Shri Rawatpura Sarkar University, Raipur, Chhattisgarh

Faculty of Engineering

Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

M.Tech.(Geotech Engineering)

Semester-III

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. Third 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	MENGE301T	Reinforced Soil Structure	3	1	-	4	30	70	100	3
2	MENGE302T	Elective-III	3	1	-	4	30	70	100	3
3	MENGE303P	Technical Paper Writing and Seminar	-	-	4	2	100	-	100	-
4	MENGE304P	Pre-dissertation (Literature Review/ Problem Formulation/ Synopsis	-	-	20	10	140	60	200	-
	Total Contact Hr Per Week: 32		**Total Credit: 20**				**Grand Total Marks:**		**500**	

L: Lecture T: Tutorial P: Practical

Elective-III

S.NO.	Course Title
1	Earth and Rock fill Dams
2	Expansive Soil Engineering
3	Offshore Geotechnical Engineering

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Course Title	**Reinforced Soil Structures**				
Course Code	**MENGE301T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Geotechnical Engineering-I & II**				
Course Objectives	**This course will enable students to:** • Identify the soil suitable for reinforced earth • Identify the type of reinforcing material suitable for the project. • Design the reinforced earth				
Course Contents	**UNIT-I** **Historical Background:** Introduction to reinforced soil structures, comparison with reinforced cement concrete structures. **Reinforced Earth:** Principles, concepts and Mechanisms of reinforced earth **UNIT-II** Materials used properties, laboratory testing and constructional details, metallic strips, metallic grids, geo-textiles, geo-grids, geo-membranes and geo-composites, their functions and design principles. **UNIT-III** **Geo-textiles:** Introduction, design methods, function and mechanism, geo-textile properties and test methods – physical, mechanical and hydraulic properties, construction methods and techniques using geo-textiles **UNIT-IV** Design applications of reinforced soil structures in pavements, embankments, slopes, retaining walls and foundations, reinforced soil structures for soil erosion control problems, geosynthetic clay liners **UNIT-V** Case studies of reinforced soil structures, discussion on current literature and design problems				
Course Outcomes	**After the completion of course:** • Design and incorporate the reinforced earth for the sites at weak soil sites • Design the pavements, embankments using reinforced earth to enhance the engineering properties of the soils. • Understand the history and mechanism of reinforced soil. • Become aware about situations where geosynthetics can be used. iii. Know about various types of geosynthetics and their functions.				

	• Be able to do dimple design of reinforced soil retaining walls and reinforced earth beds.
Text Books	1. Designing with Geosynthetics, Koerner R H (1994)- Prentice Hall Inc. 2. Reinforcements and Soil Structures ,Jones-CJEP (1996), Butterworth Publications 3. Membranes in ground engineering, Rankilor, P R (1985) - John Wiley & Sons.
Reference Books	1. Soil Reinforcement with Geotextiles, Jewel R A (1996)- CIRIA 2. Geotextiles hand book – Ingold J S and Miller K S (1988), Thomas Telford Ltd

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Course Title	**Earth And Rock Fill Dams**				
Course Code	**MENGE302T (Elective-III)**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Geotechnical Engineering-I&II**				
Course Objectives	**This course will enable students to:** • Know the characteristics of the soil for design of earthen dam. • Effect of pore pressure in earthen dams. • Effect of fissures and folds of rock on foundation of earthen dam.				
Course Contents	**UNIT-I** **Introduction**: Necessity of Earth and Earth-rock fill dams, types, typical embankment dam sections. **Site Selection and Exploration**: Factors influencing location and alignment of the dam, foundation subsurface exploration and studies of embankment construction materials. **Factors influencing Design**: Availability of material for construction, character of foundation, climate, shape and size of valley, river diversion, probable wave action, time available for construction, function of the reservoir and earthquake activity. **UNIT-II** **Design details:** Material, location and inclination of earth core, shell materials and embankment side slopes, free board, crest width and camber. Filter zones, curving embankment for arch action and raising earth dams. Design provisions to control construction and draw down pore pressures. Berms, slope protections, internal drainage systems. **Measurement of pore water pressure and movements:** Purpose and types of instruments, piezometer, devices for measuring movements, USBR measurements of pore water pressure and embankment compression, compression of rock fill embankment sections, during construction and post construction foundation settlement, foundation spreading, observation and measurement of leakage. **UNIT-III** **Stability analysis**: Zones of planes of weakness in foundation, linear failure, plastic failure, composite failure, bearing capacity failure, stability analysis of embankment by Taylor's modified method suggested by Sherard et al., wedge method, stability analysis in three dimension, stability during construction, full reservoir and drawdown conditions. **Special Design problems and details:** Design considerations in earthquake, ground movements, earthquake intensity scales, periods and amplitudes of				

