COURSE STRUCTURE & EVALUATION SCHEME
M.TECH. (Soil Mechanics and Foundation Engineering- Part Time)
Effective from Session 2017-18 (for New Entrants)

I SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	BMA 509	Numerical Methods and Computer Programming	4(3-1-0)	30	20	-	50	50	100
2.	ECE 527	Advanced Soil Mechanics	4(3-1-0)	30	20	-	50	50	100
3.	ECE 529	Earth Retaining Structures	4(3-1-0)	30	20	-	50	50	100

II SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 526	Stability of Slopes	4(3-1-0)	30	20	-	50	50	100
2.	ECE 528	Ground Improvement Techniques	4(3-1-0)	30	20	-	50	50	100
3.	BMA 502	Advanced Mathematics	4(3-1-0)	30	20	-	50	50	100

III SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 621	Advanced Foundation Engineering	4(3-1-0)	30	20	-	50	50	100
2.	ECE 635 to 645	Elective I	4(3-1-0)	30	20	-	50	50	100
3.	ECE 615	Seminar	2(0-0-4)				100		100

IV SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 646 to 658	Elective II	4(3-1-0)	30	20	-	50	50	100
2.	ECE 627,ECE 634 ECE 660 ,ECE 662, ECE 666,ECE 668	Elective III	4(3-1-0)	30	20	-	50	50	100
3.	ECE 650	Minor Project	2(0-0-4)				100		100

V SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 701	Dissertation	8(0-0-16)				100		100

VI SEMESTER

Sr. No.	Subject Code	Course Title	Credits (L-T-P)	Sessional Marks				ESM	Total Marks
				CT	TA	Lab	Total		
1.	ECE 702	Dissertation	8(0-0-16)				100		100

NUMERICAL METHOD AND COMPUTER PROGRAMMING (BMA-509)

L T P C 3 1 0 4

UNIT I

Linear equations and Eigen value problems, Accuracy of approximate calculations, Nonlinear equations, interpolation, differentiation and evaluation of single and multiple integrals,

UNIT II

Initial and boundary value problems by finite difference method, Newton's method, variation and weighted residual methods, introduction to finite element methods, fundamental of statistical distribution.

UNIT III

Principles of computer aided design, computer configuration for CAD applications, Computer peripherals for CAD. Computer graphics fundamentals, points and lines, Three dimensional transformations and projections, plane curve, space curves surface descriptions and generation.

UNIT IV

Hidden line algorithms for wire-frame modelling, Surface modelling, Solid modelling, Representation of 3D objects. B-rep solid modellers and constructive solid geometry.

UNIT V

CAD system utilization and application Hidden surface algorithms and Shading, Finite element systems, Computer aided drafting system.

Books and References

1. Scarborough, J.B., Numerical mathematical analysis, Oxford & IBH Publishing CO Pvt., 2000
2. Jain, K.K., Iyengar, S.R.K and Jain, R.K., Numerical methods-problem and solutions, Wiley eastern limited, 2001
3. Hamming, R.W., Numerical methods for scientist and engineers, McGraw Hill, 1998.
4. Mathews, J.H. and Fink, K.D., Numerical methods using MATLAB, Pearson Education, 2004
5. Hayter, A.J., Probability and statistics, Duxbury, 2002.
6.Rogers, D.F., Mathematical elements for computer graphics, McGraw Hill, 1990.
7. Rogers, D.F., Elements of computer graphics, McGraw Hill International edition, 1998
8. Mortenson, M.E., Geometric modelling, John Wiley and Sons, 1989.

ADVANCED SOIL MECHANICS (ECE-527)

L T P C 3 1 0 4

UNIT I

Introduction to stress-strain behaviour of soils; Mohr Circle of Stress; Principal Stresses. Shear strength of cohesive and cohesion less soils; drained and undrained shear strength of soils, Significance of pore pressure parameters; Determination of shear strength; Interpretation of tri-axial test results.

UNIT II

Stress path; Drained and undrained stress path; Stress path with respect to different initial state of the soil; Stress path for different practical situations.

UNIT III
Critical state soil mechanics; Critical state parameters; Critical state for normally consolidated and over consolidated soil; Significance of Roscoe and Hvorslev state boundary surface; drained and undrained plane.

UNIT IV
Behaviour of sands; Critical void ratio; Effect of dilation in sands; Different dilation models.

UNIT V
Elastic and plastic deformations: elastic wall; introduction to yielding and hardening; yield curve and yield surface.

Books and References
1. Atkinson, J.H. and Bransby, P.L, The Mechanics of Soils: An introduction to critical soil mechanics, McGraw Hill, 1978.
2. Atkinson J.H, An introduction to the Mechanics of soils and Foundation, McGraw- Hill Co., 1993.
3. Das, B.M., Advanced Soil Mechanics, Taylor and Francis, 2nd Edition, 1997
4. Wood, D.M., Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press, 1990.
5. Craig, R.F., Soil Mechanics, Van Nostrand Reinhold Co. Ltd., 1987.
6. Terzaghi, K., and Peck, R.B., Soil Mechanics in Engineering Practice, John Wiley & Sons, 1967.
7. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley & Sons, 1979

EARTH RETAINING STRUCTURES (ECE 529)

L T P C 3 1 0 4

UNIT I
Earth pressure, introduction, earth pressure as a stability problems, concept of strain dependence of developed stresses, active, at rest and passive conditions, plastic equilibrium, various theories related with E.P. Distillation, Rankine, Coulomb and Hansen theoretical derivation and graphical construction with different geometric and boundary conditions.

UNIT II
Retaining wall - types, material, method of construction, nature of forces acting. Comparison of different earth pressure
Theories and application in retaining wall. Stability analysis and design aspects, application of theory of elasticity in analysis of earth pressure distribution.

