Shri Rawatpura Sarkar University, Raipur, Chhattisgarh

Faculty of Engineering

Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

M.Tech.(Geotech Engineering)

Semester-I

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Session: 2022-23)

Shri Rawatpura Sarkar University, Raipur, Chhattisgarh

Faculty of Engineering

Two Years M.Tech. Programme

Scheme of Teaching and Examination

M.Tech. First Semester Geotech Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2022-2023)

S.No.	Course Code	Course Title	Hours / Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs)
			L	**T**	**P**		Continuous Evaluation	Sem End Exam	Total	
1	MENGE101T	Advanced Computational Methodology	3	1	-	4	30	70	100	3
2	MENGE102T	Advanced Soil Mechanics	3	1	-	4	30	70	100	3
3	MENGE103T	Advanced Foundation Engineering-I	3	1	-	4	30	70	100	3
4	MENGE104T	Theory of Elasticity and Plasticity	3	1	-	4	30	70	100	3
5	MENGE105T	Elective-I	3	1	-	4	30	70	100	3
6	MENGE106P	Geotechnical Laboratory-I	-	-	2	1	15	35	50	-
7	MENGE107P	Computer Application in Geotechnical Engineering	-	-	2	1	15	35	50	-
	Total Contact Hr Per Week: 24		**Total Credit: 22**				**Grand Total Marks:**		**600**	

L: Lecture T: Tutorial P: Practical

Elective-I

S.NO.	Course Title
1	Structural Design of Foundation and Retaining Structure
2	Finite Element Methods in Geotechnical Engineering
3	Rock Mechanics

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<table>
<tr><td>Course Title</td><td colspan="5">Advanced Computational Methodology</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE101T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Engineering Mathematics –I & II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
• Represent the problems mathematically.
• Optimize the solutions.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT – I
Graph Theory And Its Application
Basic Terminology. Simple graph. Multi graph,. Types of graph .Path .Cycles Eulerian and Hamiltonian graph. Shortest path problem Representation of graph. Trees and their properties. Spanning Tree. Binary Tree. Tree traversal.
UNIT - II
Fuzzy Set And Its Applications
Fuzzy sets-Basic definitions, α-level sets. Convex fuzzy sets. Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products, Algebraic products. Bounded sum and difference, t-norms and t-conorms. The Extension Principle- The Zadeh’s extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic.
UNIT - III
Cryptography And Its Application
Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks. DES, RSA, Digital Signature.
UNIT - IV
Statistical Analysis
Expectation and variance of random variable. Sampling Distribution. Testing a Hypothesis. Level of significance. Confidence limits. Test of significance for large sample. Central limit theorem. Test of significance for means of two large samples. Sampling Variables-small samples. Student t-distribution, Chi-square test.</td></tr>
</table>

	UNIT - V **Optimization Techniques** Dynamic Programming-Deterministic and Probabilistic Dynamic programming. Inventory- Basic characteristics of an inventory system. The Economic order quantity. Deterministic models. Network analysis (PERT/ CPM).
Course Outcomes	**After the completion of course:** • This is the foundation of research and development in the computational domain of engineering and technology. • Analyze the result numerically and linguistically by fuzzy theory. • Emphasize the meaning and purpose of these techniques and their use in solving Engineering Problems. • As the prerequisite, this will be traced the thought and ideas to design the behavioral tools over the engineering range. • This is a transformation from theory to application through measuring theory of natural problems and its applications.
Text Books	1. Calculus of Variations with Applications, Gupta, A.S.-Prentice Hall of India(P) Ltd., New Delhi, 6th print,2006 2. Introduction to Partial Differential Equations, Sankar Rao, .K.- Prentice Hall of India(P) Ltd., New Delhi, 5th print,2004 3. Advanced Engineering Mathematics, Jain R. K Iyengar S.R.K.-Narosa publications 2nd Edition,2006 4. Numerical Methods in Science and Engineering, Grewal, B.S-Kanna Publications, New Delhi. 5. Numerical Methods, S Chandand Co. Ltd, Kandasamy. P, Thilagavathy. Kand Gunavathy, K- New Delhi, 5th Edition,2007 6. Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications, Schaum's outline series, Spiegel, M.R-McGraw Hill BookCo.,1987.
Reference Books	1. Multi - Objective Optimization Using Evolutionary Algorithms, K. Deb (2003) John Wiley 2. Applied Statistics & Probability for Engineers: Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Wiley India. 3. Parallel distributed processing Vol.1 (1986) Rumelhart, D.E and McClelland, J.L., M I T Press, 1986. 4. Fuzzy logic implementation and applications (1996), Patyra, M.J. and Mlynek Wiley

