R22

M.Tech. (GEO-TECHNICAL ENGINEERING)

M.Tech. R22 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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DEPARTMENT OF

CIVIL ENGINEERING

VISION OF THE DEPARTMENT

To develop Civil Engineering Department as a Centre of excellence for imparting value based education to the students at undergraduate and post-graduate level to meet industry needs and to develop as a major research center meeting national and international standards.

MISSION OF THE DEPARTMENT

- To impart in-depth and up-to-date knowledge of Civil Engineering concepts with focus on character enhancement, leadership qualities, effective communication, social responsibility and pursuit of lifelong learning and professional development.

- To provide a platform to the students to engage in original innovative research.

M.TECH.
(GEO-TECHNICAL ENGINEERING)

M.TECH. (GTE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: To apply knowledge of geotechnical engineering to produce engineers to integrate and build concepts to improve professional leadership, teamwork, life-long learning, and career advancement.

PEO-II: To design and conduct experiments, to analyze and interpret data related to the geotechnical engineering, as well as to formulate systems within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

PEO-III: To accentuate the understanding of the basic principles and exposes the student to the latest developments, with a strong research foundation so as to provide engineering solutions in a global, economic, environmental, and societal context.

M.TECH. (GTE)

PROGRAM OUTCOMES

PO-1: An ability to independently carryout research/investigation and development work to solve practical problems.

PO-2: An ability to write and present a substantial technical report/document.

PO-3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO-4: To motivate the graduate students to address the societal needs by interdisciplinary approach through advanced courses.

PO-5: To enrich the graduate students to get hands on training on latest equipment / software to be industry ready / pursue advanced research.

PO-6: To inculcate ethical practices and to establish understanding of professionalism, safety, sustainability, their duties, and contribution to the society

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(GEO-TECHNICAL ENGINEERING)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1GT01	Advanced Soil Mechanics	3	0	0	3
Professional Core-II	22PC1GT02	Advanced Foundation Engineering	3	0	0	3
Professional Core-III	22PC1GT03	Ground Improvement Techniques	3	0	0	3
Professional Elective-I	22PE1GT01	Soil Structure Interaction	3	0	0	3
	22PE1GT02	Engineering Rock Mechanics				
	22PE1GT03	Critical State Soil Mechanics				
	22PE1GT04	Environmental Impact Assessment				
	22PE1GT05	Computational Methods in Geotechnical Engineering				
Professional Elective-II	22PE1GT06	Tunneling Technology	3	0	0	3
	22PE1GT07	Subsurface Investigations and Instrumentation				
	22PE1GT08	Offshore Geotechnical Engineering				
	22PE1GT09	Design of Substructures				
	22PE1GT010	Geotechnics for Infrastructures				
Professional Core Lab-I	22PC2GT01	Soil Mechanics Laboratory - I	0	0	2	1
Professional Core Lab-II	22PC2GT02	Soil Mechanics Laboratory - II	0	0	2	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing	0	0	2	1
Project	22PW4GT01	Technical Seminar	0	0	4	2
Mandatory	22MN6HS01	Research Methodology and IPR	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(GEO-TECHNICAL ENGINEERING)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1GT04	Dynamics of Soils and Foundations	3	0	0	3
Professional Core-V	22PC1GT05	Design with Geosynthetics	3	0	0	3
Professional Core-VI	22PC1GT06	Earth Retaining Structures	3	0	0	3
Professional Elective-III	22PC1HW04	Pavement Analysis and Design	3	0	0	3
	22PE1GT11	Earth and Rockfill Dams				
	22PE1GT12	Environment and Ecology				
	22PE1GT13	Numerical Methods for Geotechnical Engineering				
	22PE1GT14	Physical and Constitutive Modeling on Geomechanics				
Professional Elective-IV	22PE1GT15	FEM in Geotechnical Engineering	3	0	0	3
	22PE1GT16	Geographical Information System				
	22PE1GT17	Stability Analysis of Slopes				
	22PE1GT18	Unsaturated Soil Mechanics				
	22PE1GT19	Geotechnical Aspects of Landfills				
Professional Core Lab-III	22PC2GT03	Advanced Geotechnical Engineering Laboratory	0	0	2	1
Professional Core Lab-IV	22PC2GT04	Geotechnical Engineering Studio	0	0	2	1
Industry Engagement	22SD5GT01	Industry Engagement	0	0	2	1
Project	22PW4GT02	Mini-Project	0	0	4	2
Mandatory	22MN6HS02	Ancient Wisdom	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. II YEAR COURSE STRUCTURE AND SYLLABUS

(GEO-TECHNICAL ENGINEERING)

III SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	22PE1GT20	Foundations on Weak Rocks	3	0	0	3
	22PE1GT21	Geotechnical Earthquake Engineering				
	22PE1GT22	Environmental Geotechnology				
	22PE1GT23	Advanced Engineering Geology				
	22PE1GT24	Expansive Soil Engineering				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Industrial Safety				
	22OE1AM02	Operations Research				
	22OE1AM03	Entrepreneurship and Start-ups				
	22OE1PS01	Waste to Energy				
Project	22PW4GT03	Project Part – I	0	0	16	8
Total			**6**	**0**	**16**	**14**

IV SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	22PW4GT04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1GT01) ADVANCED SOIL MECHANICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To describe the in-depth theoretical concepts pertaining to the mechanical behavior of soil
- To identify the various terminology and their applications in solving problems related to soil
- To differentiate between the various stress states of the soil and their consequences
- To apply the knowledge gained to solve problems in the field

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Describe different concepts and terms used in soil mechanics

CO-2: Differentiate between the various stress states to be applied for a given problem

CO-3: Analise the behavior of given soil structure

CO-4: Apply the appropriate formulae to be used with the knowledge of the mechanics of soil

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	1	1
CO-2	3	-	3	-	2	1
CO-3	3	1	3	1	1	1
CO-4	3	2	3	1	1	1

UNIT-I:

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 in layered soil and Consolidation for time dependent loading. Determination of Consolidation co-efficient of Consolidation (Casagrande and Taylor's method)

UNIT-II:

Stress-Strain-Strength Behavior of Soils: Mohr Circle of Stress, drained and undrained shear strength of Sand and Clay. Significance of pore pressure parameters;

Determination of shear strength; Drained, Consolidated Undrained and Unconsolidated Undrained tests; Interpretation of triaxial test results.

UNIT-III:

Geostatic Stresses: Stresses within a soil mass: Concept of stress for a particulate system, Effective stress principle, Geostatic stresses, Soil water hydraulics.

UNIT-IV:

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

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.

TEXT BOOKS:

1. Advanced Soil Mechanics, Das B. M., 3rd Edition, Taylor and Francis, 2007
2. The Mechanics of Soils: An Introduction to Critical State Soil Mechanics, Atkinson J. H. and Bransby P. L., McGraw Hill, 1978

REFERENCES:

1. The Mechanics of Soils and Foundation, Atkinson J. H., 2nd Edition, 2007, McGraw Hill Co., 2010
2. Soil Mechanics, Craig R. F., Spon Press, 8th Edition, An Imprint of Taylor & Francis, 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1GT02) ADVANCED FOUNDATION ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Foundation Engineering

COURSE OBJECTIVES:

- To create an ability to identify, formulate and solve foundation engineering problems
- To design shallow and deep foundations in soil
- To estimate the settlement of foundations
- To abreast with advanced techniques of foundation analysis and design

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Select type of foundations to be recommended for construction of different engineering structures

CO-2: Determine the Bearing capacity of soil and settlements for the design of shallow foundations

CO-3: Analyze the deep foundations under different loading conditions

CO-4: Interpret the behavior of problematic soils and suggest reliability-based design for shallow and deep foundations

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	1	2	1
CO-2	3	1	3	1	1	1
CO-3	3	-	3	1	1	2
CO-4	3	-	3	1	1	2

UNIT-I:

Stress Distribution: Types of stresses, Estimation of stresses in soils, Isobar and Pressure bulb, Variation of vertical stress under point load along the vertical and horizontal directions, Newmark's Influence Chart

UNIT-II:

Shallow Foundations: Requirements for satisfactory performance of foundations, methods of estimating bearing capacity, settlements of footings and rafts, proportioning of foundations using field test data and IS codes.

UNIT-III:

Pile Foundations: Methods of estimating load transfer of piles, settlements of pile foundations, pile group capacity and settlement, negative skin friction of piles, laterally loaded piles, pile load tests, lateral and uplift capacity of piles.

UNIT-IV:

Well Foundation: Types, Shapes and component parts, Forces acting, Grip length, Sinking of wells, Rectification of Tilts and Shifts, Lateral stability - Terzaghi's method and IRC method. Coffer Dams- Various types, analysis and design Foundations under uplifting loads

UNIT-V:

Foundations on Problematic Soils: Significant characteristics of expansive soils, Preventive measures for expansive soils; Design of foundation on collapsible and expansive soils, Shoring and Underpinning.

TEXT BOOKS:

1. Soil Mechanics and Foundation Engineering, Murthy V. N. S, CBS Publications, 2007
2. Geotechnical Engineering, Das B. M., Cengage Learning, New Delhi, 2009

REFERENCES:

1. Basic and Applied Soil Mechanics, Gopal Ranjan, Rao A. S. R., New Age Publication, Delhi, 2000
2. Geotechnical Engineering, Iqbal H. Khan, Prentice Hall, Delhi, 2007
3. Foundation Analysis and Design, Bowles J. E., 5th Edition, Tata McGraw-Hill International Edition, 1997
4. Shallow Foundations: Bearing Capacity and Settlement, Das B. M., CRC Press, 1999

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1GT03) GROUND IMPROVEMENT TECHNIQUES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To know the needs and objectives of ground improvement techniques
- To comprehend the principles of various ground improvement methods
- To compare different methods of ground improvement and understand their suitability
- To apply the relevant method to remedy a difficult soil condition

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply the principles of ground improvement to a given site conditions
CO-2: Select the choice of right technique to improve different difficult grounds
CO-3: Estimate safety, stability of economical construction of any structure
CO-4: Identify the issues affecting design and construction of various methods for soil improvement

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	1	1
CO-2	3	-	2	-	1	1
CO-3	3	1	1	1	3	1
CO-4	3	-	2	1	3	1

UNIT-I:
Introduction to Ground Modification: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques – suitability and feasibility.

UNIT-II:
Mechanical: Methods of compaction, Shallow compaction, Deep compaction techniques - Vibro-floatation, Blasting, Dynamic consolidation, pre-compression and compaction piles, Field compaction control.

UNIT-III:
Hydraulic Modification: Hydraulic Modification: Methods of dewatering – open sumps and ditches, Well-point system, Electro-osmosis, Vacuum dewatering wells; pre-loading without and with sand drains, strip drains and rope drains.

UNIT-IV:

Physical and Chemical Modification: Stabilization with admixtures like Cement, Lime, Calcium Chloride, fly Ash and Bitumen. Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control.

UNIT-V:

Soil Confinement Systems: Soil reinforcement: Reinforced earth, basic mechanism, type of reinforcements, selection of stabilisation/improvement of ground using Geotextiles, Goegrid, geomembranes, geocells, geonets, and soil nailing.

TEXT BOOKS:

1. Engineering Principles of Ground Modifications, Hausmann M. R., McGraw Hill, 1990
2. Designing with Geosynthetics, Koerner R. M., Prentice Hall, 1994

REFERENCES:

1. Engineering Principles of Ground Modification, Hausmann M. R., McGraw-Hill International Edition, 1990
2. Grouting and Deep Mixing, Yonekura R., Terashi M. and Shibazaki M. (Eds.), A. A. Balkema, 1966
3. Ground Improvement, Moseley M. P., Blackie Academic & Professional, 1993
4. Earth Reinforcement and Soil Structures, Jones C. J. F. P., Butterworths, 1985
5. Ground Control and Improvement, Xianthakos, Abreimson and Bruce, John Wiley & Sons, 1994

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT01) SOIL STRUCTURE INTERACTION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce the concepts and terminology of soil structure interaction
- To analyze different type of framed structures resting on natural deposits
- To develop knowledge on behavior of piles and pile groups on soils
- To create and formulate advance programming to solve interaction problems

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics

CO-2: Prepare comprehensive design-oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.

