Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Choice Based Credit System (CBCS) in Light of NEP-2020

M. Tech (Common for all Engineering branches)

(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTRM301	AECC	Research Methodology in Engineering	60	20	20	0	0	3	1	0	4

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 Educational Objectives (CEOs):

1. The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property.
2. To analyze and evaluate research works and to formulate a research problem to pursue research.
3. To develop skills related to professional communication and technical report writing.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understanding and formulation of research problem.
2. Apply quantitative and qualitative methods used in engineering research.
3. Analyze interpret and evaluate data that relate to engineering problems.
4. Develop skills related to professional communication, technical report writing and publishing papers.
5. Act professionally, autonomously, ethically and in teams to produce a professional product.

Syllabus

Unit-I

Introduction to Research Methodology: - An overview of Research process, Types of research; Approaches to research, Importance of criticism in Literature review, identifying research gaps; Formulation of research problem; Research design,

Data: Primary and secondary data-sources, advantages/disadvantages; Sampling and primary data collection, sampling size, random and structured sampling

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Unit-II

Measurement and Scaling Techniques: - Types of scales, Criteria for good measurement, Attitude measurement - Likert's scale, Semantic differential scale, Thurstone-equal appearing interval scale.

Statistical Tools for Data Analysis: - Measure of central tendency, Measures of dispersion, Correlation and Regression, Formulation of hypothesis, Type I & Type II error, Parametric test, non-parametric test.

Unit-III

Research Methods I - Use of computer software in research and understanding the limitations. Multi-attribute decision making methods, Data envelopment analysis, Grey relational analysis etc., Multidisciplinary research problems, Synthesis of disciplinary research findings; Reliability and sensitivity analysis.

Unit-IV

Research Methods II - Modeling and simulation of engineering problem; Mathematical modeling-formulation, calibration, validation, application; measurement design – validity, reliability, scaling and sources of error. Mathematical programming methods, Numerical analysis, Optimization techniques, Design of laboratory experiments and field tests.

Unit-V

Academic Writing Skills and Presentation - Layout of a Research paper, research report, Thesis structure, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Reference Management Software like Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Guidelines on how to write research papers. Content of Poster presentation, Power point presentation, Oral presentation

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Text Books -

1. C.R. Kothari, 2012. Research Methodology Methods and Techniques, 3/e, Vishwa Prakashan,
2. Montgomary, Douglas C., 2007. Design and Analysis of Experiments (Wiley India).
3. Chawla, D. and Sodhi, N., 2011. Research methodology: Concepts and cases. Vikas Publishing House.

Reference:

1. Donald H.McBurney, "Research Methods", 5th Edition, Thomson Learning, ISBN: 81-315-0047.
2. Donald R. Cooper, Pamela S. Schindler, "Business Research Methods", 8/e, Tata McGraw-Hill Co. Ltd.,
3. Timothy J. Ross, "Fuzzy Logic with Engg Applications", , Wiley Publications, 2nd Ed[d]
4. Thiel D.V. "Research Methods for Engineering", Published by Cambridge University Press, UK
5. P.J. van Laarhoven & E.H. Aarts, "Simulated Annealing: Theory and Applications" (Mathematics and Its Applications).

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M.Tech. in Civil Engineering with Geotechnical Engineering
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COURSE CODE	CATE-GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTCE 4201	DCC	Dynamics of Soils and Foundations	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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Course Educational Objectives (CEOs):

1. Learning the peculiarities of soil response when subjected to dynamic actions, either seismic or not.
2. Understanding the fundamentals of wave propagation and seismology, necessary to characterize the dynamic load.
3. Knowledge of in situ and laboratory tests for soil dynamic characterization.

Course Outcomes (COs):

1. Understands theory of vibration and resonance phenomenon, dynamic amplification.
2. Understand propagation of body waves and surface waves through soil.
3. Exposed to different methods for estimation of dynamic soil properties required for design purpose.
4. Apply theory of vibrations to design machine foundation based on dynamic soil properties and bearing capacity.

