CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Scheme of Teaching & Examination

M-Tech (Civil) with Specialization in Geotechnical Engineering.

I SEMESTER.

S. No	Board of Study	Subject Code	NAME OF SUBJECT	Periods per Week			Scheme of Examination Theory / Practical			Total marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Civil Engg.	…. (20)	Geotechnical Earthquake Engineering	3	1	0	100	20	20	140	4
2	Civil Engg.	…. (20)	Geo Mechanics	3	1	0	100	20	20	140	4
3	Civil Engg.	…. (20)	Rock Mechanics	3	1	0	100	20	20	140	4
4	Civil Engg.	…. (20)	Geotechnical behaviour of Earth Materials	3	1	0	100	20	20	140	4
5	Refer Table - I		Elective-I	3	1	0	100	20	20	140	4
6	Civil Engg.	…. (20)	Numerical Computational Lab	-	-	10	75	-	75	150	5
7	Civil Engg.	…. (20)	Geotech Field Testing Lab	-	-	10	75	-	75	150	5
TOTAL				**15**	**05**	**20**	**650**	**100**	**250**	**1000**	**30**

L- Lecture **T-** Tutorial
P- Practical, **ESE-** End Semester Exam
CT- Class Test **TA-** Teacher's Assessment

** *student can opt any one elective subject from the subject mentioned below.*

Table- I

ELECTIVE- I			
S. No.	**Board of Study**	**Subject Code**	**NAME OF SUBJECT**
1	Civil Engg.	…. (20)	Geodynamics and Machine Foundations
2	Civil Engg.	…. (20)	Foundation Engineering
3	Civil Engg.	…. (20)	Geo-Technics of Dam
4	Civil Engg.	…. (20)	Advance Soil Mechanics

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

Note (2) – Choice of elective course once made for an examination cannot be changed in future examinations.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Geotechnical Earthquake engineering** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT- I **ELEMENTRY SEISMOLOGY:**
Earth and its interior, sismic waves, plate tectonics, plate boundries, Elastic rebound theory, size of earthquakes- magnitude, intensity, intensity scales, locating the earthquakes, Iso-seismal map, past earthquakes, seismic zoning of India.

UNIT- II **STROING GROUND MOTION:**
Strong ground motion measurements- seismograph, seismograms: strong motion records: characteristics of strong motion- peak ground acceleration, velocity and displacement PGA, PGV and PGD: seismic Hazard Analysis.

UNIT- III **DYNAMIC BEARING CAPACITY:**
Dynamic soil properties, Dynamic earth pressure theories

UNIT- IV **EARTH PRESSURE & STABILITY ANALYSIS:**
Mononobe- Okabe Theory, Seismic Slop stability analysis, pseudo static method, dynamic bearing capacity of shallow foundation problems.

UNIT- V **LIQUEFACTION OF SOILS:**
Theory of Liquefaction, Factor affecting Liquefaction, Determination of Liquefaction potential, Seed and Idriss method. Uses of SPT data for assessment of Liquefaction potential, Anti Liquefaction measure, problem & case histories.

Text Books:

1. Geotechnical Earthquake Engineering by Kramer S.L. Prentice Hall Pub.
2. Geotechnical Earthquake Engineering Hand book by Robert W Day, Mc Graw Hill Hand book

References:

1. Soil Dynamics by Samsher Prakash
2. Soil Dynamics and machine foundation by Swamisaran, GalgotiaPub.Pvt Ltd New Delhi.
3. Soil Dynamics and Earthquake Engineering by Bharat Bhusan Prasad, PHI Learning Pvt. Ltd New Delhi

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Geo-mechanics** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT- I **SHEAR STRENGTH:**

Mechanism, Effective stress, state of stress-strain, stress and strain paths and invariant, Failure theories, Hvorsley Parameters, Effect of intermediate principal stress, shear strength characteristics of saturated soil under drained and untrained condition: shear behaviour of dry and partially saturated soil, numerical problems.

UNIT- II **DETERMINATION OF SHEAR STRENGTH PARAMETERS:**

Laboratory and field methods for determination of shear strength parameters. Selection of shear strength parameters for the analysis of geotechnical problems. Numerical problems, shear strength of rocks, case histories.

UNIT- III **SOIL PHYSICS:**

1) Soil as dispersed system, clay the active soil-fraction, surface behaviour of clay particles.
2) Physical behaviour of soil- water system. Hydration of clays, Viscosity of colloidal clays, swelling of colloidial clays, Soil consistency. Form of soil-consistency, consistency of moist and wet soil, soil plasticity, Soil structure- classification and genesis, Soil as a 3-phase system.