CO-3: Analyze different types of frame structure founded on stratified natural deposits with Linear and non-linear stress-strain characteristics

CO-4: Understand action of group of piles considering stress-strain characteristics of real soils

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	2	1	1
CO-2	3	1	3	2	3	1
CO-3	3	1	3	1	1	1
CO-4	3	1	3	1	1	1

UNIT-I:

Importance of Soil Structure Interaction: Critical Study of Conventional Methods of Foundation design, Nature and Complexities of Soil Structure Interaction.

UNIT-II:

Numerical Techniques in SSI: Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method

UNIT-III:

Simulation Program: Effect of seismic load on structure interaction, Preparation of Comprehensive Design Oriented Computer Programs for simple seismic soil structure interaction model, Interaction of Beams, Footings, Rafts Etc. based on Sub Grade Reaction.

UNIT-IV:

Soil Structure Interaction of Framed Structure: Analysis of Different Types of Framed Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

UNIT-V:

Analysis of Laterally and Axially Loaded Pile Groups: Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.

TEXT BOOKS:

1. Analytical and Computer Methods in Foundation, Bowels J. E., McGraw Hill Book Co., 1974
2. Elastic Analysis of Soil-Foundation Interaction, Selvadurai A. P. S, Elsevier Scientific Publishing Company
3. Numerical Methods in Geotechnical Engineering, Desai C. S. and Christian J. T., McGraw Hill Book Co.

REFERENCES:

1. Soil Structure Interaction - The Real Behaviour of Structures, Institution of Structural Engineers
2. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engineering, Vol.17, Elsevier
3. Analysis & Design of Substructures, Swami Saran, Oxford & IBH Publishing
4. Design of Foundation System-Principles & Practices, Kurian N. P., Narosa Publishing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT02) ENGINEERING ROCK MECHANICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the concepts of Rock Mechanics and various terminology involved
- To conduct experiments as well as to analyze and interpret data related to the rock mechanics
- To impart the understanding of the basic principles, latest developments on real world problems
- To connect the theoretical knowledge to real life problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the formation of rocks and its properties
CO-2: Determine different engineering properties of rock
CO-3: Apply the latest trends, modern standards and state-of-the-art techniques for understanding rock mechanics and engineering
CO-4: Identity the mode of failure of Rock Structures and to implement appropriate preventive measures

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	1	2	2	2	1
CO-2	2	1	2	2	3	1
CO-3	2	2	2	2	3	2
CO-4	3	2	3	3	3	2

UNIT-I:

Introduction to Rock Mechanics: Rocks of peninsular India and the Himalayas, Development of rock mechanics, problems of rock mechanics, applications and scope of rock mechanics. Classification by Rock Quality Designation, Rock structure Rating, Geomechanics and NGI classification systems.

UNIT-II:

Laboratory Testing: Rock sampling, Determination of density, Porosity and Water absorption, Uniaxial Compressive strength, Determination of elastic parameters, Tensile strength, Shear Strength, Flexural strength, Strength criterion in rocks, Swelling and slake durability, permeability, point load strength, Dynamic methods of testing, Factors affecting strength of rocks.

UNIT-III:

In – situ Testing: Necessity and Requirements of in – situ tests – Types of in – situ tests – Flat jack Technique – Hydraulic Fracturing Technique, pressure meter Test, Plate Load Test, Shear Strength Test, Radial Jack Test, Goodman Jack Test and Dilatometer Test.

UNIT-IV:

Methods of Improving Rock Mass Properties: Rock Reinforcement – Rock bolting – Mechanism of Rock bolting – Principles of design – Types of rock bolts. Pressure grouting – grout curtains and consolidation grouting. Stability of Rock Slopes- Causes of landslides, Modes of failure, Methods of analysis, Prevention and control of rock slope failure, Instrumentation for Monitoring and Maintenance of Landslides.

UNIT-V:

Substructures on Rock: Shallow foundations, Pile and well foundations, Basement excavation, Foundation construction, Allowable bearing pressure. Tunnels: Rock stresses and deformation around tunnels, Rock support interaction, Tunnel driving methods, Design of tunnel lining.

TEXT BOOKS:

1. Introduction to Rock Mechanics, Goodman, 2nd Edition, Wiley, 1989
2. Engineering in Rocks for Slopes, Foundations and Tunnels, Ramamurthy T., 3rd Edition, Prentice Hall of India, 2014

REFERENCES:

1. Fundamentals of Rock Mechanics, Jaeger J. C. and Cook N. G. W., 3rd Edition, Chapman and Hall, London, 1979
2. Underground Excavation in Rock, Hoek E. and Brown E. T., 1982
3. Rock Mechanics for Underground Mining, Brady B. H. G. and Brown E. T., 3rd Edition, Chapman & Hall, Springer Science & Business Media, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT03) CRITICAL STATE SOIL MECHANICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To describe the in-depth theoretical concepts pertaining to the critical behavior of soil
- To identify the various terminology and their applications in solving problems related to soil
- To differentiate between the various critical stress states of the soil and their consequences
- To enable the students to connect the knowledge gained to solve field problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Describe different concepts and terms used in critical soil mechanics
CO-2: Differentiate between the various critical stress states to be applied for a given problem
CO-3: Predict the kind of critical behavior expected from a given soil structure
CO-4: Identify the appropriate formulae to be used with the knowledge of the critical mechanics of soil

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	1	1
CO-2	3	-	3	1	1	1
CO-3	3	-	3	1	1	1
CO-4	3	-	3	1	1	1

UNIT-I:
Soil Behavior: State of stress and strain in soils, Stress and strain paths and invariants, behavior of soils under different laboratory experiments.

UNIT-II:
The Critical State Line and the Roscoe Surface: Families of undrained tests, Families of drained tests, the critical state line, drained and undrained surfaces, The Roscoe surface.

UNIT-III:
Behavior of Over Consolidated Samples: The Hvorslev surface: Behaviour of over consolidated samples, drained and undrained tests, The Hvorslev surface, complete State Boundary Surface, Volume changes and pore water pressure changes.

UNIT-IV:

Behaviour of Sands: The critical state line for sands, Normalized plots, the effect of dilation, Consequences of Taylor's model.

UNIT-V:

Behaviour of Soils before Failure: Elastic and plastic deformations, Plasticity theory, Development of elastic-plastic model based on critical state soil mechanics.

TEXT BOOKS:

1. The Mechanics of Soils: An Introduction to Critical State Soil Mechanics, Atkinmson J. H. and Bransby P. L., McGraw Hill, 1982
2. Advanced Soil Mechanics, Das B. M., 3rd Edition, Taylor and Francis, 2007

REFERENCES:

1. Soil Behaviour and Critical State Soil Mechanics, D. M. Wood, Cambridge University Press, 1990
2. Fundamental of Geotechnical Engineering, B. M. Das, Cengage Learning, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT04) ENVIRONMENTAL IMPACT ASSESSMENT

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To educate the students on the scope, steps involved, and various methods related to assessment of environmental impact due to development projects
- To impart Knowledge on Environmental Management and Environmental Impact Assessment
- To understand the environmental impact assessment procedure
- To apply the knowledge of recent environmental issues

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Predict environmental impacts due to developmental activities
CO-2: Define various environmental impact assessment methodologies
CO-3: Examine legislations to safeguard environment
CO-4: Identify and analyze the recent environmental issues

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	2	1	1
CO-2	3	3	2	1	1	1
CO-3	3	1	1	2	1	1
CO-4	3	2	2	2	1	1

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:
EIA 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 wildlife, 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.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, Anjaneyulu Y., B. S. Publication
2. Environmental Science and Engineering, Glynn J. and Gary W. H. K., Prentice Hall Publishers, 1999

REFERENCES:

1. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania & Sons
2. Environmental Pollution and Control, Bhatia H. S., Galgotia Publication, 2003

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT05) COMPUTATIONAL METHODS IN GEOTECHNICAL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the finite element method as it is used in geotechnical engineering and geomechanics
- To understand critical aspects of commonly encountered problems in geotechnical engineering
- To apply a commercial finite element code for geotechnical analysis
- To critically analyse numerical results of the finite element method for solving problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Comprehend finite element and finite difference software
CO-2: Analyze shallow and deep foundations, retaining walls, tunnels under different loading conditions using FEM packages
CO-3: Predict slope stability using numerical software
CO-4: Apply seismic hazard and ground response analysis

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	3	3	3	1
CO-2	3	1	3	1	3	-
CO-3	3	-	3	2	3	1
CO-4	3	-	2	1	3	1

UNIT-I:

Solution of Non-linear and Linear Equations: Bisection, False Position, Newton-Raphson, Jacobi's method, Gauss Seidel method.

UNIT-II:

Solution of ODE Using Numerical Techniques: Initial value problems and boundary value problems; Taylor series method, Picard's method, Euler's method, Runge-Kutta method The continuum theory of Soil Mechanics, methodology of continuum mechanics, introduction to vector algebra, tensor algebra and tensor calculus, deformation and strain, traction and stress.

UNIT-III:

Finite Difference Method: Boundary value and Initial value problems – Dirichlet conditions, Neumann conditions; Ordinary and partial differential equations; Non-linear problems.

UNIT-IV:

Introduction to Finite Element Method: Formulation of weak form, interpolation functions

UNIT-V:

Constitutive Modelling of Soil: Critical state soil mechanics; Elastic-plastic constitutive models; Cam-Clay model and Modified Cam-Clay model, Mohr-Coulomb model, Hardening Soil model

TEXT BOOKS:

1. Numerical Methods for Scientific and Engineering Computations, Jain M. K., Iyengar S. R. K. and Jain R. K., 3rd Edition, New Age International, 2012
2. Finite Elements in Geotechnical Engineering, Naylor D. J. and Pande G. N., Pineridge Press, 1981
3. Numerical Methods in Geotechnical Engineering, C. S. Desai and J. T. Christian, McGraw Hill, 1977

REFERENCES:

1. Constitutive Modelling in Geomechanics: Introduction, Alexander Puzrin, Springer, 2012
2. Applied Soil Mechanics with ABAQUS Applications, Sam Helwany, John Wiley, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT06) TUNNELING TECHNOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the use of elastic and plastic analysis in the design of underground support system
- To explain the field tests generally conducted during and after construction of under structures
- To use of codes and standards in design of underground structures
- To classify the rock mass system and ground condition in tunneling

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Explain the various principles used in design of underground construction projects

CO-2: Estimate and analyze various moduli of deformation of rocks by performing the suitable rock test

CO-3: Apply the knowledge gained to the design of tunnel in different ground conditions

CO-4: Design the underground structure using empirical, analytical and numerical approaches

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	2	3	1
CO-2	3	1	3	2	1	1
CO-3	3	1	3	2	2	1
CO-4	3	1	3	2	2	1

UNIT-I:

Introduction: Planning and exploration for various underground construction projects, stereographic projection method, principle and its application in underground excavation design.

UNIT-II:

Stresses: Elastic stress distribution around tunnels, stress distribution for different shapes and under different in-situ stress conditions, Greenspan method, design principles, multiple openings, openings in laminated rocks, elasto-plastic analysis of tunnels, Daemen's theory

UNIT-III:

Classification Systems: Application of rock mass classification systems, ground conditions in tunneling, analysis of underground openings in squeezing and swelling ground, empirical methods.

UNIT-IV:

Tunneling Methods: Estimation of elastic modulus and modulus of deformation of rocks; uniaxial jacking / plate jacking tests, radial jacking and Goodman jacking tests, long term behaviour of tunnels and caverns, New Austrian Tunneling Method (NATM), Norwegian Tunneling Method (NTM), construction dewatering.

UNIT-V:

Instrumentation and Monitoring: In-situ stress, flat jack, hydraulic fracturing and over coring techniques and USBM type drill hole deformation gauge, single and multi-point bore hole extensometers, load cells, pressure cells, etc. Instrumentation and monitoring of underground excavations, during and after construction, various case studies.

