNIT II SHEAR STRENGTH OF COHESIVE SOILS
Shear strength of NC and OC clays - Stress-strain behaviour - Total stress and effective stress approach - Triaxial testing and stress path plotting - pore pressure parameter of Skempton and Henkel - shear strength of partially saturated clay in terms of stress state variables. Factors influencing shear strength.

UNIT III FAILURE THEORIES
Concepts of yield and failure in soils- Failure theories of Von Mises, Tresca and their extended form, their applicability to soils - Detailed discussion of Mohr - Coulomb failure theory.

UNIT IV CONSTITUTIVE LAW FOR SOIL

UNIT V CRITICAL STATE SOIL MECHANICS
The critical state line- Roscoe’s surface- Hvorslev’s surface- Behavior of sand- Effects of dilation-Limitations of Taylor model- Elastic and plastic deformation-Camclay critical state model- Modified Camclay model- Parameters for design

OUTCOME:
- Students are able to select the shear strength and compressibility parameters to design different structures for different conditions of loading, drainage and failure criteria.

REFERENCES:
SF7103  SOIL PROPERTIES AND BEHAVIOUR  L T P C  3 0 0 3

OBJECTIVES:

- To impart knowledge on the various factors governing the Engineering behaviour of soils and the suitability of soils for various Geotechnical Engineering applications.

UNIT I  SOIL DEPOSITS AND CLAY MINERALS  8

UNIT II  PHYSICAL AND PHYSIO CHEMICAL BEHAVIOUR OF SOILS  9

UNIT III  SWELLING, SHRINKAGE AND COMPACTION BEHAVIOUR OF SOILS  10

UNIT IV  COMPRESSIBILITY, SHEAR STRENGTH AND PERMEABILITY BEHAVIOUR OF SOILS  10
Compressibility, shear strength and permeability behaviour of fine and coarse grained soils – mechanisms and factors influencing engineering properties – liquefaction potential – causes and consequences.

UNIT V  CONDUCTION PHENOMENA AND PREDICTION OF SOIL BEHAVIOUR  8

TOTAL: 45 PERIODS

OUTCOME:

- Students are able to select suitable soils for various geotechnical applications based on the factors governing the Engineering behaviour of soils.

REFERENCES:

OBJECTIVES:

- Students are expected to understand the importance of site investigation, planning of sub soil investigation, interpretation of investigated data to design suitable foundation system.

UNIT I  PLANNING OF EXPLORATION AND GEOPHYSICAL METHODS 8
Scope and objectives, planning an exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole– down hole methods.

UNIT II  EXPLORATION TECHNIQUES 7
Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs.

UNIT III  SOIL SAMPLING 8
Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples.

UNIT IV  FIELD TESTING IN SOIL EXPLORATION 12
Field tests, penetration tests, Field vane shear, In situ shear and bore hole shear test, pressuremeter test, dilatometer test - plate load test–monotonic and cyclic; field permeability tests – block vibration test. Procedure, limitations, correction and data interpretation of all methods.

UNIT V  INSTRUMENTATION 10
Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements - slope indicators, sensing units, case studies.

OUTCOME:

- Students are capable of planning and executing the sub soil investigation programme. They are also capable of interpreting the investigated data and can design suitable foundation system.

REFERENCES:

OBJECTIVES:
- To impart knowledge to select, analyse and geotechnical and structural design of shallow foundation depending on ground condition.

UNIT I  SHALLOW FOUNDATIONS  6
Types of foundations – Types of shallow foundation – Design concept - General requirements - Additional consideration - selection of type of foundation - hostile environment.

UNIT II  BEARING CAPACITY  9

UNIT III  SETTLEMENT AND ALLOWABLE BEARING PRESSURE  9

UNIT IV  INTERACTIVE ANALYSIS AND DESIGN OF FOUNDATIONS  12

UNIT V  FOUNDATION FOR SPECIAL CONDITIONS  9

OUTCOME:
- Students are able to select, analyse and design shallow foundation based on both the type of soil and loading.

REFERENCES:
OBJECTIVES:
- The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions.

UNIT I  PILE CLASSIFICATIONS & LOAD TRANSFER PRINCIPLE  10

UNIT II  AXIAL LOAD CAPACITY PILES AND PILE GROUPS  10

UNIT III  LATERAL AND UPLIFT LOAD EVALUATION OF PILES  10

UNIT IV  STRUCTURAL DESIGN OF PILE AND PILE GROUPS  9

UNIT V  CAISSONS  6

TOTAL: 45 PERIODS

OUTCOME:
- Students are able to select, analyse and design individual pile, group piles and caissons for different subsoil conditions.