UNIT III
Sheet pile and cofferdam. Type, material, method of construction, distribution of earth pressure and related approximation. Distinction between Sheet Pile and Retaining wall, analysis and design.

UNIT IV
Earth - structure - Definition, Features of an earth dam, stability analysis of slope, total - vs. - effective stress analysis, limit equilibrium method of slices based on circular failure surfaces, introduction to analysis based on general failure surfaces,

UNIT V

Stability of earth dams during different stages - during and at end of construction, steady seepage, sudden draw down, estimation of pore water pressure - use of stability charts.

Books and References

1. J.L.Sherard, R.J.Woodward, S.F.Gizienski, and W.A. Clevenger, Earth and Earth –Rock Dams Engineering Problems of Design and Construction, John Wiley and Sons, New York, 1963.
2. R F Craig, Soil Mechanics, Chapman and Hall(ELBS)
3. C. Justin and Hinds, Engineering for Dams Vol. 2 & 3.
4. S. Leliavsky, 'Design of Dams for Percolation and Erosion', Chapman and Hall.

STABILITY OF SLOPES (ECE-526)

L T P C 3 1 0 4

Unit I

Landslide phenomenon: Types and causes of slope failures, Practical applications, Stability analysis of infinite slopes with or without water pressures; Stability analysis of finite and infinite slopes: concept of factor of safety.

Unit II

Pore pressure coefficients, Mass analysis, Limit Equilibrium method, Wedge methods, friction circle method; Method of slices, IS Method, Bishop's method, Jambu's method.

Unit III

Effect of seepage, Seepage analysis, Flownets, Stability conditions during construction, Full reservoir and sudden drawdown - cut off walls – Trenches – Importance of drainage and filters Design of slopes in cutting, Embankments and Earth dams.

Unit IV

Site Investigation of slopes, Reconnaissance, Preliminary and detailed investigation, Investigation for foundations; Advances in stability analysis of slopes, Case studies Failure and damages,

Unit V

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.

Books and References

1. Abramson L. W., Thomas S. Lee, Sharma S. and Boyce G M., "Slope Stability and Stabilization Methods", Willey Interscience publications 10.
2. Das B. M., "Principles of Geotechnical Engineering", Thomson Brooks/Cole.
3. Lambe T. W. and Whitman R .V., "Soil Mechanics", John Wiley & sons.
4. Murthy V .N. S., "Principles of Soil Mechanics and Foundation Engineering", UBS
5. IS: 7894 "Code of Practice for Stability Analysis of Earth Dams", Bureau of Indian Standards, New Delhi.

GROUND IMPROVEMENT TECHNIQUES (ECE-528)

L T P C 3 1 0 4

Unit I

Introduction: Need of Ground Improvement: Different methods of Ground improvement, General Principal of Compaction: Mechanics, field procedure, quality control in field.

Unit II

Ground Improvement in Granular Soil: In place densification by (i) Vibrofloatation (ii)Compaction pile (iii) VibroCompaction Piles (iv) Dynamic Compaction (v) Blasting.
Ground Improvement in Cohesive Soil: Compressibility, vertical and radial consolidation, preloading methods.Types of Drains, Design of vertical Drains, construction techniques.

Unit III

Stone Column: Function Design principles, load carrying capacity, construction techniques, settlement of stone column foundation.
Ground Improvement by Grouting: Grouting in soil, types of grout,desirable characteristics, grouting pressure, grouting methods.

Unit IV

Soil Reinforcement: Mechanism, Types of reinforcing elements, reinforcement-soil interaction, Reinforcement of soil beneath the roads, foundation. Geosynthetics and their application.

Unit V

Soil Stabilization: Lime stabilization-Base exchange mechanism, Pozzolanic reaction, lime-soil interaction, line columns, Design of Foundation on lime columns. Cement stabilization: Mechanism, amount, age and curing. Fly-ash - Lime Stabilization, Soil Bitumen Stabilization.

Books and References

1. Mosely, M.P. “Ground Improvement”, Blackie Academic and Professional.

2. Raj, P. Purushothama, “Ground Improvement Techniques”, LaxmiPublications, New Delhi.

3. US Army Corps of Engineers “Guidelines on Ground improvement for Structures and Facilities”.

4. FHWA manuals

a. Design and Construction of Stone Columns, Volume 1 ,1983 , FHWARD- 83-026

b. Design and Construction of Stone Columns, Volume 2, 1983, FHWA-RD-83-027

c. Manual for Design & Construction of Soil Nail Walls, 1999, FHWASA- 96-069R.

d. Permanent Ground Anchors, Volume 1, Final Report 1991 FHWADP- 90-068

e. Permanent Ground Anchors, Volume 2, Field Demonstration ProjectSummaries 1991, FHWA-DP-90-068.

f. Prefabricated Vertical Drains, Volume 1, 1986, FHWA-RD-86-168.

ADVANCED MATHEMATICS (BMA-502)

L T P C 3 1 0 4

Unit I

Set Theory: Definition of set, Subsets and supersets. Set operations, finite and infinite set, Cardinality, Venn diagram, Cartesian product, Fuzzy sets– basic properties, Simple problems. Recurrence Relation and Generating Functions: Formation of recurrence relation, Solution of linear and nonlinear

recurrence relation, Properties of generating function and solve the recurrence relation using the generating function and related problems.

Unit II

Numerical analysis: Introduction to interpolation, Newton's Forward and Backward interpolation (Statement only), Lagrange and Divided interpolation (Statement only), Simple problems. Numerical differentiation for equal and unequal interval. Matrix Eigen value and Eigen vactor by power methods, simple problems. Curve fitting and problems.

Unit III

Statistics: Analysis of Bivariate data. Correlation Analysis – Meaning of correlation;

Unit IV

Scatter Diagram; Karl Pearson's coefficient of linear correlation. , Linear regression, Properties of regression and related problem.

