

**ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS**

**M.TECH.
GEO TECHNICAL ENGINEERING**

(Applicable for the batches admitted from 2011-2012)



**VNR VIGNANA JYOTHI
INSTITUTE OF ENGINEERING & TECHNOLOGY
(AFFILIATED TO JNTUH)
*An Autonomous Institute under JNTUH***

Bachupally, Nizampet (S.O), Hyderabad –500090
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**Academic Regulations 2011 For M.Tech. Degree Course
(Effective for the students admitted into first year from the academic year 2011-2012)**

1. Introduction

Academic Programmes of the institute are governed by rules and regulations as approved by the academic council of the institute.

These academic rules and regulations are effective from the academic year 2011-12, for the students admitted into two year post graduate programme offered by the college leading to Master Of Technology (M. Tech.) degree in the disciplines viz., Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics and Communication Engineering, Computer science and Engineering, Information Technology, Electronics and Instrumentation Engineering and Automobile Engineering.

The M.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the program after fulfilling all the requirements for the award of the Degree.

1.1 Eligibility for Admissions

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by the University from time to time. Admissions shall be made on the basis of GATE Rank and merit rank obtained by the qualifying candidate at an Entrance Test conducted by the University, subject to reservations prescribed by the university/ State Government from time to time.

2. Courses of Study

The following specializations are offered at present for the M.Tech. Course of study.

1. Advanced Manufacturing Systems
2. Highway Engineering
3. Structural Engineering
4. Power Electronics
5. Software Engineering
6. VLSI System Design
7. Embedded Systems
8. Geotechnical Engineering
9. Electronic Instrumentation
10. Automation

and any other course as approved by the Academic Council of the Institute and the authorities of the University from time to time.

2.1 Departments offering M.Tech. Programmes with specializations are mentioned below:

ME	1. Advanced Manufacturing Systems 2. Automation
CE	1. Highway Engineering 2. Structural Engineering 3 Geotechnical Engineering
EEE	Power Electronics
CSE	Software Engineering
ECE	1. VLSI System Design 2. Embedded Systems
EIE	Electronic Instrumentation

3. Attendance

Each academic year shall be divided into two semesters, each of 90 Instructions days, excluding examination, evaluation, declaration of results etc.

- 3.1 A candidate shall be deemed to have eligibility to write end semester examinations in a subject if he has put in at least 75% of attendance in that subject.
- 3.2 Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by the College Academic Committee on genuine and valid reasons on application by the candidate with supporting evidence.
- 3.3 A candidate shall get minimum required attendance at least in three (3) theory subjects in the present semester to get promoted to the next semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.
- 3.4 Shortage of attendance below 65% shall in no case be condoned.
- 3.5 A stipulated fee shall be payable towards condonation of shortage of attendance.
- 3.6 In case the candidate secures less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). He shall re-register the subject when next offered.

4. Evaluation

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

- 4.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination, 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the better of the marks secured in the two Mid Term-Examinations conducted one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for duration of 2 Hours with 4 questions to be answered out of 6 questions.

4.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations, 40 marks shall be awarded based on the day-to-day performance as Internal Marks.

4.3 There shall be two seminar presentations during the I year, one in each semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

4.4 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva- Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects studied during the M.Tech. course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-Voce.

4.5 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

4.6 A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and he has failed in the end examination. In such a case candidate may re-register for the subject(s) and secure required minimum attendance. Attendance in the re-registered subject(s) has to be calculated separately to become eligible to write the end examination in the re-registered subject(s). Re-registration for the subjects is allowed only if that particular re-registration subjects are the hindrance for the award of Degree. Re-registration is allowed in this case provided the student doesn't have any subject(s) yet to pass other than the re-registration subjects with prior permission.

4.7 Laboratory examination for M.Tech. courses must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner shall be a teacher of same specialization either external or from the same dept.