TEXT BOOKS:

1. Underground Excavations in Rocks, Hoek E. and Brown E. T., Institute of Mining Engineering
2. Rock Mechanics and Design of Structures in Rocks, Obert L. and Duvall W. I., John Wiley

REFERENCES:

1. Rock Mass Classification-A Practical Engineering Approach, Singh B. and Goel R. K., Elsevier
2. Tunnelling in Weak Rocks, Singh B. and Goel R. K., Elsevier

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT07) SUBSURFACE INVESTIGATIONS AND INSTRUMENTATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To apply the various methods of geotechnical investigation and the field tests based on field conditions
- To develop clear idea about planning and execution of geotechnical investigation programme
- To analyze and take proper engineering decisions in practical situations
- To gain the knowledge about the instrumentation for critical sites

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Identify subsurface investigation based on the requirement of civil engineering project and site condition

CO-2: Execute different subsurface exploration tests, collect disturbed/undisturbed samples for laboratory tests and can suggest design parameters

CO-3: Understand various methods for estimation of dynamic soil properties required for design purpose

CO-4: Categories instrumentation scheme for monitoring of critical sites

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	1	1
CO-2	3	2	3	1	1	1
CO-3	3	-	3	3	1	1
CO-4	3	-	3	1	1	1

UNIT-I:

Planning Investigation and soil sampling: Factors to be considered; Exploration for preliminary and detailed design; Guidelines for location, depth and spacing of drilling bore holes. Sampling- Disturbed and undisturbed soil sampling, representative samples; Methods to minimize sample disturbance; Types of samplers; Preservation and handling of samples.

UNIT-II:

Exploration Techniques: Accessible exploration and Semi-direct methods; Drilling methods, equipment's, and applicable soil types; Stabilization of boreholes, Logging of Boreholes-logging methods, Ground water observations-Water table fluctuations and effects, Preparation of soil profile-Calculations.

UNIT-III:

Field Tests: Standard Penetration Test; Dynamic and static cone penetration tests; Plate load test, Pressure meter test; Field vane shear; Dilatometer, Field permeability test; Analysis of test results, Soil Investigation report.

UNIT-IV:

Instrumentation: Settlement gauges, Inclinometers, Stress measurements, Strain gauges, Seismic measurements, Pore pressure measurements.

UNIT-V:

Geophysical Methods: Geophysical methods-types, Electrical Resistivity Methods– Schlumberger & Wenner Array, Electrical Profiling-Sounding Method, Seismic Methods-Seismic refraction, and reflection methods, Crosshole seismic testing, Downhole seismic testing, Sub-soil Investigation Report.

TEXT BOOKS:

1. Foundation Analysis and Design, Bowles J. E., McGraw Hill International, 1997
2. In Situ Testing in Geomechanics, Schnaid F., Taylor and Francis
3. Advanced Soil Mechanics, Das B. M., 2nd Edition, Taylor and Francis, 1997

REFERENCES:

1. Geotechnical Engineering Investigation Manual, Hunt R. E., 2nd Edition, McGraw Hill, 2005
2. Principles of Geotechnical Engineering, Braja M. Das, 7th Edition, Cengage Learning Inc., 2010
3. Soil Mechanics & Foundation Engineering, Purushothama Raj P., Pearson Education India, 2008
4. American Society of Civil Engineers: Soil Sampling, 1999
5. Engineering Properties of Soil and Their Measurements, Bowles B., McGraw-Hill Companies, 1992

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT08) OFFSHORE GEOTECHNICAL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the behavior of marine soils in offshore and coastal zones
- To investigate Marine soil samples under regular and cyclic loads
- To analyze and design foundations for offshore structures
- To study and Prepare solutions for coast protection

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Execute investigation program for marine soil deposits

CO-2: Select necessary design parameters

CO-3: Design suitable marine foundation as per project requirement

CO-4: Develop numerical model for response of marine foundation for offshore conditions

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	3	1
CO-2	3	2	3	1	2	1
CO-3	3	-	3	1	3	1
CO-4	3	1	3	1	3	1

UNIT-I:

Marine Soil Deposits: Offshore environment, Offshore structures and foundations, Specific problems related to marine soil deposits, Physical and engineering properties of marine soils.

UNIT-II:

Behavior of Soils Subjected to Repeated Loading: Effect of wave loading on offshore foundations, Behavior of sands and clays under cyclic loading, Laboratory experiments including repeated loading, Cyclic behavior of soils based on fundamental theory of mechanics, Approximate engineering methods which can be used for practical cases.

UNIT-III:

Site Investigation in the Case of Marine Soil Deposits: Challenges of site investigation in marine environment, Different site investigation techniques, sampling techniques, Geophysical methods, Recent advancements in site investigation and sampling used for marine soil deposits.

UNIT-IV:

Foundations in Marine Soil Deposits: Different offshore and near shore foundations, Gravity platforms, Jack-up rigs, pile foundations, caissons, spud cans.

UNIT-V:

Numerical Modeling of Marine Foundations Subjected to Wave Loading: Numerical modeling of cyclic behavior of soils, empirical models, elastic-plastic models, FEM analysis of marine foundations subjected to wave loading.

TEXT BOOKS:

1. Numerical Methods in Geotechnical Engineering, S. Chandrakant Desai and John T. Christian, McGraw Hill Book Company, 1977
2. Numerical Methods for Scientific and Engineering Computations, M. K. Jain, S. R. K. Iyengar and R. K. Jain, 3rd Edition, New Age International

REFERENCES:

1. Finite Elements in Geotechnical Engineering, D. J. Naylor and G. N. Pande, Pineridge Press Ltd.
2. Applied Soil Mechanics, Sam Helwany, John Wiley & Sons

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT09) DESIGN OF SUBSTRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To gain familiarity with different types of foundation
- To explore the students to the design of shallow foundations and deep foundations
- To understand the concept of designing shallow, deep and machine foundations
- To understand the purpose of retaking wall

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Design shallow and deep foundations for different loading conditions
CO-2: Examine and check the stability of retaining walls
CO-3: Analise design of machine foundations
CO-4: Estimate the load carrying capacity of pile foundation

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	2	3	1
CO-2	3	2	2	2	3	1
CO-3	3	1	2	2	3	1
CO-4	3	-	2	2	3	1

UNIT–I:

Shallow Foundations: Basic requirements of foundation –Types and selection of foundations and Special 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.

TEXT BOOKS:

1. Foundation Analysis and Design, Bowles J. E., McGraw Hill Publishing, 1986
2. Foundation Design and Construction, Tomlinson M. J., 6th Edition, Longman, 1995
3. Principles of Foundation Engineering, Design and Construction, Das B. M., 4th Edition, PWS Publishing, 1999

REFERENCES:

1. Foundation Design Manual, Narayan V. Nayak, Dhanpat Rai & Sons, 2006
2. Foundations for Machines, Analysis and Design, Prakash Shamsher and Puri Vijay K., John Wiley and Sons, 1988
3. 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1GT10) GEOTECHNICS FOR INFRASTRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To impart knowledge required for computing stress and settlement at any point due to foundation loads
- To evaluate the stability of foundations, slopes, cuts and retaining structures both for the conditions of undrained and drained loading through theorems of plastic collapses
- To apply the theories of elasticity and plasticity to soils
- To understand the theories of critical state soil mechanics

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Decide the type of mathematical models to be used for analyzing the behavior of soil mass at critical state

CO-2: Understand the elastic and plastic behavior of soils under various loads

CO-3: Stress deformation behavior for various loads and subsoil conditions

CO-4: Illustrate stress deformation behavior around underground openings

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	2	1	3	1
CO-2	3	-	3	1	3	1
CO-3	3	-	1	1	3	1
CO-4	3	-	1	1	2	1

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.

TEXT BOOKS:

1. Elastic Solutions for Soil and Rock Mechanics, Poulos H. G. & Davis E. H. John Wiley and Sons, 1974
2. Principles of Foundation Engineering, Das B. M., 5th Edition Nelson Engineering, 2004
3. Foundations of Theoretical Soil Mechanics, Harr M. E., McGraw Hill, 1966

REFERENCES:

1. An Introduction to the Mechanics of Soils and Foundation - Through Critical State Soil Mechanics, Atkinson J. H., McGraw Hill, 1993
2. Soil Behavior and Critical State Soil Mechanics, Wood D. M., Cambridge University Press, 1991

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2GT01) SOIL MECHANICS LABORATORY-I

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To know the concepts of various types of soils
- To understand the real-world problem related to geotechnical engineering
- To apply the knowledge of science, mathematics and engineering with the context of applications in geotechnical engineering
- To conduct experiments, analyze and interpret data related to the various laboratory tests studied in geotechnical engineering

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Identify the various types of soils existing at the site

CO-2: Apply techniques, skills, and modern engineering tools necessary for engineering practice

CO-3: Predict probable problems that may be encountered in any Geotechnical Engineering project

CO-4: Formulate and solve geotechnical engineering related issues

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	1	1	1
CO-2	3	-	3	2	1	1
CO-3	3	-	3	1	1	1
CO-4	3	1	3	3	3	1

LIST OF PRACTICALS:

1. Specific gravity of coarse- and fine-grained soils.
2. Grain Size Distribution Analysis:
   a) Sieve analysis and b) Hydrometer analysis
3. Cone penetrometer test
4. Atterberg Limits (Liquid Limit, Plastic limit, Shrinkage limit)
5. Visual Classification Tests
6. Test for relative density of sand
7. Standard and modified proctor compaction test
8. Falling head permeability test and Constant head permeability test
9. Consolidation test
10. Free swell index test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2GT02) SOIL MECHANICS LABORATORY-II

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To know the concepts of various types of soils
- To introduce traditional program consisting mostly of practical courses related to geotechnical engineering
- To apply the knowledge of science, mathematics, and engineering with the context of applications in geotechnical engineering
- To conduct experiments, analyze and interpret data related to the various laboratory tests studied in geotechnical engineering

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the suitable type of test for determining the shear strength of soils
CO-2: determine the soil density at filed condition
CO-3: Predict swelling behavior of soils
CO-4: investigate the stress, strain behavior of soils

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	2	3	1
CO-2	3	1	2	1	3	1
CO-3	3	1	2	1	2	1
CO-4	3	1	2	1	3	1

LIST OF PRACTICALS:

1. Unconfined compression test
2. Direct shear test
3. Tri-axial compression test
4. Laboratory vane shear test
5. Field Density test
6. Modified direct shear test
7. California Bearing Ratio test
8. Brazilian Test
9. Swell Pressure test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22SD5HS01) COMMUNICATION SKILLS FOR ACADEMIC AND RESEARCH WRITING

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To equip the students with an understanding of the mechanics and conventions of academic and research writing including cohesion and coherence to produce texts that demonstrate precision and clarity
- To enable students to present focused, logical arguments that support a thesis
- To empower the students to find, analyze, evaluate, summarize and synthesize appropriate source material for literature review
- To enable students to use appropriate language to analyze and interpret the data, and prepare an outline
- To enable students to become adept in the requirements and specifications of standard writing to produce academic and research papers

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of academic language features, and text structure and ensure cohesion and coherence as connected to various text types

CO-2: Demonstrate the use of writing process strategies through outlining, reviewing, composing, and revising

CO-3: Evaluate sources and use summary, analysis, synthesis, and integration to construct a literature review on a topic chosen by the student

CO-4: Prepare an outline for Research Articles and Thesis

CO-5: Apply standard documentation style to produce academic and research papers that meet the demands of specific genres, purposes, and audiences

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	3	1	-	2
CO-2	2	3	3	1	-	2
CO-3	2	3	3	1	-	2
CO-4	3	3	3	1	-	1
CO-5	3	3	3	1	-	2

UNIT-I:

a) Factors Influencing Effective Writing: Mechanics of Writing, Purpose of Writing, Audience/reader, Organisation- Cohesion, and Coherence

b) Features of Academic Writing: Introduction, Complexity, Formality, Precision, Objectivity, Explicitness, Accuracy and Appropriacy, Relevance, Hedging

UNIT-II:

1. Academic Writing Forms:

a) Analysing arguments; Building an argument
b) Making a Counter Argument- Managing tone, and tenor

