## UNIVERSITY OF PUNE
### COURSE STRUCTURE FOR M.E. (For 2008 Course) (w.e.f. June – 2008)

#### SEMESTER I

<table>
<thead>
<tr>
<th>CODE</th>
<th>SUBJECT</th>
<th>TEACHING SCHEME</th>
<th>EXAMINATION SCHEME</th>
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#### SEMESTER III

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8104-- Elective I

1. Applied Soil Mechanics
2. Rock Mechanics and Tunnelling
3. Site Investigations and Ground Improvement
4. Shallow and Deep Foundations

8105-- Elective II

1. Soil Stabilization
2. Soil Structure Interaction
3. Geoenvironmental Engineering
4. Earth Pressure and Retaining Structures
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E. CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I:

SUBJECT CODE 501201

Numerical Methods

Teaching scheme:                      Examination Scheme:
Lectures: 3 hrs/week                  Paper 100 marks

Credits: 3

Fundamentals of numerical methods, Error analysis, Differentiation, integration, interpolation & extrapolation, Solution of non-linear algebraic and transcendental equation, Solution of systems of linear & non-linear algebraic equations, Eigen value problems, Solution of partial differential equation, initial and boundary value problems, Computer oriented algorithms, Numerical solution of problems related to shallow and deep foundation, Flow through porous media., Settlement computations under different loading conditions & consolidation

Reference

3. Numerical methods in FORTRAN by John M.Mc & M.G.Salvadori Published by Prentice Hall of India
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M.E. CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER - I

SUBJECT CODE 501202
Systems Approach to Management and Development of Human Resources

Teaching scheme:
Lectures: 3 hrs/week
Examination Scheme:
Paper 100 marks
Credits: 3


Texts/References

- Physical & geotechnical properties of soils – Joseph E.Bowels, Tata Mc.- Grawhill
- Advanced soil mechanics- Braja M.Das, Tata Mc.- Grawhill
- Indian standards compendium in soil engineering, SP 36( Part I ) 1987, Bureau of Indian standards
- Soil physics by Baver.
UNIVERSITY OF PUNE
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M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I

SUBJECT CODE 501204 (ELECTIVE I)
Applied Soil Mechanics

Teaching scheme:
Lectures: 3 hrs/week

Examination Scheme:
Paper 100 marks

Credits: 3


- Physical & geotechnical properties of soils – Joseph E.Bowels, Tata Mc.- Grawhill
- Advanced soil mechanics- Braja M.Das, Tata Mc.- Grawhill
- Indian standards compendium in soil engineering, SP 36( Part I ) 1987, Bureau of Indian standards
- Soil physics by Baver.

Reference:

1. Rock Mechanics for Engineers: B.P.Varma, Khanna Publishers
2. Rock Mechanics and Design of Structures: Obert and Duvall, John Willey & Sons
3. Rock Mechanics in Engineering Practice: Stag and Zienkiewez, John Willey & Sons
SYLLABUS FOR

M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I

SUBJECT CODE 501204 (ELECTIVE I)

Site Investigations and Ground Improvement

Teaching scheme:                                                        Examination Scheme:
Lectures: 3 hrs/week                                                     Paper 100 marks
Credits: 3


Reference Books:
1. Site investigation by Clayton, Mathews and Simons.
3. Hvorslev M.J. subsurface exploration and sampling of soils for Civil Engineering Purposes.
SYLLABUS FOR

M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I

SUBJECT CODE 501204 (ELECTIVE I)

Shallow and Deep Foundations

Teaching scheme: Examination Scheme:
Lectures: 3 hrs/week Paper 100 marks
Credits: 3


Caissons-types, construction techniques, difficulties in construction. Design of well foundation.

Foundations in difficult soils: expansive soils, chemically aggressive environment, soft soils, fill, regions of subsidence.

2. Vibration Analysis and Foundation Dynamics by N.S.V, Kameswara Rao, published by Wheeler publishing
4. Soil Dynamics and Machine Foundation by Swami Saran published by Galgotia Publication
5. Vibration of Soil and Foundation by F.E. Richart, J.R. Hall and R.D. Woods Published by Prentice-Hall Inc, New Jersey
7. Advanced soil mechanics- Braja M. Das, Tata Mc.- Grawhill
SYLLABUS FOR

M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I

SUBJECT CODE 501205 (ELECTIVE II)

Soil Stabilization

Teaching scheme: Examination Scheme:
Lectures: 3 hrs/week Paper 100 marks
Credits: 3

Objectives of soil stabilization. Classification of stabilizing agents and stabilization processes, nature and surface characteristics of soil particles, concepts of surface area and contact points.