Unit V

Optimisation Technique: Linear programming problem (LPP) Formation of LPP, Graphical Method and related problems. Transportation Problems,

Text Books

1. Mott, Kandel& Baker, Discrete Mathematics for Comp. Scientists & Mathematicians, PHI
2. C.L.Liu, Discrete Mathematical Structure, TMH
3. Dutta & Jana, Introductory Numerical Analysis.
4. J.B.Scarborough, Numerical Mathematical Analysis.
5. Jain, Iyengar& Jain, Numerical Methods (Problems and Solution).
6. V.K. Kapoor, Operation Research.
7. PaneerSelvam, Operation Research, PHI
8. Hillier & Lieberman, Operations Research, TMH
9. Kalavati, Operations Research, VIKAS
10. R.I.Levin& D.S. Rubin, Statistics for Management, Pearson Education
11. Amir D. Aczel&JayavelSounderpandian, Complete Business Statistics, Tata McGraw- Hill
12. R.S Bhardwaj, Business Statistics, Excel Books.
13. Balagurusamy: Numerical Methods,
14. Scitech.OperationResearch,HumdyTaha,PHI
15. Statistics,Random Process & Queuing Theory, Prabha, Scitech
16. S P Gupta & M.P. Gupta, Business Statistics, Sultan Chand & Sons
17. G. C. Beri, Statistics for Management, Tata McGraw- Hill

ADVANCED FOUNDATION ENGINEERING (ECE-621)

L T P C 3 1 0 4

UNIT I

Modern methods of soil investigations, Geophysical methods; soil resistivity methods seismic refraction method, stress below ground due to loads

UNIT II

Bearing capacity and settlement analysis of shallow foundations: Meyerhof and Hansen's bearing capacity equations, BIS bearing capacity equation, immediate and consolidation settlements in cohesive soil, De-Beer and schmmertman's methods of settlement prediction in non cohesive soil.

UNIT III

Classification of piles, load carrying capacity of single piles in clay, silt and sand by dynamic and static methods, Pile load test, Pile group, Negative skin friction, Settlement of pile group.

UNIT IV

Foundation on expansive soil, Construction on expansive soil, Alteration of soil condition, under-reamed piles. Elements of well foundation, Shape, Depth of scour, Well sinking, Tilt, shift and their prevention.

UNIT V

Stability of slopes, Limit equilibrium method, Method of slices, Simplified Bishop method, Stability Charts. Soil behavior under dynamic loads ,Machine foundation classification, definitions, design principle in brief, Barken's method.

Books and References

1. Alam Singh – Modern Geotechnical Engineering.
2. B. M. Das – Foundation Engineering, CENGAGE Learning
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics
4. J. E. bowles – Analysis and Design of Foundation.
5. K. R. Arora – Soil Mechanics & Foundation Engineering.
6. V. N. S. Murthy – Soil Mechanics and Foundation Engineering.

ELECTIVE-I (ECE 635-645)

List of Elective I

ECE 635	Soil structure interaction analysis
ECE 637	Earthquake geotechnical engineering
ECE 639	Finite element in geotechnical engineering
ECE 641	Design of Landfills
ECE 643	Design of special Foundations
ECE 645	Offshore geotechnical Engineering

SOIL STRUCTURE INTERACTION ANALYSIS (ECE-635)

L T P C 3 1 0 4

UNIT I

Introduction to soil - Foundation interaction problems, Soil behavior, Foundation behavior, Interface, behavior, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behavior, Time dependent behavior.

UNIT II
Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

UNIT III
Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions.

UNIT IV
Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

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

References :

1. Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.
2. McCarthy, D.F. Essentials of Soil Mechanics and Foundations, basic geotechnics (6^{th} Edition), Prentice Hall, 2002.
3. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
4. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980.
5. Scott, R.F. Foundation Analysis, Prentice Hall, 1981.
6. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.

EARTHQUAKE GEOTECHNICAL ENGINEERING (ECE 637)

L T P C 3 1 0 4

UNIT I
Theory of vibration - Basic Definition - Governing equation for single degree freedom system - Forced vibrations - Rotating mass type excitation - Base excitation - Isolation vibration measuring instruments. Mechanism of Earthquakes - Causes of earthquake - Earthquake Fault sources - Elastic Rebound theory - Seismic wave in Earthquake shaking - Definition of earthquake terms - Locating an earthquake - Quantification of earthquakes.

UNIT II
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
Wave propagation Analysis - Site Amplification Need for Ground Response Analysis - Method of analysis - One Dimensional Analysis - Equipment linear Analysis site effects - Design Ground Motion - Developing Design Ground Motion. Application of software package Edushake - Shake-91.

UNIT IV

Earthquake - Resistant Design of foundation of buildings. Design considerations – Geotechnical, Architectural, Structures, Capacity Design, Seismic analysis. Earthquake Response of slopes - Evaluation of slope stability - Pseudo static Analysis - Newmark's Study of Block Analysis - Dynamic Analysis - Earth pressure due to ground shaking Evaluation. Liquefaction-Susceptibility-Evaluation Cyclic stress approach - Liquefaction Resistance - Laboratory and Field Tests with interpretation - Lateral Deformation - Case Study.

UNIT V

Seismic risk vulnerability and hazard - Percept of risk - risk mapping - scale - hazard assessment - Maintenance and modifications to improve hazard resistance - Different type of foundation and its impact on safety - Ground Improvement Techniques.

Books and References

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing - New Delhi, 2000.
2. KrammerS.L., Geotechnical Earthquake Engineering, prentice hall, international series, Pearson Education (Singapore) Pvt. Ltd., 2004.
3. KameswaraRao, Vibration Analysis and Foundation Dynamics, wheeler Publishing, New Delhi, 1998.