UNIT- IV **CLAY –MINERALOGY:1**

1) Bonding, crystal structure and surface characteristics, Minerals in soils. Non-clay and clay mineral
2) Clay minerals, their lattice patterns, genesis, sizes, colloidal particles and their effect on the soil-structure and expansiveness.

UNIT V **CLAY –MINERALOGY:2**

Clay mineral relationship with water and swelling, swelling theories. Determination of swelling values. Identification of clay-minerals. Clay and engineering structures.

Text books:

1. Basic and Applied Soil Mechanics (Revised Edition) – Gopal Rajan and Rao A.S.R. (New Age)
2. Foundation Engineering – R. B. Peck, W. E. Hanson, and T. H. Thorn burn (John Wiley)

References:

1. Clay mineralogy by Grim.
2. Soil –physics by C.D. Waver, John Wiley &sons, New York.
3. Design Aids in Soil Mechanics and Foundation Engineering – S.R. Kaniraj (Tata McGraw Hill)

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Rock Mechanics** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT-I: Revision of physical and structural geology, faults and shear zones - treatment -engineering classification -need -classification of intact rock and insitu rock masses -insitu state of stress - mapping of joints.

UNIT-II: Mechanical properties -intact rock -insitu rock masses. Brittle failure of rock -fracture in compression -rupture criteria for brittle rock

UNIT-III: Insitu test: need -plate load test -pressure tunnel test -flat jack test - cable jacking test -dynamic insitu shear test -permeability test

UNIT-IV: Principles of rock stress measurements stresses relief techniques -bore hole deformation meters - stress meter -photoelastic stress meter -multipoint strain cell -flat jack.

UNIT-V: Behaviour of rock structures -plasticity and- failure of rock -introduction of analysis of general slip -rock bolting and grouting.

Text Books:

1. Stagg K G and Zienkiewicz 0 C, “Rock Mechanics in Engineering Practical”, John Wiley & Sons, London, 1969.
2. Goodman R E, “Introduction to Rock Mechanics”, John Wiley & Sons, New York, 1989.

References Books:

1. Muller L, “Rock Mechanics”, Springer -Verlag, New York, 1972
2. Ramamurthy T., “Engineering in Rocks for Slopes, Foundation and tunnels”, Prentice Hall of India Pvt Ltd. New Delhi, 2007
3. Hudson J A and Harrison J P., “Engineering Rock Mechanics – An Introduction to the Principles”Elsevier, Oxford, 1997.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Geotechnical behaviour of earth material** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT-I: **GROUND WATER AND SEEPAGE:**
Fundamentals of rround water flow. Basic equation for ground water flow. Unconfined flow. Flow through earth and rock fill dams. Seepage from canals & diches. Seepage towards wells. Unsteady flow through eath & rock fill dams, Analog methods for obtaining flow net, computation of flow through porous media.

UNIT-II: **CONSOLIDATION AND SETTLEMENT ANALYSIS:**
General theory of teansient flow in porus media. One dimensional consolidation, vertical& radia flow. Three dimensional consolidation, Renulic analysis & Biost theory. Secondary consolidation- Tylor merchant & Gibson approaches, field compression curve. Computation of settlement of foundation resting on freely draining & non freely draining geotechnical materials including U.C., N.C.. & O.C. soil.

UNIT-III: **BEARING CAPACITY OF SHALLOW FOUNDATION:**
Modes of failure, ultimate criteria, computation of ultimate load, Bearing capacity of foundation. Homogeneous soil. Methods of Terzaghi Meyeroff, Brinch Henson IS Code, Kerisel & Graphical determination. Factors affecting bearig capacity, choice of factor of safety, Bearing capacity of foundation on lavered strata

UNIT-IV: Case histories pertaining to settlement, seepage and shear failure. Effects of seismic forces on the seepage

UNIT-V: Consolidation & bearing capacity of soils, field problems pertaining to settlement determination.

Text Books:

1. Soil Mechanics and Foundation Engineering – S.N. Murthy (DhanpatRai Publications)
2. Basic and Applied Soil Mechanics – Gopal Ranjan and Rao A.S.R. (New Age International)
3. Design Aids in Soil Mechanics and Foundation Engineering – S.R. Kaniraj (Tata McGraw Hill)

Reference Books:

1. Geotechnical Engineering Principles and Practice – D. P. Coduto (Prentice Hall of India)
2. Soil Mechanics and Foundation Engineering – Garg S.K. (Khanna Publishers)
3. Soil Mechanics and Foundation Engineering – Purushothama Raj (Pearson Education)

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Elective-I: Geodynamics and Machine Foundations** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT — I: THEORY OF VIBRATIONS:
Definitions; degree of freedom, damping, amplitude, period, natural frequency. Harmonic motion, free & forced vibrations of a single degree of freedom system, undamped and damped system. Logarithmic decrement, transmissibility. Vibrations of multiple degree of freedom systems.

