JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH. (GEOTECHNICAL ENGINEERING)
COURSE STRUCTURE AND SYLLABUS

I Year – I Semester

Category	Course Title	Int. marks	Ext. marks	L	P	C
Core Course I	Advanced Soil Mechanics	25	75	4	--	4
Core Course II	Advanced Foundation Engineering	25	75	4	--	4
Core Course III	Ground Improvement Techniques.	25	75	4	--	4
Core Elective I	Earth & Rockfill Dams Optimization Techniques Soil Dynamics and Machine Foundations	25	75	4	--	4
Core Elective II	Geo-Environmental Engineering Rock Mechanics and Engineering Physical Modeling in Geotechnical Engineering.	25	75	4	--	4
Open Elective I	Computer Oriented Numerical Methods Environment and Ecology Remote Sensing & Geographical Information Systems	25	75	4	--	4
Laboratory I	Advanced Geotechnical Engg. Lab-I	25	75	--	4	2
Seminar I	Seminar-I	50	--	--	4	2
Total Credits				**24**	**8**	**28**

I Year – II Semester

Category	Course Title	Int. marks	Ext. marks	L	P	C
Core Course IV	Retaining Structures	25	75	4	--	4
Core Course V	Applied Statistics	25	75	4	--	4
Core Course VI	Geotechnical Earthquake Engineering	25	75	4	--	4
Core Elective III	Groundwater Contamination and Remediation Soil - Structure Interaction Geotechnics for Infrastructure	25	75	4	--	4
Core Elective IV	Geosynthetics & Soil Reinforcement Material Characterization and Pavement Engineering. Offshore Geotechnical Engineering.	25	75	4	--	4
Open Elective II	Finite Element Methods Disaster Management Environmental Impact Assessment and Management	25	75	4	--	4
Laboratory II	Advanced Geotechnical Engg. Lab-II	25	75	--	4	2
Seminar II	Seminar-II	50	--	--	4	2
Total Credits				**24**	**8**	**28**

II Year - I Semester

Course Title	Int. marks	Ext. marks	L	P	C
Comprehensive Viva-Voce	--	100	--	--	4
Project work Review I	50	--	--	24	12
Total Credits			--	24	**16**

II Year - II Semester

Course Title	Int. marks	Ext. marks	L	P	C
Project work Review II	50	--	--	8	4
Project Evaluation (Viva-Voce)	--	150	--	16	12
Total Credits			**--**	**24**	**16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

ADVANCED SOIL MECHANICS

OBJECTIVE: To understand the physical and mechanical properties of soil and its behavior under external loads.

Unit-I

Introduction & Geostatic Stresses: Classification of Soils, Consistency Limits, Stresses within a soil mass, Effective Stress principle, Geostatic stresses.

Unit-II

Flow through Soils: Permeability, seepage – Finite difference formulae for steady state and transient flows – flow nets – computation of seepage – uplift pressure, and critical hydraulic gradient.

Unit-III

Compaction and Consolidation: Compaction Curve, Compaction Control, Oedometer test, Over consolidation ratio, Primary and secondary consolidation settlement, One, two and three dimensional Consolidation, Consolidation of partially saturated soils.

Unit-IV

Stress-Strain-Strength Behaviour of Soils: Principle Stresses, Mohr Circle, Shear strength of soils; Failure criteria, drained and undrained shear strength of soils. Significance of pore pressure parameters; Determination of shear strength; Drained, Consolidated Undrained and Undrained tests; Interpretation of triaxial test results. Behaviour of sands; Critical void ratio; dilation in soils, Stress paths.

Unit-V

Critical State Soil Mechanics: Critical state parameters; Critical state for normally consolidated and overconsolidated soil; Significance of Roscoe and Hvorslev state boundary surfaces; Yielding, Bounding Surfaces.