5. Evaluation of Project / Dissertation Work.

5.1 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

- 5.2** A Project Review Committee (PRC) shall be constituted with at least four members namely HOD, PG Coordinator of the Department, project supervisor and one senior faculty member of same specialization.
- 5.3** After satisfying 5.1, a candidate has to submit, in consultation with the project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for its approval. Only after obtaining the approval of Departmental Academic Committee, the student can initiate the Project work.
- 5.4** If a candidate wishes to change his supervisor or topic of the project he can do so with the approval of Departmental Academic Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- 5.5** Internal Evaluation of the project shall be on the basis of the seminars(Project reviews) conducted during the II year by the committee consisting of Head of the Department, project supervisor ,PG coordinator of the Department and senior faculty member of the Department. belonging to same specialization. A candidate shall submit status report in a spiral bound copy form.
- 5.6** The work on the project shall be initiated in the beginning of the second year and the duration of project is for two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 240 days from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department (Through project supervisor/PG coordinator) and shall make an oral presentation before the PRC.
- 5.7** After approval of PRC, every student has to submit three copies of the Project Thesis certified by the supervisor to the Department.
- 5.8** The thesis shall be adjudicated by one examiner selected by the Chief Superintendent. For this, HOD shall submit a panel of 3/ 5 examiners, who are eminent in that field with the help of the concerned guide.
- 5.9** If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, within the time frame as described by PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.
- 5.10** If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report candidates work as:
- A. Excellent
 - B. Good
 - C. Satisfactory
 - D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination. The candidate has to secure any one of the grades as Excellent, Good or Satisfactory on his thesis/dissertation and viva-voce. If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination, he has to reregister the project work as in clause 5.1. However, the candidate may select a new guide and new topic with the approval of the PRC and submit the project report with a minimum of 240 days from the date of re-registration. Of course this shall not prejudice the clause 6.1 below. The candidate can be permitted to change the topic/guide only once.

6. Award of Degree and Class

A student shall be declared eligible for the award of the M.Tech. degree, if he pursues a course of study and completes it successfully for not less than two academic years and not more than four academic years.

6.1 A student, who fails to fulfil all the academic requirements for the award of the degree within four academic years from the year of his admission, for any reason whatsoever, shall forfeit his seat in M.Tech. Course.

6.2 After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

7. Withholding of Results

If the candidate has not paid any dues to the Institute or if any case of indiscipline is pending against him, the result of the candidate will be withheld and he will not be allowed into the next higher semester. The issue of the degree is liable to be withheld in such cases. This delay shall not prejudice clauses Nos.6.0 and 6.1

8. Transitory Regulations

Candidate who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered without precluding clauses Nos.6.0 and 6.1

9. General

- 9.1** The academic regulations should be read as a whole for purpose of any interpretation.
- 9.2** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
- 9.3** The Institute may change or amend the academic regulations and syllabi at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the Institute.
- 9.4** Wherever the words he, him or his occur, they will also include she, her and hers.

10. Supplementary Examination

Supplementary examinations will be conducted along with regular semester end examinations. Supplementary examinations will be conducted to a maximum number of four continuous times subsequent to the revision of the syllabus. Supplementary examinations will be conducted in the equivalent courses as approved by the Institute Academic Committee.

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VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

M. TECH – GEOTECHNICAL ENGINEERING

I YEAR I SEMESTER

COURSE STRUCTURE

Subject Code	Group	Subject Name	L	P	Credits
R11GTE2101		Advanced Soil Mechanics	3	0	3
R11GTE2102		Advanced Foundation Engineering	3	0	3
R11GTE2103		Soil Dynamics and Machine Foundations	3	0	3
R11GTE2104		Engineering of Ground	3	0	3
R11GTE2105	Elective - I	Numerical Methods for Geotechnical Engineers	3	0	3
R11GTE2106		Groundwater Hydrology			
R11GTE2107		Geo-Environmental Engineering			
R11GTE2108	Elective - II	Environment and Ecology	3	0	3
R11GTE2109		Groundwater Contamination and Remediation			
R11GTE2110		Finite Element Method			
R11GTE2201	Lab	Advanced Geotechnical Engg. Lab-I	0	3	2
R11GTE2301		Seminar	--	--	2
		Total Credits (6Theory + 1 Lab)			22

I YEAR II SEMESTER

COURSE STRUCTURE

Subject Code	Group	Subject Name	L	P	Credits
R11GTE2111		Retaining Structures	3	0	3
R11GTE2112		Earth & Rock Fill Dams and Slope Stability	3	0	3
R11GTE2113		Geosynthetics & Soil Reinforcement	3	0	3
R11GTE2114		Ground-Foundation-Structure Interaction	3	0	3
R11GTE2115	Elective – III	Geotechnical Earthquake Engineering	3	0	3
R11GTE2116		Pavement Analysis and Design			
R11GTE2117		Rock Mechanics and Engineering			
R11GTE2118	Elective -IV	Theoretical Soil Mechanics	3	0	3
R11GTE2119		Environmental Impact Assessment and Management			
R11GTE2120		Geographical Information Systems			
R11GTE2202	Lab	Advanced Geotechnical Engg Lab-II	0	3	2
R11GTE2302		Seminar	--	--	2
		Total Credits (6Theory + 1 Lab)			22