FINITE ELEMENT IN GEOTECHNICAL ENGINEERING (ECE-639)

L T P C 3 1 0 4

UNIT I

Basic concepts - Discretization of continuum, typical elements, the element characteristic matrix, Element assembly and solution for unknowns - Applications.

UNIT II

Variational principles, variational formulation of boundary value problems, Variational methods approximation such as Ritz and weighted residual (Galerkin) methods, Applications

UNIT III

Displacements based elements, finite elements for axial symmetry. One-dimensional problems of stress, deformation and flow, Assembly, Convergence requirements, Finite elements analysis of two-dimensional problems. The linear and quadratic triangle, Natural coordinates.

UNIT IV

Application of FEM to Problems in soils and rocks, Introduction to non-linearity, Finite difference method, Description and Description and application to consolidation, seepage, Winkler foundation etc.,

UNIT V

Finite element: Potential Energy, shape function, linear, triangular and rectangular element, fundamentals for one-dimensional,two dimensional structure, isoparametric formulation, simple two dimensional problems related to Geotechnical Engineering.

Books and References

1. Cook, R.D., Malkus, D.S., and Plesha, M.E., Concepts and Applications of Finite Element Analysis, John Wiley, 1989.
2. Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill, 1984.
3. Chadrapati, A.T., and Beligundu., Introduction to Finite Elements in Engineering, Prentice- Hall, 1991.
4. Rockey, K.C., Erans, H.R., Griffiths, D.W., and Nethercot, D.A., The Finite Element method, Grostry Lockwood Staples, London, 1975.
5. Rajasekaran, S., Finite Element Analysis in Engineering Design, Wheller Publishing, Allahabad, 1993.
6. Smith, I.M., Programming the Finite Element Method with Application to Geomechanics, John Wiley and sons, New Delhi, 2000.
7. Gupta, O.P. Finite and Boundary Element Methods in Engineering, Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi, 2000.
8. Rao, S.S. The finite element method in engineering, Butterworth - Heinemann., 1998.
9. Potts, D.M. and Zdramcovic, L., Finite Element analysis in Geotechnical Engineering - Application, Thomas Telford, 2001.
10. Shen, J. and Kushwaha. R.L., Soil-Machine Interaction - A finite element perspective Moral Dikker, Inc. 1998.

DESIGN OF LANDFILLS (ECE-641)

L T P C 3 1 0 4

UNIT I

Landfill engineering - Criteria for selection of sites for waste disposal facilities-parameters controlling the selection of wastes disposal sites - current practices for waste disposal, Liners – types and design Passive containment systems-Leachate contamination - applications of geomembrane, Land fill gases and their properties, Landfill Gas monitoring systems.

UNIT II

Long-term behaviour of landfills – Landfill closure Recultivation and aftercare of landfill, Ground modification techniques in waste fill, covers and liners for landfills, material aspects and stability considerations,

UNIT III

landslides - occurrences and methods of mitigation, Erosion causes, control and construction techniques.

UNIT IV

Contaminants of Solid Waste in Land fills: Waste contaminants, landfills, types, shape and size of land fills. Liner and liner system, Cover and cover system,

UNIT V

Stability of land fills. Land fill construction & operation, sustainable waste management.

Books and References

1. Edward A., McBean, Frank A. Rovers “Solid Waste Landfill Engineering and Design”, Prentice Hall PTR.
2. Sharma, H. D. and Lewis, S. P. “Waste Containment Systems, Waste Stabilization and Landfills”, Wiley, New York.
3. Oweis, I. S. and Khera, R. P. “Geotechnology of Waste Management”, PWS Publishing Company, Boston.

DESIGN OF SPECIAL FOUNDATION (ECE-643)

L T P C 3 1 0 4

UNIT I
Raft Foundation: Settlement and Bearing Capacity analysis, Analysis of flexible and rigid raft as per IS 2950.Computation of settlements (Immediate & Consolidation); Permissible settlements, Allowable total and differential settlement of structures.

UNIT II
Proportioning of footing, Inclined & Eccentric loads. Settlement of footings on stratified deposits. Influence of adjacent footings.
Bearing Capacity from SPT and SCPT and Plate load Test data, Proportioning of footing based on settlement criteria.Foundations on Problematic soils: Problems and Remedies

UNIT III
Deep Foundation: Modes of failure. Bearing capacity and settlement of pile foundation. Types of piles. Allowable load, Pile Load test. Dynamic and static formulae. Bearing Capacity factors. Pile group bearing capacity and settlement. Interference, Behavior of piles under lateral loading. Winkler's assumption. Pile resistance and deflection under lateral loads, elastic method, Broms method.

UNIT IV
Well Foundation: Design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts.

UNIT V
Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis

Books and References
1. B. M Das, Principles of Foundation Engineering, Thomson Brooks/Cole
2. J. E. Bowles, Foundation Analysis and Design, McGraw-Hill Book Company
3. H.G. Poulos, and E.H.Davis, Pile Foundation Analysis and Design, John Wiley and Sons, New York.
4. N.P. Kurien, Design of Foundation Systems : Principles & Practices, Narosa, New Delhi 1992
5. H. F. Winterkorn and H Y Fang, Foundation Engineering Hand Book, Galgotia Booksource

OFFSHORE GEOTECHNICAL ENGINEERING (ECE-645)

L T P C 3 1 0 4

UNIT I
Submarine soils: Origin, nature and distribution. Terrigenic and pelagic soils. Submarine soils of India. Engineering behaviour of submarine soils: under-consolidated soils, calcareous soils, cemented soils, corals;

UNIT II
Offshore site investigations: sampling and sampling disturbance, insitu testing, wireline technology.

UNIT III
Offshore pile foundations for jacket type structures. Foundations of gravity structures; Foundations for jackup rigs.

UNIT IV
Anchors and breakout forces; anchor systems for floating structures.

UNIT V
Stability of submarine slopes. Installation and stability of submarine pipelines.