2. Types of Research: Primary and Secondary Research;
3. Research Design: Statement of the Problem, Survey of relevant literature, Writing Hypotheses, Developing Objectives; Research Tools

UNIT-III:

a) Criteria of Good Research- Avoiding Plagiarism
b) Data Interpretation
c) Preparing an outline for Research Articles & Research Reports

UNIT-IV:

a) Reference Skills -Paraphrasing (Change of parts of speech, word order, synonyms, using the passive form), -Summarizing (Steps in summarising)
b) Documentation Format: APA style
c) Documentation Format: MLA style

UNIT-V:

a) Writing Article Reviews
b) Report Writing: a) Writing Technical Reports b) Writing Proposals

TEXT BOOKS:

1. A Course in Academic Writing, Gupta R., Orient Black Swan, 2010
2. Academic Writing: Exploring Processes and Strategies, Leki I., CUP, 1998
3. Writing-up Research: Experimental Research Report Writing for Students of English, Weissberg R., & Buker S., Englewood Cliffs, Prentice Hall, 1990

REFERENCES:

1. English Academic Writing for Students and Researchers. Yakhontova T., 2003
2. Inside Track: Successful Academic Writing, Gillett A., Hammond A., Martala M., Pearson Education, 2009
3. English for Academic Research: Writing Exercises, Wallwork, Springer, 2013
4. The MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association
5. Academic Writing for Graduate Students: A Course for Non-native Speakers of English, Swales J. M., & Feak C. B., University of Michigan Press, 1994

ONLINE RESOURCES:

1. https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/support-for-students/academic-writing-resources/
2. https://www.biz-e-training.com/resources-for-learners/academic-writing-online-resources/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22MN6HS01) REASEARCH METHODOLOGY AND IPR

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand research problem formulation

CO-2: Analyze research related information & Follow research ethics

CO-3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO-4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

CO-5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	-	2	2	3	3
CO-2	3	-	2	2	3	3
CO-3	3	2	-	2	-	3
CO-4	3	2	-	2	-	3
CO-5	3	2	-	2	-	-

UNIT–I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT–II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT–III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT–IV:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT–V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System.
New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS:

1. Research Methodology: An Introduction for Science & Engineering Students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition

REFERENCES:

1. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd., 2007
2. Industrial Design, Mayall, McGraw Hill, 1992
3. Product Design, Niebel, McGraw Hill, 1974
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
5. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1GT04) DYNAMICS OF SOILS AND FOUNDATIONS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Soil Mechanics, Foundation Engineering, Physics, Mathematics, Strength of Materials

COURSE OBJECTIVES:

- To understand the fundamental concepts of vibrations
- To calculate and assess liquefaction behavior of soil
- To determine the dynamic properties of soil by conducting laboratory and field test
- To design foundation for supporting different types of vibrating machines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Differentiate propagation of body waves and surface waves through soil
CO-2: Perform different methods for estimation of dynamic soil properties required for design purpose
CO-3: Predict dynamic bearing capacity and assess liquefaction potential of any site
CO-4: Apply theory of vibrations to design machine foundation based on dynamic soil properties and bearing capacity

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	2	3	1
CO-2	3	1	2	2	1	1
CO-3	3	1	3	3	3	2
CO-4	3	1	3	3	2	1

UNIT-I:
Fundamentals of Vibrations: single, two and multiple degree of freedom systems, vibration isolation, vibration absorbers, vibration measuring instruments. Wave Propagation- elastic continuum medium, semi-infinite elastic continuum medium, soil behaviour under dynamic loading.

UNIT-II:
Liquefaction of Soils: liquefaction mechanism, factors affecting liquefaction, studies by dynamic tri-axial testing, oscillatory shear box, shake table and blast tests, assessment of liquefaction potential.

UNIT-III:

Dynamic Elastic Constants of Soil: determination of dynamic elastic constants, various methods including block resonance tests, cyclic plate load tests, wave propagation tests, oscillatory shear box test.

UNIT-IV:

Machine Foundations: Design criteria for machine foundations; Elastic homogeneous half space and lumped parameter solutions, analysis and design of foundations for reciprocating and impact type machines, turbines, effect of machine foundation on adjoining structures.

UNIT-V:

Dynamic Bearing Capacity of Foundations: Introduction to bearing capacity of dynamically loaded foundations, Pseudo-static Analysis, Bearing capacity of Footings, Dynamic Analysis, response of pile foundations.

TEXT BOOKS:

1. Handbook of Machine Foundations, Srinivasulu P., Vaidyanathan C. V., Tata McGraw Hill Education, 1976
2. Soil Dynamics and Machine Foundation, Swami Saran, Galgotia Publishing, 1999

REFERENCES:

1. Design of Structures and Foundations for Vibrating Machines, Arya S. D., O'Neil M. and Pincus G., Gulf Publishing Co., 1979
2. Foundation for Machines: Analysis and Design, Prakash S. and Puri V. K., John Wiley & Sons, 1998
3. Soil Dynamics, Prakash S., McGraw Hill, 1981
4. Vibration Analysis and Foundation Dynamics, Kameswara Rao N. S. V., Wheeler Publication Ltd., 1998
5. Dynamics of Structures and Foundation, I. Chowdhary and S. P. Dasgupta, 2009

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1GT05) DESIGN WITH GEO-SYNTHETICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To create awareness of the latest trends, modern standards and state of the art techniques for solving geotechnical engineering problems
- To develop an ability to design a geosynthetic system to meet desired needs such as economic, environmental and sustainability related
- To identify latest trends in the curriculum consisting mostly of practical courses in numerous special aspects of civil engineering
- To apply the basic knowledge and to solve critical civil engineering problems in the field like landslides, pavements, dams etc.

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Describe different concepts used in Civil Engineering
CO-2: Identify the critical awareness of current issues in Geotechnical Engineering
CO-3: Examine the various techniques, skills, and modern engineering tools for successful carrier in geotechnical engineering practices
CO-4: Solve various Geotechnical Engineering problems using geosynthetics

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	3	-	-
CO-2	2	2	3	2	-	-
CO-3	3	2	3	1	2	-
CO-4	2	2	3	2	-	-

UNIT-I:
An Overview of Geosynthetic: Geosynthetics classifications, functions, applications, raw materials used. Different types of Geosynthetics, manufacturing, Design, and sustainability

UNIT-II:
Geosynthetic Testing: Various properties of Geosynthetics - physical properties, mechanical properties, hydraulic properties & endurance properties.

UNIT-III:
Geosynthetic in Filtration, Drainage and Erosion Control: Mechanism of filtration and drainage functions & their applications, Design step for erosion control and geocomposite drainage Geosynthetics in Pavements & Embankments: Mechanisms and concept of pavement, design of unpaved road, Giroud and Noiray method, U.S.

Forest services, reflection cracking, pavement rehabilitation and repair -Design of basal reinforced embankment, placement of Geosynthetics, construction procedure, widening of existing road embankments

UNIT-IV:

Geosynthetic in Reinforced Soil Retaining Wall & Slopes: Different types of facing elements, construction procedure, design of Geosynthetics wrap around faced wall, geogrid reinforced soil walls, geocell wall, gabion wall. Design of reinforced slopes, guidelines for design of reinforced slopes

UNIT-V:

Geosynthetic in Ground Improvement, Landfills & Bearing Capacity: Consolidation techniques, Development of design chart for prefabricated vertical drains, ground instrumentation and monitoring, Design of encased stone columns, geocell/geofoam systems.

Design of landfill liners, Bearing capacity of Geosynthetics reinforced soil system, geocell reinforced sand overlaying soft clay

TEXT BOOKS:

1. Geosynthetics – An Introduction, G. V. Rao, Sai Master Geo-environmental Services Pvt. Ltd. Hyderabad, 2011
2. Designing with Geosynthetics, Vol. 1, Koerner R. M., 6th Edition, Xlibris Corporation, 2012

REFERENCES:

1. Engineering Principles of Ground Modifications, Hausmann M. R., McGraw Hill Ryerson Limited, 1990
2. Ground Control and Improvement, Xianthakos Abremson and Bruce, John Wiley & Sons, 1994
3. Ground Improvement, Mosley, 2nd Edition, CRC Press, 2004
4. Earth Reinforcement and Soil Structures, Jones C. J. F. P., Elsevier, 2013

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1GT06) EARTH RETAINING STRUCTURES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Soil Mechanics

COURSE OBJECTIVES:
- To describe the theoretical concepts considered in design of retaining structures
- To explain and arrive at the design methodology prescribed for various retaining structures
- To identify the kind of retaining structure required to serve the design purpose adequately
- To connect the knowledge gained to real life earth retaining structure problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Describe different concepts and terms used in retaining structures
CO-2: Identify various formulae used and the design procedures of different retaining structures
CO-3: Relate and explain the effectiveness of any kind of retaining structure for a given situation
CO-4: Analyze the retaining structures using the appropriate methodology and formulas

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	2	-	-
CO-2	2	1	3	2	-	-
CO-3	2	1	3	3	-	-
CO-4	2	2	3	2	-	-

UNIT-I:
Earth Pressure: Rankine and Coulomb theories, active, passive and pressure at rest; concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill. Retaining Walls- Types of retaining walls, proportioning of retaining walls, stability of retaining walls, mechanically stabilized retaining walls/reinforced earth retaining walls.

UNIT-II:
Sheet Pile Walls: Construction methods- Cantilever and Anchored sheet pile wall, free earth system, fixed earth system.

UNIT-III:

Bulkheads: Bulkheads with free and fixed earth supports, equivalent beam method, Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates.

UNIT-IV:

Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits; Arching and Open Cuts: Arching in soils- Analysis of Arching in Soil.

UNIT-V:

Braced Excavations: Earth pressure against bracings in cuts-Design of various components, Heave of the bottom of cut in soft clays, Diaphragm walls –slurry support; Soil Nailing.

TEXT BOOKS:

1. Principles of Foundation Engineering, Das B. M, 8th Edition, Cengage Learning, 2015
2. Foundation Analysis and Design, Bowles J. E., 5th Edition, Tata McGraw Hill International, 1997

REFERENCES:

1. Foundation Engineering Handbook, Rowe R. K., Springer Science & Business Media, 2001
2. Foundation Engineering Handbook, Winterkorn and Fang, Springer Science & Business Media, 2013
3. Foundation Analysis & Design, Bowles J. E., 5th Edition, McGraw Hill, 2004

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1HW04) PAVEMENT ANALYSIS AND DESIGN

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the design factors considered for the design of flexible and rigid pavements
- To estimate the stresses and strains in flexible pavement from layer theories
- To determine the stresses and strain for rigid pavement analysis
- To learn various design methods for flexible and rigid pavement

COURSE OUTCOMES: After the completion of the course student should be able to

CO-1: Explain the design factors used for flexible and rigid pavements

CO-2: Determine the stresses and strains in a flexible pavement using the multi-layered elastic theory and KENPAVE

CO-3: Compute stresses and strains in a rigid pavement using Westergaard's theory and KENSLABS

CO-4: Design flexible and rigid pavement using various methods

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	-	-	1	2
CO-2	3	1	3	2	3	-
CO-3	3	1	3	2	3	-
CO-4	3	2	3	2	2	2

UNIT–I:

Introduction: Historical development of pavements; Introduction to different types of flexible pavements; Road Pavements and pavement layers - types, functions, choice Factors affecting design, Introduction to traffic loading, Understanding the concept of equivalent standard axle load (ESAL), ESWL, EWL, VDF due to varying loads.

UNIT–II:

Stresses and Deflection / Strain in Flexible Pavements: Application of elastic theory, stresses, deflections / strains in single, two layer and multi-layer system, Analysis of pavements using software such as IITPAVE and KENPAVE.

UNIT–III:

Flexible Pavement Design: Empirical, semi-empirical, and theoretical design approaches, principle, advantages, and application; Outline of other common design methods such as AASHTO: Mechanistic-Empirical Pavement Design Guide - I

(MEPDG); Flexible Pavement Design as per IRC:37-2018; Overlay design - flexible pavements as per IRC guidelines IRC:115-2014

UNIT–IV:

Stresses in Rigid Pavements: Types of stresses and causes; Introduction to Westergaard's equation for calculation of stresses in rigid pavements due to wheel loads and temperature; Considerations in rigid pavement analysis, wheel load stresses, warping stresses, frictional stresses, combined stresses, KENSLAB.