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

M. TECH – GEOTECHNICAL ENGINEERING

II YEAR I SEMESTER

COURSE STRUCTURE

Code	Group	Subject	L	P	Credits
R11GTE2303		Comprehensive Viva	-	-	2
R11GTE2304		Project Seminar - I	0	3	2
R11GTE2305		Project Work	-	-	18
Total Credits					22

II YEAR II SEMESTER

COURSE STRUCTURE

Code	Group	Subject	L	P	Credits
R11GTE2306		Project Work	0	0	20
R11GTE2307		Project Seminar - II	0	0	2
Total Credits			0	0	22

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2101)ADVANCED SOIL MECHANICS

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.

References:

1. Atkinson, J.H. and Bransby, P.L. - The Mechanics of Soils: An Introduction to Critical State Soil Mechanics, McGraw Hill.
2. Atkinson J. H. - An Introduction to the Mechanics of Soils and Foundation, McGraw- Hill Co.
3. Mitchell, J.K. - Soil Behavior.
4. Das, B. M.- Advanced Soil Mechanics, Taylor and Francis.
5. Wood, D.M.- Soil Behavior and Critical State Soil Mechanics.
6. Craig, R. F.- Soil Mechanics, Van Nostrand Reinhold Co. Ltd.
7. Lambe, T. W. and Whitman, R. V.- Soil Mechanics, John Wiley & Sons.
8. Muniram Budhu.- Soil Mechanics and Foundations, John Wiley & Sons, Inc.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2102)ADVANCED FOUNDATION 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, on Layered Soils, on slope and on top of the slopes, on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth.

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; 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; Mini and Micro Piles, Buckling of Fully and Partially Embedded 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

Soil-Foundation-Structure Interaction

Contact pressures and soil-structure interaction for shallow foundations; Concept of subgrade modulus; effects/parameters influencing subgrade modulus; Analysis of foundations of finite rigidity; Beams on elastic foundations; Analysis of raft foundations; Compensated Foundations.

Reference:

1. Das, B. M. - Principles of Foundation Engineering 5th Edition
2. Bowles, J. E. - Foundation Analysis & Design 5th Edition
3. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design
4. Reese, L. C. & Van Impe, W. F. - Single Piles and Pile Groups under Lateral Loading
5. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Hand Book
6. Tomlinson, M. J. - Foundation Design and Construction
7. Reese, L. C. & Wang, S. T. - Analysis and Design of Shallow and Deep Foundations
8. Salgado, R. - The Engineering of Foundations

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VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

L T/P/D C
3 0 3

(R11GTE2103)SOIL DYNAMICS AND MACHINE FOUNDATIONS

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 cyclically loaded soils, 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: An introduction and 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.

References:

1. I.Chowdhary and S P Dasgupta - Dynamics of Structures and Foundation, 2009.
2. Arya, S. D, O'Neil, M. and Pincus, G.- Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Co., 1979.
3. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.
4. Prakash, S. - Soil Dynamics, McGraw Hill, 1981.
5. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.
6. Richart, F. E. Hall J. R and Woods R. D. - Vibrations of Soils and Foundations, Prentice Hall Inc., 1970.
7. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publishing, 1999.
8. Das, B. M. - Principles of Soil Dynamics, PWS KENT publishing Company, Boston.
9. Kramer S. L. - Geotechnical Earthquake Engineering, Prentice Hall, 1996.

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VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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3 0 3

(R11GTE2104)ENGINEERING OF GROUND

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, 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, 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.

References:

1. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications
2. Koerner, R. M (1994) – Designing with Geosynthetics – Prentice Hall, New Jersey
3. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
4. Xianthakos, Abreimson and Bruce - Ground Control and Improvement
5. Mosley – Ground Improvement

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2105) NUMERICAL METHODS FOR GEOTECHNICAL ENGINEERS

UNIT-I

Approximations and Errors in Numerical Methods; Solutions of Algebraic and Transcendental Equations, Bisection, False Position, Secant & Iterative Methods, Aitken's Δ_2 , 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; Applications.

UNIT-II

Matrix Inversion and Eigenvalue 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-III

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

UNIT-IV

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.

UNIT-V

Soft Computing -Linear Programming - Simplex Method; Artificial Variable Techniques M Method, Two Phase Method; Applications; ANN, Fuzzy Logic, etc.