Books and References
1. E.T. Richard Dean. Offshore Geotechnical Engineering, ICE, UK, London, 2009.
2. Mark Randolph and Susan Gourvenec. Offshore Geotechnical Engineering, CRC Press, 2011.
3. H. G. Poulos. Marine Geotechnics, Unwin Hyman, 1988.
4. Susan Gourvenec and Mark Cassidy. Frontiers in Offshore Geotechnics,Taylor & Francis, 2005.
5. William O. McCarron. Deepwater Foundations and Pipeline Geomechanics, J. Ross Publishing, 2011.

SEMINAR (ECE-615)

L T P C 0 0 4 2

Individuals have to select topic of current interest, Review and Evaluate available Literature & present the content in own Language and style

ELECTIVE-II (ECE 646-658)

List of Elective II

ECE 646	Rock Mechanics
ECE 648	Construction Techniques in Geotechnical Engineering
ECE 652	Environmental geo-technique
ECE 654	Design of earthen dams
ECE 656	Tunnel Engineering
ECE 658	Design of sub-structures

ROCK MECHANICS (ECE-646)

L T P C 3 1 0 4

Unit I
Introduction-Geological formation of rocks, Structural Geology, Classification of rocks, Defects in rock, Physical mechanical properties of rocks,

Unit II
Exploration techniques – RQD and RMR, Laboratory tests for shear strength, tensile strength, flexural strength, elastic constants, Field tests – test for deformability, shear tests and strength tests

Unit III

Engineering classification of Rock mass, Stress-strain behaviour, Failure criteria for rock masses-Yield criteria for failure theories: maximum stress theories, maximum elastic strain theories etc, and Griffith's theory of fracture initiation, stresses around open flaw and equation defining fracture

Unit IV

Tunnelling in rocks - different phases and methods oftunnelling, Instrumentation in tunnels, Rock freezing, Rock fall, Improvement techniques for rock – Grouting, Rock bolting

Unit V

Rock reinforcement - Mechanism, types of reinforcement, steps involved in installation, Foundations on rock, Rock blasting- explosives, Selection criteria for explosives, steps involved in blasting

Books and References

1. Verma, B. P., "Rock Mechanics for Engineers" Khanna Publishers
2. Singh, B. and Goel, R. K. "Rock Mass Classification Systems – A Practical Approach in Civil Engineering "Elsevier Publisher.
3. Hoek, E. and Brown, E. T. "Underground Excavations ", Span Press.
4. Hoek, E. and Bray, J D., "Rock Slope Engineering ", Span Press.
5. Brown, E.T., "Rock Characterisation, Testing and Monitoring", Pergamon Press, London, U.K.14
6. Herget, G., "Stresses in Rock", Balkema, Rotterdam, The Netherlands
7. Hoek, E. and Brown, E.T., "Underground Excavation in Rock", Institution of Mining and Metallurgy, London U.K.
8. Goodman, R.E., "Introduction to Rock Mechanics", John Wiley & Sons, NewYork, N.Y., USA.
9. Bieniawski, Z.T., "Engineering Rock Mass Classification", John Wiley and Sons, New York, N.Y., USA.

CONSTRUCTION TECHNIQUES IN GEOTECHNICAL ENGINEERING (ECE-648)

L T P C 3 1 0 4

UNIT I

Methods of Dewatering.Construction of Raft Foundation Pile foundation - Pile driving equipment – Hammer, Pile drivers and other accessory equipment, Construction of precast and cast-in-situ piles.Cofferdams - Sheet piling in cofferdams – Setting and driving, Length and penetration, splicing, Extraction, Scaling to existing structures, Bracing systems – Circular cofferdams, Rectangular cofferdams, Setting, Bracing, Removing bracing, Excavation – Pre-dredging, excavation inside cofferdams.

UNIT II

Pile driving within the cofferdam – Bottom seal – Resistance to uplift, Seal construction bybucket method, Seal construction by Tremic method, Seal construction by grout intrusion method, Dewatering – Pumping, other dewatering methods,Cofferdam difficulties – Cofferdam destroyed by surge, Cofferdam bottom blows, Impropersheet pile sections and bracing, Sheet pile stopped by boulders, Buckling of long struts, Improper procedure in unstable soil, Scour and poor Tremic-concrete procedures, problems with Tremic.Box

UNIT III

Caissons – General considerations, Site and foundation preparation, fabrication, Launching and Towing, Setting, Concreting. Open Caissons – General considerations, Cutting edges, Setting, Construction of steining, sinking, Tipping and sliding, completing and installation, Construction of Pneumatic Caissons.

UNIT IV

Rock excavation – Evaluation and planning, Drilling equipment, Blast design – Criteria fordesign, Selection of explosive, Blast hole design, Blasting round design, Over break Control– Line drilling, Pre-splitting, Trim blasting, Loading and hauling equipment

UNIT V

Tunneling in solid rocks – Means of excavation in solid rocks, Full- face tunneling without support, Full-face tunneling with support Tunneling in moderately firm rocks and ground –Classical or mining method, Single stage mining method, Multistage classical method of tunneling, Sinking caisson method, Shield tunneling method, tunneling by Tunnel boring machines, Types of TBM

Books and References

1. Handbook of Heavy Construction, John Havers and Frank W .Stubbs, McGraw Hill,1971.29/55
2. Construction & Geotechnical Methods in Foundation Engineering, R. M. Koerner,McGraw Hill,1985.
3. Tunneling Management by Design, A. M. Wood ,Windle edition.
4. The Introduction to Tunnel Construction, David Chapman, Nicole Metje and AlfredStärk ,Spon Press, 2010.

ENVIRONMENTAL GEO-TECHNIQUE (ECE-652)

L T P C 3 1 0 4

Unit I

Soil as a multiphase system; Soil-environment interaction; Properties of water in relation to the porous media; Water cycle with special reference to soil medium. Soil mineralogy; significance of mineralogy in determining soil behavior; Mineralogical characterization.