UNIT–V:

Rigid Pavement Design: Design of cement concrete pavements for highways; PCA and AASHTO Methods: Design of joints, reinforcements, tie bars, dowel bars and slab thickness as per IRC 58 2015. Design features of continuously reinforced concrete pavements. Mechanistic-Empirical Pavement Design Guide - II (MEPDG). Overlay design - flexible pavements as per IRC guidelines IRC:117-2015

TEXT BOOKS:

1. Pavement Design and Materials, Papagiannakis A. T. and E. A. Masad, John Wiley
2. Pavement Analysis and Design, Huang Y .H., 2nd Edition, Dorling Kindersley (India) Pvt. Ltd.
3. Asphalt Institute. Thickness Design – Asphalt Pavements for Highways and Streets Manual Series No. MS-2, Asphalt Institute

REFERENCES:

1. The Design And Performance of Road Pavements, Croney D. and P. Croney, McGraw Hill Book Company
2. Mechanistic-Empirical Pavement Design Guide, A Manual of Practice, Interim Edition, Publication Code: MEPDG-1, American Association of State Highway and Transportation Officials (AASHTO)
3. IRC: 37-2018 Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi, India
4. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, The Indian Roads Congress, New Delhi, India
5. Ministry of Road Transport and Highways. Specifications for Road and Bridge Works, Fifth Edition, Indian Roads Congress, New Delhi, India, 2015

ONLINE RESOURCES:

1. http://onlinepubs.trb.org/onlinepubs/archive/mepdg/home.htm
2. http://www.asphaltinstitute.org/thicknessdesignsw/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT11) EARTH AND ROCKFILL DAMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To differentiate between the various kinds of structures depending upon its composition and usage
- To impart the ability to design dams without leading to failure
- To recognize the importance of various hazards involved in building dams and to take up suitable precautions or repairs
- To identify the type of material which is appropriate for the purpose

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the appropriate formulae to be used in the design of various structures
CO-2: Classify and design a dam with high efficiency
CO-3: Interpret the knowledge gained to solve problems in the field
CO-4: Differentiate & select the methods of providing drainage in earthen dams

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	-	1	-
CO-2	3	2	3	-	1	-
CO-3	3	3	2	-	-	-
CO-4	3	2	3	-	-	-

UNIT-I:
Earthen Dams: General features, Selection of site; Merits and demerits of the earth dams. Design of Earthen Dams- Classification of earth dams, Materials of construction and requirements, Causes of failure, Nature and importance of failure, Safe design criteria.

UNIT-II:
Instrumentation in Earth Dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, seismic measurements.

UNIT-III:
Failures and Prevention in Earthen Dams: Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control and Filter design.

UNIT-IV:

Rock-fill Dams: Types and Historical development, General characteristics of Rock fill dams, Requirements of compacted rock fill, Merits and demerits of the Rock fill dams.

UNIT-V:

Strength and Settlement: Materials for the Rock fill dams, Shear strength of rock fill, Settlement for Rock fill dams, Movements in rock fill dams.

TEXT BOOKS:

1. Earth and Earth Rock Dams, Sherard, John Wiley, 1967
2. Earth and Rockfill Dams, Sowers G. F. and Salley H. I., Asia Pub. House, 1962

REFERENCES:

1. Earth and Rockfill Dams, Bharat Singh and Sharma H. D., Central Board of Irrigation and Power, 1986
2. Earth & Rockfill Dams–Principles of Design and Construction, Christian Kutzner, Oxford and IBH, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT12) ENVIRONMENT AND ECOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To create ability to identify, formulates, and solve environment related problems
- To develop an understanding of professional responsibility
- To understand the impact of engineering solutions in economic and environmental context
- To apply the knowledge of recent environmental issues

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Develop an ability to apply knowledge of environment and ecology to solve problems

CO-2: Design a process for economic and safe aspects for the society

CO-3: Interpret, formulate and solve stability related problems

CO-4: Predict and analyze the recent environmental issues

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	2	1	-
CO-2	3	2	1	3	1	1
CO-3	3	2	1	3	2	-
CO-4	3	2	1	3	2	1

UNIT-I:

Environment: Introduction, Components of Environment, types of Environments, Environmental Ethics Ecosystems: Concept of an ecosystems, structure and functions of Ecosystem, producers, consumers and decomposers, energy flow and bio geo chemical cycles.

UNIT-II:

Ecological Succession Food Chains: Food webs and ecological pyramids, types, characteristic feature structures and functions of eco system.

UNIT-III:

Human Population and Environment: Population growth, variation among nations-Biotech potential and population growth, growth rate formula, carrying capacity, variation among nations, demographic transition, Developed and developing countries, Population explosion, consumption and affluence urbanization and environmental impacts, Industrialization and environmental impacts, family welfare program, immunization.

UNIT-IV:

Recent Environmental Issues: Global warming, Global dimming Greenhouse gas, Ocean acidification, Urban Heat Islands, Ozone depletion- CFC, Biological effects of UV exposure, Nuclear Issues: Nuclear fallout, Nuclear meltdown, Nuclear power, Nuclear weapons, Nuclear and radiation accidents, Nuclear safety, High-level radioactive waste management.

UNIT-V:

Environmental Pollution: Nonpoint source pollution, Point source pollution, Light pollution, Noise pollution, Visual pollution Water Pollution: Acid rain, Eutrophication, Marine pollution, Ocean dumping, Oil spills, Thermal pollution, Land Degradation: Land pollution, Desertification, Soil conservation, Soil erosion, Soil contamination, Soil salination, Alkali soils. Air Pollution: Effects and control of air pollution, Smog, Troposphere ozone, Indoor air quality, volatile organic compound, atmospheric particulate matter, effects and control, control devices.

TEXT BOOKS:

1. Comprehensive Environmental Studies, Dr. J. P. Sharma, Laxmi Publications, 2009
2. Text Book of Environmental Studies, Dr. K. Raghavan Nambiar

REFERENCES:

1. Text Book of Environmental Studies, Kaushik, New Age Publishers, 2009
2. Environmental Science, Tyley Miller, 11th Edition, Cengage Learning, 2005
3. Concepts of Ecology, E. J. Kormondy, Prentice-Hall, 1969

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT13) NUMERICAL METHODS FOR GEOTECHNICAL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To impart the basic concepts of mathematical modeling of problems in Geotechnical engineering
- To learn procedures for solving different kinds of problems
- To understand the various numerical techniques which provide solutions
- To nonlinear equations, partial differential equations etc. that describe the mathematical models of problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Know solutions to simultaneous equations
CO-2: Formulate equations for given data
CO-3: Calculate differentiation and integration problems using numerical methods
CO-4: Solve ordinary and partial differential equations

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	3	-	-	-
CO-2	3	2	3	-	-	-
CO-3	3	1	3	-	-	-
CO-4	3	2	3	-	-	-

UNIT–I:
Approximations and Errors in Numerical Methods - Solutions of Algebraic and Transcendental Equations, Bisection, False Position, Secant & Iterative Methods, Newton- Raphson, 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, Applications.

UNIT–III:
Interpolation – Lagrange's, Newton's, Hermite's, Spline, Inverse Interpolation, Applications. Curve Fitting – Least Square regression

UNIT–IV:
Numerical Differentiation & Integration – Finite differences, Newton's difference formulae- Derivatives, Maxima and Minima of a Tabulated Function; Integration – Quadrature, Romberg's, Euler-Maclaurin, 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.

TEXT BOOKS:
1. Numerical Methods in Engineering & Science, Grewal, B. S., Khanna Publishers, 1999
2. Numerical Methods in Geotechnical Engineering, Desai C. S. and Christian J. T., McGraw Hill

REFERENCES:
1. Numerical Methods for Engineers, Chapra S. C. & Canade R. P., McGraw Hill, 2011
2. Numerical Methods For Engineers and Scientists, Joe D. Hoffman, Steven Frankel, 2nd Edition, 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT14) PHYSICAL AND CONSTITUTIVE MODELING ON GEOMECHANICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand geotechnical modeling considerations
- To select model to simulate field conditions
- To use and acquire data using various instruments
- To compare with recent development geotechnical modelling

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: To understand scaling laws and modeling considerations for physical modeling in geotechnical problems both for static and dynamic conditions

CO-2: To comprehend physical modeling, scale effects, simulation of field conditions, conceptualization, and fixing boundary conditions etc.

CO-3: Data acquisition for all the conditions

CO-4: To know new improvements in physical modeling to comprehend physical modeling, scale effects, simulation of field conditions, conceptualization, and fixing boundary conditions etc.

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	3	2	1
CO-2	2	2	2	2	2	1
CO-3	2	1	2	2	1	1
CO-4	3	2	2	2	2	1

UNIT–I:

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

UNIT–II:

Design of Physical Model and Model Ground Preparation: scale effects, flexible and rigid boundary conditions, preparation of sand/clay bed preparation, wet pluviation, dry pluviation, tamping techniques, slurry consolidation, uniformity of sand/clay beds.

UNIT–III:

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

UNIT–IV:

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

UNIT–V:

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

TEXT BOOKS:

1. Geotechnical Modelling, David Muir Wood, Spon Press, Taylor & Francis, 2004
2. Centrifuge Modeling for Civil Engineers, Madabhushi G., CRC Press, Taylor and Francis, 2015
3. Geotechnical Centrifuge Technology, Taylor R. N., Taylor and Francis, 1995

REFERENCES:

1. Proceedings of 6th International Conference on Physical Modeling in Geotechnics, Charles N. G., Zhang L. M., and Wang Y. H., Hong Kong, 2006
2. Proceedings of the 7th International Conference on Physical Modelling in Geotechnics, S. Springman, J. Laue & L. Seward, Zurich, Switzerland, 2010
3. Proceedings of the 8th International Conference on Physical Modeling in Geotechnics, Gaudin C. & White D. Perth, Australia, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT15) FEM IN GEOTECHNICAL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To provide the fundamental concepts of the theory of the finite element method
- To develop proficiency in the application of the finite element method to realistic engineering problems
- To understand the theory of elasticity including strain/displacement and Hooke's law relationships
- To learn to model complex geometry problems and solution techniques

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Understand basic stress-strain relationship for soil and develop Stress deformation analysis

CO-2: Develop finite element formulation for different geotechnical problems like shallow foundation

CO-3: Apply this knowledge onto Plaxis for plotting stress distribution and settlement curves

CO-4: Analyze and give appropriate solution to practical geotechnical concerns like seepage and consolidation problems

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	-	3	-
CO-2	3	3	2	-	2	-
CO-3	3	2	3	-	3	-
CO-4	3	1	3	1	3	-

UNIT-I:

Stress-Deformation Analysis: One dimensional, Two dimensional and Three-dimensional formulations.

UNIT-II:

Discretization: Discretization of a Continuum, Elements, Strains, Stresses, Constitutive Relations, Hooke's Law, Formulation of Stiffness Matrix, Boundary Conditions, Solution Algorithms.

UNIT-III:

Principles of Discretization: Element stiffness and mass formulation based on direct, variational and weighted residual techniques and displacements approach, Shape functions and numerical integrations, convergence.

UNIT-IV:

Displacement Formulation: Displacement formulation for rectangular, triangular and iso- parametric elements for two dimensional and axisymmetric stress analysis.

UNIT-V:

Settlement Analysis: 2-D elastic solutions for homogeneous, isotropic medium, Steady Seepage Analysis. Finite element solutions of Laplace's equation, Consolidation Analysis: Terzaghi consolidation problem, Choice of Soil Properties for Finite Element Analysis.