TEXT BOOKS

1. Das, B. M. & Sobhan K, .- Principles of Geotechnical Engineering, Cengage Learning, Edition (2015)
2. Mitchell J.K. - Fundamentals of soil behaviour - John Wiley and Sons, Inc., New York. (Third edition) 2005

REFERENCES:

1. Atkinson J. H. - An Introduction to the Mechanics of Soils and Foundation - through critical state soil mechanics, McGraw- Hill Co. (1993)
2. J A Knappett and R F Craig – Craig's Soil Mechanics, Eighth Edition, Spon Press Taylor & Francis (2012)
3. Lambe, T. W. and Whitman, R. V.- Soil Mechanics SI version , John Wiley & Sons.(2011)

OUTCOME: Students should be able to understand the soil behaviour under external loads, and procedures to measure relevant soil parameters.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

ADVANCED FOUNDATION ENGINEERING

OBJECTIVE: To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

Unit-I

Soil Exploration: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report, Case Studies.

Unit-II

Shallow Foundations: **Bearing Capacity:**- Shear Failure; Effect of Water Table; Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

Unit-III

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter; Settlement of foundations on Sands-Schmertmann and Burland & Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, Codal Provisions.

Unit-IV

Deep Foundations: **Single Pile:** Vertically loaded piles, Static capacity- α, β and λ Methods, Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results; Bearing Resistance of Piles on Rock; Settlement; Pile Load Test; Uplift Resistance; Laterally Loaded Piles -Ultimate Lateral Resistance; Negative Skin Friction; Batter Piles; Under Reamed Piles; Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral Load; Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions.

Unit-V

Special Topics of Foundation Engineering

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

***Introduction to Reliability-Based Design**: Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

TEXT BOOKS

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning (2008)

REFERENCE BOOKS

1. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
2. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john wiley & sons inc (1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall (2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering, Wiley Publications (2003)

Outcome: Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

GROUND IMPROVEMENT TECHNIQUES

Objective: To understand the importance of ground improvement and know various ground improvement techniques available to date, and selecting and designing suitable ground improvement technique for given soil conditions.

Unit-I

Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, In-situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications.

Unit-II

Mechanical Modification – Principles of soil densification – Properties of Compacted soil, Compaction control tests, Specification of compaction requirements, Blasting, Vibrocompaction, Dynamic Tamping and Compaction piles.

Unit-III

Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geosynthetics, sand drains, Preloading and vertical drains, Electro-kinetic dewatering.

Unit-IV

Physical and Chemical Modification – Modification by admixtures, Shotcreting and Guniting Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

Unit-V

Modification by Inclusions and Confinement - Soil reinforcement, reinforcement with strip, bar, mesh, sheet and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing, case studies.

TEXT BOOKS

1. Hausmann, M. R. (1990) –Engineering Principles of Ground Modification, McGraw Hill publications, New York.
2. P.Purushothama Raj (1995) - Ground Improvement Techniques, Laxmi Publications, India.

REFERENCES:

1. M.P.Moseley and K. Krisch (2006) – Ground Improvement, II edition, Taylor and Francis.
2. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
3. K. Krisch & F.Krisch (2010) –Ground Control and Improvement, John Wiley & Sons, 1994.
4. Peter G. Nicholson (2015): Soil Improvement and Ground Modification Methods, Elsevier Publishers

Outcome: Depending on the site conditions, students will be able to identify suitable ground improvement technique for specific project and its implications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

EARTH & ROCKFILL DAMS
(Core Elective -I)

Objective: Suitability of materials for earth and rockfill dams, causes of failures and to determine slope stability.

Unit-I

Earth and Rockfill Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Materials of construction and requirements, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.

Unit-II

Failures, Damages and Protection of Earth Dams: Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and down stream of slopes, Drainage control, Filter design.

Unit-III

Slope Stability Analysis: Types of Failure: Failure surfaces - Planar surfaces, Circular surfaces, Non-circular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes.

Unit-IV

Methods of Slope Stability: Taylor Charts, Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Morgenstern and Price Analysis, Janbu Analysis, Spencer Analysis, Sliding Block Analysis, Seismic stability, Stabilization of slopes: Drainage measures, Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime/thermal treatment), surface protection (vegetation/erosion control mats/shotcrete).

Unit-V

Rockfill Dams: Requirements of compacted rockfill, Shear strength of rockfill, Rockfill mixtures, Rockfill embankments, Earth-core Rockfill dams, Stability, Upstream & Downstream slopes.