Unit II

Soil-water-contaminant interaction; Theories of ion exchange; Influence of organic and inorganic chemical interaction.

Unit III

Introduction to unsaturated soil mechanics; water retention property and soil-water characteristic curve; flow of water in unsaturated soil.

Unit IV

Concepts of waste containment facilities; desirable properties of soil; contaminant transport and retention; contaminated site remediation.

Unit V

Introduction to advanced soil characterization techniques; volumetric water content; gas permeation in soil; electrical and thermal properties; pore-size distribution; contaminant analysis.

Books and References

1. Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
2. Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press,1997.
3. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
4. Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.
5. Rowe, R.K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
6. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000.
7. Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and Landfills:
8. Design and Evaluation, John Wiley & Sons Inc., 1994.

DESIGN OF EARTHEN DAMS (ECE-654)

L T P C 3 1 0 4

Unit I-Analysis, design and methods of construction of different types of earth dams;

Unit II- Stability conditions and analysis

Unit III- Special design problems;

Unit IV- Installation of instruments and their observations;

Unit IV-Different methods of foundation exploration and treatment

Books and References

1. Sowers, G.F., Earth and Rockfill Dam Engineering, Asia Publishing House, 1962.

2. S.K. Garg , Irrigation Engineering And Hydraulic Structure

TUNNEL ENGINEERING (ECE-656)

L T P C 3 1 0 4

UNIT – I

Introduction: Scope and application, historical developments, art of tunnelling, tunnel engineering, future tunnelling considerations.

Types of Underground Excavations: Tunnel, adit, decline, shaft; parameters influencing location, shape and size; geological aspects; planning and site investigations.

UNIT – II

Tunnelling Methods: Types and purpose of tunnels; factors affecting choice of excavation technique; Methods -soft ground tunnelling, hard rock tunnelling, shallow tunnelling, deep

tunnelling; Shallow tunnels –cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered and remedial measures.

UNIT – III

Tunnelling by Drilling and Blasting: Unit operations in conventional tunnelling; Drilling-drilling principles, drilling equipment, drilling tools, drill selection, specific drilling, rock drillability factors; Blasting-explosives, initiators, blasting mechanics, blast holes nomenclature; types of cuts-fan, wedge and others; blast design, tunnel blast performance -powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection

UNIT – IV

Tunnelling by Roadheaders and Impact Hammers: Cutting principles, method of excavation, selection, performance, limitations and problems.

Tunnelling by Tunnel Boring Machines:Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications.

Supports in Tunnels: Principal types of supports and applicability

UNIT – V

Ground Treatment in Tunnelling: Adverse ground conditions and its effect on tunnelling; introduction to ground control.

Tunnel Services: Ventilation, drainage and pumping.

Methods of Sinking Shafts: Vertical and inclined, decline; shaft/raise boring machines and their application.

Tunnelling Hazards: Explosion, flooding, chimney formation, squeezing ground

Books and References

1.Tunnel Engineering Handbook by J O Bickel & T R Kuesel
2.Rock Mechanics Design in Mining & Tunneling by Z T Bieniawski
3.Harbour & Dock & Tunnel by R. Srinivasan
4.Tunnel Engineering by S.C. Saxena

DESIGN OF SUB-STRUCTURES (ECE-658)

L T P C 3 1 0 4

Unit I

Building foundation design: Design of footing, isolated footing and steel grillage, combined footings of rectangular, Trapezoid cantilever types. Mat or raft foundation of dry and saturated soil floating foundations.

Unit II

Design of Piles, Pile caps and pile foundations buildings,

Unit III

Design of retaining structures, Design of retaining walls with surcharge loads. Retaining walls resting on piles,

Unit IV

Design of bridge abutments, Design of foundation for transmission towers:-Design of basement walls,

Unit V

Bridges structures Analysis and Design: Design of wells foundation and caissons of different types, Design of bridge pairs resting on piles.

Books and References

1. Swami Saran, Analysis and Design of Sub structures, Oxford and IBH Publishing Co. PVT. Ltd, New Delhi.
2. Tomlinson, Foundation Design and Construction, Prentice Hall Publication.

ELECTIVE-III (ECE 660-670)

List of Elective III

ECE 660	Soil Dynamics
ECE 662	Machine Foundations
ECE 627	Structural Dynamics
ECE 666	Remote Sensing and Geographical Information System
ECE 668	Geo environmental and geo-hazard engineering
ECE 634	Finite element analysis

SOIL DYNAMICS (ECE-660)

L T P C 3 1 0 4

UNIT I

Introduction: Comparison of Soil mechanics and Soil Dynamics, Nature of Dynamic loads, Stress conditions on soil element under earthquake loading, seismic force for pseudo static analysis as per IS Code

UNIT II

Dynamic Soil Properties: Dynamic moduli, Dynamic elastic constants. Poission's Ratio, Damping ratio, Liquefaction parameters, Laboratory techniques, Field tests, Factors affecting shear modulus, Elastic modulus and Elastic Constants.

UNIT III

Dynamic Earth Pressure: Pseudo static methods, Displacement methods for active and passive case. Behaviour of Retaining walls during earthquakes. Modification of Coulomb's theory.

UNIT IV

Dynamic Bearing Capacity of Shallow Foundation: Criteria for satisfactory action of footing. Pseudo static analysis, bearing capacity of footings. Dynamic analysis of horizontal and vertical loads.

UNIT V

Liquefaction of Soils: Definition, Mechanism of liquefaction. Laboratory studies, Cyclic Triaxial test, Cyclic simple shear test. Evaluation of zone of liquefaction in field. Vibration table studies, Field blast studies, Evaluation of liquefaction using Standard Penetration Resistance. Factors affecting liquefaction and measures for avoiding liquefaction.

