Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Transportation Engineering/Water Resource Engineering)

SEMESTER I

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
MTCE 2101	BS	SYSTEM MATHEMATICS AND MATHEMATICAL MODELLING	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

To introduce the concepts of System Mathematics and Mathematical Modelling

Course Outcomes

After the successful completion of this course students will be able to:

1. *To understand different aspects of system analysis.*
2. *To understand the formulation of linear programming.*
3. *To acquire knowledge about network analysis and various methods.*
4. *To understand the fundamentals of simulation.*

Course Content:

UNIT – I

Concept of a system and system analysis; Mathematical modeling; Introduction to mathematical programming techniques viz–non linear programming, geometric programming, quadratic programming, linear programming, dynamic programming, game theory etc; Transportation problems, their formulations and solutions.

UNIT – II

Linear Programming, formulation, Graphical solution, Simplex method, BIG-M & Two Phase methods, Duality in LP, Revised Simplex.

UNIT – III

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Network analysis; CPM-PERT technique; Project optimality analysis; Updating; Dynamic programming; Stage coach problem and its D.P. solution.

UNIT – IV

Measures of central tendency; Central limit theorem; Statistical frequency distributions; Additional and multiplication laws of probability; Baye's theorem; Mathematical expectation; Binomial, Poisson, Normal 't', 'F' & Square distributions; Tolerance limits, confidence limits; Tests of significance; Analysis of variance.

UNIT – V

Linear and Non-linear Regression Analysis; Testing of Hypothesis; Acceptance Sampling; Fundamentals of Simulation; Introduction to Sensitivity Analysis, its limitations.

Texts:

1. Operations Research: Principles and Practice, 2nd Ed by Ravindran, Phillips, Solberg, John Wiley & Sons, 2007.
2. Operations Research: An Introduction by Hamdy A. Taha, Pearson/Prentice Hall, 2007.

References:

1. Probability, Statistics & Decision in Civil Engineering by Benjamin & Cornell Optimization by S.S. Rao, McGraw-Hill, New York.

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Master of Technology (Geotechnical Engineering)

SEMESTER I

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 4101	DCS	ADVANCED SOIL MECHANICS	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To impart knowledge about the engineering properties of soils with a focus on consolidation and shear strength
2. To introduce the fundamental concepts relevant to the strength behaviour of soils
3. To enable the students to understand the factors that control the strength behaviour of the soils

Course Outcomes:

1. The students obtain the complete knowledge on strength of soil mass.
2. The students are able apply principles of advanced soil mechanics to civil engineering problem
3. The students are able to develop mathematical models for solving different problems in Soil mechanics

Syllabus:

UNIT I

Compressibility of soils; consolidation theory (one, two, and three dimensional Consolidation theories), consolidation in layered soil and consolidation for time dependent loading, determination of coefficient of consolidation (Casagrande's method and Taylor's method)

UNIT II

Strength behavior of soils; Mohr Circle of Stress; UU, CU, CD tests, drained and un-drained behavior of sand and clay, significance of pore pressure parameters; determination of shear strength of soil; Interpretation of tri-axial test results

UNIT III

Stress path; Drained and un-drained stress path; Stress path with respect to different initial state of the soil; Stress path for different practical situations

UNIT IV

Critical state soil mechanics; Critical state parameters; Critical state for normally, consolidated and over consolidated soil; Significance of Roscoe and Hvorslev state boundary surface; drained and untrained plane. Critical void ratio; effect of dilation in sands; different dilation models

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SEMESTER I

UNIT V

Elastic and plastic deformations: elastic wall; introduction to yielding and hardening; yield curve and yield surface, associated and non-associated flow rule

Text Books:

1. Das, B.M., Advanced Soil Mechanics, Taylor and Francis, 2013.
2. Murthy V. N. S., Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series, CBS; 1ST edition (2018)

Reference Books:

1. Wood, D.M., Soil Behavior and Critical State Soil Mechanics, Cambridge University Press, 1990.
2. Craig, R.F., Soil Mechanics, Van Nostrand Reinhold Co. Ltd., 1987.
3. Terzaghi, K., and Peck, R.B., Soil Mechanics in Engineering Practice, John Wiley & Sons, 1967.
4. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley & Sons, 1979.

List of Practical:

1. Determination of Moisture Content and Specific gravity of soil
2. Grain Size Distribution Analysis and Hydrometer Analysis
3. Atterberg Limits (Liquid Limit, Plastic limit, Shrinkage limit)
4. Visual Classification Tests
5. Vibration test for relative density of sand
6. Standard and modified proctor compaction test
7. Falling head permeability test and Constant head permeability test
8. Consolidation test

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SEMESTER I

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 4102	DCS	ADVANCED FOUNDATION ENGINEERING	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The primary objective of this course is to equip the student with the knowledge of how to explore the soil, design the foundations for different conditions and check the stability of structures.