TEXT BOOKS:

1. Christian, K. Earth & Rockfill Dams – Principles of Design and Construction, CRC Press, 1997.
2. Sowers, G.F. – Earth and Rockfill Dam Engineering, Asia Publishing House, 1962.

REFERENCES:

1. Bharat Singh and Sharma, H. D. – Earth and Rockfill Dams, 1999
2. Abramson, L. W., Lee, T. S. and Sharma, S. - Slope Stability and Stabilisation methods – John Wiley & sons. (2002)
3. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963.
4. US Army Corp of Engineers, Earth and Rock-fill Dams, General Design and construction Considerations, University Press of the Pacific (2004).

Outcome: Able to design earth and rockfill dams, get familiarity with slope stability calculations, and prevention techniques for slope failures.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

OPTIMIZATION TECHNIQUES
(Core Elective -I)

Objective: To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems

Unit-I

Linear Programming: Introduction and need for optimization in engineering design, formulating linear programs, graphical solution of linear programs, special cases of linear programming.

Unit-II

The Simplex Method: Converting a problem to standard form, the theory of the simplex method, the simplex algorithm, special situations in the simplex algorithm, obtaining initial feasible solution.

Unit-III

Duality and Sensitivity Analysis: Sensitivity analysis, shadow prices, dual of a normal linear program, duality theorems, dual simplex method. Integer Programming: Formulating integer programming problems, the branch-and-bound algorithm for pure integer programs, the branch-and-bound algorithm for mixed integer programs.

Unit-IV

Non-linear Programming: Introduction to non-linear programming (NLP), Convex and concave functions, NLP with one variable, Line search algorithms, Multivariable unconstrained problems, constrained problems, Lagrange Multiplier, The Karush-Kuhn-Tucker (KKT) conditions, the method of steepest ascent, convex combination method, penalty function, Quadratic programming,

Unit-V

Dynamic programming: Evolutionary algorithms: Genetic Algorithm, concepts of multiobjective optimization, Markov Process, Queuing Models.

TEXT BOOKS

1. S.S. Rao, Engineering Optimization: Theory and Practice, Wiley & Sons, New Jersey, 2009.

REFERENCES:

1. F.H. Hiller and G.J.Liberman, Introduction to Operations Research, Tata-McGraw-Hill, 2010.
2. W.L.Winston, Operations Research: Applications and Algorithm, 4th Edition, Cengage Learning, 1994.
4. K.Deb, Optimization for Engineering Design, Prentice Hall, 2013.
5. M.C.Joshi and K.M.Moudgalay, Optimization: Theory and Practice, Narosa, 2004.
6. K.Deb, Multi-objective Optimization using evolutionary algorithms, John Wiley and Sons, 2009.

Outcome: The student will be able to understand the basic principles of optimization, and in a position to formulate optimization models for a wide range of civil engineering problems and able to solve them.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (Geotechnical Engineering)

SOIL DYNAMICS AND MACHINE FOUNDATIONS
(Core Elective -I)

Objective: To understand the wave propagation in soils, determine dynamic properties of soil for analyzing and designing foundations subjected to vibratory loading.

Unit-I
Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

Unit-II
Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behaviour of soils under cyclic loads, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils and its evaluation using simple methods.

Unit-III
Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

Unit-IV
Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

Unit-V
Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

TEXT BOOKS:

1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt.Ltd. (2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company (1981)

REFERENCES:

1. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.
2. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.
3. Das, B. M. & Ramana, G.V. - Principles of Soil Dynamics, 2nd Edition, CL Engineering Publishers, 2010.

Outcome: Able to understand the fundamentals of wave propagation in soil media, evaluate the dynamic properties of soil, and design foundations for centrifugal and reciprocating machines.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

GEOENVIRONMENTAL ENGINEERING
(Core Elective -II)

Objective: To understand various sources of contamination of ground and to characterize contaminated ground and to find extent of contamination and to get familiarize with various remediation methods.

Unit-I

Sources and Site Characterization: Scope of Geoenvironmental Engineering, Various Sources of Contaminations, Need for contaminated site characterization; and Characterisation methods.

Unit-II

Solid and Hazardous Waste Management: Classification of waste, Characterisation of solid wastes, Environmental Concerns with waste, waste management strategies.

