# ACADEMIC REGULATIONS
# COURSE STRUCTURE AND
# DETAILED SYLLABUS

## CIVIL ENGINEERING

*For*

## M. Tech. (Geotechnical Engineering)

(Two Year **Full Time** Programme)

**JNTUH COLLEGE OF ENGINEERING HYDERABAD**
**(Autonomous)**
Kukatpally, Hyderabad – 500 085, Telangana, India.

**2015**

## JNTUH COLLEGE OF ENGINEERING HYDERABAD
## M.Tech. (Geotechnical Engineering) – Full Time w.e.f. 2015-16

### I Year - I Semester

| S.No. | Subject | L | T | P | C |
|---|---|---|---|---|---|
| 1 | Advanced Soil Mechanics | 4 | 0 | 0 | 4 |
| 2 | Advanced Foundation Engineering | 4 | 0 | 0 | 4 |
| 3 | Elective – 1 | 4 | 0 | 0 | 4 |
| 4 | Elective – 2 | 4 | 0 | 0 | 4 |
| 5 | Elective – 3 | 4 | 0 | 0 | 4 |
| 6 | Elective – 4 | 4 | 0 | 0 | 4 |
| 7 | Advanced Geotechnical Engineering Laboratory-I | 0 | 0 | 4 | 2 |
| 8 | Soft Skills Lab | 0 | 0 | 4 | 2 |
| | **Total Credits** | | | | **28** |

### I Year -II Semester

| S.No. | Subject | L | T | P | C |
|---|---|---|---|---|---|
| 1 | Retaining Structures | 4 | 0 | 0 | 4 |
| 2 | Geotechnical Earthquake Engineering | 4 | 0 | 0 | 4 |
| 3 | Elective – 5 | 4 | 0 | 0 | 4 |
| 4 | Elective – 6 | 4 | 0 | 0 | 4 |
| 5 | Elective – 7 | 4 | 0 | 0 | 4 |
| 6 | Elective – 8 | 4 | 0 | 0 | 4 |
| 7 | Advanced Geotechnical Engineering Laboratory-II | 0 | 0 | 4 | 2 |
| 8 | Seminar | 0 | 0 | 4 | 2 |
| | **Total Credits** | | | | **28** |

### II Year -I Semester

| Code | Subject | L | T | P | C |
|---|---|---|---|---|---|
| 1 | Comprehensive Viva voce | | | | 4 |
| 2 | Project Phase -I | | | | 12 |
| | **Total Credits** | | | | **16** |

### II Year -II Semester

| Code | Subject | L | T | P | C |
|---|---|---|---|---|---|
| 1 | Project Phase - II & Dissertation | | | | 18 |
| | **Total Credits** | | | | **18** |

## JNTUH COLLEGE OF ENGINEERING HYDERABAD
## M.Tech. (Geotechnical Engineering) – Full Time w.e.f. 2015-16

**Elective –1**
1. Engineering of Ground
2. Theoretical Soil Mechanics
3. Applied Statistics

**Elective – 2**
1. Geoenvironmental Engineering
2. Ground water Hydrology
3. Geotechnical Exploration Methods

**Elective – 3**
1. Soil Dynamics and Machine Foundations
2. Physical Modeling in Geotechnical Engineering.
3. Offshore Geotechnical Engineering.

**Elective – 4**
1. Environment and Ecology
2. Numerical Methods
3. Disaster Management

**Elective – 5**
1. Geosynthetics and Soil Reinforcement
2. Soil - Structure Interaction
3. Material Characterization and Pavement Engineering

**Elective – 6**
1. Earth & Rock fill Dams and Slope Stability
2. Geotechnics for Infrastructure
3. Construction Management

**Elective – 7**
1. Rock Mechanics and Engineering
2. Finite Element Methods
3. Ground Water Contamination and Remediation

**Elective – 8**
1. Environmental impact Assessment
2. Geographical Information Systems
3. Artificial Intelligence: Techniques

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## ADVANCED SOIL MECHANICS

**Prerequisites:** Soil Mechanics or Geotechnical Engineering-I

**OBJECTIVE:**

To understand the physical and Engineering properties of soil and its behavior under external loads and for different site conditions.

**OUTCOME:**

Students will be able to understand the soil behavior under external loads, and procedures to measure relevant soil parameters.

**UNIT- I**

**Geostatic Stresses & Stress Paths**: Stresses within a soil mass: Concept of stress for a particulate system, Effective stress principle, Geostatic stresses, Soil water hydraulics: Principal stresses and Mohr's circle of stress, Stress paths; At Rest earth pressure, Stress paths for different practical situations.

**UNIT- II**

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

**UNIT- III**

**Compressibility and Consolidation**: One dimensional compression, Oedometer test, parameters – coefficient of volume change, constrained modulus, compression index, swell or unloading, maximum past consolidation stress, Over consolidation ratio, Primary and secondary compression, consolidation -One, two and three dimensional problems, Consolidation of partially saturated soils, Creep/Secondary Compression in soils.

**UNIT- IV**

**Stress-Strain-Strength Behaviour of soils**: 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;

**UNIT- V**

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

**REFERENCE:**

1. Das, B. M.- Advanced Soil Mechanics, Taylor and Francis. 7 edition (2008)
2. Mitchell J.K. - Fundamentals of soil behaviour - John Wiley and Sons, Inc., New York. (third edition) 2005
3. Craig, R. F.- Soil Mechanics, Van Nostrand Reinhold Co. Ltd. (1987)
4. Lambe, T. W. and Whitman, R. V.- Soil Mechanics SI version , John Wiley & Sons.(2011)
5. Muniram Budhu.- Soil Mechanics and Foundations, John Wiley & Sons, Inc.(2007)
6. Atkinson J. H. - An Introduction to the Mechanics of Soils and Foundation - through critical state soil mechanics, McGraw- Hill Co. (1993)
7. Wood, D.M.- Soil Behavior and Critical State Soil Mechanics.cambridge university press (1991)

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## ADVANCED FOUNDATION ENGINEERING

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

**OBJECTIVE:**

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

**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.

**UNIT- I**

**Soil Exploration**: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane & Borehole shear tests, Dilatometer, Pressuremeter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report.

**UNIT- II**

**Shallow Foundations**: **Bearing Capacity:**- General Formulae; Effect of Water Table; Footings with eccentric or Inclined Loads, Foundations on Layered Soils, on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil.

**UNIT- III**

**Settlement**: Components – Immediate, Consolidation & Creep, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Consolidation Settlement; One, Two & Three Dimensional Consolidation; Secondary Compression Settlement; Bearing Pressure using SPT, CPT, Dilatometer and Pressuremeter; Settlement of foundations on Sands-Schmertmann and Burland & Busbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation of Tall Structures.

**UNIT- IV**

**Deep Foundations**: **Single Pile:** Vertically loaded piles, Static capacity α, β and λ Methods, Dynamic formulae; 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.

**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**: Methods, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements.