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<table>
<tr><td>Course Title</td><td colspan="5">Advanced Soil Mechanics</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE102T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-I&II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
Students will get relationships among various soil properties.
Will study effect of rate of stress on shear parameters
They will be responsible for reducing and plotting data, and deducing material properties from the plotted data.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT – I
One and three dimensional consolidation theories and applications, Immediate settlement, Methods of determination, Estimation of Pre-consolidation pressure, Secondary consolidation.
UNIT – II
Shear strength parameters of cohesion less and saturated cohesive soils, Principles of Effective stress condition, Effect of rate of stress on shear parameters, Stress-Strain relationship, Skempton's Pore pressure coefficients, Hvorslev's true shear parameters, Effect of over consolidation on shear parameters.
UNIT – III
Stability analysis of slope -effective vs. total stress analysis, Stability Analysis of Slope: Effective and total stress approach, shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical conditions.
UNIT – IV
Earth pressure – Rankine, Columb and Graphical Methods, Retaining walls structures, Gravity cantilever and counter fort retaining walls: Stability checks and design.
Sheet Pile Structures: Cantilever sheet piling, Anchored sheet piling: Free and fixed earth support methods of Analysis, Braced excavations.
UNIT – V
Soil Anchors: Inclusions and Installation Techniques, Design of Soil Anchors, Application Criteria, Advantages and Limitations</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
Analyze effective stress for different field conditions.</td></tr>
</table>

	• Calculate settlement of soils using one dimensional and three dimensional consolidation theories. • To develop suitable method for analyzing the slope stability. • Estimate shears strength of saturated and partially saturated soils. • The course covers various topics like compaction, shear strength, consolidation, earth pressure, stress distribution which gives insight to students to analyse soil parameters based on application and need of project site.
Text Books	1. Advanced Soil Mechanics, B M Das, Taylor and Francis. 2. Principles of Soil Mechanics, R F Scott, Addison & Wesley. 3. Elasticity and Geo-mechanics, R.O. Davis and A.P.S. Selvadurai, Cambridge University Press New York. 4. Fundamentals of Soil Behaviour, Mitchell, James K, John Wiley and Sons 5. Soil Behaviour and Critical State Soil Mechanics, D.M. Wood, University of Glasgow.
Reference Books	1. Clay Mineralogy, Grim , R.E. " Clay Mineralogy" 2. Foundation of Theoretical soil Mechanics Harr, M.E. 3. Soil Mechanics, Lambe & Whitman 4. Principles of Soil Mechanics Scott, R.F

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<table>
<tr><td>Course Title</td><td colspan="5">Advanced Foundation Engineering-I</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE103T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Technical-I & II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
The course covers various aspects of foundation engineering including soil exploration, details of shallow and deep foundations, retaining walls.
The soil-foundation interaction will also be discussed along with the numerical solution techniques of beams and plates resting on elastic foundation bed.
The behaviour and design methods of foundation on reinforced earth will be discussed.
The advanced theories and design of various foundation components will be discussed in logical way.
The earth pressure theories for designing the retaining walls will be discussed.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT – I
Shallow Foundation: Terzaghi's bearing capacity equation, General bearing capacity equation, different bearing capacity theories, I.S. Code method, Effect of foundation shape, eccentricity and inclination of load, Influence of soil compressibility and water table, Footing pressure for settlement on sand, Soil pressure at a depth, Boussinesq's &Westergaard methods,
UNIT – II
Raft Foundation: Settlement and Bearing Capacity analysis, Analysis of flexible and rigid raft as per IS 2950.
UNIT – III
Computation of settlements (Immediate & Consolidation); Permissible settlements, Allowable total and differential settlement of structures.
UNIT – IV
Proportioning of footing, Inclined & Eccentric loads. Settlement of footings on stratified deposits. Influence of adjacent footings.
UNIT – V
Bearing Capacity from SPT and SCPT and Plate load Test data, Proportioning of footing based on settlement criteria. Foundations on Problematic soils: Problems and Remedies.</td></tr>
</table>