Syllabus

UNIT I **08 Hrs.**

Fundamentals of vibrations: Single, two and multiple degree of freedom systems; Vibration isolation, vibration absorbers, vibration measuring instruments

UNIT II **08 Hrs.**

Wave propagation: Elastic continuum medium; Semi-Infinite elastic continuum medium; Soil behavior under dynamic loading

UNIT III **08 Hrs.**

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 IV **08 Hrs.**

Bearing capacity of foundations: Introduction to bearing capacity of dynamically loaded foundations for water towers, chimneys and high-rise buildings; Response of pile foundations

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MTCE 4201	DCC	Dynamics of Soils and Foundations	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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UNIT V **08 Hrs.**

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.

Text Books:

1. Sarana S, Soil Dynamic and Machine Foundations, Galgotia Publications Pvt Ltd-New Delhi, 2016
2. Das B.M., Fundamentals of Soil Dynamics, Elsevier,2005

Reference Books:

1. Steven Kramer, Geotechnical Earthquake Engineering, Pearson, 2008.
2. Prakash, S., Soil Dynamics, McGraw Hill, 1981.
3. Kameswara Rao, N.S.V., Vibration analysis and foundation dynamics, Wheeler Publication Ltd., 1998.

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MTCE 4202	DCC	Stability Analysis of Slopes	60	20	20	0	0	2	1	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 Educational Objectives (CEOs):

1. Understand the basic concept of slope stability analysis
2. Understand the basic design considerations
3. Be familiar with slope stability analysis and design procedure
4. Be able to perform simple slope stability analysis

Course Outcomes (COs):

Student will be able to

1. Understands types and causes of slope failures
2. Check the stability of earthen dams, and the safety measures to be undertaken to prevent the instability of slopes, earthen dams and embankments.
3. Analyze flow nets in different conditions.
4. Learn about the strengthening measures.

Syllabus:

UNIT I **07 Hrs.**

Slopes: Types and causes of slope failures, mechanics of slope failure, failure modes

UNIT II **09 Hrs.**

Stability analysis: Infinite and finite slopes with or without water pressures; Concept of factor of safety, pore pressure coefficients, mass analysis, Wedge methods, friction circle method; Method of slices, Bishop's method, Janbu's method, Morgenstern and Price, Spencer's method

UNIT III **08 Hrs.**

Stability analysis in the presence of seepage: Two-dimensional flow – Laplace equation and solution, graphical method, determination of phreatic line

UNIT IV **08 Hrs.**

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 analysis of dam body during steady seepage

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MTCE 4202	DCC	Stability Analysis of Slopes	60	20	20	0	0	2	1	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.

UNIT V **08 Hrs.**

Strengthening measures: Stabilization of slopes by drainage methods; Surface and subsurface drainage; Use of synthetic filters; Retaining walls, stabilization and strengthening of slopes; Shot-creting; Rock bolting and rock anchoring, Instrumentation and monitoring of slopes, slope movements, warning devices, maintenance of slopes

Text Books:

1. Chowdhary R and Chowdhary I, Geotechnical Slope Analysis, CRC Press, 2010
2. Y. M. Cheng and C. K. Lau, Slope Stability Analysis and Stabilization: New Methods and Insight, CRC Press; 2008

Reference Books:

1. J. Michael Duncan, Soil Strength and Slope Stability, John Wiley & Sons; 2nd edition, 2014
2. Paul Guyer, An Introduction to Slope Stability Analysis, Independently Published , 2018

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MTCE 4203	DCC	Geotechnical Exploration and Measurement Technique	60	20	20	30	20	2	0	2	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 Educational Objectives (CEOs):

1. To impart knowledge about soil investigation techniques.
2. To introduce the boring techniques and assessment of bearing capacity
3. To enable the students to learn various techniques of soil and rock sampling and prepare the soil and rock testing reports.

Course Outcomes (COs):

1. Students can plan subsurface investigation based on the requirement of civil engineering project and site condition. Can finalize depth and number of boreholes
2. Students can execute different subsurface exploration tests, collect disturbed/undisturbed samples for laboratory tests and can suggest design parameters.
3. Student exposed to different methods for estimation of dynamic soil properties required for design purpose.
4. Students can develop instrumentation scheme for monitoring of critical sites

Syllabus:

UNIT I **07 Hrs.**

Necessity and importance of soil exploration; Method of sub surface exploration; Test pits, trenches, caissons, tunnels and drifts; Wash boring, percussion drilling, rotary drilling, factors affecting the selection of a suitable method of boring