TEXT BOOKS:

1. Concepts and Applications of Finite Element Analysis, Robert D. Cook, David S. Malkus, Michael E. Plesha, John Wiley & Sons
2. Fundamentals of Finite Element Analysis, David V. Hutton, McGraw Hill

REFERENCES:

1. Finite Element Analysis, Seshu P., Prentice-Hall of India, 2005
2. Finite Element Methods in Engineering, Belegundu A. D., Chandrupatla T. R., Prentice Hall India, 1991
3. Finite Element Methods Vol. I & Vol. II, O. C. Zienkiewicz and R. L. Taylor, McGraw Hill, 1989 & 1992
4. Finite Element Procedures, K. J. Bathe, PHI Ltd., 1996
5. Finite Element Analysis in Geotechnical Engineering Theory and Application, David M. Potts and Lidija Zdravkovic, Thomas Telford, 1999

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT16) GEOGRAPHICAL INFORMATION SYSTEM

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To describe and define various concepts of remote sensing and GIS
- To enable the students to analyze remote sensing and GIS data
- To make the students appraise the importance accuracy of remote sensing and GIS data
- To enable the students to apply remote sensing and GIS knowledge in solving various Geotechnical engineering related problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Describe different concepts and terms used in remote sensing and GIS
CO-2: Compare and process different data sets
CO-3: Evaluate the accuracy and decide whether a data set can be used or not
CO-4: Demonstrate various applications in RS and GIS

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	-	-	-	1	-
CO-2	2	-	-	1	1	-
CO-3	3	-	-	3	3	-
CO-4	3	-	3	2	3	2

UNIT-I:
Remote Sensing: Introduction- Principle of remote sensing, components of remote sensing, Remote sensing platforms, Radiometric quantities, Electromagnetic radiation and its properties, Electromagnetic energy laws, Interaction of EMR with earth features, Interaction of EMR with atmospheric features, atmospheric effects on remote sensing data, spectral reflectance curves, Spectral properties of soil, water, vegetation. Advantages and Disadvantages of Remote Sensing Data.

UNIT-II:
Sensors and Satellites: Sensors - Remote sensing sensors types, Along track scanners, Across track scanners Sensor Characteristics – Swath, IFOV, Nadir view, Spatial Resolution, Spectral Resolution, Temporal, Resolution, Radiometric resolution, Atmospheric, Radiometric, Geometric corrections Satellites- Satellite orbits, Geostationary and polar satellites, various satellites and their main applications, IRS satellites

UNIT-III:

Remote Sensing Data Processing and Enhancement: Image enhancement techniques - necessity and importance, contrast enhancement techniques, low pass (smoothing) filters and high pass (sharpening) filters, linear and non-linear filtering techniques, edge detection, supervised classification, unsupervised classification, and Classification accuracy. Introduction to GPS and DGPS.

UNIT-IV:

Geographical Information System: Introduction, Definition and Terminology, Components of GIS, GIS Data Input - Keyboard entry, Manual digitizing, scanning methods, Errors in digitizing, Data output formatting and output devices, GIS Data Models – Raster, Vector, TIN, Spatial Data Analysis – Interpolation, Buffering techniques, Overlay operations

UNIT-V:

Applications of GIS in Geotechnical Engineering: Developing a Soil information system for Multiple decisions, GIS and Remote Sensing based Soil mapping, Soil moisture investigation, land slide hazard zonation using remote sensing and GIS, Land use land cover classification, Agriculture applications, Dam site selection using RS and GIS

TEXT BOOKS:

1. Remote Sensing and Image Interpretation, Thomas M. Lillesand and Ralph W. Kiefer, 7th Edition, John Wiley & Sons, 2014
2. Remote Sensing and GIS, Basudeb Bhatta, Oxford University Press, 2008

REFERENCES:

1. Introduction to Geographic Information Systems, Kang-tsung Chang, 7th Edition, McGraw Hill Education, 2013
2. Basics of Remote sensing and GIS, S. Kumar, Laxmi Publications, 2005
3. Textbook of Remote Sensing and Geographical Information Systems, M. Anji Reddy, 3rd Edition, B. S. Publications, 2008
4. Textbook of Remote Sensing and Geographical Information Systems, Kali Charan Sahu, Atlantic Publishers and Distributors, Atlantic Publishers, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT17) STABILITY ANALYSIS OF SLOPES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To inculcate the ability to identify, formulate and solve soil stability related problems
- To impart the ability to design soil slopes without leading to failure
- To recognize the importance of various hazards involved in building slopes and dams and to take up suitable precautions or repairs
- To apply limit equilibrium methods for slopes

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify the appropriate formulae to be used in the design of various structures
CO-2: Analyze a given structure and predict its behavior
CO-3: Design and check stability of slope with high efficiency
CO-4: Identify the appropriate the slope stabilization methods

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	2	2	-	1	-
CO-2	2	2	2	-	1	-
CO-3	2	1	2	1	2	1
CO-4	-	1	1	1	-	1

UNIT-I:
Slope Stability Analysis: Types and causes of slope failures, mechanics of slope failure, failure modes. Infinite and finite slopes with or without water pressures; concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods.

UNIT-II:
Stability Methods: Friction circle method; Method of slices, Bishop's method, Janbu's method, Morgenstern and Price, Spencer's method

UNIT-III:
Stability Analysis in the Presence of Seepage: Two-dimensional flow – Laplace equation and it's solution, graphical method, determination of phreatic line, flow nets in homogeneous and zoned earth dams under steady seepage and draw-down conditions, seepage control in earth dams, influence of seepage on slope stability, stability analysis of dam body during steady seepage.

UNIT-IV:

Strengthening Measures: Stabilization of slopes by drainage methods, surface and subsurface drainage, use of synthetic filters, retaining walls, stabilization and strengthening of slopes.

UNIT-V:

Rock Stabilization: Shotcreting, rock bolting and rock anchoring, instrumentation and monitoring of slopes, slope movements, warning devices, maintenance of slopes

TEXT BOOKS:

1. Geotechnical Slope Analysis, Chowdhary R. and Chowdhary I., CRC Press
2. Ground Water and Seepage, Harr M. E., McGraw Hill

REFERENCES:

1. Soil Strength and Slope Stability, Duncan J. and Wrught G., Wiley Publishers
2. Slope Stability and Stabilization Methods, Abramson L. W., Lee T. S. and Sharma S., John Wiley
3. The Stability of Slopes, Bromhead E. N., 2nd Edition, Blackie Academic and Professional, 1992

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT18) UNSATURATED SOIL MECHANICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To differentiate gravimetric and volumetric water content
- To determine unsaturated shear parameters
- To appreciate mechanical behaviour of unsaturated soils
- To gain knowledge on principles of unsaturated soil by constructing Soil Water characteristics curve

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Interpret the Soil Water characteristic curves
CO-2: Comprehend the unsaturated flow
CO-3: analyze the stress state variables
CO-4: apply the unsaturated strength behaviour to Engineering structures

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	2	-	-
CO-2	2	2	3	1	-	-
CO-3	2	2	3	1	-	-
CO-4	2	2	3	2	-	-

UNIT-I:
Introduction: Unsaturated soil, Gravimetric and Volumetric water content, Pore water pressure, Matric and Osmotic suction, Soil Water Characteristic Curve (SWCC), Hysteresis in SWCC, Methods to determine SWCC

UNIT-II:
Seepage in Unsaturated Soil: Permeability and Hydraulic Conductivity, Hydraulic Conductivity Function (HCF), One-dimensional steady state flow, Darcy's and Gardner's Principles, Transient Flow, Infiltration, Numerical Modelling, Capillary Barriers.

UNIT-III:
Strength Characteristics of Unsaturated Soil: Extended Mohr Coulomb's criterion, Shear strength and pore pressure parameters, Measurements of unsaturated shear strength parameters; Unsaturated shear strength models

UNIT-IV:
Stability Analysis of Unsaturated Soils: Applications in Bearing Capacity, Lateral Earth Pressure, and Slope stability in Unsaturated soils

UNIT-V:

Volume Change Behavior of Soils: Stress state variables for unsaturated soils, Stress Deformation Behavior, Volumetric continuity, Volume-Mass Constitutive Relations, Swelling and Collapse behavior

TEXT BOOKS:

1. Unsaturated Soils: A Fundamental Interpretation of Soil Behaviour, Murray E. J. and Shivakumar V., 1st Edition, Wiley-Blackwell, 2010
2. Unsaturated Soil Mechanics, Ning Lu and William J. Likos, John Wiley, 2004

REFERENCES:

1. Advanced Unsaturated Soil Mechanics and Engineering, Charles W. W. Ng, and Menzies B., 1st Edition, CRC Press, 2007, (Reprint 2019)
2. Soil Mechanics for Unsaturated Soils, Fredlund D. G. and Rahardjo H., 1st Edition, John Wiley, 1993

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1GT19) GEOTECHNICAL ASPECTS OF LANDFILLS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To identify the physical characteristics of landfill materials
- To design suitable liner systems at landfill locations
- To perform stability analysis of landfill slopes
- To asses suitable cover systems during post closure conditions

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Characterize the landfill materials and determine landfill properties
CO-2: Select suitable sites for constructing landfills
CO-3: Design of suitable liner and cover systems
CO-4: Adopt developments in landfill Engineering and monitoring

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	1	3	1	2
CO-2	2	2	2	3	2	3
CO-3	3	1	3	3	3	3
CO-4	3	1	3	3	1	2

UNIT-I:
Geotechnical Characterization of Landfills: Physical Characterization of landfill material (Size distribution, Porosity, Moisture content, Field capacity, Wilting point, Unit weight, Hydraulic conductivity, Shear strength, Compressibility), Dynamic Properties; Landfill regulations (USEPA, RCRA).

UNIT-II:
Landfill Configurations: Landfill siting methodology; liner systems and properties; Recommended Design Procedure; Geomembranes, Geosynthetic Clay Liners (GCL's); Soil Drainage Layer and various materials used for providing drainage, Interface effect among various liner components; Liner system performance, estimation of leakage, Rate of flow through composite liner.

UNIT-III:
Stability of Landfills Slopes: Sliding Failure of Leachate Collection System and Final Cover System; Rotational Failure of Landfill Waste, Liner, and Subsoil; Translational Failure along the Liner System; Two Part Wedge Failure Mechanism; Vertical expansion of MSW landfills, Geosynthetics for Reinforcement, Three Part Wedge Failure Mechanism, Stability under seismic conditions.

UNIT-IV:

Analysis and Design of Veneer Cover Soils: Seismic Analysis of Veneer Cover Soil, Geosynthetic Reinforced Veneer Slopes, Seepage Induced Veneer Slope Instability: Horizontal seepage build-up and Parallel-to-slope seepage build-up.

UNIT-V:

Landfill Closure conditions: Hydraulic and Structural Design Criteria for Drainage Layer Material, stresses due to liner self-weight, temperature, expansion, and contraction. Anchor Trenches; Design of Final Cover Systems; Alternate Cover Systems and Materials. End Uses of Closed Landfills, Typical Landfill failures and mitigation measures.

TEXT BOOKS:

1. Solid Waste Management and Engineered Landfills, Rao G. V. and Sasidhar R. S., Sai Master Geo environmental Services Pvt. Ltd., Hyderabad, 2009
2. Geotechnical Aspects of Landfill Design and Construction, Xuede Qian, Robert M. Koerner, Donald H. Gray, Prentice Hall, 2002

REFERENCES:

1. Sustainable Engineering: Drivers, Metrics, Tools, and Applications, Claudio Cameselle, Jeffrey A. Adams and Krishna R. Reddy, Wiley, 2019
2. Geoenvironmental Engineering, Hari D. Sharma, Krishna R Reddy, John Wiley, 2004
3. Waste Disposal in Engineered Landfills, Manoj Datta, Narosa Publishing House, 1997

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2GT03) ADVANCED GEOTECHNICAL ENGINEERING LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To know the effect of contamination on the behavior of soil
- To identify the influence of stress on the permeability of soil
- To determine the properties of geosynthetics
- To conduct in situ experiments on soil

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Evaluate the field properties of soil
CO-2: Identify suitability of geosynthetics for specific application
CO-3: Understand the influence of contaminants on the chemical properties of soil
CO-4: Perform experiments to determine the variation permeability with the application of pressure

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	1	2	1
CO-2	2	2	3	2	1	1
CO-3	2	1	1	3	2	2
CO-4	2	2	2	1	3	1

LIST OF EXPERIMENTS:

1. Exploration of sub soil by Auger Boring
2. Dynamic cone penetration test
3. Determination of permeability using Flexi wall permeameter
4. Determination of pH, electrical conductivity and total dissolved solids in contaminated soil
5. Estimation of specific surface area of soil
6. Determination of chlorides, hardness and presence of organic content in soil
7. Measurement of physical properties of Geosynthetic materials
   a) Thickness
   b) Stiffness
   c) Mass/ unit area
8. CBR Puncture test for geosynthetics
9. Determination of percentage open area and apparent opening size for geosynthetics material
10. Radial in-plane flow test on geotextiles

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2GT04) GEOTECHNICAL ENGINEERING STUDIO

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To apply theoretical knowledge on the numerical computation techniques
- To analyse the stability the slope using softwares
- To create templates for the design different types of foundation
- To design land fill liner, embankments, retaining earth structures etc.