**REFERENCE:**

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)
3. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
4. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john wiley & sons inc (1980-08)
5. Reese, L. C. & Van Impe, W. F. - Single Piles and Pile Groups under Lateral Loading - Taylor & Francis Group (Jan 2000)
6. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall (2003)
7. Lymon C. Reese, William M. Isenhower, Shin-Tower Wang- Analysis and Design of Shallow and Deep Foundations (2006)
8. Salgado, R. - The Engineering of Foundations McGraw-Hill, Boston (2008)

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### ENGINEERING OF GROUND
### (Elective-1)

**Prerequisites:** Soil Mechanics or Geotechnical Engineering-I

**OBJECTIVE:**

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

**OUTCOME:**

Depending on the site conditions, students will be able to identify suitable Ground Improvement technique for specific project and its implications.

**UNIT- I**

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

**UNIT- II**

**Mechanical Modification** – Deep Compaction Techniques- 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, Electro-kinetic dewatering.Filtration, Drainage and Seepage control with Geosynthetics, Preloading and vertical drains.

**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, and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing.

**REFERENCE:**

1. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications
2. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis
3. Koerner, R. M (1994) – Designing with Geosynthetics – Prentice Hall, New Jersey
4. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
5. Xianthakos, Abreimson and Bruce - Ground Control and Improvement, John Wiley & Sons, 1994.
6. K. Krisch & F. Krisch (2010) - Ground Improvement by Deep Vibratory Methods, Spon Press, Taylor and Francis
7. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### THEORETICAL SOIL MECHANICS
### (Elective-1)

**Prerequisites:** Soil Mechanics or Geotechnical Engineering-I

**OBJECTIVE:**
To understand the elastic and plastic behavior of soils and to determine the stresses and deformations for various geotechnical structures.

**OUTCOME:**
Will be able to understand the elastic and plastic behavior of soils under various loads. Stress deformation behavior can be determined for various loads and subsoil conditions.

**UNIT- I**
**Theory of Elasticity**: Basic concepts, definitions and notations of stress & strain components – Generalized Hooke's Law, Equilibrium and Compatible conditions in Cartesian, Polar coordinates – Principal stresses and strains

**UNIT- II**
**Theory of Plasticity**: Ideal Plastic substance strain hardening – yield criteria – Tresca, & Van Mises, Mohr & Coulomb, Drucker-Prager theories, Critical State Soil Mechanics, – applications to soil mechanics problems.

**UNIT- III**
**Stresses and Displacements due to Surface and Subsurface Loads** – Boussinesq, Cerutti, Mindlin Solutions, Stresses and Displacements in Finite Layer & Multi-Layered Systems. Stress-path methods; Rotation of Foundations.

**UNIT- IV**
**Critical state & constructive behavior of soils** – introduction to yield criteria, constructive modeling.

**UNIT- V**
**Underground Structures:** Stresses and Displacements around Underground Openings unlined and lined tunnels.

**REFERENCE:**
1. Poulos, H. G. & Davis, E. H. – "Elastic Solutions for Soil and Rock Mechanics, John Wiley and Sons, New York, 1974
2. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
3. Harr,M.E. – "Foundations of Theoretical Soil Mechanics" Mc Graw-Hill, 1966.
4. Atkinson J. H. - An Introduction to the Mechanics of Soils and Foundation - through critical state soil mechanics, McGraw- Hill Co. (1993)
5. Wood, D.M.- Soil Behavior and Critical State Soil Mechanics.cambridge university press (1991)

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### APPLIED STATISTICS
### (Elective- I)

**Prerequisites:** Mathematics /Probability and Statistics

**OBJECTIVE:**

A deep understanding of the most important statistical models and analytical tools for practical analysis of complex data, as well as the ability to analyze new types of problems.

**OUTCOME:**

Upon successful completion of the course, students should be able to apply statistics to a variety of problem from different areas.

**UNIT-I**

**Introduction & Sampling Techniques:** Histogram, Frequency diagram, Role of Probability and Statistics in Civil Engineering, Skewness; Kurtosis; Definitions and Applications; Simple random sampling; Stratified sampling; Systematic sampling; Sample Size determination; Collection & Presentation of data, Design of Experiment.

**UNIT-II**

**Statistical Distributions and Probability :** Random Variability, conditional probability, Uniform, Binomial, Poisson, Exponential and Normal distributions; Fitting of distributions; Skewness and Kurtosis, Mean and variance; Chi-square test of goodness-of-fit; lognormal, Beta distribution Probability - Laws of Probability; Conditional probability and Independent events; Kolmogorov – Smirnov (K-S test) Laws of expectation.

**UNIT-III**

**Regression And Correlation:** Linear/non-Linear and multiple linear correlation analysis, Linear regression and correlation; Multiple correlation; Multiple correlation coefficient; Standard error of estimate; Analysis of Variance; Curvilinear regression;

**UNIT-IV**

**Multi-Variate Data Analysis and Exact Sampling Distributions :**Types of data; Basic vectors and matrices; Simple estimate of centroid, Standard deviation, Dispersion, Variance and covariance; Correlation matrices; Principal component analysis; Time series analysis. Exact Sampling Distributions - Chi-square distribution; Students T-distribution;

**UNIT-V**

**Tests Of Significance & Confidence Interval Estimation & Statistical Testing – I & II:** Large sample and small sample tests; Tests for single mean, Means of two samples, Proportions, two variances, two observed correlation coefficients, paired T-tests, Applications. Tests Of Significance & Confidence Interval – Intervals for mean, variance and regression coefficients; Tests of Hypothesis, goodness of fit test.

**REFERENCE:**

1. Haldar, A.S. & Mahadevan,S., Probability, Reliability, Statistical Methods in Engineering Design, John Wiley and Sons Inc., New York, 2007.
2. Ang, A.H.S. & Tang, W.H. - Probability Concepts in Engineering – Emphasis on Applications to Civil Environmental Engineering, John Wiley and Sons Inc., New York, 2007.
3. Fenton, G.A. and Griffiths, D.V. - Risk Assessment in Geotechnical Engineering, John Wiley and Sons Inc., New York, 2008.
4. Montgomery, D.C. and Runger, G.C. – Applied Statistics for

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### GEOENVIRONMENTAL ENGINEERING
### (Elective 2)

**Prerequisites:** Environmental Engineering

**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.

**OUTCOME:**
Able to characterize the contaminated ground and identify most appropriate method of remediation for a different sites.

**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.

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

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## GROUND WATER HYDROLOGY
## (Elective 2)

**Prerequisites:** Hydrology

**OBJECTIVE:**
To understand the basics of groundwater hydrology, it's hydrologic and engineering aspects, and the mechanics involved in the study of flow of groundwater. Modeling of ground water flow through aquifers.

**OUTCOME:**
Able to understand the principles of ground water hydrology and movement and yield of ground water aquifer.

**UNIT- I**
**Groundwater**: Groundwater hydrologic cycle. Origin of groundwater, quality of groundwater, vertical distribution of groundwater-zone of aeration and zone of saturation; Geologic formations as aquifers; types of aquifers, porosity, specific yield, specific retention; Permeability, Darcy's law, storage coefficient, Transmissibility.