REFERENCES:
UNIT I  DEA WATERING 9
Introduction – Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques - Applications.

UNIT II  COMPACTION AND SAND DRAINS 9
Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains etc. – Theories of sand drain – design and relative merits of various methods – Case studies.

UNIT III  STONE COLUMN, LIME PILES AND SOIL NAILING 9

UNIT IV  EARTH REINFORCEMENT 9
Earth reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber based Geotextiles and their applications. Filtration, drainage, separation, erosion control – case studies.

UNIT V  GROUTING 9

TOTAL : 45 PERIODS

OUTCOME:
• Based on the knowledge gained student will be in a position to identify and evaluate the deficiencies if any in the deposits of the given project area and capable of providing alternative methods to improve its quality so that the structures built on it will be stable and serve the intended purpose.

REFERENCES
1. Pappala, A.J., Huang,J., Han, J., and Hoyos, L.R., Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010

SF7204  DYNAMICS OF SOILS AND FOUNDATIONS  L T P C
3 0 0 3

OBJECTIVES:
• To understand the basics of dynamics – dynamic behaviour of soils – effects of dynamic loads and the various design methods.
UNIT I       THEORY OF VIBRATION
Introduction – Nature of dynamic loads – vibrations of single degree freedom system – free
vibrations of spring – mass systems – forced vibrations – viscous damping, Transmissibility –
Principles of vibration measuring instruments effect of Transient and Pulsating loads – vibrations
of multi degree freedom system.

UNIT II      DYNAMIC SOIL PROPERTIES AND BEHAVIOUR
Dynamic stress – strain characteristics – principles of measuring dynamic properties – Laboratory
Techniques – Field tests – Factors affecting dynamic properties - Typical values- Dynamic bearing
capacity – Dynamic earth pressure.

UNIT III     FOUNDATIONS FOR RECIPROCATING MACHINES
Types of Machines and Foundations – General requirements – Modes of vibration of a rigid
foundation, block method of analysis – Linear Elastic weightless spring method – Elastic half –
space method – Analog models ; Design of Block foundation -- Codal Provisions

UNIT IV      FOUNDATION FOR IMPACT AND ROTARY MACHINES
Dynamic analysis of impact type machines – Design of Hammer foundations – use of vibrator
Absorbers – design – Codal recommendation.  Special consideration for Rotary machines –
Design criteria – Loads on Turbo Generator Foundation – method of analysis – Design; Dynamic

UNIT V       INFLUENCE OF VIBRATION AND REMEDIATION
Mechanism of Liquefaction--Influencing factors--Evaluation of Liquefaction potential based on
SPT-Force Isolation – Motion Isolation – use of spring and damping materials – vibration control of
existing machine foundation – screening of vibration – open trenches – Pile Barriers – salient
construction aspects of machine Foundations.

TOTAL:  45 PERIODS

OUTCOME:
• Students are able to design foundation for different machines, access the influence of
vibrations and selection of remediation methods based on the nature of vibration, properties
and behaviour of soil.

REFERENCES:
Delhi, 2000.
1995.
Hall, 198UNIT - I
Delhi 1999.
Delhi, 1998.
OBJECTIVES:
- At the end of the course student attains adequate knowledge in assessing index properties, compaction, CBR, Compressibility, Swell characteristics and permeability of soils by conducting laboratory tests.

LIST OF EXPERIMENTS

UNIT I  INDEX TESTS  12
Specific gravity of soil solids-Grain size distribution (Sieve analysis and Hydrometer analysis) - Liquid limit and Plastic limit tests - Shrinkage limit and Differential free swell tests - Field density Test

UNIT II  CHEMICAL TESTS  12
Chemical analysis – pH – Conductivity – quantification of ions through flame Photometer – Determination of organic, sulphate and chlorite content.

UNIT III  COMPACTION AND CBR TESTS  12

UNIT IV  CONSOLIDATION AND PERMEABILITY TESTS  12
One dimensional consolidation test, Cv, Cc and mv determination. Permeability of soil – constant and falling head methods.

UNIT V  SWELL TESTS  12
Determination of percent swell – swell pressure, constant volume method; expanded - loaded method.

TOTAL: 60 PERIODS

OUTCOME:
- Students will be capable of assessing various properties of soils by conducting appropriate tests.