Course Outcomes:

1. Identify a suitable foundation system for a structure.
2. Evaluate the importance of raft foundation and principles of design for buildings and tower structures.
3. Analyse and design pile foundations.
4. Examine and discuss various machine foundations.
5. Analyse and design Sheet piles and cofferdams.

Syllabus:

UNIT I

Planning of soil exploration for different projects, methods of subsurface exploration, methods of borings along with various penetration tests

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, 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, analytical estimation of load- settlement behavior of piles, proportioning of pile foundations, lateral and uplift capacity of piles.

UNIT IV

Well foundation: IS and IRC codal provisions, elastic theory and ultimate resistance methods

Coffer dams: Various types, analysis and design foundations under uplifting loads

Foundations on collapsible and expansive soil: Foundations for collapsible and expansive soil

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SEMESTER I

UNIT V

Computation of settlements (Immediate & Consolidation); Permissible settlements, allowable total and differential settlement of structures

Text Books:

1. Murthy V.N.S. Advanced Foundation Engineering Geotechnical Engineering Series, CBS (2017).
2. Varghese P.C, Foundation Engineering, Prentice Hall India Learning Private Limited (2005)

Reference Books:

1. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.
2. Das B.M., Shallow Foundations: Bearing capacity and settlement, CRC Press, 1999.
3. Tomlinson M.J., Pile design and construction Practice, Chapman and Hall Publication, 1994.
4. Poulos, H. G. and Davis, F. H., "Pile Foundation Analysis and Design", Wiley and Sons. 1980

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SEMESTER I

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 4103	DCS	GROUND IMPROVEMENT TECHNIQUES	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

At the end of course work the student is expected to learn various techniques of in-situ ground modification using various stabilization techniques depending upon the soil characteristics

Course Outcomes:

At the completion of the course the students will be able

1. To understand the different types of ground modification can be done depending upon the site condition, type and purpose of structure to be constructed.
2. To understand need of ground improvement.
3. To learn ground improvement techniques for different types of soil.

Syllabus:

UNIT I

Introduction: Need of Ground Improvement; Different methods of Ground improvement; General Principal of Compaction, mechanics, field procedure, quality control in field.

UNIT II

Mechanical modification: Dynamic compaction, impact loading, compaction by blasting; Vibro-compaction; Pre-compression, stone columns; Hydraulic modification; Dewatering systems, preloading and vertical drains, electro-kinetic dewatering; Chemical modification; Modification by admixtures, stabilization using industrial, wastes, grouting

UNIT III

Ground Improvement in Cohesive Soil: Compressibility, vertical and radial consolidation, preloading methods; Types of drains, design of vertical drains, construction techniques; Stone column; Design principles, load carrying capacity, construction techniques, settlement of stone column foundation

UNIT IV

Ground Improvement by Grouting and Soil Reinforcement: Grouting in soil, types of grout, desirable characteristics, grouting, pressure, grouting methods; Soil Reinforcement, mechanism, types of reinforcing elements, reinforcement-soil interaction; Reinforcement of soil beneath the roads, foundation; Geosynthetics and their application

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SEMESTER I

UNIT V

Soil Stabilization: Lime stabilization- Base exchange mechanism, pozzolanic reaction, lime-soil interaction, line columns; Design of Foundation on lime columns; Cement stabilization, mechanism, amount, age and curing; Fly-ash - lime stabilization, soil bitumen stabilization

Text Books:

1. P. Purushothama Raj, Ground Improvement Techniques, Laxmi Publications; Second edition (2016).
2. Chattopadhyay and Maity, Ground Improvement Techniques, PHI Learning; Eastern Economy edition (30 June 2017)

Reference Books:

1. R. M. Korner, Design with Geosynthetics, Prentice Hall, New Jersy, 3rd edition 2002
2. G. V. Rao and G. V. S. Rao, Text Book on engineering with Geotextiles, Tata McGraw Hill

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SEMESTER I

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 4104(1)	DCS	ENGINEERING ROCK MECHANICS	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
*__Teacher Assessment__ shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The objectives of the course are for the students to develop an understanding of the engineering properties of rocks, geological and engineering rock classifications, rock failure theories, in-situ stresses in rock, and the fundamental concepts and principles of rock mechanics.

Course Outcomes:

1. The students will be able to perform various laboratory tests on rock and classify rock mass.
2. Be able to predict strength of rock mass with respect to various Civil Engineering applications

Syllabus:

UNIT I

Rock: Formation of rocks; Physical properties, classification of rocks and rock masses; Elastic constants of rock; Insitu stresses in rock; Rock coming, various methods of obtaining rock cores, Engineering properties of rock, stress - strain relations, elastic theory application to design in rock.

UNIT II

Discontinuities in Rock Masses: Discontinuity orientation; Effect of discontinuities on strength of rock.

Strength Behavior: Compression, tension and shear, stress-strain relationships; Rheological behavior

UNIT III

Strength and Failure of Rocks: Uniaxial and triaxial strength of rocks, other shear tests and application in Civil Engineering problems; Failure theories of rocks and propagation of cracks, Griffith Chack theory - Water in rock; Structural feature of mass rocks and their effects on engineering properties.