**UNIT- II**
**Groundwater flow**: Groundwater flow in one, two and three- dimensions; Groundwater flow contours and their applications; Steady groundwater flow towards a well in confined and unconfined aquifers- Dupuits' and Theism's equations, Formation constants, yield of an open well, interference and well tests; Unsteady flow towards a well – Non-Equilibrium equations – Theis's solution- Jacob and Chow's simplifications, Leaky aquifers.

**UNIT- III**
**Modeling and Analysis of Aquifer Systems**: Need, model calibration, single and multi-cell models, Inverse problems, estimation of regional aquifer problems; aquifer management; linear and non-linear programming methods.

**UNIT- IV**
**Investigations**: Surface methods of exploration - Electrical resistivity and seismic refraction methods. Subsurface methods; Geophysical logging and resistivity logging; hydrologic maps; groundwater balance; contamination.

**UNIT- V**
**Artificial Recharge of Groundwater**: Concept of artificial recharge and recharge methods, relative merits, Saline water intrusion, Ghyben-Hergberg relation, shape of interface, control of sea water intrusion.

**REFERENCE:**
1. David K. Todd - Groundwater Hydrology, John Wiley & Sons. New York, 1998
2. Bear, J. - Hydraulics of Groundwater, McGrawHill, New York, 1979
3. Raghunath, H. M. Groundwater, Wiley Eastern Ltd., 1990
4. Bauer, Groundwater, John Wiley & Sons, 1992

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### GEOTECHNICAL EXPLORATION METHODS
### (Elective 2)

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

**OBJECTIVE:**
To know about the various subsoil exploration methods and its suitability for the specific site. Evaluation of subsoil properties by penetration and geophysical methods.

**OUTCOME:**
Can identify the effective subsoil exploration method for a specific geotechnical project and evaluation of properties of sub soil for various civil engineering projects.

**UNIT- I**
**Introduction:** Data required for soil investigation - Methods of Exploration - Planning the Exploration Program

**UNIT-II**
**Sampling and Programme:** Soil Boring - Soil Samplers and Sampling - Underwater Sampling Groundwater Table (GWT) Location - Number and Depth of Borings - Drilling and/or Exploration of Closed Landfills or Hazardous Waste Sites – Preparation of Soil Report

**UNIT-III**
**Penetration Tests**: Standard Penetration Test - SPT Correlations - Design *N* Values - Cone Penetration Tests - Field Vane Shear Testing - Borehole Shear Test - Flat Dilatometer Test - Pressuremeter Test.

**UNIT-IV**
**Rocks:** Rock Sampling – RQD – Strength and modulus from classifications, Classification based on strength & modulus and strength and fracture strain, Geoengineering classification.

**UNIT-V**
**Non-Destructive testing**: Techniques–sounding techniques, Rader techniques, Ultrasonic pulse wave tests, Bender elements etc.

**REFERENCE:**

1. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
2. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
3. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.
4. Goodman – Introduction to Rock mechanics, Willey International (1980).
5. Geotechnical Investigation Methods: A Field Guide for Geotechnical Engineers.Roy.E HUNT, Taylor & Francis, .2006.
6. Handbook of Geotechnical Investigation and Design Tables, Routledge, (2007).

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### SOIL DYNAMICS AND MACHINE FOUNDATIONS
### (Elective 3)

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

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

**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.

**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, Logarithmic decrement, Determination of viscous damping, 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 behavior of cyclically loaded soils, Dynamic soil properties - Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sands and clays.

**UNIT- III**
**Foundation Vibration Analyses**: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Vertical vibration of circular foundations resting on Elastic Half Space- Lambs, Reissner, Quinlan & Sungs analogies.

**UNIT- IV**
**Design of Machine Foundations**: Analysis and design of block foundations for reciprocating engines, 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, Design procedure for a pile supported machine foundation.

**REFERENCE:**
1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt. Ltd. (2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company (1981)
3. I.Chowdhary and S P Dasgupta - Dynamics of Structures and Foundation, 2009.
4. Arya, S. D, O'Neil, M. and Pincus, G.- Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Co., 1979.
5. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.

6. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.
7. Richart, F. E. Hall J. R and Woods R. D. - Vibrations of Soils and Foundations, Prentice Hall Inc., 1970.
8. Das, B. M. - Principles of Soil Dynamics, PWS KENT publishing Company, Boston.2002
9. Bharat Bhushan Prasad – Advanced Soil Dynamics and Earthquake Engineering, PHI Learning Pvt. Limited, New Delhi, 2011.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)** **L T P C**
**4 0 0 4**

### PHYSICAL MODELLING IN GEOTECHNICAL ENGINEERING
### (Elective-3)

**Prerequisites:** Soil Mechanics or Geotechnical Engineering-I

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

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

**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: S**train 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.

**REFERENCE:**
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.
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.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## OFFSHORE GEOTECHNICAL ENGINEERING
## (Elective-3)

**Prerequisites:** Soil Mechanics and Foundation Engineering or Geotechnical Engg.-I&II

**OBJECTIVE:**
To understand differences between the soil and loading conditions of on-shore and offshore structures, various types of offshore foundation systems, and to evaluate the performance of offshore structures.

**OUTCOME:**
Students should be able to design and evaluate the performance of offshore foundations.

**UNIT- I**
**The nature of Submarine Soils**: origin, classification and distribution of marine sediments; in-situ stress state in submarine deposits; inorganic clay deposits; calcareous sediments; siliceous sediments. Offshore Geotechnical Investigations: phases of the investigation, geophysical survey, drilling and sampling procedures, in-situ testing techniques, laboratory testing.

**UNIT- II**
**Foundations for Offshore Gravity Structures**: construction, installation, instrumentation of gravity platforms, stability analysis, deformation analysis based on elastic theory, piping and erosion. Design of suction piles for offshore structure.

**UNIT- III**
**Foundations for Jack-up Rigs**: foundations types and design loads, Prediction of individual footing performance, prediction of mat footing performance, seabed anchors, load capacity of anchors, breakout forces, anchor systems for floating structures.

**UNIT- IV**
**Offshore Pile Foundations**: types of offshore piles, temporary support of piled structures, dynamic analysis of pile driving, axial load capacity, axial deformation analysis, Lateral loading, and dynamic response.

**UNIT -V**
**Seafloor Stability**: causes of seafloor instability, geological features of submarine slides, mechanisms of instability, slope stability under gravity forces and wave forces, Effects of soil instability on piles, installation and stability of submarine pipelines.