Unit-III

Contaminant Transport: Transport process, Mass-transfer process, Modeling, Bioremediation, Phytoremediation.

Unit-IV

Remediation Techniques: Objectives of site remediation, various active and passive methods, remediation of NAPL sites, Emerging Remediation Technologies.

Unit-V

Landfills: Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system.

TEXT BOOKS:

1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008
2. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)

REFERENCES:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook, Kluwer Academic, 2001
2. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).
3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001

Outcome: Able to characterize the contaminated ground and identify most appropriate method of remediation.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

ROCK MECHANICS AND ENGINEERING
(Core Elective -II)

Objective: To determine properties and behavior of various types of rock under different loading conditions for underground and open excavations.

Unit-I

Engineering Classification of Rocks: Classification of intact rocks, Rock mass classifications, Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR), Norwegian Geotechnical Classification (Q-system), Strength and modulus from classifications, Classification based on strength & modulus and strength and fracture strain, Geoengineering classification.

Unit-II

Laboratory and In-Situ Testing of Rocks: Physical properties, Compressive strength, Tensile strength, Direct shear test, Triaxial shear test, Slake durability test, Schmidt rebound hardness test, Sound velocity test, In-Situ Tests: Seismic methods, Electrical resistivity method, In situ stresses, Plate loading test, Goodman jack test, Plate jacking test, In-situ shear test, Field permeability test.

Unit-III

Strength, Modulus and Stresses-Strain Responses of Rocks: Factors influencing rock response, Strength criteria for isotropic intact rocks, Modulus of intact rocks, effect of confining pressure, Uniaxial Compressive strength, Strength criteria for intact rocks, Strength due to induced anisotropy in rocks,. Stress Strain Models: Constitutive relationships, Elastic, Elasto-plastic, Visco-elastic, Elasto-viscoplastic stress-strain models.

Unit-IV

Stability of Rock Slopes and Foundations on Rocks: Rock slopes, Modes of failure, Rotational failure, Plane failure, Design charts, Wedge method of analysis, Buckling failure, Toppling failure, Improvement of slope stability and protection. Foundations on Rock: Introduction, Estimation of bearing capacity, Stress distribution, Sliding stability of dam foundations, strengthening measures, Settlements in rocks, Bearing capacity of pile/pier in rock, Remedial measures, Foundations located on edge of jointed slope.

Unit-V

Underground and Open Excavations: Blasting operational planning, Explosive products, Blast Design, Underground blast design, Controlled blasting techniques, blasting damage and control, Safe practice with explosives and shots.

TEXT BOOKS:

1. Goodman – Introduction to Rock mechanics, Willey International (1980).
2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prentice Hall India (2007).

REFERENCES:

1. Jaeger, J. C. and Cook, N. G. W. – Fundamentals of Rock Mechanics, Chapman and Hall, London.(1979)
2. Hoek, E. and Brown, E. T. - Underground Excavation in Rock, Institution of Mining and Metallurgy, 1982.
3. Brady, B. H. G. and Brown, E. T. - Rock Mechanics for Underground Mining, Chapman & Hall, 1993.

Outcome: Able to determine the required rock properties, determination of bearing capacity of rocks, checking the stability of slopes, and design underground and open excavation.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (Geotechnical Engineering)

PHYSICAL MODELLING IN GEOTECHNICAL ENGINEERING
(Core Elective -II)

Objective: To learn fundamental knowledge and techniques related to physical modeling in geotechnical boundary value problems, including similitude, principles of measurement and test program

Unit-I
Similitude and Modeling Principles: Importance of physical Modeling, scaling laws, small-scale model studies in 1-g and N-g, historical Perspectives.

Unit-II
Design of physical model and model ground preparation: scale effects, flexible and rigid boundary conditions, preparation of sand/clay bed preparation, wet pluviation, dry pluviation, tamping techniques, slurry consolidation, uniformity of sand/clay beds.

Unit-III
Model planning and measurement strategy: Selection of Model dimension, model containers, preparation of models to test shallow and deep foundations, pull-out behavior, retaining walls, shaking table studies, vertical and inclined loading system, Perspex walls, markers, digital analysis.