Drainage and compaction, principles of mechanical stabilization, inorganic stabilizing agents and their characteristics - lime, cement, lime-fly ash, hydroxides, carbonates etc., inorganic stabilizers, reaction mechanism in relation to strength improvement, characteristics under various conditions of soil properties, time, temperature and stress.

Deleterious effects of organic substance and sulphates on inorganic stabilization, organic stabilizers, binding and water-proofing agents-bituminous materials, lignin, large organic cations, aniline furferols, resins, rosins and derivatives and other organic wastes, bituminous stabilization, electrical and thermal stabilization.

2. Physical & geotechnical properties of soils – Joseph E.Bowels, Tata Mc.- Grawhill
3. Advanced soil mechanics- Braja M.Das, Tata Mc.- Grawhill
SYLLABUS FOR

M.E.CIVIL (GEOTEchnical Engineering)

SEMESTER I

SUBJECT CODE 501205 (ELECTIVE II)

Soil Structure Interaction

Teaching scheme: Examination Scheme:
Lectures: 3 hrs/week Paper 100 marks
Credits: 3


Reference:
3. Soil Structure Interaction, the real behaviour of structures, Institution of Structural Engineers.
Sources and effects of subsurface contamination; Physical, Chemical and biological characteristics of solid wastes; Soil-waste interaction; Contaminant transport; Laboratory and field evaluation of permeability; Factors affecting permeability; Waste disposal on land.

Types of landfills: Silting criteria; waste containment principles; Types of barrier materials; Planning and design aspects relating to waste disposal. Landfills, in ash ponds and tailing ponds, and in rocks.

Environmental monitoring around landfills; Detection, control and remediation of subsurface contamination; Engineering properties and geotechnical reuse of waste, demolition waste dumps; Regulations; Case studies.

Reference:
2. Kays, W.B. Construction of Linings for reservoirs, Tanks and Pollution control facilities.
Earth Pressure and Retaining Structures

Teaching scheme:                 Examination Scheme:
Lectures: 3 hrs/week                 Paper 100 marks
Credits: 3

Earth Pressure: Types - at rest, active, passive; Rankine’s theory; Backfill features - soil
type, surface inclination, loads on surface, soil layers, water level; Coulomb's theory;
Effects due to wall friction and wall inclination; Graphical methods; Earthquake effects.

Rigid Retaining Structures: Types; Empirical methods; Stability analysis.

Flexible Retaining Structures: Types; Material; Cantilever sheet piles; Anchored
bulkheads - free earth method, fixed earth method, moment reduction factors, anchorage.

Braced Excavation: Types; Construction methods; Pressure distribution in sands and
clays; Stability - bottom heave, seepage, ground deformation.

Reinforced Soil Walls: Elements; Construction methods; External stability; internal
stability.

Laterally Loaded Piles: Short and long piles; Free head and fixed head piles; Lateral load
capacity of single piles; Lateral deflection; Elastic analysis; Group effect; Lateral load test;
Codal provisions.

Underground Structures in Soils: Pipes; Conduits; Trench less technology; Tunnelling
techniques - cut-and-cover method, shield tunnelling.

References:

1. Earth pressure and Earth Retaining structures by C.R.I. Clayton, J. Milititsky, Ufrgs and R.I. Woods Published by Blackie Academic and Professional
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I

SUBJECT CODE 501206

LAB PRACTICE I

Teaching scheme: Practical: 6 hrs/week
Examination Scheme: TW-50 marks
Credits: 3

I. LABORATORY TESTS (Any seven)

1. Determination of water content-dry density relation using light and heavy Compaction on unstabilized
   and stabilized soil with admixture such as fly ash/lime etc and comparison of results.

2. Determination of unconfined compressive strength of unstabilized and stabilized soil with admixture
   such as fly ash/lime etc and Comparison of results.

3. Determination of shear strength parameter of soil from consolidated Undrained triaxial compression
   test with measurement of pore water pressure

4. Determination of density index of cohesion less soils.

5. Determination of consolidation properties of soil.

6. Determination of centrifuge moisture equivalent.

7. Determination of free swell index and swelling pressure of soil.

8. Plummert balance/Hydrometer analysis.


II. Assignment (Any two)

1. Use of a suitable computer software for analysis and design of substructure, stability of slopes, retaining structure or any other geotechnical related problem.