Books and References

1. A Major, Vibration Analysis and Design of Foundations for Machines and Turbines: Dynamical Problems

2. B M Das, Principles of Soil Dynamics, Thomsons Engineering, 1992
3. D.D. Barkan, Dynamics of Bases and Foundation, McGraw-Hill, New York, 1962.
4. K.G. Bhatia, Foundations For Industrial Machines, D-CAD Publishers , 2008
5. N. S. V. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wiley New Delhi, 1998
6. S. Saran, Soil Dynamics and Machine Foundations, Galgotia Publications Private Ltd.1999

MACHINE FOUNDATIONS (ECE-662)

L T P C 3 1 0 4

UNIT I

Theory of Vibration: Definitions, Harmonic motion, free and forced Vibration of a single degree freedom system with and without damping, Theory of vibration, Vibration measuring Instruments. Vibration isolation, spectral response

UNIT II

Natural frequency of foundation, soil system , Barkan's and I.S. methods of determining natural frequency. Tachehotarioff's reduced natural frequency.Elastic properties of soil for dynamical purpose and their experimental determination of shear modulus from wave theory , Apparent soil mass , bulb of pressure concept , Pauw's analogy of foundation.

UNIT III

Principles of Machine Foundation Design: Typical machine and foundations. General requirements of machine foundation; Permissible amplitude, allowable soil pressure. Modes of vibration of a rigid foundation block, Methods of analysis, Linear elastic weightless spring method, Elastic half space method Design procedure for block foundation, IS code practice. Behaviour and design of Machine foundations, Reciprocating Machines, Hammer foundations, Introduction to T.G.foundations.

UNIT IV

Vibration Isolation: 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.

UNIT V

Liquefaction of Soils: Definition, Mechanism of liquefaction. Laboratory studies, Cyclic Triaxial test, Cyclic simple shear test. Evaluation of zone of liquefaction in field. Vibration table studies, Field blast studies, Evaluation of liquefaction using Standard Penetration Resistance. Factors affecting liquefaction and measures for avoiding liquefaction.

Books and References

1. A Major, Vibration Analysis and Design of Foundations for Machines and Turbines: Dynamical Problems
2. B M Das, Principles of Soil Dynamics, Thomsons Engineering, 1992
3. D.D. Barkan, Dynamics of Bases and Foundation, McGraw-Hill, New York, 1962.
4. K.G. Bhatia, Foundations For Industrial Machines, D-CAD Publishers , 2008
5. N. S. V. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wiley New Delhi, 1998
6. S. Saran, Soil Dynamics and Machine Foundations, Galgotia Publications Private Ltd.1999

STRUCTURAL DYNAMICS (ECE 627)

L T P C 3 1 0 4

Unit-I

Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles.

Unit-II

Dynamics of Single-degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems. Methods of evaluation of damping.

Unit-III

Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to Single-degree-of-freedom systems -
Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

Unit-IV

Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems - Natural frequencies and mode shapes – orthogonality. property of modes.

Unit-V

Approximate methods: Rayleigh's method Dunkarley's method, Stodola's method. Dynamics of Continuous systems: flexural vibration of beams with different end conditions,. Stiffness matrix, mass matrix (lumped and consistent); equations of motion for the discretised beam in matrix form.

Books and References

1. Dynamics of Structures – Theory and Application to Earthquake Engineering"- 2nd ed., Anil K. Chopra, PearsonEducation.
2. Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (india)
3. Vibrations, structural dynamics- M. Mukhopadhaya : Oxford IBH
4. Structural Dynamics- Mario Paz : CBS publishers.
5. Structural Dynamics- Clough & Penzien : TMH
6. Vibration Problems in Engineering Timoshenko, S, Van-Nostrand Co.

REMOTE SENSEING AND GEOGRAPHICAL INFORMATION SYSTEM (ECE-666)

L T P C 3 1 0 4

UNIT I

Definitions and introduction to remote sensing, components of remote sensing system. Spectral windows and spectral signatures and their significance in remote sensing. Radiometric quantities used in the collection of spectral signatures.

UNIT II

Remote sensing satellite orbits, image acquisition process, repeativity, row/path and ground swath and coverage. Various remote sensing platforms. Passive and active remote sensors: Radar, Lidar and SAR. Spectral and spatial resolution of various remote sensors with special relevance to Indian Remote Sensing satellites. Different types of remotely sensed data products.

UNIT III

Characteristics of photographic images, colour, tone and texture, photo,interpretation keys, techniques of photo interpretation. Digital image classification techniques and extraction of thematic information. Global Positioning System (GPS): Introduction & components of GPS, Space segment, control segment and user segment, Elements of Satellite based surveys –Map datums, GPS receivers, GPS observation methods and their advantages over conventional methods.

UNIT IV

Geographic Information System (GIS) ,Definition of GIS, Geographical concepts and terminology, Components of GIS, Data acquisition, Raster and vector formats, scanners and digitizers. Advantages of GPS and GIS in the storage thematic information extracted from remotely sensed images.Role of remote sensing and GIS in terrain investigation and advantages over conventional mapping techniques. Extraction of topographic information from remotely sensed data and generation of digital terrain model from stereo pairs of images.

UNIT V

Resource mapping for engineering project: selection of sites for construction materials, water resources, soil, buildings, railways, and highways etc. using remotely sensed data.

Geological mapping for the geotechnical investigation of soil strata. Monitoring of areas prone to landslides using remote sensing, digital model and GIS. Application of visible, infra,red and microwave remote sensing for the identification of soil types, grain size and moisture studies.

Books and References

1.Lillesand T.M. and Kiefer R. W., Remote Sensing and image interpretation, John Wiley and Sons. New York.