UNIT IV

Design of Structure in Rocks: Basic design principles of tunnels in rock; Principle of design of rock slopes

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SEMESTER I

UNIT V

Application of rock mechanics in Civil Engineering: Rock tunneling, rock slope stability, bolting, blasting, grouting and rock foundation design; Modern modeling techniques & analyses in rocks.

Text Books:

1. Deb Debasis and Verma Abhiram Kumar, Fundamentals and Applications of Rock Mechanics, PHI Learning Pvt. Ltd. 2016
2. Richard E. Goodman, Introduction to Rock Mechanics, Wiley India Pvt Ltd; Second edition, 2010

Reference Books:

1. Hudson J.A. and J.P. Harrison. Engineering Rock Mechanics: an Introduction to the Principles,. Elsevier, Oxford, 1997
2. Ramamurthy, T., Engineering in Rocks, PHI Learning Pvt. Ltd.
3. Jaeger, J.C. and Cook, N.G.W, Fundamentals of Rock Mechanics, Chapman and Hall, 1976.
4. Wyllie, D.C., Foundations on Rock, E & FN Spon. 2nd Edition, 1992.

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SEMESTER I

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 4104(2)	DCS	EARTH RETAINING STRUCTURES	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To understand lateral earth pressure theories and pressure theories and design of retaining walls.
2. To understand pressure envelops and design of various components in braced cuts and cofferdams.
3. To understand stability of earth dams and its protection and construction.

Course Outcomes:

Upon successful completion of this course students should be able to:

1. Apply the design philosophy of the foundations and retaining structures
2. Assess and select the geotechnical design parameters
3. Analysis and design of different types of retaining structures

Syllabus:

UNIT I

Earth Pressure: Rankine's 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.

UNIT II

Retaining walls: Proportioning of retaining walls, stability of retaining walls, mechanically stabilized retaining walls/reinforced earth retaining walls; Design of retaining structures; Design of retaining walls with surcharge loads

UNIT III

Sheet Pile wall: Free earth system, fixed earth system; Braced excavations; Earth pressure against bracings in cuts; Heave of the bottom of cut in soft clays

UNIT IV

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

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SEMESTER I

UNIT V

Tunnel and Conduit: Stress distribution around tunnels; Types of conduits; Load on projecting conduits; Arching and open cuts; Arching in soils

Text Books:

1. Muni Budhu, Foundations and Earth Retaining Structures, John Wiley & Sons, 2008
2. Chris R.I. Clayton, Earth Pressure and Earth-Retaining Structures, CRC Press; 3 edition, 2017

Reference Books:

1. Gregory Tschebotarioff, Foundations, Retaining and Earth Structures: The Art of Design and Construction and Its Scientific Basis in Soil Mechanics, McGraw-Hill Education; 2 edition, 1973
2. Hugh Brooks and John P Nielsen, Basics of Retaining Wall Design, H B A Publications; 9 edition, 2012

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SEMESTER I

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 4104(3)	DCS	SOIL STRUCTURE INTERACTION	2	1	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. Explain the effects of soil flexibility in the response of the structure
2. Analyse the structure with soil structure interaction effects to obtain the realistic response.

Course Outcomes:

1. Students can apply different soil response models for specific problem based on the requirement.
2. Students can analyze footings/rafts resting on soil as beams/plates on elastic foundation and work out design bending moments/shear and displacements.
3. Student can compute pile response for various loading condition for design purpose.

Syllabus:

UNIT I

Soil-Foundation Interaction: Introduction to soil-foundation interaction problems; Soil behavior, foundation behavior, interface behavior; Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, two parameter elastic models; Elastic plastic Behavior; Time dependent behavior

UNIT II

Beam on Elastic Foundation- Soil Models: Infinite beam, two parameters, isotropic, elastic half space; Analysis of beams of finite length; Classification of finite beams in relation to their stiffness

UNIT III

Plate on Elastic Medium: Thin and thick plates; Analysis of finite plates; Numerical analysis of finite plates, simple solutions

UNIT IV

Elastic Analysis of Pile: Elastic analysis of single pile; Theoretical solutions for settlement and load distributions; Analysis of pile group; Interaction analysis; Load distribution in groups with rigid cap.

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SEMESTER I

UNIT V

Laterally Loaded Pile: Load deflection prediction for laterally loaded piles; Sub-grade reaction and elastic analysis; Interaction analysis; Pile-raft system; Solutions through influence charts.

Text Books:

1. Rolando P. Orense, Nawawi Chouw, Soil-Foundation-Structure Interaction, CRC Press; 1 edition, 2017
2. J.W. Bull, Soil-Structure Interaction: Numerical Analysis and Modeling, CRC Press, 2019

Reference Books:

1. Selvadurai, A.P.S, Elastic Analysis of Soil-Foundation Interaction, Elsevier, 1979.
2. Structure Soil Interaction - State of Art Report, Institution of Structural Engineers, 1978.

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