UNIT — II: WAVE PROPAGATION & DYNAMIC SOIL PROPERTIES:
Wave propagation in elastic infinite medium, wave propagation in elastic half space. Soil spring constants. Dynamic moduli, poission's ratio, field & laboratory techniques, cyclic shear test, cyclic plate load test, block vibration test, seismic refraction tests, high strain tests.

UNIT — III: MACHINE FOUNDATIONS:
General Principles: Type of machine and foundations, modes of vibration of a rigid foundation block, general requirements. Permissible amplitude and allowable soil pressure General design criteria, I S codes.

UNIT — IV: DESIGN OF MACHINE FOUNDATIONS:
Foundations for impact type machine, design procedure for hammer foundations. Foundations for reciprocating & rotary type machines.

UNIT — V: VIBRATION ISOLATION AND SCREENING:
Force and motion isolation, screening of vibrations, materials for base isolation.

Text books:

1. Soil Dynamics and Machine Foundations by Swamisaran; Galgotia publications Pvt. Ltd. New Delhi
2. Dynamics of Bases and Foundations: Barken D D, McGraw Hill New York

Reference Books-

1. Soil Dynamics: by Shamsher Prakash Me Graw Hill Bookco.
2. IS2974 (part I to V) ISI New Delhi
3. Soil Dynamics and Earthquake Engineering by Bharat Bhusan Prasad, PHI Learning Pvt. Ltd. New Delhi

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Elective-I: Foundation Engineering** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT-I: **SOIL PROPERTIES AND EXPLORATION**

Soil properties and its applications, Laboratory testing, Soil exploration techniques –comparisons, Sounding tests, Geophysical methods, Sampling, Interpretation of Laboratory & field Testing.

UNIT-II: **INTRODUCTION SHALLOW FOUNDATION**

Soil Investigation Reports study, Bearing capacity of soil, Settlement of Foundations

UNIT-III: **MACHINE FOUNDATION**

Machine foundation – Types of machine foundation, General criteria, Theory of vibration, Single degree freedom system, Soil dynamic parameters, Block type machine foundation (Checking of resonance and permissible amplitude), vibration isolation techniques

UNIT-IV: **PILE FOUNDATION**

Pile foundation – Types of piles, Factors affecting choice of types of piles, Load carrying capacity of piles, Pile group, Group efficiency, Lateral resistance of piles, settlement of piles, Negative skin friction

UNIT-V: **SPECIAL FOUNDATIONS**

Classification of Foundation, Special foundations, Raft foundation, types of rafts, Beams on elastic foundation, Footing subjected to moments, Footing subjected to tension, Geotextiles, various methods of foundation design, Technological consideration in Geotechnical Engineering.

Text books:

1. Bowles J E “Foundation Analysis & Design” McGraw Hill Inc. New York, 1988.
2. Nayak N V “Foundation Design Manual” Dhanpatrai & Sons, New Delhi 1985.
3. Das B M “Principles of Foundation Engineering” PWS Publishing Co., Boston, 1990.
4. Terzaghi , Peck .and Mesri “ Soil Mechanics in Engineering Practice “ 1996

References Books:

1. Foundation Design Principles and Practice by D.P. Coduto, Pearson Education India.
2. Principles of Geotechnical Engineering by Braja M. Das, Thomson.
3. Principles of Foundation Engineering by Braja M Das, Cengage Learning Custom Publishing

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Elective-I: Geo-Technic of dam** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT-I: Types of dams. Site selection for major/minor dams, regional map preparation using satellite imagery. Design criteria. Types and selection of earth dam and its suitability on various soil parameters. Components of earth dam. Analysis of different geologic conditions influencing the design of an earthen dam/embankment.

UNIT-II: Suitability of earth dam over others types. Components of earthen dam and their design criteria. Soil and hydraulic factors affecting the design. Types and selection of earth dam.

UNIT-III: Seepage analysis of an earthen dam, flow net, its applications, phreatic line, seepage below hydraulic structure, pore water pressure and its control. Method of foundation treatment. Critical review of stability analysis.

UNIT-IV: Embankment construction procedures & equipment, methods and quality control.Various methods of embankment improvement by geo-synthetics and other available procedures.

UNIT-V: Critical Study of earth dam failure. Lesson failure cases, maintenance of earthen dam. Critical review of earthen dam construction over other types.