**REFERENCE:**
1. Marine Geotechnics – H.G. Poulos (1988), Prentice Hall Inc.
2. Construction of marine and offshore structures – Ben C Gerwick, jr., CRC Press, Taylor and Francis Group.(2012)
3. Seabed Reconnaissance and Offshore Soil Mechanics (for the installation of petroleum structures) – Pierre LE Tirant (1979), Gulf Publishing Company, Houston, Texas.
4. API (2000) – Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – API, RP2A.
5. Pile design and construction practice – M J Tomlinson, View point Publications, Palladian Publications Limited.(1987)
6. Port Engineering planning, construction, maintenance and security – George P Tsinker, John Wiley & Sons, Inc. (2004)

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## ENVIRONMENT AND ECOLOGY
## (Elective-4)

**Prerequisites:** None

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

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

**UNIT- I**
**Environment,** Ecology and Sustaining the Earth; Nature and Humans: Earth, population, environment.

**UNIT- II**
**Ecosystems;** Ecosystem, 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.

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

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### NUMERICAL METHODS
### (Elective-4)

**Prerequisites:** Mathematics

**OBJECTIVE:**
This course offers an introduction to numerical linear algebra. Topics include direct and iterative methods for linear systems, eigen value problems and numerical solution for differential equations.

**OUTCOME:**
Will be able to model numerically using one of the method for various problems. Numerical approach enables solution of a complex problem with simple operations.

**UNIT- I**
**Approximations and Errors in Numerical Methods**; Solutions of Algebraic and Transcendental Equations, Bisection, False Position, Secant & Iterative Methods, Newton-Raphson, Horner's Methods; Comparison of Iterative Methods.

**UNIT- II**
**Simultaneous Linear Algebraic Equations** – methods of solution using inverse of the matrix, method of successive elimination, Iterative methods – Gauss-Siedel method, Relaxation method; Applications.

**UNIT- III**
**Matrix Inversion and Eigen value Problems** – Power, Jacobi Methods; Calculus of Finite Differences – Differences, Difference Formulae, Difference Table, Factorial Notation; Interpolation – Lagrange's, Newton's, Hermite's, Spline, Inverse Interpolation; Applications.

**UNIT- IV**
**Numerical Differentiation** – Derivatives, Maxima and Minima of a Tabulated Function; Numerical Integration – Quadrature, Romberg's, Euler-Maclaurin, Double Integration; Applications.

**UNIT- V**
**Numerical Solution of Ordinary Differential Equations** - Modified Euler's, Runge-Kutta's, Predictor-Corrector, Milne's Methods; Partial Differential Equations - Finite Difference Approximations, Elliptic, Laplace, Parabolic, Hyperbolic Equations; Applications.

**REFERENCE:**
1. Grewal, B. S. - Numerical Methods in Engineering & Science, Khanna Publishers, 1999
2. Indian culture values and professional ethics by PSR Murthy, BS Publications
3. Chapra, S. C. & Canade, R. P. - Numerical Methods for Engineers, McGraw Hill publications, 2011
4. by Joe D Hoffman, Hoffman D Hoffman, Steven Frankel, Numerical Methods For Engineers and Scientists Second Edition, 2001
5. Ethics in Engineering, Mike W.Martin & Roland Schinzinger. TMH Publishers

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### DISASTER MANAGEMENT
### (Elective-4)

**Prerequisites:** None

**OBJECTIVE:**
To understand the nature of various types of natural disasters and to develop Skills to develop disaster management plans.

**OUTCOME:**
Knowledge on the causes and effects of natural disasters like floods, cyclones, earthquakes etc. An integrated approach on mitigation and management of disasters and skill for the development of action oriented disaster management plan.

**UNIT-I:**
**Overview of Natural disasters**- Tropical cyclones, Floods, Droughts, Earthquakes & Tsunamis, Severe Thunderstorms & Tornadoes- Need for Disaster Management Plan;

**UNIT-II:**
**Cyclone warning system in India**- cyclone disaster management plan, Floods-Flood management in India; Warning system for major river basins-Role of Central Water Commission; Water purification technologies in flood affected areas, Droughts-Meteorological drought and agricultural drought; monsoon long range Forecasts- Drought management plan-parameters & assessment; Drought Monitoring

**UNIT-III:**
**Earthquakes-seismity in India**- status of prediction and disaster management; Tsunamis; Landslides and Avalanches; Volcanoes

**UNIT-IV:**
**Hazards associated with convective clouds** -Thunderstorms-Lightning; Tornadoes Waterspouts-Hail storms, Aviation hazards and safety measures.

**UNIT-V:**
**Key Factors in Disaster management** – Early warning, communications, Response by administration, Disaster Management & Mitigation- National Disaster Management Authority (NDMA) Govt of India.

**REFERENCE:**
1. Natural Disaster Management: New Technologies and Opportunities by Subir Ghosh; Icfai University Press
2. Earth and Atmospheric Disasters Management by N.Pandharinath and C.K.Rajan, BS Publication
3. Natural Hazards and Disaster Management by R.B.Singh; Rawat Publication

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

## ADVANCED GEOTECHNICAL ENGINEERING LABORATORY– I

**Prerequisites:** Geotechnical Engineering Lab

**OBJECTIVE:**
To Obtain Physical and Engineering Properties of Various Soil Subjected to various conditions.

**OUTCOME:**
Enables the Students to learn and conduct appropriate tests on soil, So as to apply the obtained results for a specific civil engineering project.

1. Wet Sieve Analysis
2. Consistency Limits
3. Oedometer Test for $c_c$ and $c_v$.
4. Direct Shear Test
5. Triaxial Tests- UU Test
6. Triaxial Tests- CU Test
7. Block Vibration Test
8. Pollutant Transport using column test
9. Determination of Chlorides and Sulphates in soils
10. Model plate Load test.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year I-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

### SOFT SKILLS LAB
### (Activity-based)

**Prerequisites:** None

**OBJECTIVES**

- To improve the fluency of students in English
- To facilitate learning through interaction
- To illustrate the role of skills in real-life situations with case studies, role plays etc.
- To train students in group dynamics, body language and various other activities which boost their confidence levels and help in their overall personality development
- To encourage students develop behavioral skills and personal management skills
- To impart training for empowerment, thereby preparing students to become successful professionals

**OUTCOMES**

- Developed critical acumen and creative ability besides making them industry- ready.
- Appropriate use of English language while clearly articulating ideas.
- Developing insights into Language and enrich the professional competence of the students.
- Enable students to meet challenges in job and career advancement.

**INTRODUCTION**

Definition and Introduction to Soft Skills – Hard Skills vs Soft Skills – Significance of Soft/Life/Self Skills – Self and SWOT Analysis ***and***

1. **Exercises on Productivity Development**
   - Effective/ Assertive Communication Skills (Activity based)
   - Time Management (Case Study)
   - Creativity & Critical Thinking (Case Study)
   - Decision Making and Problem Solving (Case Study)
   - Stress Management (Case Study)
2. **Exercises on Personality Development Skills**
   - Self-esteem (Case Study)
   - Positive Thinking (Case Study)
   - Emotional Intelligence (Case Study)
   - Team building and Leadership Skills (Case Study)
   - Conflict Management (Case Study)
3. **Exercises on Presentation Skills**
   - Netiquette
   - Importance of Oral Presentation – Defining Purpose- Analyzing the audience- Planning Outline and Preparing the Presentation- Individual & Group Presentation- Graphical Organizers- Tools and Multi-media Visuals
   - One Minute Presentations (Warming up)
   - PPT on Project Work- Understanding the Nuances of Delivery- Body Language – Closing and Handling Questions – Rubrics for Individual Evaluation (Practice Sessions)
4. **Exercises on Professional Etiquette and Communication**
   - Role-Play and Simulation- Introducing oneself and others, Greetings, Apologies, Requests, Agreement & Disagreement….etc.