REFERENCES:
9. I.S. Code of Practice (2720): Relevant Parts, as amended from time to time.
OBJECTIVES:

- At the end of the course student attains adequate knowledge in assessing Shear Strength, dynamic properties of soil and Shear strength, indirect tensile strength and compressive strength of Rocks. Student learns to assess the different properties of geosynthetics. Student is trained to gain knowledge in assessing the properties of soils through field tests and also by conducting model tests.

UNIT I SHEAR STRENGTH TESTS 12
Direct shear – Triaxial compression (UU and CU) test – Unconfined compression test – Vane shear test.

UNIT II SUCTION TESTS 8
Soil water characteristic curves of soil by Pressure Plate apparatus – Filter paper technique.

UNIT III TEST ON GEOSYNTHETICS 12
Opening size of Geotextiles – Tensile strength of Geosynthetic materials – Interfacial friction – Permeability

UNIT IV TEST ON ROCKS 12
Point load index – Brazilian test – Direct shear test – Uniaxial compressive strength test

UNIT V MODEL AND FIELD TESTS 16
Model test on foundation elements - strain gauges - load cells. Field tests - Plate load test – static cone penetration test – standard penetration test – pressuremeter test - Block vibration test.

TOTAL: 60PERIODS

OUTCOME:

- Students will be capable of assessing shear strength, dynamic properties of soils by conducting appropriate tests. They will be in a position to assess the properties of geosynthetics and rocks. They can also supervise different field tests.

REFERENCES:

11. I.S. Code of Practice (2720): Relevant Parts, as amended from time to time.
PRACTICAL TRAINING (4 Weeks)

OBJECTIVES:
- To train the students in field work so as to have a first hand knowledge of practical problems in carrying out Soil Mechanics and Foundation engineering tasks. To develop skills in facing and solving the geotechnical engineering field problems.

SYLLABUS:
The students individually undertake training in reputed Soil Mechanics and Foundation Engineering Companies during the summer vacation for a specified period of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOME:
- Students are able to solve Soil Mechanics and Foundation engineering problems in the field either individually or in team.

PROJECT WORK (PHASE I)

OBJECTIVES:
- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS:
The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

OUTCOME:
- At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

PROJECT WORK (PHASE II)

OBJECTIVES:
- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS:
The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS
OUTCOME:
- On completion of the project work students will be in a position to take up any research and challenging practical problem for finding better solutions.

SF7001 EARTH PRESSURE AND EARTH RETAINING STRUCTURES  L T P C  3 0 0 3

OBJECTIVES:
- At the end of this course, students are expected to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

UNIT I EARTH PRESSURE THEORIES 12
Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques – Active and passive cases – Earth pressure due to external loads, empirical methods. Wall movement and complex geometry.

UNIT II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES 8
Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT III SHEET PILE WALLS 8
Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT IV SUPPORTED EXCAVATIONS 8
Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

UNIT V SLURRY SUPPORTED TRENCHES 9
Basic principles – Slurry characteristics – Specifications - Diaphragm and bored pile walls – stability Analysis and design

TOTAL: 45 PERIODS

OUTCOME:
- Students will be capable of analysing and designing rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

REFERENCES:
SF7002  ROCK MECHANICS IN ENGINEERING PRACTICE  L T P C  3 0 0 3

OBJECTIVE:
- Students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in situ stress in the stability of various structures and various techniques to improve the in situ strength of rocks.

UNIT I  CLASSIFICATION OF ROCKS  9
Rocks of peninsular India and the Himalayas - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

UNIT II  STRENGTH CRITERIA OF ROCKS  9
Behaviour of rock under hydrostatic compression and deviatory loading - Models of rock failure - planes of weakness and joint characteristics - joint testing, Mohr-Coulomb failure criterion and tension cut-off. Hoek and Brown Strength criteria for 12 rocks with discontinuity sets.

UNIT III  DESIGN ASPECTS IN ROCKS  10
Insitu stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations - Design aspects of openings in rocks - case studies.

UNIT IV  SLOPE STABILITY OF ROCKS  9
Rock slopes - role of discontinuities in slope failure, slope analysis and factor of safety - remedial measures for critical slopes - case studies.

UNIT V  REINFORCEMENT OF ROCKS  8
Reinforcement of fractured and joined rocks - shotcreting, bolting, anchoring, installation methods - case studies.

TOTAL: 45 PERIODS

OUTCOME:
- Students are capable of classifying the rock. They can understand stress-strain characteristics, failure criteria, and influence of in situ stress in the stability of various structures. They also know various techniques to improve the in situ strength of rocks.

REFERENCES:
OBJECTIVE:

Students are expected to learn reasons for failure and damages of embankments and slopes, various methods of analysis of slopes and remedial techniques to protect the slopes.