2. J. B. Campbell, Introduction to remote sensing , Taylor & Francis, London.

3. J. R.Jensen, Introductory Digital Image Processing, Prentice Hall International Ltd., London.

4. Kennie, T. J. M. and Matthews M. C., Remote Sensing in Civil Engineering, Surrey University Press, Glasgow.

GEO ENVIRONMENTAL AND GEO-HAZARD ENGINEERING (ECE-668)

L T P C 3 1 0 4

UNIT I

Fundamentals of Geoenviromental Engineering: Scope of geoenvironmental engineering , multiphase behavior of soil ,role of soil in geoenvironmental applications ,importance of soil physics, soil chemistry, hydrogeology, biological process ,sources and type of ground contamination ,impact of ground contamination on geoenvironment , case histories on geoenvironmental problems.

UNIT II

Soil mineralogy characterization and its significance in determining soil behavior, soil,water interaction and concepts of double layer, forces of interaction between soil particles. importance of unsaturated soil in geoenvironmental problems , measurement of soil suction , water retention curves ,water flow in saturated and unsaturated zone.

UNIT III

Factors effecting retention and transport of contaminants**.** Evolution of waste containment facilities and disposal practices , Site selection based on environmental impact assessment, different role of soil in waste containment ,different components of waste containment system and its stability issues ,property evaluation for checking soil suitability for waste containment ,design of waste containment facilities.

UNIT IV

Site characterization ,risk assessment of contaminated site , remediation methods for soil and groundwater ,selection and planning of remediation methods ,some examples of in,situ remediation**.**

UNIT V

Contaminant analysis , water content and permeability measurements ,electrical and thermal property evaluation ,use of GPR for site evaluation , introduction to geotechnical centrifuge modeling**.**

Books and References

1. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., Environmental Engineering, McGraw Hill Inc., 1985.

2. Tchobanoglous, G., and Frank Kreith, Hand Book of Solid Waste Management, McGraw Hill, Inc., 2002.,

3. Tchobanoglous, G., Theisen, H., and Vigil, S. A., Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw-Hill, 1993.

4. Vesilind, P. A., Worrell, W., and Reinhart, D., Solid Waste Engineering, Brooks/Cole Thomson Learning Inc., 2002

FINITE ELEMENT ANALYSIS (ECE 634)

L T P C 3 1 0 4

UNIT-1

Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method of structural analysis – Rayleigh – Ritz method – Finite difference method – Finite element method. Variation method and minimization of Energy approach of element formulation. Principles of finite element method – advantages & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – Numbering of nodes to minimize band width.

UNIT-2

Nodal displacement parameters – Convergence criterion – Compatibility requirements – Geometric invariance – Shape function – Polynomial form of displacement function. Generalized and Natural coordinates – Lagrangian interpolation function – shape functions for one, two & three dimensional elements.

UNIT-3

Isoparametric elements, Internal nodes and higher order elements, Serendipity and lagrangian family of Finite Elements, Sub-parametric and superparametric elements, condensation of internal nodes, jacobian transformation Matrix. Development of strain-displacement matrix and stiffness matrix, consistent load vector, numerical integration.

UNIT-4

Application of Finite Element Method for the analysis of one & two dimensional problems - Analysis of simple beams and plane trusses – Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements.

UNIT-5

Application to Plates & Shells- Choice of displacement function (C^0, C^1 and C^2 type) – Techniques for Non – linear Analysis.

Books and References

1. Krishnamoorthy C S, “Finite Element Analysis”- Tata McGraw Hill

2. Desai C and Abel J F, “Introduction to the Finite Element Method”- East West Press Pvt. Ltd., 1972
3. Bathe K J, “Finite Element Procedures in Engineering Analysis”- Prentice Hall
4. Rajasekaran. S, “Finite Element Analysis in Engineering Design”-Wheeler Publishing
5. Cook R D, Malkan D S & Plesta M.E, “Concepts and Application of Finite Element Analysis” - 3rd Edition, John Wiley and Sons Inc., 1989
6. Shames I H and Dym C J, “Energy and Finite Element Methods in Structural Mechanics”- McGraw Hill, New York, 1985

MINOR PROJECT (ECE-650)

L T P C 0 0 4 2

DISSERTATION (ECE-701)

L T P C 0 0 16 8

DISSERTATION (ECE-702)

L T P C 0 0 16 8

Soil Mechanics and Foundation Engineering, Vol. 54, No. 3, July, 2017 (Russian Original No. 3, May-June, 2017) SOIL MECHANICS Introduction Construction of foundations using reinforced concrete (RC) piles is popular and widespread in Malaysia, especially for buildings that are of limited height.Â They are able to carry working axial loads of 450 to 3500 kN [1]. The RC pile is a type of displacement pile that transmits loads from above structures into the soil stratum through shaft friction and end bearing capacity of the pile [2-4]. Set criteria for driven RC piles are predetermined by calculation before pile-driving activity begins.Â However, the MLT is a very costly and requires a long time for testing, which makes it undesirable. Soil Mechanics and Foundation Engineering is one of the few international journals all over the world that provides engineers, scientific researchersÂ Soil Mechanics and Foundation Engineering is one of the few international journals all over the world that provides engineers, scientific researchers, construction and design specialists with the latest achievements in soil and rock mechanics theory, experimental investigations, geotechnical and foundation engineering problems and innovative solutions, design and construction practice in regions with regular and extreme soil conditions. Geotechnical engineering (soil mechanics and foundation engg) books. Prestressed concrete books. Professional Ethics Books.Â This book has been established itself as a useful text in most of the engineering colleges and technical institutions of the country. A large number of multiple choice questions and objective questions have been added at the end of each chapter. The basic aim of Soil Mechanics and Foundation Engineering written by Dr.K.R. Arora is to present the fundamentals of the subject in a simplified manner.Â Get New Updates Email Alerts. Enter your email address to subscribe this blog and receive notifications of new posts by email. Enter Your Email Address. Email Address.