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Course Outcomes	**After the completion of course:** • Identify a suitable foundation system for a structure. • Evaluate the importance of raft foundation and principles of design for buildings and tower structures. • Analysis and design pile foundations. • Examine and discuss various machine foundations. • Analysis and design Sheet piles and cofferdams.
Text Books	1. Principles of Foundation Engineering, B. M Das, Thomson Brooks/Cole 2. Foundation Analysis and Design J. E. Bowles, , McGraw-Hill Book Company 3. Design of Foundation Systems : Principles & Practices, N.P. Kurien, Narosa, New Delhi 1992 4. Foundation Engineering Hand Book, H. F. Winterkorn and H Y Fang, Galgotia Book source
Reference Books	1. Dynamic of Bases and Foundation, Barken, D.D. 2. Engineering and Thornolour Foundation Peek Hansen 3. Engineering Leaconards 4. Bowles " Foundation Design" **5.** Vibration of Soils - Foundations."Rechartetal

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<table>
<tr><td>Course Title</td><td colspan="5">Theory of Elasticity and Plasticity</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE104T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-I & II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
• Understand the fundamentals of the continuum mechanics of solids.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT–I
Elasticity-Theory of Elasticity vs ordinary mechanics, concept of homogeneity, anisotropy, isotropy and orthotropy, generalized Hook’s law, ideal stress – strain diagram for rigid, plastic and viscous materials. Numerical Problems
UNIT-II
Principal Stresses And Strains-Notation for forces and stress components of stresses and strain, plane stress and plane strain, principal stress and strain, maximum shear stress, and shear planes, Mohr circle of stress and strain, strain rosettes Differential equations of equilibrium, boundary conditions, compatibility equations and stress functions. Numerical Problems
UNIT-III
Plane Stress And Plane Strain-Two-dimensional problems rectangular coordinates, displacement and deformation, St. Venant’s and Prandtl’s theories, determination of displacements Two-dimensional problems in polar coordinates – governing equations, stress distribution symmetric about axis. Numerical Problems
UNIT –IV
Theory of Plasticity-Crystal Grains, mechanics of plastic deformation, consecutive stages of deformation: elastic and plastic deformation and fracture, inelastic deformation, factors affecting plastic deformation, strain hardening, stress-strain relationship, Tresca and VonMises criterion of yielding. Numerical Problems
UNIT- V
Visco Elastic Material-Maxwell body, Kelvin Voigt body, linear standard body
Theories of Failure: maximum principle stress theory, maximum principle strain theory, strain energy theory, distortion energy theory, distortional energy, maximum shear stress theory. Numerical Problems</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
• Idealize the criteria governing the failure of soil in elastic and plastic states
• Provide better solutions to the problems of the soil related to deformation.</td></tr>
</table>

	• Understand the failure criteria with focus on plasticity • Understand the relationship between mechanical behaviour of solids and their underlying microstructure. • Enable students to select appropriate constitutive theory for finite element analysis.
Text Books	1. Theory of Plasticity, S. Timoshenko and J N Goodier, McGraw Hill 2. Theory of Plasticity, Sadhu Singh, Khanna Publications 3. Applied Elasticity, T G Sitaram and L Govindraju- Interline Publication, Banglore
Reference Books	1. Mechanics of Material, Hearn E J (1985) - Pergamon Press, Oxford 2. Introduction to Solid Mechanics, Irving H Shames and James M Pitarresi, - Prentice Hall of India 3. Theory of Plasticity (1987),Chakrabarty

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<table>
<tr><td>Course Title</td><td colspan="5">Structural Design of Foundation and Retaining Structure</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE105T(Elective-I)</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
This course covers the analysis, design, and construction aspects of shallow and deep foundations and retaining structures.
The main objective is to enable students to select, analyze, and design an appropriate foundation and/or an earth retaining structure for a given scenario.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT–I
Building foundation design: Design of footing, isolated footing and steel grillage, combined footings of rectangular, Trapezoid cantilever types. Mat or raft foundation of dry and saturated soil floating foundations,
UNIT-II
Design of Piles, Pile caps and pile foundations buildings,
UNIT-III
Design of retaining structures, Design of retaining walls with surcharge loads. Retaining walls resting on piles.
UNIT–IV
Design of bridge abutments, Design of foundation for transmission towers: - Design of basement walls
UNIT- V
Bridges structures Analysis and Design: Design of wells foundation and caissons of different types, Design of bridge pairs resting on piles.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
Understand the application of theories of soil mechanics to foundation design.
Ability to design foundations (shallow, piled, piled raft); advantages and disadvantages of different earth retaining systems.
Select the most technically appropriate and cost-effective type of retaining wall for the application from a thorough knowledge of available system;
Quantify the lateral earth pressures within reinforced earth structures.
Complete the design of retaining structures using appropriate design methods, factors of safety, design charts and field verification methods.</td></tr>
</table>