UNIT II **06 Hrs.**

Indirect method of exploration; Seismic method; Electrical resistivity, resistivity sounding and profiling, qualitative and quantitative interpretation of test results; Comparison of resistivity and seismic surveys, shortcomings; Stabilization of bore holes

UNIT III **06 Hrs.**

Extent of boring, factors controlling spacing and depth of bore holes; Different method of stabilization of the bore holes and their relative merits and demerits; Ground water observation; Different method of ground water observation; Time lag in observation

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MTCE 4203	DCC	Geotechnical Exploration and Measurement Technique	60	20	20	30	20	2	0	2	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
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UNIT IV **06 Hrs.**

Sampling –Introduction, source of disturbance and their influence; Type of sampler; Principle of design of sampler; Representative and undisturbed sampling in various types of soils; Surface sampling; Amount of sampling; Boring and sampling record; Preservation and shipment of sample preparation of bore log

UNIT V **06 Hrs.**

Penetration tests; Standard penetration tests; Dynamic cone penetration tests with and without bentonite slurry; Static cone penetration tests, factor affecting the penetration tests; Various corrections in the test results; Interpretation of test result for design and determination of modulus of deformation; Small size penetrometer; Correlation among various test results

Text Books:

1. Dr Mohamed Abdallah El-Reedy, Soil Investigation and Foundations Design, Independently Published, 2020
2. G. Ranjan and A S R Rao, Basic and Applied Soil Mechanics, New Age international Publishers.
3. B. M Das, Principles of Foundation Engineering, Thomson Brooks/Cole

Reference Books:

1. N.P. Kurien, Design of Foundation Systems: Principles & Practices, Narosa, New Delhi 1992
2. H. F. Winterkorn and H Y Fang, Foundation Engineering Handbook, Galgotia Book source

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List of Practicals:

1. Exploratory borings by different methods including auger boring, wash boring, percussion drilling and rotary drilling.
2. To evaluate geotechnical engineering properties of subsurface soils using Standard penetration test
3. To measure the strength of in-situ soil and the thickness and location of subsurface soil layers using Dynamic cone penetration test
4. To measure the strength of in-situ soil and the thickness and location of subsurface soil layers using Static cone penetration test.
5. To determine the ultimate bearing capacity of the soil and the probable settlement under a given load using Plate load test.
6. To determine the stress strain relations of in-situ soil using Pressure meter test.
7. To measure material properties for assessment of potential subsurface conditions using Geophysical exploration tests.

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MTCE 4204	DCC	FEM in Geotechnical Engineering	60	20	20	0	0	2	1	0	3

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Course Educational Objectives (CEOs):
This course will enable students to

1. Understand in general how finite elements obtain approximate solutions to differential equations
2. Appreciate the structure of a typical finite element program
3. Gain experience of finite element analysis applied to classical geotechnical problems (e.g., settlement, seepage, consolidation, slope stability)
4. Gain insight into the soil properties needed for finite element analysis

Course Outcomes (COs):
During this course, students will be trained:

1. To understand the basic concepts of finite element analysis in general and the transition from structural engineering aspects to geotechnical engineering aspects
2. To understand the finite element techniques for seepage analysis and joint rock masses
3. In Finite element applications in design and Analysis of bearing capacity of the soil for shallow foundations

Syllabus:

UNIT I **08 Hrs.**
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 **09 Hrs.**
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, Isoparametric Formulation: Concept, Different isoparametric elements for 2D analysis, formulation of 4-noded and 8-noded isoparametric quadrilateral elements, Lagrangian elements, Serendipity elements

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UNIT III **08 Hrs.**

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 invariant relation, stress-strain component relation, parametric values) with numerical examples.

UNIT IV **07 Hrs.**

Geotechnical Applications - Seepage analysis: Finite element discretization of seepage equation, computation of velocities and flows, treatment of free surface boundary.

UNIT V **08 Hrs.**

Geotechnical Applications - Analysis of jointed rock mass: Characters and discontinuity of rock, model behaviour of jointed rocks, plane strain analysis

Text Books:

1. Introduction to the Finite Element Method (1972), Desai, C. S. and J.F., Abel. Van Nostrand 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, D J Naylor & G N Pande (2012)

Reference Books:

1. O.C. Zienkiewicz and R.L. Taylor, Finite element methods Vol. I & Vol. II, McGraw Hill,2010
2. K.J. Bathe, Finite element procedures, PHI Ltd., 1996.

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