2. Design of reinforced earth wall

3. Determination of earth pressure using software or manually using graphical method


III. A report on the basis of field visit to reinforced earth retaining structures, well foundation, pavement, embankment etc. all under construction. Report should contain the technical details such as design, construction techniques being adopted, and type of construction machinery being used.
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I

SUBJECT CODE 501207

Seminar I

Teaching scheme: Examination Scheme:
Practical: 4 hrs/week TW-50 marks
Credits: 2

Contents of seminar- I report to be submitted could be any of the following.

1. Literature review on any topic associated with the syllabus by referring to standard journal, papers published in various conferences and by using the internet, etc presented in a standard format
2. Documented case studies associated with Geotechnical engineering.

Note:-Seminar I should not be meagre submission of report. Student should be asked to deliver lecture on the topic of the seminar for undergraduate students or a group of students/faculty members.
UNIVERSITY OF PUNE
SYLLABUS FOR

M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER II

SUBJECT CODE 501208

Finite Element Methods in Geotechnical Engineering


Reference:
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER II

SUBJECT CODE 501209

Reinforce Earth and Geosynthetics/Geosynthetics

Basic introduction to the elements of Ground Engineering characteristics of reinforcing materials, definition of reinforced and advantage of RE, soil reinforcement interaction, behaviour of Reinforced earth walls, basis of wall design, the Coulomb force method, the Rankine force methods, internal and external stability condition, field application of RE, randomly reinforced earth and analysis of reinforced soils, testing of soil reinforcements.

Definitions, functions, properties, and application of Geotextiles, design of Geotextile applications, definitions, functions, properties and applications of geomembranes, design of geomembranes applications, Geotextiles associated with geomembranes, testing on geotextiles, environmental efforts, ageing and weathering.

Texts/References

5. ASTM and Indian Standards on Geotextiles.
Analysis and interpretation of soil exploration data, estimation of soil parameters for foundation design, selection of type of foundation, load calculations, depth of foundation, proportioning of shallow foundations for safe pressure and allowable settlement, structural design: individual footings, strip footing, combined footing, rigid and flexible mat, buoyancy raft, basement raft and detailing in each case, deep foundation: design of single pile and pile groups, pile cap design and detailing, design of well foundation, check for stability, base pressure, side pressure and lateral deflection, design of retaining wall including detailing, stability calculations, design of cantilever and anchored sheet pile walls and ring foundations.

1. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Grawhill
2. Design Aids in Soil Mechanics and Foundation Engineering-Shenbage R Kaniraj, TATA Mc-Grawhill
3. Design of Foundation Systems- Nainan P Kurian, Narosa publication house
4. Foundation Design & Construction- M.J.Tamlinson, ELBS publication
LIST OF ELECTIVES

8211-- ELECTIVES--III

1. Slope Stability and Earth Dams
2. Geosynthetics:
3. Geotechnical Earthquake Engineering
4. Foundations of Offshore Structures

8212-- Elective IV (Open)

1. Geotechnical Engineering Survey
2. Slopes and Foundations
3. Geotechnical Processes in Rock Engineering
4. Numerical Methods
UNIVERSITY OF PUNE  
SYLLABUS FOR  
M.E.CIVIL (GEOTECHNICAL ENGINEERING)  
SEMESTER II  
SUBJECT CODE 501211 (ELECTIVE III)  
Slope Stability and Earth Dams  

Teaching scheme:  
Lectures: 3 hrs/week  
Credits: 3  

Examination Scheme:  
Paper 100 marks  

Slope Stability: Short term and long term stabilities; Limit equilibrium methods; Infinite slopes; Finite height slopes - Swedish method, Bishop's simplified method, other methods; Stability charts;  

Conditions of analysis - steady state, end of construction, sudden draw down conditions; Factor of safety; Codal provisions; Earthquake effects.  

Seepage Analysis: Types of flow; Laplace equation; Flow net in isotropic, anisotropic and layered media; Entrance-exit conditions; Theoretical solutions; Determination of phreatic line.  

Earth Dams: Introduction; Factors influencing design; Design of components; Construction; Instrumentation - piezometer, settlement gauge, inclinometer; Road and rail embankments.  