- Telephone Etiquette
- Active Listening
- Group Discussions (Case study)- Group Discussion as a part of Selection Procedure- Checklist of GDs
- Analysis of Selected Interviews (Objectives of Interview)
- Mock-Interviews (Practice Sessions)
- Job Application and Preparing Resume
- Process Writing (Technical Vocabulary) – Writing a Project Report- Assignments

**5. Exercises on Ethics and Values**

Introduction —- Types of Values - Personal, Social and Cultural Values - Importance of Values in Various Contexts

- Significance of Modern and Professional Etiquette – Etiquette (Formal and Informal Situations with Examples)
- Attitude, Good Manners and Work Culture (Live Examples)
- Social Skills - Dealing with the Challenged (Live Examples)
- Professional Responsibility – Adaptability (Live Examples)
- Corporate Expectations

☞ Note: Hand-outs are to be prepared and given to students.

☞ Training plan will be integrated in the syllabus.

☞ Topics mentioned in the syllabus are activity-based.

**SUGGESTED SOFTWARE:**

☞ The following software from **'train2success.com'**

- Preparing for being Interviewed
- Positive Thinking
- Interviewing Skills
- Telephone Skills
- Time Management
- Team Building
- Decision making

**SUGGESTED READING:**

1. Alex, K. 2012. Soft Skills. S. Chand Publishers
2. Management Shapers. 2011. Collection of 28 Books by different Authors. Universities Press.
3. Sherfield, Robert M. 2005. et al Cornerstone: Developing Soft Skills. Pearson
4. Suresh Kumar,E; Sreehari, P. & Savithri, J. 2011. Communication Skills and Soft Skills- An Integrated Approach. New Delhi: Pearson
5. The ACE of Soft Skills by Gopalaswamy Ramesh & Mahadevan Ramesh. 2013. Pearson Publishers. New Delhi.
6. Patnaik, P. 2011. Group Discussion and Interview Skills. New Delhi: Foundation
7. Sudhir Andrews. 2009. How to Succeed at Interviews. New Delhi: Tata McGraw Hill
8. Sasikumar, V & Dhamija, P.V. 1993. Spoken English - A Self-Learning Guide to Conversation Practice. New Delhi: Tata McGraw-Hill
9. Dixson, Richard J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd
10. Mukhopadhyay. L et al. 2012. Polyskills. New Delhi: CUP India Pvt Ltd
11. Rizvi, M. A. 2005. Effective Technical Communication. New Delhi: Tata McGraw Hill
12. The Hindu Speaks on Education by the Hindu Newspaper
13. Naterop, B. Jean and Revell, Rod. 2004. Telephoning in English. Cambridge: CUP

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## RETAINING STRUCTURES

**Prerequisites:** Soil Mechanics & Foundation Engineering or Geotechnical Engineering-I &II

**OBJECTIVE:**
To study the various retaining structures and design the earth retaining structures used in construction of road/railways/pipe lines/open excavations.

**OUTCOME:**
Able to design conventional/Reinforced earth retaining walls, sheet pile walls, bracing system for open excavations.

**UNIT-I**
**Earth Pressure Theories:** Rankine's and Coulomb's Earth pressure theories for cohesive and cohesionless soils, stresses due to compaction and surcharge loads.

**UNIT-II**
**Conventional Retaining Wall**: Types of retaining walls, Stability (sliding, overturning, bearing capacity & overall) of gravity and cantilever walls, Proportioning of retaining walls, Backfill material and drainage.

**UNIT-III**
**Flexible Walls:** Sheet pile walls, Construction methods**-** Cantilever and Anchored (Free and Fixed support methods) sheet pile walls in coarse and fine grained soils, moment reduction method.

**UNIT-IV**
**Reinforced Soil Walls/Mechanically Stabilised Earth: -** Failure mechanisms-bond and rupture failures, Analysis methods, Limit equilibrium method- Internal and external stability, Static analyses.

**UNIT-V**
**Braced Cuts and Soil Nailing**: Lateral earth pressure in braced cuts, Design of various components, Stability of braced cuts, base heave and stability, yielding and settlement of ground surrounding excavation, Diaphragm walls – slurry support; Soil Nailing.

**REFERENCE:**
1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
3. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Hand Book -Springer (2001)
4. Hans Friedrich Winterkorn, Hsai-Yang Fang - Foundation Engineering Handbook, Van Nostrand Reinhold, 1975
5. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)** **L T P C**
**4 0 0 4**

## GEOTECHNICAL EARTHQUAKE ENGINEERING

**Prerequisites:** none

**OBJECTIVE:**
To understand the effect of earthquake on soil structures and to design earthquake resistant geotechnical structures.

**OUTCOME**:
Able to understand the behavior of ground during the earthquakes, so that geotechnical structures can be designed to resist/ sustain the earthquake loading.

**UNIT – I**
**Earthquake Seismology** – Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Earthquake, Intensity and magnitudes, Effects of earthquake, Modified Mercalis intensity scale and seismic instruments.

**UNIT – II**
**Earthquake Ground Motion** – Characteristics of ground motion, Effect of local site conditions on ground motions, Design earthquake, Design spectra, Development of site specification and code-based design.

**UNIT – III**
**Ground Response Analysis** – One-dimensional ground response analysis: Linear approach, Nonlinear approach, Comparison of one dimensional ground response analyses. Two-dimensional ground response analysis: Equivalent linear approach, Nonlinear approach, Comparison of two dimensional ground response analyses.

**UNIT – IV**
**Liquefaction and Lateral Spreading** - Liquefaction related phenomena, Liquefaction susceptibility: Historical, Geological, Compositional and State criteria. Evaluation of liquefaction by cyclic stress and cyclic strain approaches, Lateral deformation and spreading, Soil improvement for remediation of seismic hazards.

**UNIT – V**
**Seismic Design of Foundations, Retaining Walls & Slopes** - Seismic design requirements for foundation, Seismic bearing capacity, Seismic settlement, Design loads. Seismic slope stability analysis - Internal stability and weakening instability, Seismic design of retaining walls: Dynamic response of retaining walls, Seismic displacement of retaining walls.