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Conduct stress deformation analysis using softwares
CO-2: Perform stability analysis of slopes, embankments, and retaining earth structures
CO-3: Evaluate the amount of contamination on the field
CO-4: Design templates for the design of various geotechnical structures

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	3	1	3	1
CO-2	3	1	3	2	3	2
CO-3	2	1	1	3	3	2
CO-4	2	1	3	2	3	1

LIST OF PRACTICALS:

1. Design of templates for foundations using MS Excel
2. Slope stability Analysis using Slope/W
3. Contaminant transport analysis using CTRAN
4. Creation of template for design of land fill liners using MS Excel
5. Creation of template for the design of Machine Foundations
6. Numerical Analysis of settlement of footing using PLAXIS
7. Finite Element analysis of construction of embankment using PLAXIS
8. Deformation analysis due to tunnel construction using PLAXIS
9. Linear frequency analysis using DEEP SOIL
10. Equivalent linear frequency domain analysis using DEEP SOIL

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4GT02) MINI-PROJECT

TEACHING SCHEME

L	T/P	C
0	4	2

CIE	SEE	TOTAL
40	60	100

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the formulated industry / technical / societal problems
CO-2: Analyze and / or develop models for providing solution to industry / technical / societal problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo a mini-project during II semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the project work, submit it to the department in a prescribed report form and shall make an oral presentation before the departmental Project Review Committee.
- Evaluation of the mini-project shall consist of CIE and SEE and shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- CIE shall be carried out for 40 marks on the basis of review presentation as per the calendar dates and evaluation format.
- SEE shall be carried out at the end of semester fpr 60 marks on the basis of oral presentation and submission of mini-project report.
- Prior to the submission of mini-project report to the PRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The mini-project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22MN6HS02) ANCIENT WISDOM

TEACHING SCHEME

L	T/P	C
2	0	0

EVALUATION SCHEME

SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To introduce the contribution from Ancient Indian system & tradition to modern science & Technology
- To trace, identify and develop the ancient knowledge systems
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Familiarize learners with major sequential development in Indian science, engineering and technology

CO-2: Understand eco-friendly, robust and scientific planning and architecture system of ancient India

CO-3: Trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge

CO-4: Understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within

UNIT-I:

Indian Science & Technology: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)

Ancient Architecture:

Scientific Achievements though Ancient Architect: Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79oE 41'54, Veerbhadra temple with 70 hanging pillars

UNIT-II:

Foundation Concept for Science and Technology: The Introduction to Ancient Mathematics & Astronomy Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, 22 bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system,

Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System

UNIT-III:

Humanities & Social Sciences: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

UNIT-IV:

Aspiration and Purpose of Individual and Human Society: Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha.

Individual Level:

Program for Ensuring Human Purpose:

Fundamental Concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul).

The True Constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana

Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. the six cleansing procedures of Yoga, understanding of Indian psychological concept, consciousness, tridosha & triguna.

UNIT-V:

Five Important Slokas for Enlightenment

Gayatri Mantram, Santi Mantram: Asatoma Sadgamaya, Geeta (Yada Yadahi Dharmasya, Glanirbhavati Bharata), Amanitwam Adambitwam.., Karmanyevadikarastu… Maa phaleshukadachana

TEXT BOOKS:

1. Textbook on Indian Knowledge Systems, Prof. B Mahadevan, IIM Bengaluru
2. Indian Knowledge Systems, Kapur K. and Singh A. K., 2005

REFERENCES:

1. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
2. Value and Distribution System in India, B. L. Gupta, Gyan Publication House
3. Ancient Indian Culture and Civilization, Reshmi Ramdhoni, Star Publication, 2018
4. Ancient Indian Society, Maharaj Swami Chidatmanjee, Anmol Publication
5. Ancient Indian Classical Music, Lalita Ramkrishna, Shubhi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1GT20) FOUNDATIONS ON WEAK ROCKS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the Engineering properties of weak rocks
- To classify different types of rock mass
- To design different types of foundations placed over rock mass
- To identify the pressure settlement criteria of weak rocks

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Explain the various types rock mass classification systems
CO-2: Determine in-situ shear strength of rocks and rock masses
CO-3: Apply the knowledge gained to the design shallow foundation and treatment of it
CO-4: Analyze the bearing capacity and settlement of pile in weak rocks

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	2	1	1	1
CO-2	2	1	2	1	1	1
CO-3	3	2	2	3	3	1
CO-4	3	2	2	2	3	1

UNIT-I:
Rock Mass Properties: Engineering properties of weak rocks, different rock mass classification systems, relative merits and demerits, Failure criteria for weak rocks, bi-linear Mohr-Coulomb failure criterion, Hoek and Brown criterion and modified Hoek and Brown failure criterion etc.

UNIT-II:
Strength Behaviour of Rock Mass: Effect of structural planes on rock foundations, possible modes of failure of foundations on rocks/ rock masses, determination of in-situ shear strength of rocks and rock masses.

UNIT-III:
Bearing Capacity: Requirements for satisfactory performance of foundations, bearing capacity of foundations on rocks and rock masses, allowable bearing pressure of rock foundations using a nonlinear failure criterion, monotonic and cyclic plate load tests. Pressure-settlement characteristics, effect of layering, anisotropy, heterogeneity and inelasticity

UNIT-IV:

Shallow Foundations: Shallow foundations, shallow foundations on sloping ground, raft foundations, stilt foundations, foundations for suspension bridges, transmission line towers, framed buildings etc, treatment of foundations - open joints, solution cavities, weak seams.

UNIT-V:

Deep Foundations: Piles in weak rocks, bearing capacity and settlement of piles, piles in stratified rock masses, field load tests on piles in weak rocks, behavior of bored / driven piles in soft / weathered rocks.

TEXT BOOKS:

1. Foundations on Rock: Engineering Practice, Wyllie Duncan C., E & FN Spon, Taylor and Francis
2. Engineering Rock Mechanics: An Introduction to the Principles, Hudson J. A. and J. P. Harrison, Oxford, Elsevier, 1977

REFERENCES:

1. Rock Mass Classification-A Practical Engineering Approach, Singh B. and Goel R. K., Elsevier
2. Engineering in Rocks, Ramamurthy T., PHI Learning
3. Practical Rock Engineering, Hoek E., Rock Science

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1GT21) GEOTECHNICAL EARTHQUAKE ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basics of earthquake seismology
- To predict the nature of ground motion during earthquake
- To analyse the ground response using computer code
- To learn the phenomena of liquefaction

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Analyze the magnitude of earth quake
CO-2: Understand the effect of earthquake
CO-3: Perform seismic stability analysis of slopes, dams and earth retaining structures
CO-4: Acquire on the design criterions to be followed for the design different geotechnical structures

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	1
CO-2	2	1	1	2	1	1
CO-3	3	2	3	3	2	2
CO-4	3	1	2	3	2	1

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 sites specification and code-based design. Ground Response Analysis- One-dimensional ground response analysis: Linear approaches, Equivalent linear approximation of non-linear approaches, Computer code "SHAKE".

UNIT-III:
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.

UNIT-IV:

Seismic Design of Foundations, Seismic Slope Stability Analysis: Internal stability and Weakening instability and Seismic design of retaining walls.

UNIT-V:

Seismic Analysis and Design of Various Geotechnical Structures: Pseudo-static method, Pseudo dynamic method, Seismic slope stability analysis, Behavior of reinforced soil under seismic conditions, Seismic analysis of Tailings Dam, seismic design of shallow foundations, seismic design of Municipal Solid Waste (MSW) landfills. Codal provisions/guidelines for seismic design of geotechnical structures.

TEXT BOOKS:

1. Geotechnical Earthquake Engineering, Steven Kramer, Pearson, 2008
2. Seismic Behaviour of Ground and Geotechnical Structure, Pinto P. A., Secoe

REFERENCES:

1. The Seismic Design Handbook, Naeim F., 2nd Edition, Kluwer Academic Publication, 2001
2. Seismic Design Criteria for Soil Liquefaction, Ferrito J. M., Tech. Report of Naval Facilities Service Center, Port Hueneme, 1997
3. Geotechnical Earthquake Engineering Handbook, Robert W. Day, McGraw-Hill
4. Geotechnical Earthquake Engineering, Ikuo Towhata, Springer-Verlag, Heidelberg

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1GT22) ENVIRONMENTAL GEOTECHNOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the basics concepts of properties of water in relation to soil media
- To differentiate various mineralogical characteristics
- To develop a clear idea on soil-water interaction mechanism
- To classify various waste containment systems & remediation techniques

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Understand Soil-environment interaction, Soil mineralogy and Mechanisms of soil- water interaction

CO-2: Learn about ground water flow and predict contaminant transport phenomenon

CO-3: Apply remediation techniques for contaminated site

CO-4: Create an idea in the development of various landfill design techniques

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	1	1	-	-
CO-2	3	1	3	1	2	-
CO-3	3	1	-	-	1	-
CO-4	3	3	2	-	-	-

UNIT-I:

Soil Mineralogy: Scope of Geoenvironmental Engineering - Soil environment interaction; Properties of water in relation to the porous media; Water cycle with special reference to soil medium. Significance of mineralogy in determining soil behavior; Mineralogical characterization.

UNIT-II:

Mechanisms of Soil-Water Interaction: Diffuse double layer models; Force of attraction and repulsion; Soil-water-contaminant interaction; Theories of ion exchange; Influence of organic and inorganic chemical interaction.

UNIT-III:

Concepts of Waste Containment: Sources, production and classification of wastes, Environmental laws and regulations, ground water flow, desirable properties of soil; contaminant transport and retention; contaminated site remediation.

UNIT-IV:

Soil Characterization Techniques: Physico-Chemico mineralogical, electrical, and thermal properties and volumetric water content; gas permeation in soil; pore-size distribution; contaminant analysis. Contaminated site characterization.

UNIT-V:

Quantification and Remediation: Estimation of landfill quantities, landfill site location, design of various landfill components such as liners, covers, leach ate collection and removal, gas generation and management, ground water monitoring, end uses of landfill sites, Engineered landfills, slurry walls and barrier systems, design and construction, stability, compatibility and performance, remediation technologies, stabilization of contaminated soils and risk assessment approaches.

TEXT BOOKS:

1. Introduction to Environmental Geotechnology, Fang H. Y., 2nd Edition, CRC Press, 2016
2. Environmental Geotechnology, R. W. Sarsby, Thomas Telford, 2000

REFERENCES:

1. Fundamentals of Soil Behavior, Mitchell J. K. and Soga K., John Wiley, 2005
2. Geotechnical Practice for Waste Disposal, Daniel D. E., Chapman and Hall, 2012
3. Clay Barrier Systems for Waste Disposal Facilities, Rowe R. K., Quigley R. M. and Booker J. R., 2nd Edition, E & FN Spon,1997
4. Geotechnical and Geo-environmental Engineering Handbook, Rowe R. K., Kluwer Academic Publishers, 2001
5. Geo-environmental Engineering Principles, Reddi L. N. and Inyang H. F

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1GT23) ADVANCED ENGINEERING GEOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the formation of soils / rock and its influence on their engineering behavior
- To learn classification and characterization using advanced techniques such as geophysical methods, RS, GIS etc.
- To gain comprehensive understanding about geological factors influencing the ground water hydraulics
- To competence for accounting the geological aspects in the selection civil engineering structures

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Ability to characterize the soil and rock based on their formation
CO-2: Knowledge of RS & GIS in engineering geology
CO-3: Competence in application of geophysical methods for investigation of soils and rock
CO-4: Understanding the geological aspects on ground water

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	2	1	1
CO-2	3	2	2	3	3	1
CO-3	3	2	2	3	3	1
CO-4	3	2	2	1	2	1

UNIT–I:
Geology of Soils: evolution, classification, characteristics, features, mechanical behavior and engineering uses of soils. Important clay minerals and their importance in soils. Engineering geomorphology: evolution of different landforms ,(erosional and depositional) characteristic features and their suitability or response to various engineering works.