Reinforced Slopes: Steep slopes; Embankments on soft soils; Reinforcement design.  

Landslides: Remedial measures for unstable slopes - soil nailing, gabions, drainage.  

References:  
- Earth & Rock fill dams – Principles of design and construction by Christian Kutzner Published Oxford and IBH  
- Design of small dams – united states department of the Interior Bureau of Reclamation Published by Oxford and IBH Publishing Company  
- Earth Manual – CBS Publishers and distributors  
- The stability of slopes by E.N.Bromhead published by Blackie Academic and Professional  
- Earth pressure and Earth Retaining structures by C.R.I. Clayton, J. Milititsky, Ufrgs and R.I. Woods Published by Blackie Academic and Professional  
- Earth and Rock fill dams by Sherad
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER II

SUBJECT CODE 501211 (ELECTIVE III)

Geosynthetics

Teaching scheme: 3 hrs/week

Examination Scheme: Paper 100 marks

Credits: 3

Geosynthetics and Reinforced Soil Structures:

Types and functions; Materials and manufacturing processes; Testing and evaluations; Principles of soil reinforcement; Design and construction of geosynthetic reinforced soil retaining structures - walls and slopes; Codal provisions; Bearing capacity improvement; embankments on soft soils; Indian experiences.

Geosynthetics in Pavements:

Geosynthetics in roads and railways; separations, drainage and filtering in road pavements and railway tracks; overlay design and construction; AASHTO and other relevant guidelines; trench drains.

Geosynthetics in Environmental Control:

Liners for ponds and canals; covers and liners for landfills - material aspects and stability considerations; Landslides - occurrences and methods of mitigation; Erosion - causes and techniques for control.

References:

3. ASTM and Indian Standards on Geotextiles.
Teaching scheme:
Lectures: 3 hrs/week

Examination Scheme:
Paper 100 marks
Credits: 3

Introduction, Seismic Risks and seismic hazards, cause and strength of earthquake, social and economic consequences, theory of dynamics and seismic response, the nature and attenuation of ground motion. Determination of site characteristics, local geology and soil condition, site investigation and soil test. Determination of design earthquake, response spectra and accelerograms as design earthquake, criteria for earthquake resistant design. Site response to earthquake, liquefaction of saturated cohesion less soils, seismic response of soil structure system, shallow foundation, pile foundation, foundation in liquefiable ground. A seismic design of earth retaining structures.

Reference:
3. Arya, Shamsher Prakash, Srivastava L.S., Brijesh Chandra, “Earthquake Engineering
7. Vibration of Soil and Foundation by F.E. Richart, J.R. Hall and R.D. Woods Published by Prentice-Hal Inc, New Jersy
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER II

SUBJECT CODE 501211 (ELECTIVE III)

Foundations of Offshore Structures

Teaching scheme: Lectures: 3 hrs/week
Examination Scheme: Paper 100 marks
Credit: 3

Nature and magnitude of load on foundations of offshore structures, criteria of foundation design in offshore environment, features of foundations of gravity structures, bearing capacity and settlement under dynamic loads, immediate and long term behaviour, liquefaction under cyclic loads, problems relating to jack-up platforms, dynamic stress in pile driving, pile behaviour under cyclic lateral loads, development of p-y curves, analysis of single piles and pile groups, finite element and other numerical methods of interactive analysis using linear and nonlinear foundation response, geotechnical aspects of anchors and submarine pipelines.

Texts/References

Teaching scheme: Lectures: 3 hrs/week
Examination Scheme: Paper 100 marks

Importance of geotechnical engineering surveys and maps in the planning and execution of major civil engineering projects, such as construction of earth dams, highways and railways, rural, urban and industrial development etc., concept of land use planning, drainage, soil horizons, colour, texture, structure, consistency, reaction etc., landscape and geomorphology, different types of base maps.

Organization of field work and collection of soils and the parent materials, identification and nomenclature of soil horizons and series, preparation of geotechnical engineering maps for specific uses, soil survey reports.

The entire course of instruction and field work will be covered intensively over a period of about three weeks, normally during winter vacation.