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Text Books	1. Analysis and Design of Sub structures, Swami Saran, Oxford and IBH Publishing Co. PVT. Ltd, New Delhi. 2. Foundation Design and Construction, Tomlinson, Prentice Hall Publication.
Reference Books	1. Principles of Foundation Engineering B.M.Das, Thomson, Indian Edition, 2003. 2. Principles and Practices of Soil Mechanics and Foundation Engineering, V.N.S. Murthy, UBS Publishers and Distributors, New Delhi, 1996 3. Geotechnical Engineering, P. Purushothama Raj, Pearson Education, India

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<table>
<tr><td>Course Title</td><td colspan="5">Finite Elements Method in Geotechnical Engineering</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE105T(Elective-I)</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-I & II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
• Know about how finite elements obtain approximate solutions to differential equations.
• Appreciate the structure of a typical finite element programme.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT–I
Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.
UNIT – II
Element Properties: Concept of an element, various element shapes, Displacement models, Generalized coordinates, Shape functions, Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates Generation of Element Stiffness and Nodal Load Matrices, Iso-parametric Formulation: Concept, Different iso-parametric elements for 2D analysis, formulation of 4-noded and 8-noded iso-parametric quadrilateral elements, Lagrangian elements, Serendipity elements
UNIT–III
Discretization of a structure, numbering systems, Aspect ratio its effects, Assemblage, Direct Stiffness method Strain laws: Introduction, Bilinear elastic model, K-G model, hyperbolic model, comparison of models and critical state model (geometric model, hardening law, yield function, flow rule, stress strain in variant relation, stress-strain component relation, parametric values) with numerical examples
UNIT– IV
Geotechnical Applications Sequential construction, Excavations and embankments, Bearing capacity and Settlement analysis.
UNIT– V
Geotechnical Applications: Seepage analysis: Finite element discretization of seepage equation, computation of velocities and flows, treatment of free surface boundary, Analysis of jointed rock mass: Characters and discontinuity of rock, model behaviour of jointed rocks, plane strain analysis.</td></tr>
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Course Outcomes	**After the completion of course:** • Understand the basic concepts of finite element analysis in and the transition from structural engineering aspects to geotechnical engineering aspects. • Understand the finite element techniques for seepage analysis and joint rock masses. • In finite element applications in design and analysis of bearing capacity of the soil for shallow foundations. • Gain experience of finite element analysis applied to classical geotechnical problems (e.g. settlement, seepage, consolidation, slope stability) • Gain insight into the soil properties needed for finite element analysis.
Text Books	1. Introduction to the Finite Element Method (1972), Desai, C. S. and J.F. , Abel.Van No strand Reinhold Company 2. Finite Element Analysis in Geotechnical Engineering Vol 1&2, (1999), D M Potts & L Zdravkovic, - Thomas Telford publishing, London 3. Finite Element Analysis in Geotechnical Engineering (2012), D J Naylor & g N Pande 4. Introduction to the Finite Element Method (1993),J.N. Reddy, McGraw-Hill Publishers
Reference Books	1. Finite element analysis - Theory and programming(1994) Krishna Murthy, C. S.-Tata McGraw Hill, 2. Finite element Methods (1971) Zienkiewicz, O. C. -, McGraw-Hill Publishers,

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<table>
<tr><td>Course Title</td><td colspan="5">Rock Mechanics</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE105T(Elective-I)</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-I & II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
• Identify the type of the rock
• Analyze the rock quality designation and also evaluate its strength
• Determine the method of tunneling and mining</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT–I
Classification of rocks, geological petro graphic and engineering. Index properties of rocks- porosity, density, permeability, durability and slake. Core recovery, RQD and its importance in engineering Stress-strain behaviour, factors influencing the strength of rock, temperature, confining pressure, strain rates, modes of failures of rocks.
UNIT – II
Failure theories of rocks Mohr’s hypothesis, Griffith’s Criteria, Muller’s extension of Griffith’s theory, elementary theory of crack propagation, failure of rock by crack propagation, effects of cracks of elastic properties. Testing of rocks: Laboratory and field test, assessment of in-situ-strength.
UNIT–III
Rock Foundation: Shallow and deep investigation for foundation design and construction aspect, slope stability analysis, mode of failures in rock. Design of slopes, excavation in rock and stabilization concepts.
UNIT– IV
Strengthening of rocks: Foundation treatment for dams and heavy structures by grouting and rock reinforcement. Methods and principles of grouting, principles of design of rock bolts.
UNIT– V
Tunnels – Basic terminology and application, site investigations, methods of excavation of tunnels supports and stabilization, construction control and maintenance, tunnel ventilation, control of ground water and gas Underground Mining; mining methods, planning and design, mining equipments and mining procedures, cause for subsidence and its remedial measures</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
• Classify Rock system with complete testing program and calculate bearing</td></tr>
</table>