**REFERENCE:**
1. Kramer S. L - Geotechnical Earthquake Engineering, Prentice Hall, 1996.
2. Bharat Bushan Prasad- Advanced Soil Dynamics and Earthquake Engineering, PHI Learning Pvt. Ltd., New Delhi, 2011.
3. R. W. Day - Geotechnical Earthquake Engineering Handbook, McGraw-Hill, 2002.
4. Naeim, F. - The Seismic Design Handbook, Kluwer Academic Publication, 2nd Edition, 2001.
5. Bolt, B. A. - Earthquakes, W. H. Freeman and Company, 4th Edition, 1999.
6. Lourie, W. - Fundamentals of Geophysics, Cambridge University press, 1997.
7. Kamalesh Kumar - Basic Geotechnical Earthquake Engineering – New Age International Publishers, 1st Edition, 2008
8. Dowrick - Earthquake Resistant Design, John Wiley & Sons.(2009)

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### GEOSYNTHETICS AND SOIL REINFORCEMENT
### (Elective-5)

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

**OBJECTIVES:**

To impart knowledge on site investigation and soil testing methods and design of different types of foundation appropriate to the type of soil for different structures.

**OUTCOME:**

The learner will be able to design shallow and deep foundations for railway and highway bridges, and marine structures.

**UNIT-I**

**An Overview of Geosynthetics**: Description of Geosynthetics, types, Properties, Functions, Testing methods.

**UNIT-II**

**Geosynthetics for Soil Reinforcement:** Design of reinforced soil wall – internal and external stability with Geotextiles, Geogrids, Geostrips; Design of Gabion wall without and with geosynthetics reinforcement

**UNIT-III**

**Geosynthetics for Slope Stability**: Design of reinforced slopes, Embankments; Slope stabilization/protection; Erosion control.

**UNIT-IV**

**Geosynthetics for Foundation Systems:** Foundation reinforcement, embankmentbase reinforcement ,geotextiles /grids/ cells for pavement base reinforcement

**UNIT-V**

**Geosynthetics for Landfills:** Separation, Filtration, Drainage, Moisture Barrier, Membrane encapsulation. Geomembranes for landfills and ponds; Geosynthetic clay liners; Design of landfills with GCL's.

**REFERENCE:**

1. Koerner, R. M. - Designing with Geosynthetics, Prentice Hall; 2nd edition, (1991)
2. Rao, G. V. & Raju G. V. S. S. - Engineering with Geosynthetics, Tata-McGraw Hill. Publication, New Delhi. (2004.)
3. Hausmann, M. R. - Engineering Principles of Ground Modifications, McGraw Hill Pub Co, 1989
4. Xianthakos, Abreimson and Bruce - Ground Control and Improvement, John Wiley & Sons, 1994.
5. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis
6. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
7. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## SOIL-STRUCTURE INTERACTION
## (Elective-5)

**Prerequisites:** Soil Mechanics and Foundation Engineering or Geotechnical Engg.-I &II

**OBJECTIVE:**

To understand the behavior of soil and its interaction analysis with the structure.

**OUTCOME:**

Can analyze soil-structure interaction considering different Models for various soil conditions and for different structures.

**UNIT-I**

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

**UNIT-II**

**Beam on Elastic Foundation**- Soil Models: Infinite beam, Two-parameters models, Isotropic elastic halfspace model, Analysis of beams of finite length, combined footings.

**UNIT-III**

**Plates on Elastic Continuum**: Thin and thick rafts, Analysis of finite plates, Numerical analysis of finite plates.

**UNIT-IV**

**Analysis of Axially and Laterally Loaded Piles and Pile Groups**: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap, Load deflection prediction for laterally loaded piles, Subgrade reaction and elastic analysis, Interaction analysis, Pile-raft system.

**UNIT-V**

**Ground-Foundation-Structure Interaction**: Effect of structure on ground-foundation interaction, Static and dynamic loads.

**REFERENCE:**

1. Selvadurai, A. P. S. - Elastic Analysis of Soil-Foundation Interaction, 1979
2. Rolando P. Orense, Nawawi Chouw & Michael J. Pender - Soil-Foundation-Structure Interaction, CRC Press, 2010 Taylor & Francis Group, London, UK.
3. Soil Structure Interaction – The real behaviour of structures, the institution of structural engineers, London, March 1989.
4. Poulos, H. G., and Davis, E. H. - Pile Foundation Analysis and Design, 1980
5. Scott, R. F. - Foundation Analysis, Prentice Hall, Englewood Cliffs, 1981
6. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
7. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)** **L T P C**
**4 0 0 4**

## MATERIAL CHARACTERIZATION AND PAVEMENT ENGINEERING
## (Elective-5)

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

**OBJECTIVE:**
To evaluate the physical and mechanical properties of sub grade, and pavement materials, and design flexible and rigid pavements subjected to wheel loads.

**OUTCOME:**
Student should be able to understand various pavement material characterization techniques, and able to design a suitable pavement for known wheel loading characteristics and sub grade soil conditions.

**UNIT-I**
**Introduction:** Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements, field CBR, field plate load test, modulus of sub grade reaction, Resilient modulus, Suitability of soil, Compaction equipment and Compaction Control.

**UNIT-II**
**Stresses and strains in flexible pavements:** Stresses and strains in an infinite elastic half space use of Boussinesq's equations - Burmister's two layer and three layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors.

**UNIT-III**
**Flexible pavement design methods for highways and airports:** Empirical, semi-empirical and theoretical approaches; Development, principle, design steps of the different pavement design methods including AASHTO, Asphalt Institute, Shell Methods. IRC method of pavement design.

**UNIT-IV**
**Stresses in rigid pavements:** Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

**UNIT-V**
**Rigid pavement design:** Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements.

**REFERENCE:**
1. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
2. Yang H Huang - Pavement Analysis and Design, 2nd Edition, Pearson Education
3. Yoder.J. & Witzorac Mathew, W. Principles of Pavement Design, John Wiley & Sons Inc
4. Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
5. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers
6. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.
7. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
8. IRC: 37 & 58 Codes for Flexible and Rigid Pavements Design.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### EARTH & ROCKFILL DAMS AND SLOPE STABILITY
### (Elective-6)

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

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

**OUTCOME:**
Able to design earth and rock fill dams, get familiarity with slope stability Calculations and prevention techniques for slope failures.

**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, 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.

**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. Taylor Charts.

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

**UNIT-V**
**Slope Protection and Rockfill Dams**: Stabilization of slopes: Soil reinforcement (geosynthetics/soil nailing/micro piles etc), soil treatment (cement/lime treatment), surface protection (vegetation/erosion control mats/shotcrete). Requirements of compacted rockfill, Shear strength of rockfill, Rockfill mixtures, Rockfill embankments, Earth-core Rockfill dams, Stability, Upstream & Downstream slopes.

**REFERENCE:**
1. Sherard, Woodward, Gizienski and Clevenger. Earth and Earth-Rock Dams. John Wiley &. Sons. 1963.
2. Bharat Singh and Sharma, H. D. – Earth and Rockfill Dams, 1999.