Text books:

1. Design of Earth Dams by A.L. Goldin, CRC Press.
2. Earth and Rock fill Dams: Principles for Design and Construction by Christian Kutzner, CRC Press.
3. Robin Felleet al., 2018,Geotechnical Engineering of Dams, CRC Press

Reference Book:

1. Sherad, “Earth and Rock fill dams”.
2. Bharat Singh, “Earth and Rock fill dams”.
3. Winterkorn and Fang, “Foundation Engineering Hand Book”.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Elective-I: Advanced Soil Mechanics** Code: ……. **(20)**

Total Theory Periods: **40** Total Tutorial Periods: **12**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

UNIT-I: Stresses and displacements in soil: soil as elastic body -concept of effective stress - equations of equilibrium in soil mass -principal stresses and strains -problems of plane stresses and strains - stress distribution by Boussenesq, Westerdgards theory –Newmark's chart -influence of anisotropy on stress distribution -applications to geotech problems

UNIT-II: Shear resistance: stress -strain relationship in soils -failure criteria –Mohr Coulomb's failure - shear parameters under different drainage conditions construction - pore pressure in saturated and unsaturated soils -analytical predictions of pore water pressures -stress dilatency theory - results of plain strain shear tests -forces on shear parameters

UNIT-III: Mechanics of consolidation: phenomenon of consolidation -Terzaghi's theory of unidimensional consolidation - methods to determine precompression history -applications to estimate settlements -introduction of creep and stress relaxation by rheological models.

UNIT-IV: Mechanics of flow through soils: flow through soils -unidimensional - radial and Spherical flow cases -seepage forces quick sand and piping

UNIT-V: Flow nets of confined and unconfined flow by relaxation techniques - phreatic surfaces by conformal mapping -flow net for anisotropic non-homogeneous soils

Text book:

1. Scott R F, "Principles of Soil Mechanics", Addition Wesley Publishing Co. Inc., 1988.
2. Harr M E, "Foundation of Theoretical Soil Mechanics", McGraw Hill Book Co., New York, 1962.

References:

1. Kaniraj S R, "Design Aids in Soil Mechanics & Foundation Engineering", Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 1988
2. Terzaghi , Peck .and Mesri " Soil Mechanics in Engineering Practice " 1996
3. Bowles J E "Foundation Analysis & Design" McGraw Hill Inc. New York, 1988.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Numerical computational lab** Code: …… **(20)**

Minimum number of class tests to be conducted: **10**

Experiments to be performed (Minimum 10 experiments to be performed)

1. To find largest among three numbers.
2. To find factorial of a given number by iteration.
3. To find whether the given number is prime number.
4. To find sum and average of n integer using linear array.
5. To read n number from keyboard and display these numbers in reverse order their entry.
6. To search a given number with in a linear array.
7. To generate the Fibonacci series.
8. To find factorial of a given number using a function.
9. To deduce error involve in polynomial equation.
10. To implement Newton's forward and backward interpolation formula.
11. To find out root of algebraic equations using Bisection, Regula-falsi and Newton Raphson method.
12. To check weather a given string is a palindrome or not.

List of Equipments / Machine Required:

1. PC system.
2. Turbo C++ compiler.

Recommended Books:

1. Let us C++ – Yeshwant Kanitkar (BPB Publications)
2. Problem Solving with C++ – Savitch (Addison Wesley Publication)

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M-Tech I** Branch: **Civil Engineering**

Subject: **Geo-Tech Field Testing-I Lab** Code: …… **(20)**

Minimum number of class tests to be conducted: **10**

Experiments to be performed (Minimum 10 experiments to be performed)

1. Determination of In-situ density by core cutter method.
2. Determination of In-situ density by sand replacement method
3. Determination of Undrained shear strength of soil by vane shear test
4. Determination of shear parameter of soil by Tri axial test
5. Determination of compressibility characteristics of soil by Oedometer test.
6. Determination of CBR of a soil specimen as per IS code recommendation
7. Demonstration of the Block Vibration Test.
8. Demonstration of the Plate Load Test.
9. Demonstration of the Electrical Resistivity Test.
10. Complete Investigations and Preparation of the Geotechnical Investigation Report of a Sample Field Site.
11. Collection of undisturbed and representative samples, soil samples using auger boring and by drilling bore hole.
12. Determination of free swell index and swelling pressure of given clay sample.

List of Equipment's / Machine Required:

1. Light Compaction Mould
2. Heavy Compaction Mould
3. Oven 4. CBR Apparatus
4. North Dakota Cone Apparatus
5. Direct Shear Test Apparatus with full accessories
6. Tri axial Compression Test Apparatus with full accessories
7. Consolidometer Apparatus
8. Unconfined Compression Test Apparatus
9. Swell Pressure Test Apparatus
10. Standard Penetration Test Apparatus with full accessories
11. Plate Load Test Apparatus with full accessories
12. Soil Sampling Tube

Recommended Books:

1. Soil Mechanics and Foundation Engineering – B.C. Punmia (Laxmi Publication)
2. Soil Engineering in Theory and Practice (Vol-II) – Alam Singh (Asia Publishing House, New Delhi)