References:

1. Grewal, B. S. - Numerical Methods in Engineering & Science.
2. Chapra, S. C. & Canade, R. P. - Numerical Methods for Engineers.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2106)GROUNDWATER HYDROLOGY

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

Modelling 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.

References:

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

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2107)GEOENVIRONMENTAL ENGINEERING

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 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 NAPL sites, Emerging Remediation Technologies.

UNIT-V

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

References:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook
2. Bedient, Refai & Newell - Ground Water Contamination
3. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering
4. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering
5. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2108)ENVIRONMENT AND ECOLOGY

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

Hazards, Risk and Health.

UNIT-IV

Air, Water and Soil Resources: Air Resources, pollution, global warming, 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.

References:

1. Environmental Science by Tyley Miller.
2. Concepts of Ecology by E.J.Kormondy

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2109)GROUND WATER CONTAMINATION AND REMEDIATION

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

Flow and Transport in the Unsaturated Zone: Capillarity, soil-water characteristics curves, unsaturated hydraulic conductivity, governing equation for unsaturated flow, measurement of soil properties.

UNIT-IV

Non-Aqueous Phase Liquids: Introduction, Types of NAPLs, NAPL transport- General processes, NAPL transport- computational methods- Fate of NAPLs in the subsurface, characterizing NAPLs at remediation sites.

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.

References:

1. Bedient, Rifai & Newell - Groundwater Contamination (Transport and remediation)
2. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook
3. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering
4. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering
5. Daniel, D. E. - Geotechnical Practice for Waste Disposal

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2110)FINITE ELEMENT METHOD

UNIT-I

Procedure, Merits and Demerits. Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axisymmetric 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.

References:

1. Desai, C. and Abel - Introduction to Finite element Method
2. Zienkiewicz, O. C. - Finite element Methods
3. Krishna Murthy, C. S. - Finite element analysis - Theory and programming

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech (Geo Technical Engineering)

L	T/P/D	C
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(R11GTE2201)ADVANCED GEOTECHNICAL ENGINEERING LABORATORY – I

1. Grain size analysis –Sieve and Hydrometer Analysis
2. Consistency Limits-Cone Test for Liquid Limit
3. Proctor Compaction Test
4. Permeability of Clay Soils.
5. Free Swell, Swell Potential, Swell Pressure Test
6. Oedometer Test
7. Triaxial Tests
8. Standard Penetration Test
9. Cone Penetration Test
10. Electrical Resistivity Test
11. Test for Cation Exchange Capacity
12. Wave Propagation Tests.

VNR VIJET

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

L	T/P/D	C
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(R11GTE2111)RETAINING STRUCTURES

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 sheet pile wall.

UNIT-IV

Reinforced Soil Walls/Mechanically Stabilised Earth: - Failure mechanisms bond and rupture failures, Analysis methods, Limit equilibrium method- Internal and external stability, Static and seismic 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
2. Bowles. J. E. - Foundation Analysis & Design
3. Rowe, R. K. - Foundation Engineering Handbook
4. Winterkorn and Fang - Foundation Engineering Handbook

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2112)EARTH & ROCKFILL DAMS AND 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, Inclined gauges, 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, Noncircular 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.

References:

1. Sherard – Earth and Earth Rock Dams.
2. Sowers, G. F. and Salley, H. I. – Earth and Rockfill Dams
3. Bharat Singh and Sharma, H. D. – Earth and Rockfill Dams.
4. Abramson, L. W., Lee, T. S. and Sharma, S. - Slope Stability and Stabilisation methods – John Wiley & sons.
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.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2113)GEOSYNTHETICS AND SOIL REINFORCEMENT

UNIT-I

An Overview of Geosynthetics: Description of Geosynthetics, Properties, Functions

UNIT-II

Soil Reinforcement: Mechanism, Reinforced slopes, Embankments on soft ground, Reinforced Embankments, Reinforced soil walls and Slope stabilization.

UNIT-III

Geoenvironmental Applications: Geomembranes for landfills and ponds, Geosynthetic clay liners, Designing with GCL's, Filtration, Erosion control, Slope protection.

UNIT-IV

Geosynthetics for Highways: Roadway Reinforcement, Separation, Filtration, Drainage, Reinforcement, Moisture Barrier, Membrane encapsulation.

UNIT-V

Ground Improvement: Drainage, PVDs, French Drains, etc.