Texts/References

- Site investigation by Clayton, Mathews and Simons.
- Instrumentation in geotechnical engineering by K.R. Saxena and V.M. Sharma.
- Hvorslev M.J. subsurface exploration and sampling of soils for Civil Engineering Purposes.
Slopes and Foundations


- Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Grawhill
- Design Aids in Soil Mechanics and Foundation Engineering-Shenbage R Kaniraj, TATA Mc-Grawhill
- Design of Foundation Systems- Nainan P Kurian, Narosa publication house
- Foundation Design & Construction- M.J.Tamlinson, ELBS publication
- Hsai-Yana-Fana- Foundation Engineering Hand book, Chapmon & hall, Newyark
Geotechnical Techniques in Rock Engineering

Teaching scheme:
Lectures: 3 hrs/week

Examination Scheme:
Paper 100 marks

Credits: 3


- Hoek E. and Brown E. T. “Underground excavation in rock”.
- Megan T.M. and Barllette J.V. “Tunnel Planning and design”.
- Szeczy K. Art of Tunneling.
UNIVERSITY OF PUNE
SYLLABUS FOR

M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER I :

SUBJECT CODE 501201

Numerical Methods

Teaching scheme: Examination Scheme:
Lectures: 3 hrs/week Paper 100 marks
Credits: 3

Fundamentals of numerical methods, Error analysis, Differentiation, integration, interpolation & extrapolation, Solution of non-linear algebraic and transcendental equation, Solution of systems of linear & non-linear algebraic equations, Eigen value problems, Solution of partial differential equation, initial and boundary value problems, Computer oriented algorithms, Numerical solution of problems related to shallow and deep foundation, Flow through porous media., Settlement computations under different loading conditions & consolidation

Reference
7. Numerical methods in FORTRAN by John M.Mc & M.G.Salvadori Published by Prentice Hall of India
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER II

SUBJECT CODE 501213
Lab Practice II

Teaching scheme:  Examination Scheme:
Practical: 6 hrs/week  TW-50 marks
Credits: 3

I. The following experiments shall be carried out
   1. California bearing ratio test (unsoaked and soaked)
   2. Soil swelling pressure test
   3. Consolidation test to determine $c_v$ and $c_c$
   4. Electrical resistivity test to find electrical resistivity of soils
   5. Exploration of soil strata by seismic refraction method
   6. Standard penetration test (SPT) / Dynamic cone penetration test as per IS 4968 Part-I (DCPT)
   7. Static cone penetration test as per IS 4963 Part III using either hand operated or Engine driven
   8. Plate bearing test
   9. To find load bearing test of under-reamed pile
   10. Mini pressure meter with 3 cell probe, driving rod, drop hammer, monitoring equipment etc. complete to determine E modulus and limit pressure PL may be used.

II. Report on the basis of the field visit, Use of a suitable computer software for analysis and design of substructure, stability of slopes, retaining structure or any other Geotechnical related problem

Reference
SP 36 (Part-I): 1987 Compendium of Indian Standard on soil Engineering: Part-I Laboratory testing of soils Civil Engineering purposes
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M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER II

SUBJECT CODE 501214

Seminar II

Teaching scheme:  
Practical: 4 hrs/week

Examination Scheme:

TW-50 marks

Credits: 2

Seminar II report and the examination shall be based on literature survey and the work for the dissertation in the semester III

Note:-Seminar I should not be meagre submission of report. Student should be asked to deliver lecture on the topic of the seminar for undergraduate students or a group of students/faculty members.
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER III

SUBJECT CODE 501215
Seminar III

Teaching scheme: Practical: 4 hrs/week
Examination Scheme: TW-50 marks

Credits: 2

Seminar III report and the examination shall be based on literature survey and the work for the dissertation in the semester III

Note:-Seminar I should not be meagre submission of report. Student should be asked to deliver lecture on the topic of the seminar for undergraduate students or a group of students/faculty members.
UNIVERSITY OF PUNE
SYLLABUS FOR
M.E.CIVIL (GEOTECHNICAL ENGINEERING)

SEMESTER III & IV

SUBJECT CODE 501216 & 501217

Project Stage I and II in Semester III &IV

SEMESTER III (501216)
Teaching scheme: 
Practical: 18 hrs/week
Examination Scheme:
TW-50 marks
Credits: 6

SEMESTER IV (501217)
Teaching scheme: 
Practical: 18 hrs/week
Examination Scheme:
Project - 150 marks
Oral - 50 marks
Credits: 12

The Project Work will start in semester III and should preferably be live problem in industry or a micro issue having a bearing on performance of the construction industry and should involve scientific research, design, collection and analysis of data, determining solution and must preferably bring out the individual contribution.