Unit-IV
Sensors and Data Acquisition: Strain gauges, Load cells, Earth Pressure Transducers, LVDTs, Linear Potentiometers, pore pressure transudes, accelerometers, Hydraulic jack, calibration methods, dead weight calibration, pneumatic calibration, frequency of calibration, calibration charts, calibration factor, In-soil & fluid calibration, data acquisition system.

Unit-V
Recent Developments in Physical Modelling: Static behaviour of shallow and deep foundations, Piles subjected to lateral loading, behaviour of foundation subjected to earthquake loading, foundations subjected to cyclic loading, use of shaking table, behaviour of foundations on expansive soils.

Text Books

1. David muir wood, Geotechnical Modelling, Spon Press, Taylor & Francis, 2004.
2. Madabhushi, G. - Centrifuge Modeling for Civil Engineers, CRC Press, Taylor and Francis Group, 2015.

Reference Books

3. Taylor, R.N. Geotechnical Centrifuge Technology, Taylor and Francis Publication, 1995.
4. Charles Ng, Zhang,L.M., and Wang, Y.H. (2006) : Proceedings of 6th International Conference on Physical Modeling in Geotechnics, Hong Kong.
5. S. Springman, J. Laue & L. Seward, Proceedings of the 7th International Conference on Physical Modelling in Geotechnics, Zurich, Switzerland, 2010.
6. Gaudin, C. & White, D. The Proceedings of the 8th international conference on Physical modeling in Geotechnics, Perth, Australia, 2014.

Outcome: Student will be able to understand scaling laws and modeling considerations for physical modeling in geotechnical problems both for static and dynamic conditions.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (Geotechnical Engineering)

NUMERICAL METHODS
(Open Elective-I)

Objective: Demonstrate understanding and implementation of numerical solution algorithms applied to various types of problems in engineering.

Unit-I
Solving Roots of equations and Linear Algebraic Equations: Approximations and Errors in Numerical Methods; Solutions of Algebraic and Transcendental Equations, Bisection, False Position, Secant & Iterative Methods, Newton-Raphson, Horner's and Muller's Methods; Comparison of Iterative Methods; Simultaneous Linear Algebraic Equations – methods of solution using inverse of the matrix, method of successive elimination, Iterative methods – Gauss-Siedel method, Relaxation method..

Unit-II
Curve Fitting and Interpolation Techniques: Least-squares regression, Linearization of data, Polynomial fitting, Multiple linear regression, MATLAB polyfit function; Lagrange polynomials, Splines, inverse interpolation.

Unit-III
Numerical Differentiation and Integration: Derivatives, Maxima and Minima of a Tabulated Function; Numerical Integration – Quadrature, Romberg's, Euler-Maclaurin, Double Integration.

Unit-IV
Numerical Solution of Ordinary and partial Differential Equations: Initial value problems - Modified Euler, Runge-Kutta, Predictor-Corrector, Milne's Methods; Boundary value problems; Partial Differential Equations - Finite Difference Approximations, Elliptic, Laplace, Parabolic, Hyperbolic Equations.

Unit-V
Advanced Numerical Techniques: Soft Computing -Linear Programming - Simplex Method; Artificial Variable Techniques Method, Two Phase Method; ANN, Fuzzy Logic, Fast Fourier Transform, Eigenvalues and Eigenvectors.

TEXT BOOKS:

1. Chapra, S. C. & Canade, R. P. - Numerical Methods for Engineers, McGraw Hill publications, 2011.

REFERENCES:

2. Hoffman, J.D.- Numerical Methods For Engineers and Scientists, Marcel Dekker, New York, Second Edition, 2001.
3. Atkinson, K.E. – An Introduction to Numerical Analysis, John Wiley and Sons, New York, 1989.

Outcome: Select appropriate numerical methods to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

ENVIRONMENT AND ECOLOGY
(Open Elective-I)

Objective: To develop a conceptual outlook on various ecological facets of environment.

UNIT I

Environment, Ecology and Sustaining the Earth; Nature and Humans: Earth, population, environment.

UNIT II

Ecosystems; Ecosystems, ecology of populations, human population dynamics – growth and urbanization; environmental economics and politics.

UNIT III

Ecological Balances – Material cycles in ecosphere, Matter and Energy Resources; Energy flow in ecosystems; bio-geochemical systems.