UNIT–II:
Photogeology & Remote Sensing: Different types of aerial photographs, stereography, principles and uses of aerial photographs in the engineering practice. Infra-red line scan(IRLS)and side looking airborne radar (SLAR) thermal properties of geological materials, sensors. Interpretation of Landsat images and use of satellite images in civil engineering practice

UNIT–III:

Engineering Geophysics: Principles, theory, instruments, filed methods, data collection and data interpretation of electrical and seismic refraction methods. application in engineering practice.

UNIT–IV:

Ground Water: Artificial recharge of ground water, fluctuations in ground water levels due to various causes and management of ground water. Environmental geology: effects of withdrawal of excessive ground water, disposal of solid and liquid wastes, environmental impact of water impoundment. With effect from the academic year 2021-22 17

UNIT–V:

Case Histories: Engineering geology of most important dams and funnels of India.

TEXT BOOKS:

1. Principles of Geology, Attewel and Farmer, Chapman and Publications, 1976
2. Fundamentals of Engineering Geology, Bell F. G., Butterworth Publications, 1983
3. Engineering Geology and Geotechnics, Bell F. G., Butterworth Publications, 1980

REFERENCES:

1. Fundamentals of Rock Mechanics, Jaeger J. C. and Cook N. G. W., 3rd Edition, Chapman and Hall, London, 1979
2. Underground Excavation in Rock, Hoek E. and Brown E. T., 1982
3. Rock Mechanics for Underground Mining, Brady B. H. G. and Brown E. T., 3rd Edition, Chapman & Hall, Springer Science & Business Media, 2007

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1GT24) EXPANSIVE SOIL ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To gain comprehensive understanding about identification and characterization of expansive soils
- To learn the laboratory test procedures for evaluation of expansiveness
- To learn the swell control measures
- To understand about open excavations in expansive soils and the remedial measures

COURSE OUTCOMES: After completion of the course, students should be able to

CO-1: Recognize the Engineering behavior of Expansive Soils, their presence and identification

CO-2: Interpret knowledge about Clay mineralogy responsible for expansive behaviour

CO-3: Relate in laboratory and field evaluation of swell potential of expansive soils

CO-4: Categorize problems posed by expansive soils on Foundations and competence in providing remediation

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	3	-	-
CO-2	2	2	3	1	-	-
CO-3	2	2	3	2	-	-
CO-4	2	2	3	3	-	-

UNIT-I:

General: Necessity of study and importance. Spread of expansive soils in India and other countries. Various problems encountered for structural safety of structures, remedial measures.

UNIT-II:

Clay Mineralogy: study of physic- chemical properties of clay mineral including their microstructures, their identification by thermal, x-ray diffraction, Electron Microscopic methods engineering properties.

UNIT-III:

Swell and Swell Potential: Determination of swell and swell potential of soil water systems- laboratory and field estimates of heave. Study of moisture movements-

swelling and shrinkage behaviors- cyclic swells multidimensional swells. Shear strength, consolidation, and earth pressure (Characteristic) properties of swelling clays.

UNIT-IV:

Problems and Remedial Measures: Problems encountered in shallow, deep foundations in swelling sub- soil strata- design considerations- study of case histories, methods of alteration or modification of swell properties. Use of under reamed piles and their design criteria – Reliability analysis of With effect from the academic year 2021-22 46 foundations on expansive soils- settlement characteristics- hysteresis of deformations of swelling soils- Inter swelling. Safety factors.

UNIT-V:

Open and Underground Excavations: Swelling and shrinkage soils- construction techniques to be adopted. Remedial measures- stabilization methods use of chemical grouts etc.

TEXT BOOKS:

1. Expansive Soils- Problems and Practice in Foundation and Pavement Engineering, Nelson J. D. and Miller D. J., John Wiley & Sons Inc. 1992
2. Fundamentals of Soil Behavior, Mitchell J. K. and Soga J., 3rd Edition, John Wiley & Sons Inc., 2005

REFERENCES:

1. Proceedings of 2nd International Conference on Expansive Soils Research and Engineering, Texas, 1963
2. Proceedings of 3rd International Conference on Expansive Soils, Haifa Israel, 1978

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1CN01) BUSINESS ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the role of business analytics within an organization and to analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making and to become familiar with processes needed to develop, report, and analyze business data
- To use decision-making tools/Operations research techniques and to manage business process using analytical and management tools
- To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of data analytics

CO-2: Think critically in making decisions based on data and deep analytics

CO-3: Use technical skills in predicative and prescriptive modeling to support business decision-making

CO-4: Translate data into clear, actionable insights

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	1	-	1	1
CO-2	3	-	2	-	1	2
CO-3	2	1	1	-	1	1
CO-4	1	2	1	-	1	1

UNIT-I:

Business Analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data Business Analytics Technology.

UNIT-III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V:

Decision Analysis: Formulating Decision Problems, Decision Strategies without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business Analytics-Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press
2. Business Analytics, James Evans, Pearson Education
3. Business Analytics, Purba Halady Rao, PHI, 2013

REFERENCES:

1. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen, Jesper Thorlund, 2nd Edition, Wiley Publications
2. Business Analytics: Data Analysis & Decision Making, S. Christian Albright, Wayne L. Winston 5th Edition, 2015
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman Elsevier, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM01) INDUSTRIAL SAFETY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Elements of Mechanical, Civil, Electrical and Industrial Engineering

COURSE OBJECTIVES:

- To achieve an understanding of principles, various functions and activities of safety management
- To communicate effectively information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities
- To anticipate, recognize, and evaluate hazardous conditions and practices affecting people, property and the environment, develop and evaluate appropriate strategies designed to mitigate risk
- To develop professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards

CO-2: Communicate effectively on health and safety matters among the employees and with society at large

CO-3: Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations

CO-4: Interpret and apply legislative / legal requirements, industry standards, and best practices in accident prevention programmes in a variety of workplaces

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	1
CO-2	-	-	-	-	2	3
CO-3	3	1	2	1	-	-
CO-4	-	2	-	1	-	2

UNIT-I:

Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit -

performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:

Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.

Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, New Delhi, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publisher's, Trivandrum
3. Managing Emergencies in Industries, Loss Prevention of India Ltd., Proceedings, 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, New Delhi, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw-Hill, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM02) OPERATIONS RESEARCH

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze linear programming models in practical and their practical use
- To apply the transportation, assignment and sequencing models and their solution methodology for solving problems
- To apply inventory and queuing, inventory models and their solution methodology for solving problems
- To evaluate the simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate the problems using linear programming
CO-2: Analyze assignment, transportation problems
CO-3: Apply inventory and queuing problems for real time problems
CO-4: Model the real-world problem and simulate it

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	3	2	-	-
CO-2	1	3	3	3	-	-
CO-3	1	3	3	3	-	-
CO-4	1	3	3	3	-	-

UNIT-I:

Introduction to Operations Research: Definitions of OR, Characteristics of OR, Scope of OR, Classification of Optimization Techniques, models in OR, General L.P Formulation, Graphical solution, Simplex Techniques.

Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II:

Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III:

Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT-IV:

Inventory Models: Deterministic inventory, models - Probabilistic inventory control models

UNIT-V:

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut, New Delhi
2. Engineering Optimization, S. S. Rao, New Age International Publications, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, Delhi, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, Delhi, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM03) ENTREPRENEURSHIP AND START-UPS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To understand different Theories of Entrepreneurship and their Classification
- To create Feasibility Reports, Business, Project Plans and resolve Operational problems
- To understand the roles of Family, non-family entrepreneurs and learning about Startups' Opportunities, Corporate Legal and Intellectual Property related issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the role of an entrepreneur in the economic development and discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Learn different Theories of entrepreneurship, the role of Family and Non-Family entrepreneurs and problem-solving skills

CO-3: Create Marketing, Financial Plans and evaluate Structural, Financial and Managerial Problems

CO-4: Apply lean methodology to startup ideas using Business Model Canvas and be able to create Business Plans through establishing business incubators. Understand Corporate Legal and Intellectual Property related matters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	3
CO-2	1	-	-	-	-	2
CO-3	1	-	-	-	-	2
CO-4	-	-	-	1	-	-

UNIT-I:

Entrepreneurship: Definition of Entrepreneur, Entrepreneurial motivation and barriers; Internal and external factors; Types of entrepreneurs, Personality and Skill Set of an Entrepreneur, Entrepreneurship as a career for engineers, scientists, and technologists.

UNIT-II:

Theories of Entrepreneurship: Classification of entrepreneurship. Creativity and Innovation: Creative Problems Solving, Creative Thinking, Lateral Thinking, Views of De Bono, Khandwala and others, Creative Performance in terms of motivation and skills.

Family and Non-Family Entrepreneurs: Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Sick industries, Reasons for Sickness, Remedies for Sickness, Role of BIFR in revival, Bank Syndications.

UNIT-III:

Creativity and Entrepreneurial Plan: Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning, Evaluation, Monitoring and Control, segmentation, Targeting and positioning of Product, Role of SIDBI in Project Management.

UNIT-IV:

Operation Problems: Incubation and Take-off, Problems encountered Structural, Financial and Managerial Problems, Types of Uncertainty. Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT-V:

Startups' Opportunity Assessment, Business Models, Entrepreneur talk, Clinical/ Regulatory, Sector Specific Group Briefing by Advisory Committee, Corporate Legal and Intellectual Property, Pitching, Payers and Reimbursement, Pitch practice, Investors, Mistakes I Won't Repeat, Business Development and Exits, Finance, Budgeting, Team Building, Opportunities in Telangana State and India – incubators, schemes, accelerators.

TEXT BOOKS:

1. Understanding Enterprise: Entrepreneurship and Small Business, Bridge S. et al., Palgrave, 2003
2. Holt- Entrepreneurship: New Venture Creation, Prentice-Hall, 1998
3. Entrepreneurship Development, Robert D. Hisrich, Michael P. Peters, Tata McGraw Hill Edition

REFERENCES:

1. New Venture Creation: An Innovator's Guide to Entrepreneurship, Marc H. Meyer and Frederick G. Crane, 2nd Edition, Sage Publications
2. Technology Ventures: From Idea to Enterprise, Byers, Dorf, Nelson
3. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist - Feld, Mendelson, Costolo
4. Breakthrough Entrepreneurship, Burgstone and Murphy
5. Business Model Generation, Alexander Osterwalder

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1PL01) WASTE TO ENERGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To create awareness in students of energy conservation
- To identify the use of different types of Bio waste energy resources
- To understand different types of bio waste energy conservations
- To detect different waste conversion into different forms of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find different types of energy from waste to produce electrical power
CO-2: Estimate the use of bio waste to produce electrical energy
CO-3: Understanding different types of bio waste and its energy conversions
CO-4: Analyze the bio waste utilization and to avoid the environmental pollution

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	1	2	1
CO-2	3	3	3	3	2	3
CO-3	3	2	3	2	2	3
CO-4	3	3	3	3	2	3

UNIT-I:
Introduction to Energy From Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW (Municipal solid waste) – Conversion devices – Incinerators, Gasifiers, Digestors. Urban waste to energy conversion, Biomass energy Programme in India.

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion.

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. Biogas Technology-Transfer and Diffusion, M. M. EL-Halwagi, Elsevier Applied Science Publisher, 1984
2. Introduction to Biomass Energy Conversions, Sergio Capareda

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1. Non-Conventional Energy, Desai Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill, 1983
3. Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing Co. Pvt. Ltd., 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996