	ground motion, influence of foundation material, earthquake waves, seiches, slope stability analysis during earthquake as per BIS, problems in loose sand, soft clay and silt foundation. **UNIT-IV** **Treatment of Rock Foundations and Abutments:** types of rock foundation, object of grouting, evaluation of necessity of grouting, planning grouting details, blanket grouting, drilling equipment, size and direction of holes, washing and pressure testing of holes, grouting equipment, procedures for grouting, pressure and consistency of grout, stopping surface leakage, surface treatment of rock foundation and abutments. Earth compaction against rock foundations and abutments, grouting through completed earthen embankments, drainage holes, grouting and drainage galleries. **Earth dams on pervious soil foundations:** Methods of foundation treatment, preventing under seepage with complete vertical barriers and grouting, reducing under seepage with partial vertical cut offs and horizontal upstream impervious blankets, controlling under seepage by regulation of leaks and relief wells. **UNIT-V** **Embankment Construction**: Equipment for excavating, hauling, spreading, blending, compacting and separating oversized rocks and cobbles, construction procedures and quality control of impervious and semi-pervious embankment sections, handling dry and wet materials, construction problems caused by fines, construction procedures of hard and soft rock fill embankments, field test on rock fill embankments, slope treatment and rip-rap.
Course Outcomes	**After the completion of course:** • Design rock and earth fill dams. • Understand the mechanism of grouting and its application in rocks. • For analyzing the complex geotechnical problems for the design of earth and rock fill dams. • Select a suitable site, materials and equipment for construction of earth/rock fill dams. • Analyze seepage through a given earth/rock fill dam section and select effective seepage control measures for the prevailing site conditions.
Text Books	1. Earth and earth-rock dams - Sheared J L, Woodward R J, Gizienski S F and Clevenger W A, John Wiley & Sons, NY 2. Earth and rock fill dam engineering – Sowers G P and Sally H L, Asia Publishing House, New Delhi 3. Engineering for Dams – Creager W P, Justin J D and Hinds J, John Wiley & Sons, NY 4. Indian storage resources with earthen dams – Strange W L, R&FN Spon Ltd., London
Reference	1. Principles for Design and Construction, Sherad , Earth and Rock fill dams,

Books	Balkema, Netherlands. 2. Earth and Rock fill dams Bharat Singh and Punmia , , Standard publishers, New Delhi, 1988.Earth Manual –USBR 3. Geotechnical and Geo environmental Engineering Handbook, Rowe, R K., Kulwer Academic Publishers,2001 4. Earth and Earth rock dam Sherard,J L.,Wood ward R J,Gizienski, R J and Clevenger W A., , John Wiley. 5. Anderson, M G., and Richards, K S Slope Stability.

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<table>
<tr><td>Course Title</td><td colspan="5">Expansive Soil Engineering</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE302T (Elective-III)</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 expansive soils.
Know the behaviour of such soils and to study the remedial measures for safety of structures.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Introduction: Origin, distribution of expansive soils, recognition and identification of expansive soils –clay mineral, x-ray diffraction, DTA, electron microscopy, classification, free swell, shrinkage index, swelling potential and swelling pressure – methods of determination, factors influencing.
Heave Prediction: Introduction, soil suction, measurement of soil suction – tensiometers, axis translation, filter paper method, psychrometers, osmotic method, and heave prediction based on oedometer tests, based on soil suction tests.

UNIT-II
Design Alternatives: Introduction, drilled pier and beam foundation, mat foundation, under-reamed pile foundation, general conditions for under reamed piles, design and construction.
Design For Highway And Air-Field Pavements: Introduction, general principles of pavement design, design features and treatment methods for expansive soil sub grades, air-field procedures.

UNIT-III
Treatment of Expansive Soils: Introduction, removal and replacement, remoulding and compaction, pre-loading, pre-wetting, stabilization – lime, cement, fly ash, application methods, moisture control, electro chemical treatments.
Remedial Measures: Introduction, remedial measures for buildings and pavement, case histories.

UNIT-IV
Methods of Construction On Expansive Soils: Introduction, sub-base preparation, constructional and water – protection measures, maintenance and</td></tr>
</table>

	rehabilitation of structures founded on expansive soils. **UNIT-V** **Swell – Shrink Behaviour of Expansive Soils:** Introduction, investigation of foundation movements, cyclic behaviours, factors affecting cyclic behaviour, case histories.
Course Outcomes	**After the completion of course:** • Classify the heaving soils and to predict their swell and shrinkage behaviour. • Provide proper remedy to the swelling soils. • Design the appropriate foundation based on the swelling characteristics. • Understand the dynamics of earth and to estimate dynamic properties of soils. • Develop the site specific design spectrum for design of sub structure and evaluation of liquefaction potential.
Text Books	1. Foundations on Expansive Soil - F H Chen, Elsevier Science Publishing Company, NY 2. Construction of buildings on expansive soils - E A Sorochan, Oxford & IBH Publications 3. Expansive soils – Problems and practice in foundation and pavement engineering – John D Nelson and Debora J Miller, John Wiley & Sons. 4. Soil Mechanics for Unsaturated Soils – D J Fredlund and H Rahardjo, John Wiley & Sons
Reference Books	1. F.H.Chen, Foundations on expansive soils - Elsevier Science; 2nd edition, 1988 2. Peck, Hansen and Thornborn, Foundation Engineering, John Wiley and Sons, New York, 1947 3. Tomlinson, Foundation design and Construction – English Language Book Society, Essex,