UNIT IV

Air, Water and Soil Resources**:** Air Resources, pollution, global warning, ozone depletion; water resources – surface and groundwater, sources of pollution; soil resources – conservation, contamination, salt water intrusion, hazardous wastes.

UNIT V

Living Resources Food resources, pesticides, pest control: land resources – forests, wetlands, wilderness, national parks; wild plants and animal resources, Energy and Mineral Exploitation: perpetual and renewable energy; non-renewable energy; non-renewable mineral resources, solid and hazardous wastes.

TEXT BOOKS:

1. Environmental Science by Tyley Miller- Brooks Cole(2012)
2. Concepts Of Ecology by Edward J Kormondy - Phi Learning(2009)

Outcome: Knowledge on Ecosystems and Ecological Balances, An outlook on living and non-living resources as well as energy resources of environment.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS
(Open Elective-I)

Objective: To impart knowledge on basic concepts of Remote Sensing and GIS and its application on various aspects of water environment.

Unit-I

Introduction: Electromagnetic spectrum, energy sources and Radiation principle, Energy interactions in the atmosphere, energy interactions with earth surface features – Vegetation, Soil and water.

Unit-II

Data Acquisition: Platforms – sensors used for the remote sensing data acquisition. Data processing – Radiometric, Geometric corrections.

Unit-III

Digital Image Processing: Image enhancement – linear, non-linear spatial filtering; edge enhancement. Classification – supervised, unsupervised classification.

Unit-IV

Geographical Information System (GIS): Definition data input and output; Topology, Digital elevation data; Data management – relational data model. Spatial data models – Raster and Vector data Models. GIS analysis – Classification, overlay operation.

Unit-V

Land use/Land cover Analysis: Classification principles and systems; Applications of soil, water resources, environmental, earthquakes, landslides. Software scenario – watershed modelling, watershed management, environmental modelling.

TEXT BOOKS:

1. Lilles and Kiefer – Remote Sensing Principles and Interpretation – John Willey and Sons. America, 2000.
2. Anji Reddy, M. – Remote Sensing and GIS – BS Publications, 2004

REFERENCES:

1. F.F. Sabins Jr., - Remote Sensing Principles and Interpretations – W.H. Freeman & Co., 1987
2. Paul J. Gibson & Clare H. Power – Introductory Remote Sensing – British Library, London. 1st Published, 2000.
3. Stan Arnoff – Geographic Information Systems – A management perspective, Canada, 1995.

Outcome: Development of multilevel conceptual outlook on Remote Sensing and GIS, development of skill based knowledge with reference to image processing, digital elevation models etc. and Specific knowledge related to application of Remote Sensing & GIS concepts for the development of water resources management.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Geotechnical Engineering)

ADVANCED GEOTECHNICAL ENGINEERING LABORATORY – I

Objective: To obtain index and engineering properties of locally available soils, to understand the behavior of these soils under various loads and subsoil conditions.

1. Grain size analysis –Wet Sieve Analysis
2. Grain size analysis – Hydrometer Analysis
3. In-situ Unit Weight (core Cutter & Sand Replacement)
4. Liquid Limit, Plastic Limit and Shrinkage Limit
5. Proctor I.S. Compaction Test
6. Permeability of Clay Soils.
7. Free Swell, Swell Potential, Swell Pressure Test
8. Oedometer Test (for determination of c_c & c_v)
9. Direct Shear Test
10. Triaxial Tests- UU
11. Triaxial Tests- CU
12. Standard Penetration Test

Reference Books:

Head, K.H. – Manual of Soil laboratory testing, Volumes I – Soil Classification and Compaction Tests, 3rd Edition, CRC Press, Taylor and Francis group, 2006.

Head, K.H. – Manual of Soil laboratory testing, Volumes II – Permeability, shear strength and Compressibility Tests, 3rd Revised Edition, Ingram International Inc, 2011.

Head, K.H. and Epps, R.J. – Manual of Soil laboratory testing, Volumes III – Effective Stress Tests, 3rd Edition, Whittle Publishing, 2014.

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Outcome: Possible to classify and evaluate the behavior of the soil subjected to various loads and subsoil conditions.