3. Sowers, G. F. and Salley, H. I. – Earth and Rockfill Dams, Willams, R.C., and Willace, T.S. 1965.
4. Abramson, L. W., Lee, T. S. and Sharma, S. - Slope Stability and Stabilisation methods – John Wiley & sons. (2002).
5. Bromhead, E. N. (1992). The Stability of Slopes, Blackie academic and professional, London.
6. Christian, Earth & Rockfill Dams – Principles of Design and Construction, Kutzner Published Oxford and IBH.
7. Ortiago, J. A. R. and Sayao, A. S. F. J. - Handbook of Slope Stabilisation, 2004.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### GEOTECHNICS FOR INFRASTRUCTURE
### (Elective 6)

**Prerequisites:** Foundation Engineering or Geotechnical Engineering-II

**OBJECTIVES:**
To impart knowledge on site investigation and soil testing methods and design of different types of foundation appropriate to the type of soil for different structures.

**OUTCOME:**
The learner will be able to design shallow and deep foundations for railway and highway bridges, and marine structures.

**UNIT – I**
**Shallow Foundations:** Basic requirements of foundation –Types and selection of foundations. Design of reinforced concrete isolated, combined, eccentric, strip, and strap footings used for infrastructure projects

**UNIT – II**
**Raft Foundations:** Types of rafts, Design of slab raft foundation and Design of beam and slab raft foundation used for infrastructure projects.

**UNIT – III**
**Pile Foundations:** Introduction, design of piles, pile caps and pile- raft foundation.

**UNIT – IV**
**Design of Retaining walls:** Stability Analysis and design of gravity, Cantilever retaining walls.

**UNIT – V**
**Machine Foundations:** Vibration analysis of machine foundation - Design of foundation for Reciprocating machines and Impact machines - as per I.S. Codes.

**REFERENCE:**

1. Bowles .J.E., “Foundation Analysis and Design”, McGraw Hill Publishing co., New York, 1986.
2. Tomlinson. M.J, “Foundation Design and Construction”, Longman, Sixth Edition, New Delhi, 1995.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Narayan V. Nayak, Foundation design manual,Dhanpat Rai & Sons, 2006.
5. Prakash Shamsher and Puri Vijay K, Foundations for Machines, Analysis and Design” John Wiley and Sons, USA, 1988.
6. IS 2911: Part 1: Sec 1: 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles, Section 1 Driven cast in-situ concrete piles.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### CONSTRUCTION MANAGEMENT
### (Elective-6)

**Prerequisites:** None

**OBJECTIVES:**
To know about various construction management techniques available for execution of project.

**OUTCOME:**
Able to plan, coordination, and control of a project from beginning to completion. Adopting the most effect method for meeting the requirement in order to produce a functionally and financially viable project.

**UNIT -I**
**Management process**- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance-leadership.

**UNIT-II**
**Classification of Construction projects**, Construction stages, Resources- Functions of Construction Management and its Applications .Preliminary Planning- Collection of Data-Contract Planning – Scientific Methods of Management: Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.

**UNIT-III**
**Resource planning** - planning for manpower, materials, costs, equipment. Labour, - Scheduling .Forms of scheduling - Resource allocation. budget and budgetary control methods

**UNIT-IV**
**Contract** - types of contract, contract document, and specification, important conditions of contract – tender and tender document - Deposits by the contractor - Arbitration . negotiation - M.Book - Muster roll -stores.

**UNIT-V**
**Management Information System** - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws - Safety in construction: legal and financial aspects of accidents in construction. occupational and safety hazard assessment. Human factors in safety. Legal and financial aspects of accidents in construction. Occupational and safety hazard assessment

**REFERENCE:**
1. Ghalot, P.S., Dhir,D.M., Construction Planning and Management, Wiley Eastern Limited,1992.
2. Chitkara,K.K., Construction Project Management¸ Tata McGraw Hill Publishing Co, Ltd., New Delhi,998.
3. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi,1987.
4. Construction Management And Planning by: sengupta, b. /guha, h. tata mcgraw-hill publications.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### ROCK MECHANICS AND ENGINEERING
### (Elective-7)

**Prerequisites:** Soil Mechanics and Foundation Engineering or Geotechnical Engg.-I &II

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

**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.

**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.

**REFERENCE:**

1. Goodman – Introduction to Rock mechanics, Willey International (1980).
2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prenice Hall of India.(2007)
3. Jaeger, J. C. and Cook, N. G. W. – Fundamentals of Rock Mechanics, Chapman and Hall, London.(1979)
4. Hoek, E. and Brown, E. T. - Underground Excavation in Rock, Institution of Mining and Metallurgy, 1982.
5. Brady, B. H. G. and Brown, E. T. - Rock Mechanics for Underground Mining, Chapman & Hall, 1993.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### FINITE ELEMENT METHODS
### (Elective-7)

**Prerequisites:** Numerical Methods

**OBJECTIVE**:
To provide the fundamental concepts of the theory of the finite element method, and apply them to numerically model behaviour of soils subjected varieties of loading systems.

**OUTCOME:**
To obtain an understanding of the fundamental theory of the Finite Element Method, and apply the theory to solve soil behavior under external loads.

**UNIT-I**
**Introduction:** Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

**UNIT-II**
**Element Properties**: Concept of an element, various element shapes, Displacement models, Generalized coordinates, Shape functions, Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.

**UNIT-III**
**Generation of Element Stiffness and Nodal Load Matrices, Isoparametric Formulation**: Concept, Different isoparametric elements for 2D analysis, formulation of 4-noded and 8-noded isoparametric quadrilateral elements, Lagrangian elements, Serendipity elements.

**UNIT-IV**
**Assemblage of Elements:** Discretization of a structure, numbering systems, Aspect ratio its effects, Assemblage, Direct Stiffness method.

**UNIT-V**
**Geotechnical Applications** Sequential construction, Excavations and embankments, Bearing capacity and Settlement analysis.

**REFERENCE:**
1. Desai, C. S. and J.F. , Abel, Introduction to the Finite Element Method, Van Nostrand Reinhold Company (1972).
2. Reddy, J. N. - Introduction to the Finite Element Method - McGraw-Hill Publishers, 1993.
3. Krishna Murthy, C. S. - Finite element analysis - Theory and programming, Tata McGraw-Hill,1994
4. Zienkiewicz, O. C. - Finite element Methods, McGraw-Hill Publishers, 1971.
5. Tirupati & Belgundu

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## GROUND WATER CONTAMINATION AND REMEDIATION
## (Elective 7)

**Prerequisites:** Geoenvironmental Engineering

**OBJECTIVE:**
To estimate the movement of contamination in the ground and to know the various remediation methods.

**OUTCOME:**
Modeling the contaminant transport in the ground and able to identify most appropriate remediation technique for various types of contaminants and ground conditions.

**UNIT-I**
**Introduction:** Sources and types of groundwater contamination, Characterisation of contaminated site, Contaminant transport mechanisms.

**UNIT-II**
**Sorption and Other Chemical Reactions:** Introduction, concept of sorption, factors influencing sorption, sorption isotherms, hydrophobic theory for organic contaminants, sorption effects on fate and transport of pollutants, Estimation of sorption.

**UNIT- III**
**Pollutant Transport:** Advection-Dispersion-Flow through low permeability soils, Retardation, fate of pollutant.