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Course Title	**Offshore Geotechnical Engineering**				
Course Code	**MENGE302T (Elective-III)**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Geotechnical Engineering-I & II**				
Course Objectives	**This course will enable students to:** • Know the type of soil strata available in offshore. • Develop a structure under different environmental condition. • Design the anchors in the sea. • Design the pipelines and cable structures.				
Course Contents	**UNIT-I** **Design of Offshore Platforms:** Introduction, fixed and floating platforms, case studies and general features, elements of hydrodynamics and wave theory, fluid structure interaction, steel concrete and hybrid platforms, Consolidation and shear strength characteristics of marine sediments. **UNIT-II** Design Criteria: Environmental loading, wind, wave and current loads after installation, stability during towing. Foundations: Site investigations, piled foundation, foundations for gravity structures, pile supported structures. **UNIT-III** Behaviour under dynamic loading, static and dynamic analysis of platforms and components. **UNIT-IV** Dynamic response in deterministic and in deterministic environment, codes of practice, analysis of fixed platform and semisubmersible related topics. **UNIT-V** Anchor design, breakout resistance analysis and geotechnical aspects of offshore pipeline and cable design.				
Course Outcomes	**After the completion of course:** • Design the structure for wind, wave loads and dynamic loads. • Design the structure for overturning. • Design the pipeline and cable structure. • Analyse loads on offshore structures and select appropriate foundations for				

	those. • Implement required ground improvement techniques for offshore structures.
Text Books	1. Offshore Geotechnical Engineering – Mark Radolph and Susan Gourvenec, CRC Press. 2. Construction of Marine and Offshore Structures – Ben C Gerwick, CRC Press. 3. Offshore Geotechnical Engineering – ETR Dean
Reference Books	1. Frontiers in Offshore Geotechnics II – Susan Gourvenec and David White, CRC Press. 2. Frontiers in Offshore Geotechnics II – Vaughan Meyer, CRC Press 3. Geotechnical Aspects of Coastal and Offshore Structures: Proceedings of the Symposium, Bangkok – A S Balasubramaniam, CRC Press

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<table>
<tr><td>Course Title</td><td colspan="5">Technical Paper Writing And Seminar</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE303P</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">Nil</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
Describe the research process.
Outline the elements of a thesis/dissertation.
Select a research topic of importance to the profession.
Effectively work with their academic advisor and graduate committee.
Develop and follow an appropriate timeline for completion of the thesis/dissertation.
Identify an appropriate theory base for their research.
Develop a conceptual model relevant to their research.</td></tr>
<tr><td>Course Contents</td><td colspan="5">Each student will select a topic in the area of geo-tech engineering and related area in the state of art area & technical development.
The topic will be decided by the Student, Guide and Departmental research committee.
Each student will make seminar presentation with audio/video aids, for the duration of 45 minutes and seminar work shall be in form of report to be submitted by the students at the end of the semester.
This report copies must be duly signed by guide and Head of Department. Attendance of all students for all seminars is compulsory.
Define the statement of research problem
Literature survey, familiarity with research journals
Broad knowledge off the available techniques to solve the problems
Technical writing skills
Presentation skills</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
Acceptable with minor or no revisions (no further approval required)
Acceptable with major revisions in content or format not acceptable</td></tr>
<tr><td>Reference</td><td colspan="5">1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the</td></tr>
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Books	selected topic of research. 2. Roberts, C. M. (2010). The dissertation journey. Thousand Oaks, CA: Corwin.

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<table>
<tr><td>Course Title</td><td colspan="5">Pre-dissertation (Literature Review/ Problem Formulation/ Synopsis)</td></tr>
<tr><td>Course Code</td><td colspan="5">MENGE304P</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>20</td><td>10</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Nil</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
Demonstrate the skills for good presentation and technical report writing skills.
Apply engineering and management principles while executing the project.</td></tr>
<tr><td>Course Contents</td><td colspan="5">Each student will select a topic in the area of geo-tech engineering and related area in the state of art area & technical development.
Every student will carry out dissertation under the supervision of a Supervisor.
The topic shall be approved by a committee constituted by the Head of the concerned department.
Every student will be required to present two seminar talks, First at the beginning of the Dissertation (Phase-I)to present the scope of the work and to finalize the topic, and second towards the end of the semester, presenting the work carried out by him/her in the semester.
The committee constituted will screen both the presentations and work.
Define the statement of research problem
Literature survey, familiarity with research journals
Broad knowledge off the available techniques to solve the problems
Technical writing skills
Presentation skills</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the completion of course:
Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research.
Students will be able to use different experimental techniques.
Students will be able to use different software/computational/analytical tools.
Students will be able to design and develop an experimental set up/equipment/test rig.
Students will be able to conduct tests on existing set ups/equipments and draw</td></tr>
</table>

	logical conclusions from the results after analyzing them. • Students will be able to either work in a research environment or in an industrial environment.
Reference Books	1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. 2. Roberts, C. M. (2010). The dissertation journey. Thousand Oaks, CA: Corwin.