UNIT I DESIGN CONSIDERATION
Design consideration, Factors influencing design, Types of earth and rock fill dams, Design details, Provisions to control pore pressure.

UNIT II STABILITY OF SLOPES

UNIT III SEEPAGE ANALYSIS
Seepage analysis, Flow nets, Stability conditions during construction, Full reservoir and drawdown - cut off walls – Trenches – Importance of drainage and filters.

UNIT IV FAILURE AND DAMAGES
Failure and damages, Nature and importance of failures in embankment and foundation - Piping, Differential settlement, Foundation slides, Earthquake damage, creep and anisotropic effects, Reservoir wave action, Dispersive piping.

UNIT V SLOPE PROTECTION MEASURES
Special design problems, Slope protection, Filter design, Foundation treatment, Earth dams on pervious soil foundation, Application of Geosynthetic materials in filtration. Treatment of rock foundation, Construction Techniques, Quality control and performance measurement.

OUTCOME:

Students are capable of reasoning out the causes of failure and damages of embankments and slopes. They can carry out slope stability analysis using various methods. They are also capable of carrying out remedial measures and protection of slopes.

REFERENCES:

OBJECTIVES:

To understand the mechanism of the reinforcement, its influence in the shear strength and design concept for various applications in geotechnical engineering. Students are able to analyse and design the geotechnical reinforced structures based on interaction mechanism of reinforcement and influence on the shear strength of soil.
UNIT I  PRINCIPLES AND MECHANISMS OF SOIL REINFORCEMENT  7
Historical Background, Principles, Concepts and Mechanisms of reinforced earth.

UNIT II  REINFORCING MATERIALS AND THEIR PROPERTIES  10

UNIT III  DESIGN OF SOIL REINFORCEMENT  13
Reinforcing the soil-Geotextiles and Geogrids – Embankments and slopes – reinforced walls – bearing capacity – Road way reinforcement-Railway reinforcement-slope stabilization-Seismic aspects

UNIT IV  DESIGN FOR SEPARATION, FILTRATION AND DRAINAGE  10

UNIT V  DURABILITY OF REINFORCEMENT MATERIALS  5

TOTAL : 45 PERIODS

OUTCOME:
• Students are able to analyse and design the geotechnical reinforced structures based on interaction mechanism of reinforcement and soil.

REFERENCES:

SF7005 FINITE ELEMENT METHOD AND APPLICATIONS  L T P C 3 0 0 3

OBJECTIVES:
• Students are focused on acquiring the basic knowledge and computational skills in terms of finite element formulation with respect to various kinds of Geotechnical Engineering problems.

UNIT I  BASIC CONCEPTS  9
Introduction – basic concepts - discretization of continuum, typical elements, the element characteristic matrix, element assembly and solution for unknowns – applications. Variational principles, variational formulation of boundary value problems, variational methods of approximation such as Ritz and weighted residual (Galerkin) methods.

UNIT II  DISPLACEMENT MODELS  9
UNIT III  ISOPARAMETRIC FORMULATION  8
Isoparametric element - Local and Natural Co-ordinates systems, Line, Triangular, Quadrilateral and Tetrahedral Element-Interpolation - Displacement Models Formulation of Isoparametric - Finite element matrices in Local and Global Coordinate system – refined elements – numerical integration techniques.

UNIT IV  GEOTECHNICAL CONSIDERATION  9

UNIT V  APPLICATION IN GEOTECHNICAL ENGINEERING  10
Use of FEM to problems in soils – description and application to consolidation – seepage - FEM to simulate soil – structure interaction problems – software package use for simulating and analyzing the real foundation problem using FEM such as footing, pile foundation and deep excavations.

TOTAL: 45 PERIODS

OUTCOME
• Students will have the capacity to use advanced numerical techniques like FEM in various Geotechnical Engineering applications and in a capacity to use FEM based software programs for arriving solutions to various practical design problems in Geotechnical Engineering.

REFERENCE BOOKS

SF7006  GEOTECHNICAL EARTHQUAKE ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
• To understand the dynamics of earth and its response, effect on earth structure and measures to mitigate the effects. Students are able to develop the design ground motion for a site by suitable response analysis to analyse and design geotechnical structures. Students are able to prepare a hazard and risk map.

UNIT I  ELEMENTS OF EARTHQUAKE SEISMOLOGY AND DYNAMICS  6
UNIT II GROUND MOTION CHARACTERISTICS
Strong Motion Records - characteristics of ground motion - Factors influencing ground motion - Estimation of frequency content parameters - Seismic site investigations - Evaluation of Dynamic soil properties.