**UNIT-IV**
**Non-Aqueous Phase Liquids:** Introduction, Types of NAPLs, NAPL transport- General processes, NAPL transport- computational methods- Fate of NAPLs in the subsurface, characterization.

**UNIT-V**
**Groundwater Remediation Technologies** – Methods of remediation of contaminated ground - pump and treat, in-situ flushing, permeable reactive treatment walls, air sparging, soil vapour extraction, natural attenuation, bioremediation and phytoremediation.

**REFERENCE:**
1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008
2. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Hand Book -Springer (2001)
3. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)
4. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).
   Daniel, D. E. - Geotechnical Practice for Waste Disposal

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### ENVIRONMENTAL IMPACT ASSESSMENT
### (Elective-8)

**Prerequisites:** Environmental and Engineering

**OBJECTIVE:**
To develop a methodical approach on assessment of environmental impacts due to developmental activities and a conceptual outlook on sustainable development.

**OUTCOME:**
Knowledge on prediction and assessment of environmental impacts due to developmental activities, Concepts on various environmental impact assessment methodologies and an outlook on legislations to safeguard environment.

**UNIT-I**
**Basic concept of EIA:** Initial environmental Examination, Elements of EIA,- factors affecting EIA IMPACT evaluation and analysis, preparation of Environmental Base maps, Classification of environmental parameters.

**UNIT-II**
**E I A Methodologies:** Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, Benefit Analysis.

**UNIT-III**
**Assessment of impact and Land use:** Assessment of impact of development activities on vegetation and wild life, environmental impact of deforestation- Causes and effects of deforestation.

**UNIT-IV**
**Environmental Audit & Environmental legislation:** Objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, on-site activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

**UNIT-V**
**The Environmental protection Act**, The water Act, The Air (Prevention & Control of pollution Act.). Wild life Act. EIA Report preparation and Case studies. Statement for various industries.

**REFERENCE:**
1. Anjaneyulu, Y. - Environmental Impact Assessment Methodologies, B. S. Publication, Sultan Bazar, Hyderabad
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice Hall Publishers, 1999
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K.,Katania & Sons Publication., New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication(P) Ltd, Delhi, 2003.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

## GEOGRAPHICAL INFORMATION SYSTEMS
## (Elective-8)

**Prerequisites:** Surveying

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

**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.

**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.

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

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

### ARTIFICIAL INTELLIGENCE: TECHNIQUES
### (Elective-8)

**Prerequisites:** None

**OBJECTIVE:**
To impart knowledge on representation of problem and solving by methods of artificial intelligence. To develop intelligent systems by assembling solutions to engineering problems.

**OUTCOME:**
Asses the applicability, strengths and weakness of problems and methods for particular engineering problem. Can develop intelligent system for particular problem.

**UNIT-I**
**Introduction to Neural Networks:** ANN definition, components, input, output and hidden layers, threshold value, weights. Relationship of ANN with other technologies.

**UNIT-II**
**Neural Networks Models:** Perceptron model, Feedforward network-back propagation, Hopfeild network, Adaline and Madaline models.

**UNIT-III**
**Learning and Training:** Objective of learning, Supervised and Unsupervised learning, Hebb's rule, Delta Rule.

**UNIT-IV**
**Fuzzy Logic:** Crispness, Uncertainty, Vagueness, Fuzzyness, Fuzzy sets, Fuzzy Relations, Fuzzy association memory, Fuzzy events, Means, Variances.

**UNIT-V**
**Applications in Water Resources:** Applications of fuzzy logic in neural networks, Applications of fuzzy logic and neural networks in water resources engineering with case studies.

**REFERENCE:**
1. Neural Networks and Fuzzy Systems by Bart. Kosko, pretence hall of India, 1994.
2. Artificial Neural Networks by Robert J. Schalokoff.
3. Fuzzysets Uncertainity an information by George.J.Klir and Tina, Pretence Hall of India, New Delhi.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

## ADVANCED GEOTECHNICAL ENGINEERING LABORATORY - II

**Prerequisites:** Geotechnical Engineering Lab

**OBJECTIVE:**
To obtain the properties of Rocks and Geosynthetics so as to use for civil engineering applications to solve the Geotechnical problems using the software.

**OUTCOME:**
Enable to understand the behavior of rocks and Geosynthetics for various loads, in order to use these properties in designs the geotechnical structures. Able to solve various Geotechnical problems using the structure.

1. a) Determination of RQD

   b) Determination of Slake Durability Index
2. Tensile strength of rock by Point Load Test and Brazilian Test
3. In-Plane and Cross-Plane Permeability of Geotextiles
4. Interface Shear Behavior of Soils with Geotextile
5. a) Tensile Strength of Geotextiles

   b) Cone Drop Test on Geotextile
6. Finding FS for slopes using software
7. Finding FS for Reinforced Soil Walls using software
8. Determination of Pile load settlement using software
9. Bearing Capacity and settlement of shallow foundations using software
10. Stability of soil Nailing using software

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. I Year II-Sem (Geotechnical Engineering)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

## SEMINAR

**Prerequisites**: None.

**OBJECTIVE:**
To understand the topic on thrust area by reviewing about 8-10 research papers and relevant books and material in the website and present the topic and prepare technical report.

**OUTCOME:**
At the end of the course, the student will be able to undertake a critical review of literature on a chosen topic. Present topics of relevance to a group of professionals. Prepare a technical report.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. II Year I-Sem (Geotechnical Engineering)** **L T P C**
**4**

### COMPREHENSIVE VIVA VOCE

**Prerequisites**: None.

**OBJECTIVE:**
To test the knowledge gained and to evaluate analyzing skills on the subjects studied in the masters programme.

**OUTCOME:**
The student will be able to undertake a assimilate knowledge of different courses studied, Develop overall comprehension about Geotechnical Engineering, Analyze real life geotechnical problems with theoretical knowledge learned, Interpret and articulate solutions to real life geotechnical problems.

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. II Year I-Sem (Geotechnical Engineering)** **L T P C**
**12**

### Project Phase-I

**Prerequisites**: None.

**OBJECTIVE:** To identify the topic by reviewing literature (Journal/ Conferences/ Articles etc.) and based on the topic, setting objectives and developing methodology to carryout project thesis work

**OUTCOME: T**he student will be able to identify topics in thrust areas of Geotechnical engineering. Take up critical review of literature on the chosen topic. Carryout independent research work on the topic by experimental / analytical approaches. Documentation and presentation of the research work

## JNTUH COLLEGE OF ENGINEERING HYDERABAD

**M.Tech. II Year II-Sem (Geotechnical Engineering)** **L T P C**
**18**

### Project Phase- II & Dissertation

**Prerequisites**: None.

**OBJECTIVE:**
To carryout experimental/analytical programme and critical analysis of results on the identified topic in thrust areas of Geotechnical engineering.

**OUTCOME:**
Take up critical review of literature on the chosen topic carryout independent research work on the topic by experimental / analytical approaches. Preparation of document and critical analysis of the results of research work and presentation.