References:

1. Koerner, R. M. - Designing with Geosynthetics
2. Rao, G. V. & Raju G. V. S. S. - Engineering with Geosynthetics
3. Hausmann, M. R. - Engineering Principles of Ground Modifications
4. Xianthakos, Abremson and Bruce - Ground control and Improvement
5. Mosley - Ground Improvement
6. Jones, C. J. F. P. - Earth Reinforcement and soil structures

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2114)GROUND-FOUNDATION-STRUCTURE INTERACTION

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 groundfoundation interaction, Static and dynamic loads.

References:

1. Selvadurai, A. P. S. - Elastic Analysis of Soil-Foundation Interaction
2. Poulos, H. G., and Davis, E. H. - Pile Foundation Analysis and Design
3. Scott, R. F. - Foundation Analysis
4. Bowles, J. E. - Foundation Design & Analyses
5. Das, B. M. - Advanced Foundation Engineering

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

L	T/P/D	C
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(R11GTE2115)GEOTECHNICAL EARTHQUAKE ENGINEERING

UNIT-I

Earthquake Seismology – Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Quantification of earthquake, Intensity and magnitudes, Earthquake source models.

UNIT-II

Earthquake Ground Motion – Seismograph, 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: Dynamic finite element 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, Criteria for mapping liquefaction hazard zones. 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, Seismic design consideration.

References:

1. Kramer S. L - Geotechnical Earthquake Engineering, Prentice Hall, 1996.
2. R. W. Day - Geotechnical Earthquake Engineering Handbook, McGraw-Hill, 2002.
3. Seco e Pinto, Seismic Behaviour of Ground and Geotechnical structure, A. A. Balkema - 1997.
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. Kamallesh Kumar - Basic Geotechnical Earthquake Engineering – New Age International Publishers, 1st Edition, 2008.
8. Dowrick - Earthquake Resistant Design, John Wiley & Sons.
9. Chowdhary, I., and Dasgupta, S. P.- Dynamics of Structures and Foundation, 2009.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2116)PAVEMENT ANALYSIS AND DESIGN

UNIT-I

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements.

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, semiempirical 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.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2117)ROCK MECHANICS AND ENGINEERING

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, Viscoelastic, 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.

References:

1. Goodman – Introduction to Rock mechanics, Willey International (1980).
2. Ramamurthy, T. - Engineering in Rocks for slopes, foundations and tunnels, Prentice Hall of India.
3. Jaeger, J. C. and Cook, N. G. W. – Fundamentals of Rock Mechanics, Chapman and Hall, London.
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.

VNR VIJET

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2118)THEORETICAL SOIL MECHANICS

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 – octahedral stresses – stress invariants.

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 and Anisotropic and Non-homogeneous Elastic Mass. Stress-path methods; Rigid Loaded areas, Rotation of Foundations.

UNIT-IV

Deep Foundations: Axially loaded single incompressible, compressible floating and end-bearing piles, pile groups; Laterally Loaded Single and Group of Piles.

UNIT-V

Underground Structures: Stresses and Displacements around Underground Openings unlined and lined tunnels.

References:

1. Poulos, H. G. & Davis, E. H. – “Elastic Solutions for Soil and Rock Mechanics”
2. Das, B. M. – Advanced Soil Mechanics

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2119)ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

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

Impact of Development Activities and Land use: Introduction, Methodology for the assessment of soil and ground water, Delineation of study area, Identification of activities, Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measure.

UNIT-IV

E I A an surfaced water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact, Assessment of Impact on development Activities of Vegetation and wildlife, environmental Impact of Deforestation –Courses and effects of deforestation.

UNIT-V

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, The Environmental pollution Act, The water Act, The Air (Prevention & Control of pollution Act.). EIA Report preparation and Case studies

References:

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
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.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2120)GEOGRAPHICAL INFORMATION SYSTEMS

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.

References:

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

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Geo Technical Engineering)

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(R11GTE2202)ADVANCED GEOTECHNICAL ENGINEERING LABORATORY - II

1. Preparation of Rock Specimen (Drilling, Cutting, Polishing)
2. Slake Durability Test
3. Brazilian Test
4. Point Load Test
5. Unconfined Compression Test
6. Interface Shear Behavior of Soils with Geosynthetics
7. Cone Drop Test on Geotextile
8. Tensile Tests (Wide Width, Narrow Width, etc. on Geotextiles)
9. CBR Push Through on Geotextiles
10. In-Plane and Cross-Plane Permeability of Geotextiles