	capacity of Rocks. • Check stability of Rock under different stress conditions. • Design and analyze the foundations and improvement techniques for the foundations on in-situ rocks. • Design methodologies for mining and tunneling where rock is encountered. • Select and Design tunnels under different circumstances.
Text Books	1. Introduction to Rock Mechanics, Goodman(1976)- John Wiley & Sons, NY 2. Fundamentals of Rock Mechanics ,J C Jeager and N G W Cook (1976)- Chapman and Hall, London 3. Geo-technology, Roberts- Pergamou Press ltd. Oxford 4. Principles of Engineering and Geology and Geotechniques, Krynine and Judd- 5. Rock Engineering, Jhon A Franklin and Maurice b Dusseault- McGraw Hill 6. Rock Mechanics for Engineers, Varma- B. P, Khanna Publishers
Reference Books	1. Principles of Engineering Geology and Geotechniques – Krynine and Judd 2. Rock Engineering – Jhon A Franklin and Maurice b Dusseault, McGraw Hill 3. Rock mechanics for Engineers: Varma, B.P, Khanna Publishers 4. Rock mechanics & Design of structures: Obert, L & Duvall, W.I., John Wiley & Sons

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<table>
<tr><td>Course Title</td><td colspan="5">Geotechnical Laboratory-I</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE106P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-I&II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
• Student able to get the practical knowledge of various techniques, and will perform various test with different methods.</td></tr>
<tr><td>Course Contents</td><td colspan="5">List of Experiments
1. Determination of In-situ density by core cutter method.
2. Determination of In-situ density by sand replacement method
3. Determination of un-drained shear strength of soil by vane shear test
4. Determination of shear parameter of soil by Triaxial test
5. Determination of compressibility characteristics of soil by Oedometer test.
6. Determination of CBR of a soil specimen as per IS code recommendation.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
• Student will be able to perform tri-axial test, oedometer test, shear test.
• Able to determination of CBR of a soil specimen.
• Able to determination of In-situ density through core cutter and sandrepla cement method.</td></tr>
<tr><td>Text Books</td><td colspan="5">1. Physical and Geotechnical Properties of Soils, 2nd Edition J.E. Bowles, Mc. Graw Hill, New York.
2. Engineering Soil Testing, Shamsher Prakash, (1979) “Nemichand, New Delhi.
3. Engineering Properties of soil and their measurements, Joesph E Bowles, McGraw hill</td></tr>
<tr><td>Reference Books</td><td colspan="5">1. Geotechnical Laboratory Measurements, John T. Germaine, Amy V. Germaine, (2009) John Wiely
2. Soil Testing for Engineers, William Lambe, (2003) MIT.</td></tr>
</table>

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<table>
<tr><td>Course Title</td><td colspan="5">Computer Application in Geotechnical Engineering</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE107P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering-I & II</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
• Student should perform practical on software based packages on various test of soil, particle size distribution,
• Safe and allowable bearing capacity of soil, Co-efficient of permeability for flow through layered soil</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS
Application Programme:
For determination of
1. Soil particle size distribution (sand%, silt%, clay %)
2. Shear strength parameters of soil,
3. Co-efficient of permeability for flow through layered soil – (a) Parallel to layers, (b) Perpendicular to layers
4. Consolidation parameters of soil
For computation of
Settlement, safe and allowable bearing capacity of soil Usage of standard Geotechnical software packages.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
• Get the practical knowledge of various software through which different test can be performed.
• Make efficient to run various software package.</td></tr>
<tr><td>Text Books</td><td colspan="5">1. Numerical Method in Engineering, M.G.Salvadori and M.L.Baron
2. Computer Programming and Engineering Analysis, Syal and Gupta</td></tr>
<tr><td>Reference Books</td><td colspan="5">1. Dynamic of Bases and Foundation, Barken, D.D.
2. Engineering and Thornolour Foundation Peek Hansen
3. Foundation Engineering Leaconards
4. Bowles " Foundation Design"
5. Vibration of Soils - Foundations."Rechartetal.</td></tr>
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