UNIT III GROUND RESPONSE ANALYSIS - LOCAL SITE EFFECTS AND DESIGN GROUND MOTION

UNIT IV SEISMIC STABILITY ANALYSIS

UNIT V EARTHQUAKE HAZARD MITIGATION

OUTCOME:
- Students are able to perform seismic stability analysis of geotechnical structures and in-situ soil by developing the design ground motion for an area based on bed rock motion and types of soils.

REFERENCES:

SF7007 PAVEMENT ENGINEERING

OBJECTIVES:
- Student gains knowledge on designing rigid and flexible pavements for different serviceability conditions of roads.

UNIT I BASIC CONCEPTS
Historical development of pavements – types, classification, components and principle of load transfer – Approaches to pavement design – vehicle and traffic considerations – behaviour of road materials under repeated loading – Stresses and deflections in layered systems.
UNIT II  FLEXIBLE PAVEMENT  9
Factors affecting flexible pavements – material characterization for analytical pavement design – AASHO, CBR, group index methods – Importance of Resilient modulus – Fatigue subsystem – failure criteria for bituminous pavements – IRC design guidelines.

UNIT III  RIGID PAVEMENT  9
Factors affecting rigid pavements - Design procedures for rigid pavement – Slab thickness, dowel bar, tie bar, spacing of joints – IRC guidelines – Airfield pavements – Comparison of highway and airfield pavements.

UNIT IV  PAVEMENT EVALUATION AND REHABILITATION  9
Pavement evaluation – surface and structural - causes and types of failures in flexible and rigid pavements – Presents serviceability index of roads – Overlay design - pavements maintenance, management and construction – Drainage and its importance in pavements.

UNIT V  STABILIZATION OF SOILS FOR ROAD CONSTRUCTIONS  9

OUTCOME:
• Students are able to design different new pavements and rehabilitate the existing roads using recent technology.

REFERENCES:

SF7008 GEOENVIRONMENTAL ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
• The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

UNIT I  SOIL – WASTE INTERACTION  8

UNIT II  CONTAMINANT TRANSPORT AND SITE CHARACTERISATION  9
UNIT III  WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES  

UNIT IV  LANDFILLS AND SURFACE IMPOUNDMENTS 

UNIT V  STABILISATION OF WASTE 

OUTCOME:
 Students are able to assess the contamination in the soil and to select suitable remediation methods based on contamination. Also they are able to prepare the suitable disposal system for particular waste.

REFERENCES:

SF7009  SOIL STRUCTURE INTERACTION  
L T P C  
3 0 0 3

OBJECTIVES:
 Students are able to assess the contamination in the soil and to select suitable remediation methods based on contamination. Also they are able to prepare the suitable disposal system for particular waste.

UNIT I  SOIL RESPONSE MODELS OF INTERACTION ANALYSIS  

UNIT II  INFINITE AND FINITE BEAMS ON ELASTIC FOUNDATIONS  
Infinite beam, General solution of the elastic line – concentrated and distributed loads on beams – Idealisation of semi-infinite and finite beams. Classification of finite beams, different end conditions and loads – solutions by general method, finite difference and application packages.
UNIT III PLATE ON ELASTIC MEDIUM

UNIT IV ANALYSIS OF PILE AND PILE GROUPS

UNIT V LATERALLY LOADED PILE
Load - deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, pile raft system, solutions through influence charts and Application packages.

TOTAL : 45 PERIODS

OUTCOME:
- At the end of this course students will have the capacity to idealize soil response in order to analyze and design foundation elements subjected to different loadings.

REFERENCE
6. ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats, American Concrete Institute, Dehit, 1988.

SF7010 MECHANICS OF UNSATURATED SOILS

OBJECTIVES:
- To impart knowledge in assessing both physical and engineering behaviour of unsaturated soils, measurement and modeling of suction – water content and suction – hydraulic conductivity of unsaturated soils.

UNIT I STATE OF UNSATURATED SOIL

UNIT II PHYSICS OF SOIL WATER SYSTEM
UNIT III  STRESS STATE VARIABLES AND SHEAR STRENGTH  

UNIT IV  STEADY AND TRANSIENT FLOWS  

UNIT V  MATERIAL VARIABLE MEASUREMENT AND MODELLING  
TOTAL: 45 PERIODS

OUTCOME:
• Students are able to assess the engineering behaviour of unsaturated soil, and understand the modeling and measurement techniques.

REFERENCES: