

**SYLLABUS**

**OF**

**M.E. CIVIL**  
**(GEOTECHNICAL ENGG.)**

**w.e.f.**  
**2013**

**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)**  
**COURSE STRUCTURE (2013 Course)**  
(w.e.f. July – 2013)

University of Pune , Document on Rules and Regulation for P.G.Courses be referred  
for the detailed information

**SEMESTER I**

CODE	SUBJECT	TEACHING SCHEME Lect./ Pract.	EXAMINATION SCHEME				Credits	
			Paper		TW	Oral/ Presentation		Total
			In Semester Assessment	End Semester Assessment				
501121	Advance Soil Mechanics	4	50	50	--	--	100	4
501122	Ground Improvement Techniques	4	50	50	--	--	100	4
501123	Rock Mechanics	4	50	50	--	--	100	4
<b>501004</b>	Research Methodology	4	50	50	--	--	100	4
501124	Elective -I	5	50	50	--	--	100	5
501125	Lab Practice- I	4			50	50	100	4
	<b>Total</b>	<b>25</b>	<b>250</b>	<b>250</b>	<b>50</b>	<b>50</b>	<b>600</b>	<b>25</b>

**501 124 Elective I**

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501124 A	Cyber Security/Information security	501124F	Economics & Finance For Engineers	501124 K	Mass communication, Photography and Videography
501124 B	Soil Structure Interaction	501124G	Foreign Language –I	501124L	Yoga and Meditation
501124C	Pavement Analysis & Design	501124H	Engineering Ethics		
501124D	Optimization techniques	501124I	Intellectual Property Rights		
501124E	Reinforced Earth & Geosynthetics				

**SEMESTER –II**

CODE	SUBJECT	TEACHING SCHEME Lect./ Pract.	EXAMINATION SCHEME				Credits	
			Paper		TW	Oral/ Presentation		Total
			In Semester Assessment	End Semester Assessment				
501126	Advance Foundation Engineering	4	50	50	--	--	100	4
501127	Construction Methods in Geotechnical	4	50	50	--	--	100	4
501128	Stability of Slopes & Earth Dam	4	50	50	--	--	100	4
501129	Elective- II	5	50	50	--	--	100	5
501130	Lab Practice- II	4	--	--	50	50	100	4
501131	Seminar -I	4	--	--	50	50	100	4
	<b>Total</b>	<b>25</b>	<b>200</b>	<b>200</b>	<b>100</b>	<b>100</b>	<b>600</b>	<b>25</b>

**501129- Elective II**

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
501129 A	Human Rights	501129 E	Foreign Language II	501129 I	Performing Arts – Music and Dance
501129 B	. Finite Element Methods in Geotechnical Engg.	501129 F	Geotechnical Techniques in Rock Engineering	501129 J	Principle Centred Leadership
501129C	Foundation Design & Detailing.	501129G	Green Building Design and Construction		
501129 D	Foundation of Offshore Structures	501129H	Forensic Civil Engineering		

**SEMESTER –III**

CODE	SUBJECT	TEACHING SCHEME Lect./ Pract.	EXAMINATION SCHEME				Credits	
			Paper		TW	Oral/ Presentation		Total
			In Semester Assessment	End Semester Assessment				
601132	Geotechnical Earthquake Engineering	4	50	50	--	--	100	4
601133	Geoenviromental Engineering	4	50	50	--	--	100	4
601134	Elective- III	5	50	50			100	5
601135	Seminar-II	4			50	50	100	4
601136	Project stage I	8	--	--	50	50	100	8
	<b>Total</b>	<b>25</b>	<b>250</b>	<b>200</b>	<b>100</b>	<b>100</b>	<b>500</b>	<b>25</b>

**601 134 Elective III**

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
601134 A	Earth Pressure & Retaining Structures	601134E	Restoration and conservation of old structures	601134 H	Chess
601134B	Soil Stabilization	601134F	Foreign Language	601134 I	Abacus
601134C	Special Geotechnical Constructions	601134G	Safety Practices in construction.		
601134D	Soil Dynamics & Machine Foundations.				

**SEMESTER –IV**

CODE	SUBJECT	TEACHING SCHEME	EXAMINATION SCHEME				Credits	
			Lect./ Pract.	Paper	TW	Oral/ Presentation		Total
			In Semester Assessment	End Semester Assessment				
601137	Seminar III	5	--	--	50	50	100	5
601138	Project Work Stage II	20	--	---	150	50	200	20
	<b>Total</b>	<b>25</b>	<b>--</b>		<b>200</b>	<b>100</b>	<b>300</b>	<b>25</b>

**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER I**  
**1 Credit = 2 Modules = 15 Lectures**  
**501121: Advance Soil Mechanics**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In semester Exam: 50 Marks**

**End Sem Theory Examination: 50 marks**

**Duration: 3Hrs**

**Module 1**

Concept of stress, strain, Principal stresses & strains, Invariant, Octahedral Stresses & strains. Stress-strain relations, Special Matrices, Plane stress, Plane strain problems, Mohr's diagram.

**Module 2**

Stresses & displacements in elastic soil mass – Line force, Distributed line loads, Concentrated force and distributed loads at the surface of semi-infinite mass, Soil bodies exhibiting non-homogeneous attributes, Influence of anisotropy in soil bodies, constitutive equations and models

**Module 3**

Soil strength – Yield criteria, Theories of failure, Effective stress principle, Stress path in various drainage conditions

Limiting equilibrium for analysis of slopes stability

**Module 4**

Earth pressure and retaining walls - Earth pressure theories, Analytical and graphical methods for determination of earth pressure, Proportioning of retaining walls,

**Module 5**

Stability analysis of retaining walls – Stability against sliding, overturning, bearing capacity and settlement

Braced cuts – Lateral earth pressure in cuts, Stability of braced cuts

**Module 6**

Three dimensional consolidation – Equation, Solution of 3-D consolidation equation, Consolidation by vertical sand drain and its design aspects, Free strain consolidation with no smear, Effect of smear zone on radial consolidation, Calculation of degree of consolidation with radial drains and solutions of problems based on it.

**Module 7**

Seepage – Flow net for anisotropic soil media, Construction of flow net for hydraulic structures on non-homogeneous soil, Directional variation of permeability in anisotropic medium

**Module 8**

Anisotropy governing differential equations for flow through porous media in Cartesian co-ordinate & polar co-ordinate systems for Laplace Equations, Numerical analysis of seepage in layered soil, computation of seepage force.

**Recommended Books:**

1. Advanced Soil Mechanics, B. M. Das., 2<sup>nd</sup> edition. Taylor and Francis, 1997.
2. Soil Engineering in Theory and Practice, Singh, A., 4<sup>th</sup> edition, CBS Publishers, New Delhi, 2002.
3. Soil Mechanics, R. F. Craig, Van Nostrand ReinGold Co. Ltd., 1987.
4. Soil Mechanics and Foundation Engineering, V.N.S. Murthy, CBS Publishers & Distributors, 1<sup>st</sup> edition, 2007.

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**SEMESTER I**  
**1 Credit = 2 Modules = 15 Lectures**

**501122: Ground Improvement Techniques**

**Teaching Scheme**

**Lectures: 4 hours/week**  
**Credits 4**

**Examination Scheme**

**In semester Exam: 50 Marks**  
**End Sem- Theory Examination: 50 marks**  
**Duration: 3Hrs**

**Module 1**

Clay mineralogy - Atomic bonds, Clay minerals. Clay-water relations, Electrical effects, cation exchange, Clay mineral identification

**Module 2**

Soil stabilization – Principle, Different methods of soil stabilization. Granular stabilization  
Chemical stabilization - Principle, Different methods, Different chemicals used, Engineering properties and behaviour of chemically stabilized soils.

**Module 3**

Cement stabilization - Types, Mechanism, Properties, Factors influencing, Applications, Laboratory testing for stabilized soil.  
Lime stabilization - Soil-lime reaction, Types and properties, Effectiveness of lime treatment, Mixture design.

**Module 4**

Ash and slag stabilization - Fly-ash stabilization.  
Bituminous stabilization - Classification, mechanism, Laboratory testing

**Module 5**

Thermal and electro kinetic stabilization – Thermal, Heating and freezing, Electro-osmosis. Construction methods for stabilized soils.

**Module 6**

Deep Compaction of Granular soil – Introduction, Vibration methods – Vibration methods – Vibro-flotation, Vibro compaction, Blasting, Displacement methods.  
Stone-gravel and sand column, Design of stone columns, Compaction piles, Dynamic consolidation, Preloading method.

**Module 7**

Stabilization of soft soil – Lime columns – Bearing capacity, Principle, Bearing capacity of lime group, Total and differential settlement, Application of lime column method, Quality control methods, Design of lime column foundations.  
Sand drains, Granular trench stabilization

**Module 8**

Grouting – Grouting techniques – Permeation grouting, Hydro fracture grouting, Compaction grouting, Jet grouting, Types of grouts, Design of soil grouting program, Grouting equipment, Quality control and testing.

**Recommended Books:**

1. Principles of Foundation Engineering, B.M. Das, 5<sup>th</sup> edition, Thomson Asia Pvt. Ltd., 2004.
2. Foundation Engineering Handbook, Hsai-Yang Fang, 2<sup>nd</sup> edition, Springer Publication, 2001.
3. Foundation Analysis and Design, J.E. Bowles, 5<sup>th</sup> edition., McGraw-Hill, 1996.
4. Engineering Principles of ground Modifications, M. R. Hausmann, McGraw-Hill International Edition, 1990.

5. Ground Improvement, M. P. Moseley, Blackie Academics and Professionals, 1993
  6. Ground Improvement and Control, P. P. Xanthakos, L. W. Abramson and D. A. Bruce, John Wiley & Sons, 1994.
  7. Engineering Principles of Ground Modifications, R. H. Manfired, McGraw-Hill, 1990.
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**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**SEMESTER I**  
**1 Credit = 2Modules =15 Lectures**

**501123: Rock Mechanics**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In semester Exam: 50 Marks**

**End Sem Theory Examination: 50 marks**

**Duration: 3Hrs**

**Module 1**

Introduction to Rock Mechanics and its field applications, Identification of common rocks, Physical and mechanical characteristics of rock material, Field and laboratory testing of rocks, Classification of rock masses for engineering purpose.

**Module 2**

Rock excavation and reinforcement – Drilling, Blasting, Braking and cutting, Rock bolting, Rock anchors, Bolted and anchor supports, Rock grouting - Types of treatment, grouting material, grouting methods, Grouting design and layout

**Module 3**

Stresses in rock mass – Types of stresses, in-situ stress determination methods – Over coning, Flat jack method, Hydraulic fracturing, Structural Geology and Ground stresses, Stresses around underground opening, stresses in tunnels and shafts, Strains and deformations around circular opening, Rheology

**Module 4**

Rock strength - Modes of rock failure, Stress-strain behavior in compression, Mohr-Coulomb failure criteria, Hook-Brown criteria, Griffith's crack theory, Empirical criteria for failure, Effect of size on strength, Anisotropic rocks, Plane of weakness in Rocks, Joint orientation and roughness

Deformability of rocks – Elastic and non-elastic behavior, influence of time on rock deformation, viscous behavior and creep.

**Module 5**

Brittle failure of Rocks – Introduction, Fracture initiation, Fracture propagation, Rock fracture in compression, Rupture criteria for brittle rock, Factors affecting rupture behavior of rock.

**Module 6**

Ultimate behavior of rock structures – Plasticity and resistance of rock structure, Principle of limit equilibrium method, analysis of general slip surfaces, Approximate methods for two dimensional limit equilibrium analysis, Structural discontinuities in rock masses and progressive failure, Water pressure and resistance of rock structures.

**Module 7**

Rock foundations - Allowable bearing pressures, Stress and deflection in rock under footing, Failure mechanisms, Subsiding and swelling rocks, Base heave and remedies, foundation anchoring

**Module 8**

Rock slopes – Modes of failure, Factors affecting, Analysis of slopes

Underground opening - Opening in competent rock, horizontally layered rocks and rock with inclined layers, Plastic behavior around tunnels, time dependent behavior of tunnels, underground opening in blocky rocks- Block theory, Review of design methods of tunnels – Empirical and semi-empirical methods, Support and stabilisation

**Recommended Books:**

1. Introduction to Rock Mechanics, R.E. Goodman, 2<sup>nd</sup> edition, John Wiley & Sons Publication, 1989.
  2. Stresses in Rock, G. Herget, Balkema, 1988.
  3. Rock Characterization, Testing and Monitoring, F. T. Borwn, Pergamon Press, 1986.
  4. Rock Mechanics for Underground Mining, B. H. G. Brady and F. T. Borwn, Chapman and Hall, 1993.
  5. Fundamental of Rock Mechanics, J. C. Jaeger and N. G. W. Cook, Chapman and Hall, 1976.
  6. Foundations on Rock, D. C. Wyllie, 2<sup>nd</sup> edition, E&FN Spon, 1992.
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER I**  
**1 Credit = 2 Modules = 15 Lectures**

**501004: RESEARCH METHODOLOGY**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In semester Exam: 50 Marks**

**End Sem Theory Examination: 50 marks**

**Duration: 3Hrs**

**Module 1:**

**Introduction to Research**, Meaning of research, types of research, process of research, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, formulation of research hypotheses. Search for causation

**Module 2:**

**Developing a Research Proposal** Format of research proposal, Individual research proposal, Institutional research proposal, Significance, objectives, methodology, Funding for the proposal, Different funding agencies. Framework for the planning

**Module 3:**

**Literature survey**- Definition of literature and literature survey, need of literature survey, sources of literature, elements and objectives of literature survey, styles of literature survey, and strategies of literature survey.

**Module 4:**

**Data collection, Measuring, Sampling and Scaling**—Classification of data, benefits and drawbacks of data, evaluation of data, qualitative methods of data collection, methods of qualitative research, Sampling, sample size, sampling strategy, attitude measurement and scaling, types of measurements, criteria of good measurements, classification of scales.

**Module 5:**

**Preliminary data analysis**- Testing of hypothesis- concepts and testing, analysis of variance techniques, introduction to non parametric tests. Validity and reliability, Approaches to qualitative and quantitative data analysis,

**Module 6:**

**Advanced data analysis techniques**-Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling, Descriptive statistics, Inferential statistics, Multidimensional measurement and factor analysis

**Module 7:**

**Report writing**—Need of effective documentation, importance of report writing, types of reports, report structure, report formulation, Plagiarism.

**Module 8:**

**Presentation of research**---Research briefing, presentation styles, impact of presentation, elements of effective presentation, Writing of research paper, presenting and publishing paper, patent procedure,

**Reference Books:**

1. Research Methodology: concepts and cases—Deepak Chawla and Neena Sondhi, Vikas Publishing House Pvt.Ltd. (ISBN 978-81-259-5205-3)
2. Research Methods for Business—Sekaran Uma and Rogure Boudie—Wiley, India

3. Research Methodology: Methods and Trends', by Dr. C. R. Kothari--- New Age International Publishers.
  4. Research Methods in Education---Louis Cohen, Manion, Morrison---Routledge(Taylor & Francis Group) / -- Cambridge University Press India Pvt. Ltd.-ISBN-978-0-415-58336-7
  5. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
  6. Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar
  7. Research in Education---John Best and James Kahn, Prentice Hall of India Pvt. Ltd.
- e-Resource---For class room ppts---[www.wileyurope.com/college/sekaran](http://www.wileyurope.com/college/sekaran)**
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**SEMESTER I**  
**1 Credit = 2Modules =15 Lectures**

**501124 Elective I**

**Teaching Scheme**  
**Lectures: 4 hours/week**  
**Credits 4**

**Examination Scheme**  
**In semester Exam: 50 Marks**  
**End Sem Theory Examination: 50 marks**  
**Duration:3Hrs**

**Select any combination having total of 5 credits from following technical / interdisciplinary courses**

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
<b>501124 A</b>	Cyber Security/Information security	<b>501124F</b>	Economics & Finance For Engineers	<b>501124 K</b>	Mass communication, Photography and Videography
<b>501124 B</b>	Soil Structure Interaction	<b>501124G</b>	Foreign Language –I	<b>501124L</b>	Yoga and Meditation
<b>501124C</b>	Pavement Analysis & Design	<b>501124H</b>	Engineering Ethics		
<b>501124D</b>	Optimization techniques	<b>501124I</b>	Intellectual Property Rights		
<b>501124E</b>	Reinforced Earth & Geosynthetics				

**501124 A --Elective I-- Cyber Security / Information security (2Credits course)**

**Module1:**

**Basic Concepts of Technology and Law:** Basics of Information Technology, Basics of Indian Legal System, Information Technology Act 2000 (Amended), Relevant Amendments in all other laws.  
**E-Contract:** The essence of digital contracts, Law of Contract, Construction of E-contracts, Issues of security, Employment contracts, Consultant Agreements and Digital signature

**Module2:**

**Intelligent Property Issues in Cyber space:** Doman names and related issues, Copyright in digital media, Patents in cyber world.

**Rights of Neitzens and E- Governance:** Privacy and freedom issues in cyber world, E-Governance, Cyber crimes and Cyber laws.

**Module 3:**

**Information Security Fundamentals:** Background, Importance, Statistics, National and International Scenario, Goals of security, Confidentiality, Privacy, Integrity, Non-repudiation, Availability.

Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis - Vulnerability identification and Assessment.

**Module 4:**

**Security Investigation:** Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

**Access Control, Intrusion Detection and Server Management, Firewalls:**

Overview of Identification and Authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features

**Security Policies and Management:** Security Policy Design, Designing Security Procedures, Risk Management and Assessment Techniques, Security standards, Security Models. Security Management Practices, Security Laws, Information Classification Process, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance,

**Reference Books:**

- 1) Bakshi P M and Sri R K, Cyber and E-commerce Laws, Bharat Publishing House, 1<sup>st</sup> Edn, 2002
  - 2) Syed Shakil Ahmed, Rajiv Raheja, A handbook on Information technology: Cyber law and E-Commerce, Capital Law House, 2004
  - 3) Rodney D Ryder, Business Process Outsourcing, Data Protection and Information Security, Wadhwa & Co., 1<sup>st</sup> Edn, 2001
  - 4) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3<sup>rd</sup> Edn, 2011
  - 5) Lipton, K., Cyberspace Law Cases and Materials, 2<sup>nd</sup> edition. Aspen Publishers. NY: New York, 2006
  - 6) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
  - 7) Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
  - 8) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
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## **501124 B --- Elective I –Soil Structure Interaction (2Credit Course)**

### **Module 1**

Introduction to Soil-Foundation interaction - Idealized soil behavior, Foundation behavior, interface behaviour.

Idealized soil response model for analysis of soil foundation interaction – Elastic models of soil behaviour - The Winklers model, Elastic continuum models, Two-parameter elastic models, Elastic plastic and time dependent behaviour of soil masses – elastic-plastic behaviour, time dependent behaviour

### **Module 2**

Plane-strain analysis of an infinite plate and an infinitely long beam – Bernoulli’s-Euler beam theory and its modifications, Plain strain analysis of the finite plate problem, Reissner’s method of analysis of the infinite plate problem, Deflection of an infinite plate on a Winkler medium.

The analysis of beams of finite length – Finite beams on a Winkler medium, Finite beams on a two-parameter elastic medium, Finite beams on an elastic solid medium, approximate methods, Classification of finite beams in relation to their stiffness

### **Module 3**

Analysis of finite plate – Axisymmetric loading of a circular plate, Analysis of rigid circular plate, analysis of rectangular plate, Plate resting on an elastic half space – Approximate method of analysis

### **Module 4**

Experimental investigation and field studies – Stress measurement beneath rigid footings, flexible beam and raft foundation

Analysis of axially loaded and laterally loaded piles.

### **Recommended Books:**

1. Elastic analysis of Soil Foundation Interaction, A. P. S. Selvadurai, Elsevier Publishing Company, 1979
  2. Soil Structure interaction, N.P Kurian., Prentice Hall, 1997.
  3. Foundation Analysis, R.F.Scott, Prentice Hall, 1981
  4. Pile foundation Analysis & Design, H. G. Poulos & E. H. Davis, John Wiley & Sons, 1980
  5. Foundation Engineering Handbook, H. Y. Fang, 2<sup>nd</sup> edition, CBS Pub., 1997.
  6. Soil Mechanics and Foundation Engineering, V.N.S. Murthy, CBS Publishers & Distributors, 1<sup>st</sup> edition, 2007.
  7. Foundation Analysis and Design, J. E. Bowels, 5<sup>th</sup> edition, McGraw-Hill, 1996
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## 501124 C Elective –I Pavement Analysis & Design (2Credit Course)

### Module 1

General: Structural action of flexible and rigid pavements. Characteristics of highway and airfield pavements.

Design parameters: Standard Axial load and wheel assemblies for road vehicles under carriage system for aircraft, Tire and contact pressure, contact area imprints, Computations of ESWL for flexible and rigid pavements. Load repetitions and distributions of traffic for highway and airfield pavement, airport traffic areas.

### Module 2

Material Characteristics: AASHO subgrade soil classification. Group index, CBR, North Dakota cone bearing value, plate load test for “K”, Marshal’s method of Bituminous mix design. Modulus of rupture and elasticity, poisson’s ratio & coefficient of thermal expansion of concrete. Layer equivalency concepts.

Analysis of Flexible and Rigid Pavements: Stress, Strain deformation analysis for single, two, three and multilayered flexible pavement systems. Stress and deflections for rigid pavements due to load and temperature, influence Charts, ultimate load analysis, joints in pavements.

### Module 3

Highway Pavement Design: Flexible: North Dakota cone, Group index, CBR, IRC-37(2001), Brumister, Triaxial (Kansas), AASHO method of design , RIGID, IRC-58, P. C. A., Design of joints and reinforcement.

Airfield Pavement Design: Flexible: U. S. Corps of Engineering, CBR, FAA, Mcload(Canadin); Rigid: PCA, FAA & LCN, ultimate load Analysis yield lines pattern, methods.

### Module 4

Pavement Testing and Evaluation : Trial and Inspection Pits, Field Density, CBR, plate load test, condition surveys and surface evaluation for unevenness, rut depth, profilometers, Bump integrators, Benkalman Beam Deflection Study.

### Recommended Books:

1. Principles of Pavement Design, Yoder & Witzace; Prentice Hall,2000
2. Pavement Analysis and Design, H. H. Yang, Pearson Prentice Hall, 2004.
3. Airport Planning & Design, Goyal & Praveen Kumar; Galgotia Publication, 2002
4. Design and Performance of Road Pavements, Croney & Croney, McGraw Hill, 2002
5. Airport Planning and Design, S K Khanna, M. G. Arora, S S Jain, 6th edition, Nemchand & Bros, Roorkee, 1999.
6. Highway Engineering; K. Khanna, and Justo, C.E.G., Khanna Publication, Roorkee, 2001
7. Pavement Analysis and Design by Yang H. Huang ,Pearson Education ,2010

## 501124 D Elective –I Optimization Techniques (2Credit Course)

### Module 1:

**Linear Programming I:** Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method

### Module 2:

**Linear Programming II:** Big M Method, Two phase method, Duality, sensitivity analysis. Application of Linear Programming to Hydraulics & Water Resource

### Module 3:

**Non Linear Programming:** Unconstrained one Dimensional search methods: Dichotomous search method, Fibonacci, Golden section, Multivariable unconstrained techniques: Steepest ascent and Descent methods, Newton's methods, Constrained technique: Lagrangian Multiplier

### Module 4:

**Dynamic Programming:** Principle of optimality, recursive equations.

### Reference Books

1. Engineering Optimazation Theory & Practice – S.S. Rao., Wiely. Wiely.
  2. Engineering Optimization—Methods and Applications—Ravindran, Wiely
  2. Operation Research – Taha Hamdey A.
  3. Principles of Operation Research – Wagner, Prentice Hall.
  4. Operation Research – Hira and Gupta, S.Chand
  5. Operation Research—Ravindran-- Wiely.
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## **501124 E Elective –I Reinforced Earth and Geosynthetics (2Credit Course)**

### **Module 1**

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,

### **Module 2**

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.

### **Module 3**

Definitions, functions, properties, and application of Geotextiles, design of Geotextile applications,

### **Module 4**

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

### **Recommended Books:**

1. Karl Terzaghi, Theoretical Soil Mechanics, Chapman and Hall, 1954.
  2. R.F. Scott, Principles of soil Mechanics, Addison Wesley, World Student Edition, 1963.
  3. Manfred R. Hausmann: Engineering Principles of Ground Modifications, McGraw Hill International.
  4. Engineering with Geosynthetics: ed. G. Venkatappa Rao, GVS Suryanarayana Raju, Tata McGraw Hill Publishing Co. Ltd.
  5. ASTM and Indian Standards on Geotextiles.
  6. Koerner, R. M.: Designing with Geosynthetics, Prentice Hall, NJ.
  7. Jones, C.J.E.P. Reinforcement and soil structures, Butter worth Publications.
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## **501124 F Elective –I Economics and Finance for Engineers (1Credit Course)**

### **Module1:**

**Introduction & Basics of Economics & Finance:** Meaning & necessity of: Economics, Costing & Finance, History & fundamentals of Economics, Basics of Finance & Accounting, rates of interest, Basics of Financial Statement, Financial Analysis, Inflation, etc.

### **Module2:**

**Principles of Costing, Estimation & Valuation:** Basics of Costing, activity based costing & case studies, Basics of Estimation & Valuation, present & future values of properties, Profitability & Financial Decisions, Inventory Management

### **Reference**

1. As specified by the instructor
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**501124 G Elective –I Foreign Language -I (French-I) (1Credit Course)**

**Module1:**

**Introduction:** Glimpse of France, life of French people (Culture, food, etc.), French alphabets, accent, etc., Unit zero of the Text Book (Grammar, Vocabulary, and Lesson), Exercise of Unit zero of Text Book & workbook

**Module2:**

**French Lessons:** Brief revision, Unit-1 of the Text Book (Grammar, vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 1 of the Text book & workbook

**Reference**

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
  2. Jumelage-I workbook by Roopa Luktuke
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## 501124 H Elective –I Engineering Ethics (1Credit Course)

### Module1:

**Introduction :** Meaning & scope of Ethics in general & for engineers in particular, Moral obligations and rules in engineering, Categories of moral, Work Culture, Corporate, local & global issues, Rights & responsibilities of Engineers, Conflicts in the profession, Mental Stresses & Emotional Intelligence

### Module2:

**Code of Ethics for Engineers:** First principles of Engineering Ethics & Ethical terminology, Social Values, Character, considerations for general Individuals, Engineers & the Society, Recommendations of the Professional bodies (Code of Conduct), Introduction to Copyright, IPR (Intellectual Property Right), Plagiarism & Legal issues

### Reference

1.Ethics in Engineering Practice and Research---Carolyn Whitbeck—Cambridge University Press—ISBN—978-1-107-66847-8

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## 501124 (I) Elective –I Intellectual Property Rights (1Credit Course)

### Module1

#### **Introduction to Intellectual Property Rights**

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

#### **International Scenario**

International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

### Module2

#### **Patent Rights**

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

#### **Recent Developments in IPR**

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies,

#### **Reference Books**

- 1 Prabuddha Ganguly, “ Intellectual Property Rights”,Tata Mc-Graw Hill.
  - 2 Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007
  - 3 Robert P. Merges, Peter S. Menell, Mark A. Lemley “Intellectual Property in New”,
-

## **501124 K Elective –I Mass communication, Photography and Videography**

**(Audit Course—No Credits)**

### **Module 1:**

#### **Mass Communication - Theories & methods**

Concepts and Theories, Communication concepts, Process and Function, Interpersonal & Intra personal, Group behaviour, need for Mass Communication. Relevance of Communication Theories to Practice, Models of Communication, Impact and Effect of Communication Old and new media, Communication Techniques, - Feedback and Evaluation of Communication Effect, Interview and Questionnaires- Method of Data Analysis, use of Information Technology, various methods of mass communication like seminars, conferences, print and digital media, internet, CDs, DVD, movies, U-tube, video conferencing.

### **Module 2 :**

#### **Photography and Videography**

Camera Basics, Still Photography, Lenses, Exposure, Composition, Colour. Shot Angle, Camera Movement, Light techniques and final printing.

Videography Basics – Video camera –types, mounting. Sound Basics, Film Sound appreciation, Sound Track analysis, Editing Basics, Fragmentation

Juxtaposition: Frame, Shot, Sequence, Scene Time, Pace, Rhythm. Learning basic editing software and primary editing on available/given materials.

### **Reference Books**

1. Richard Dimpleby and Graeme Burton, 1995, More than words: An introduction to communication, London: Routledge.
  2. Melvin L. DeFleur and Everette E. Dennis, 1991, Understanding mass communication, New Delhi: Goyal Saab.
  3. Marshall McLuhan, 1964, Understanding Media, New York: McGraw –Hill
  4. Wilbur Schramm, 1964, Mass media and national development, the role of information in developing countries, Stanford: Stanford University Press.
  5. Holman, Tomlinson, Sound for film and television, Focal Press
  6. McCormick, Tim and Rumsey, Francis, Sound and recording: An introduction, Focal Press
  7. Talbot-Smith, Michael, Sound engineering explained, Focal Press
  8. Talbot-Smith, Michael, Sound assistance, Focal Press
  9. Altman, Rick, ed., Sound theory sound practice, Routledge Talbot-Smith, Michael, Sound engineer's pocket book, Focal Press
  10. Truebitt, Rudy and David, Trubitt, Live sound for musicians,
  11. Hal Leonard Nathan, Julian, Back to basic audio,
  12. Newnes Yewdall, Lewis, David, Practical art of motion picture sound, Focal Press
  13. Leider, N., Colby, Digital audio workstation, McGraw-Hill
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## 501124 L Elective I Yoga and Meditation (Audit course--Non Credit course)

### Module 1

**Yoga:** Sukshma (subtle) yoga techniques, Difference between physical exercises and yogasans, Impact of yogasans on human body, benefits of yogasans, Patanjali yoga sutras, Technique of different yogasans like, Trikonasan, Ardhashandrasan, Padmasan, Akarnadhanurasan, Ardhamatsendrasan, Vajrasan, Pachhimottanasan, Bhujangasan, Shalabhasan, Dhanurasan, Naukasan, Makrasan, Pawanmuktasan, Halasan, Sarvangasan, Shavasana, Suryanamaskar( Sun Salutation), Yoga and Food.

### Module 2

**Meditation:** Breathing Technique, Pranayam, Benefits of Pranayam, Precautions for Pranayam, Kumbhak, Bandh(Locks), Chakras, Mudra, Technique of Pranayam, Anulom-Vilom Pranayam, Ujjayi Pranayam, Bhramari Pranayam, Bhastrika Pranayam, Agnisar Pranayam, Kapalbhathi Pranayam, Meditation(Dhyan).

### References Books:

Light on Yoga: by B.K.S. Iyengar, Harper Collins Publishers India

1. Light on Pranayama: by B.K.S. Iyengar, Harper Collins Publishers India
2. Yoga for Dummies by Georg Feuerstein and Larry Payne, Wiley India publishing
3. Yoga, Pilates, Meditation & Stress Relief By Parragon Books Ltd
4. The Yoga Sutras by [Patanjali](#), Swami Satchidananda, Integral Yoga Publications
5. Meditation - Science and Practice by N. C. Panda, D. K. Printworld Publisher
6. YogPravesh by Vishwas V Mandlik, Yogchaitanya Prakashan
7. Asanand Yog Vigyan, Bhartiya Yog Sansthan, Delhi
8. Pranayam Vigyan, Bhartiya Yog Sansthan, Delhi

### Reference Web Sites:

1. <http://www.artofliving.org/in-en/yoga>
  2. <http://www.artofliving.org/in-en/yoga/sri-sri-yoga/sukshma-yoga-relaxation>
  3. <http://www.yogsansthan.org/>
  4. <http://www.yogapoint.com/>
  5. <http://www.divyayoga.com/>
  6. <http://www.yogaville.org/about-us/swami-satchidananda/>
  7. <http://www.yogaVision.net>
  8. <http://www.swamij.com>
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**Semester I**  
**1Credit =15 Hrs.**

**501 125 : Lab.Practice–I**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits : 4**

**Examination Scheme**

**Term work : 50 Marks**

**Oral : 50 marks**

**Lab Practice I**

The lab. practice- I will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

The term work will consist of --

- i) Visit reports of minimum three site visits, exploring the field aspects for various subjects
  - ii) Report on minimum 3 assignments / designs / laboratory work on each subject.
  - iii) Report on atleast 2 experiments based on laboratory testing of rocks is mandatory.
  - iii) Report on minimum 2 software applications on any subject of the semester.
  - iv) Report on atleast one patent with its details studied in any subject of the semester.
  - v) Technical review and critique of a research article/paper on any topic from the refereed journal paper related to any subject learnt in the semester–
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER II**  
**1 Credit = 2 Modules = 15 Lectures**

**501 126 Advance Foundation Engineering**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In semester Exam: 50 Marks**

**End Sem Theory Examination: 50 marks**

**Time: 3 hrs**

**Module 1**

Planning of subsoil exploration for major Civil engineering Projects, Methods of subsoil explorations, Choice of method, Types of samplers, Sampling methods, Criteria for spacing of bores, depth of exploration, IS recommendations.

**Module 2**

Field Methods – Standard Penetration Test, Plate Load Test, Cone Penetration Test, Field Vane Shear Test, Geophysical Methods, Reports of subsurface explorations, Interpretation of results of field and laboratory tests

**Module 3**

Bearing Capacity, Terzaghi's, Skempton's, Meyerhoff, BIS methods for bearing capacity Footings: Footings with eccentric loading, moments, combined footing etc.

**Module 4**

Raft foundations – types, Bearing capacity of rafts on sands and clay, Analysis of rigid rafts, Modulus of subgrade reaction and its determination, Effect of depth on subgrade reaction, criteria for rigid / Flexible raft, Raft analysis using modulus of subgrade reaction, raft analysis using finite difference method and finite grid method

**Module 5**

Sheet pile walls – Types, Construction methods, Cantilever sheet piling penetrating clay and sand, Anchored sheet pile wall – Free earth support method and Fixed earth support method, Types of anchors, Design of anchors

**Module 6**

Pile foundations – Static analysis of piles & pile group, negative skin friction, uplift resistance of pile, Vertical piles subjected to lateral loads, Solution with soil modulus assumed constant, short and long piles, Hansen's method, Broom's method, Reese and Matlog method, Use of p-y curves, Deflection of vertical piles, Batter pile groups under inclined load, Culman's method, Analytical method, Hrehnikoffi's method, Brill's approach, Design of pile cap

**Module 7**

Cellular cofferdams – Types, components, stability analysis, design of cellular cofferdams

**Module 8**

Well foundations – Components and their functions, Different shapes, Sinking procedure, Tilts and shift, Sinking stresses, Depth of well foundation, Bearing capacity of well foundation, Loading on well foundation, Lateral stability of well foundation, Different methods of analysis – Terzaghi's analysis, Banergee and Gngopadhyay's method, IRC method, Design of components of well foundation.

**Recommended Books:**

1. Foundation Analysis and Design, J.E. Bowles, 5<sup>th</sup> edition., McGraw-Hill, 1996.
2. Design Aids in Soil Mechanics and Foundations, S.R Kaniraj., 2<sup>nd</sup> edition, McGraw Hill, 1995.
3. Pile Design and Construction Practice, M. J. Tomlinson, Chapman & Hall Pub., 1994.
4. Design of foundation System: Principles and Practices, N. P. Kurian, 3<sup>rd</sup> edition, Narosa

Publishing House, 2005.

5. Theory and Practice of Foundation Design, N. N. Som and S. C. Das, PHI Learning Pvt. Ltd., 2009.
  6. Pile Foundation Analysis and Design, H. G. Poulos and E. H. Davis, John Wiley & Sons, 1980.
  7. Foundation Engineering Handbook, R. W. Day, McGraw Hill, 2005.
  8. Soil Mechanics and Foundation Engineering, V.N.S. Murthy, CBS Publishers & Distributors, 1<sup>st</sup> edition, 2007.
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER II**  
**1 Credit = 2 Modules = 15 Lectures**

**501 127 Construction Methods in Geotechnical Engineering**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In semester Exam: 50 Marks**

**End Sem- Theory Examination: 50 marks**

**Time: 3 hrs**

**Module 1**

Methods of Dewatering. Construction of Raft Foundation

Pile foundation - Pile driving equipment – Hammer, Pile drivers and other accessory equipment, Construction of precast and cast-in-situ piles.

**Module 2**

Cofferdams - Sheet piling in cofferdams – Setting and driving, Length and penetration, splicing, Extraction, Scaling to existing structures, Bracing systems – Circular cofferdams, Rectangular cofferdams, Setting, Bracing, Removing bracing, Excavation – Pre-dredging, excavation inside cofferdams.

**Module 3**

Pile driving within the cofferdam – Bottom seal – Resistance to uplift, Seal construction by bucket method, Seal construction by Tremic method, Seal construction by grout intrusion method, Dewatering – Pumping, other dewatering methods,

**Module 4**

Cofferdam difficulties – Cofferdam destroyed by surge, Cofferdam bottom blows, Improper sheet pile sections and bracing, Sheet pile stopped by boulders, Buckling of long struts, Improper procedure in unstable soil, Scour and poor Tremic-concrete procedures, problems with Tremic.Box

**Module 5**

Caissons – General considerations, Site and foundation preparation, fabrication, Launching and Towing, Setting, Concreting.

**Module 6**

Open Caissons – General considerations, Cutting edges, Setting, Construction of steining, sinking, Tipping and sliding, completing and installation, Construction of Pneumatic Caissons.

**Module 7**

Rock excavation – Evaluation and planning, Drilling equipment, Blast design – Criteria for design, Selection of explosive, Blast hole design, Blasting round design, Over break Control – Line drilling, Pre-splitting, Trim blasting, Loading and hauling equipment

**Module 8**

Tunneling in solid rocks – Means of excavation in solid rocks, Full- face tunneling without support, Full-face tunneling with support Tunneling in moderately firm rocks and ground – Classical or mining method, Single stage mining method, Multistage classical method of tunneling, Sinking caisson method, Shield tunneling method, tunneling by Tunnel boring machines, Types of TBM

**Recommended Books:**

1. Handbook of Heavy Construction, John Havers and Frank W . Stubbs, McGraw Hill, 1971.

2. Construction & Geotechnical Methods in Foundation Engineering, R. M. Koerner, Mc Graw Hill,1985.
  3. Tunneling Management by Design, A. M. Wood , Windle edition.
  4. The Introduction to Tunnel Construction, David Chapman, Nicole Metje and Alfred Stärk , Spon Press, 2010.
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**SEMESTER II**  
**1 Credit = 2Modules =15 Lectures**

**501128 Stability of Slopes and Earth Dams**

**Teaching Scheme**  
**Lectures: 4 hours/week**  
**Credits 4**

**Examination Scheme**  
**In semester Exam: 50 Marks**  
**End Sem- Theory Examination: 50 marks**  
**Time: 3 hrs**

**Module 1**

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.

**Module 2**

Conditions of analysis –Forces acting on earth dam, steady seepage state, sudden draw down conditions; Factor of safety; Codal provisions; Earthquake effects, Stability of foundation

**Module 3**

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

**Module 4**

Earth Dams: Introduction; Components Factors influencing design; Design investigations, Design of components; Construction. Failure of earth dams

**Module 5**

Instrumentation in dam, Objectives of Instrumentation , Instrumentation data system , Working principles of Instruments , Selection of Equipments Various types of Piezometers, Vibrating wire settlement cells ,settlement gauge, inclinometer; Jointmeter, Vibrating wire pressure cell, Distributed fibre optics temperature tool.

**Module 6**

Road and rail embankments.

**Module 7**

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

**Module 8**

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

**Recommended Books:**

1. J.L. Sherard et. al., Earth and Earth-rock Dam, John Wiley, 1963.
  2. W.P. Creager, J.D. Justin and J. Hinds, Engineering for Dams, John Wiley, 1945.
  3. Earth & Rock fill dams – Principles of design and construction by Christian Kutzner Published Oxford and IBH
  4. Design of small dams – United States Department of the Interior Bureau of Reclamation Published by Oxford and IBH Publishing Company
  5. Earth Manual – CBS Publishers and distributors
  6. The stability of slopes by E.N. Bromhead published by Blackie Academic and Professional
  7. Earth pressure and Earth Retaining structures by C.R.I. Clayton, J. Milititsky, Ufrgs and R.I. Woods Published by Blackie Academic and Professional
  8. Earth and Rock fill dams by Sherad
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**SEMESTER II**  
**1 Credit = 2Modules =15 Lectures**

**501129 Elective II**

<b>Code</b>	<b>2 Credits Course</b>	<b>Code</b>	<b>1 Credit Course</b>	<b>Code</b>	<b>Audit Course (No Credit Course)</b>
501129A	Human Rights	501129 E	Foreign Language II	501129I	Performing Arts – Music and Dance
501129B	. Finite Element Methods in Geotechnical Engg.	501129F	Geotechnical Techniques in Rock Engineering	501129J	Principle Centred Leadership
501129C	Foundation Design & Detailing.	501129G	Green Building Design and Construction		
501129 D	Foundation of Offshore Structures	501129H	Forensic Civil Engineering		

**501 129 –A Elective II Human Rights (2 Credits course)**

**Module 1**

**Human Rights – Concept, Development, Evolution**

- Philosophical, Sociological and Political debates
- Benchmarks of Human Rights Movement.

**Human Rights and the Indian Constitution**

- Constitutional framework
- Fundamental Rights & Duties
- Directive Principles of State Policy
- Welfare State & Welfare Schemes

**Module 2:**

**Human Rights & State Mechanisms**

- Police & Human Rights
- Judiciary & Human Rights
- Prisons & Human Rights
- National and State Human Rights Commissions

**-Module 3:**

**Human Rights of the Different Sections** and contemporary issues

- Unorganized Sector ,
- Right to Environment, particularly Industrial sectors of Civil Engineering and Mechanical Engineering .
- Globalization and Human Rights
- Right to Development,

**Module 4. :**

**Citizens' Role and Civil Society**

- Social Movements and Non-Governmental Organizations
- Public Interest Litigation
- Role of Non Government organizations in implementation of Human rights.
- Right to Information

**Human Rights and the international scene** –Primary Information with reference to Engineering Industry.(2 hrs)

- UN Documents
- International Mechanisms (UN & Regional)
- International Criminal Court

**Reference Books:**

- 1.Study material on UNESCO,UNICEF web site
  - 2.Human Rights in India- A Mapping ,Usha Ramanathan: free download from <http://www.ielrc.org/content/w0103.pdf>
  - 3.Introduction to International Humanitarian Law by Curtis F. J. Doebbler - CD Publishing ,
  - .4.Information, by Toby Mendel - UNESCO , 2008
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## 501 129 –B Elective-II Finite Element Methods in Geotechnical Engineering-

(2 Credits course)

### Module 1

Introduction. Steps in FEM. Stress deformation analysis: One-,Two-dimensional formulations; Three-dimensional formulations; Boundary conditions; Solution algorithms; Discretization; use of FEM2D Program and Commercial packages.

### Module 2

Analysis of foundations, dams, underground structures and earth retaining structures. Analysis of flow (seepage) through dams and foundations. Linear and non-linear analysis. In situ stresses. Sequence construction and excavation. Joint/interface elements. Infinite elements. Dynamic analysis. Evaluation of material parameters for linear and non-linear analysis, recent developments.

### Module 3

Analysis of field Geotechnical Problems by Finite element solutions - Beam on elastic foundation, Mat foundation, Ring foundation, Pile foundation, Braced excavations, Sheet pile walls

### Module 4

Stability of slopes, Stress and deformations in embankments.

### Recommended Books:

1. Introduction to Finite Element Methods, C. S. Desai and J. F. Abel , 1<sup>st</sup> edition, CBS Pub., New Delhi, 1989.
  2. Concepts and Applications of Finite Element Analysis: R. D. Cook, Third Edition, Wiley India Text books, Wiley India Pvt Limited, 1989.
  3. Introduction to Finite Elements in Engineering, Chandragupta T. R. and Belegundu A. D., 3<sup>rd</sup> edition., Prentice Hall, 2002.
  4. Finite Element Analysis: Theory and Programming: C. S. Krishnamurthy, Second Edition, Tata Mc Graw Hill Publishing Company Limited, 1994, Reprint 2005.
  5. The Finite Element Method for Engineers, K. H. Huebner, D. L. Dewhurst, D. E. Smith and T.G. Byrom, 4<sup>th</sup> edition, John Wiley and Sons, Inc., 2001.
  6. Matrix and Finite Element Analysis of Structures, Madhujit Mukhopadhyay and Abdul Hamid Sheikh, First Edition, Ane books Publication, 2004.
  7. The Finite Element Method (Volume -I): O. C. Zienkiewicz and R. L. Taylor, 5<sup>th</sup> edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1989
  8. Desai C.S. and Abel J.F. "Introduction to FEM, A numerical method for Engineering analysis ", East West Edition, 1972.
-

## **501 129 –C Elective-II Foundation Design and Detailing. (2 Credits course)**

### **Module 1**

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.

### **Module 2**

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.

### **Module 3**

Design of well foundation, check for stability, base pressure, side pressure and lateral deflection.

### **Module 4**

Design of retaining wall including detailing, stability calculations, design of cantilever and anchored sheet pile walls and ring foundations.

### **Recommended Books:**

1. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Grawhill
  2. Design Aids in Soil Mechanics and Foundation Engineering-Shenbaga 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
  5. Hsai-Yana-Fana- Foundation Engineering Hand book, Chapmon & hall, Newyark
  6. G. A. Leonards, Foundation Engineering, McGraw-Hill, 1962.
  7. J.E. Bowles, Foundations Analysis and Design, 3rd Ed., McGraw-Hill, 1968.
  8. R.B. Peck, W.E. Hanson and T.H. Thornburn, Foundation Engineering, 2nd Edition, John Wiley and Sons, 1974.
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## **501 129 D Elective-II Foundations of Offshore Structures. (2 Credits course)**

### **Module 1**

Nature and magnitude of load on foundations of offshore structures, criteria of foundation design in offshore environment.

### **Module 2**

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.

### **Module 3**

Dynamic stress in pile driving, pile behaviour under cyclic lateral loads, development of p-y curves, analysis of single piles and pile groups.

### **Module 4**

Finite element and other numerical methods of interactive analysis using linear and nonlinear foundation response, geotechnical aspects of anchors and submarine pipelines.

### **Recommended Books:**

- Proceedings of the Conference on Behaviour of Offshore Structures, 1976.
  - Proceedings of the Conference on Finite Element Methods in Geotechnical Engineering (Ed.), C. S. Desai.
  - Proceedings of Offshore Technology Conference, Houston, Texas.
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**501129 E Elective II Foreign Language –II French-II (1 Credit course)**

**Module 1**

French Grammar and Vocabulary: Unit-1, Lesson 2 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 2 of the Text Book & workbook

**Module 2**

Advance Vocabulary, Writing & Speaking: Unit-1, Lesson 3 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 3 of the Text Book, Exercise of Unit-1, Lesson 3 of the Text Book & workbook, Revision & speaking practice

**Reference**

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
  2. Jumelage-I workbook by Roopa Luktuke
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## **501129 F Elective-II Geotechnical Techniques in Rock Engineering. (1 Credits course)**

### **Module 1**

Ground improvement techniques, assessment. Compaction of disintegrated and weathered rocks. Grouting, type of grouts, suspensions, solutions and resins, Rheological models. Viscous and viscoplastic flows. Spherical and radial flows. Grout ability.

### **Module 2**

Grouting techniques, materials, equipment, specifications, evaluation and quality control. Case histories, Shotcrete, method and materials, factors. Fibre reinforced shotcrete. Ground anchors, principles of reinforcement, rock bolts, mechanism, mechanical, friction, grouted tensioned and untensioned bolts. Design of bolts. Installation. Equipment. Testing. Cable anchors. Dewatering techniques, classification, assessment of insitu permeability, filter criteria and design of wells, Codal provisions.

### **Recommended Books:**

- 1) J.C. Jagger and N.G.W. Cook, Fundamentals of Rock Mechanics, Methuen and Co., London, 1971.
  - 2) Obert, Leonard and W.I. Duvall, Rock Mechanics and Design Structures of Rock, 1967.
  - 3) J.A. Hudson et. al. (Ed), Comprehensive Rock Mechanics, in 5 vols., Pergamon Press, 1993.
  - 4) Brown E.T. "Analysis and computational methods.
  - 5) Hoek E. and Brown E. T. "Underground excavation in rock".
  - 6) Megan T.M. and Barllette J.V. "Tunnel Planning and design".
  - 7) Szechy K.- Art of Tunneling.
  - 8) Zienkiewicz, OCH and Taylor R.L.- Finite element method .Vol -2.
-

**501 129 G Elective II ----Green Building Design and Construction  
(1 Credit course)**

**Module 1**

**Principles of Sustainability, Energy Conservation and Water Conservation**

Introduction to Course, Sustainability, Major Environmental Challenges, Global Warming, Introduction to Green Buildings; LEED, Sustainable Urban Development.

Building energy system strategies, Energy Conservation in Buildings, HVAC Systems, Energy and Atmosphere - LEED Credits, eQuest Energy Simulations, Conducting an Energy Audit, Fossil Fuels vs. Renewable Energy.

Water Conservation in Buildings, Storm Water Harvesting and Management, Water cycle strategies

**Module 2**

**Green Materials and Green building codes**

Green Construction Materials, Materials and Resources - LEED Credits, Building Deconstruction, C&D Recycling, Indoor Environmental Quality – Basic, IEQ - LEED Credits, Building Commissioning, Materials selection strategies, Green building codes and standards, International Green Construction Code, Carbon accounting, Green Building Specifications

**Reference Books**

- 1.C.J. Kibert (2008) “Sustainable Construction: Green Building Design and Delivery”, 3rd Ed., John Wiley, Hoboken, New Jersey
  - 2.G.T. Miller Jr. (2004) “Living in the Environment: Principles, Connections, and Solutions”, 14th Ed., Brooks Cole, Pacific Grove, California
  3. Energy Conservation Building Code (ECBC)
- 

**501129 H Elective- II Forensic Civil Engineering (1 Credit course)**

**Module 1**

Introduction to forensic engineering, Forensic investigations-tools and techniques, Failures-types, causes and mechanisms, Monitoring and instrumentation, Mitigation of failure

**Module 2**

Professional practice and ethics, Legal issues, Repairs and remediation, Risk and risk assesment, Assesment of damage, Case studies.

**References**

Proceedings, Conference on Forensic Civil Engineering, Association of Consulting Civil Engineers(I), August, 2013

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**501129 I Elective II Performing Arts – Music and Dance  
(Audit course--Non Credit course)**

**Module 1 :**

**Indian Music**

Vocal, Instrumental, Sur, Laya, Tal. Ragas and their classification based on time and “Raasa-Nirmitee”. Seasons and Ragas. Various “Bandishes” and “Gharanas” or styles. Light Indian Music-different types.

Experiencing ethos and bliss by listening to performances of various reputed artists.

Experiencing oneness with nature and the super power by performing individually or in a group.

**Module 2 : Indian Classical Dance**

Types –Kathak, Bharatnatyam, Kuchipudi, Odissy etc. Importance of “Abhinaya” (acting) in dance. Role of “Taala” and “Laya” in dance. Various dance form. Various gharanas in traditional dance types Fusion with other dance styles. Experiencing the Indian cultural power through individual and group performances.

**Books/Audio CD**

1. Hindustani Sangeet Paddhati by Pt.Vishnu Narayan Bhatkhande publ. Swarganga Foundation.
  2. Jivi Jivai (Golden Voice Golden Years) Pt.Jasraj, Publ. Bandishes with notations composed by the author.
  3. Pranav Bharati, by Pt.Ompraksh Thakur, publ. Swarganga foundation.
  4. Rasa Gunjan by Pt.Birju Maharaj, Publ. Swarganag foundation
  5. Anup Rag Vilas by Pt.Kumar Gandharava, Bandishes composed and sung by author mostly available on cassettes Swarganga Foundation.
  6. The dance Orissi – Mohan Khokar published by (2010) Abhinav Publications, New Delhi
  7. Introduction to Bharata’s Natyashastra by Adya Rangacharya, Munshiram Manoharlal publication.
  8. Art of Dancing classing and folk dance by priyabala Shah, Parimal publication
  9. Tantra Mantra Yantra in Dance: An Exposition of Kathaka, by Ranjana Shrivastava, D.K.Prinword Pvt. Ltd.
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**501129 J Elective II Principle Centered Leadership**  
**(Audit course--Non Credit course)**

**Module 1 :**

**Motivation, Leadership and Competency**

**a) Motivation:--**

Necessity, types, means of providing extrinsic motivation. Leadership. Qualities of a leader. Types of Leadership viz. Laissez Faire, transactional, transformational. Principle centered leadership based on Stephen Covey habits.

**b) Competency Mapping:-**

Definition of competency. Generic, functional and Strategic Competencies. Importance of developing competencies. Identification of competency gaps at managerial cadre level through benchmarking requirements based on role, mapping and assessment. Training and Developmental programs for competency gap closure.

**Module 2 :**

**Entrepreneurship and strategic Management**

**a) Entrepreneurship: -** Qualities of an entrepreneur. Business ideas generation methods—creative imagination, brainstorming, newspaper exercise activity. Ideas evaluation based on John Mullion's 7 point test concept of a B—plan.

**b) Strategic Management: --**

Necessity in the context of global challenges. Objectives of strategic management. Forecasting abilities and methods. Developing organizations for the achievement of strategic objectives. Dealing with uncertainties.

**Reference Books**

1. Seven habits of highly effective people—Stephen Covey—Franklin Covey Publications
  2. Living the seven habits Stephen Covey—Franklin Covey Publications
  3. 8<sup>th</sup> Habit – from effectiveness to greatness Stephen Covey—Franklin Covey Publications
  4. Human Resource Development In The Building Industry, Vinita Shah, published by NICMAR
  5. Human Resources Management & Human Relations , V P Michael , Himalaya
  6. Human Resource Management Biswajeet Pattanayak published by Prentice Hall
  7. Construction project Management, integrated approach—Feedings First Indian Reprint 2011—Yesdee publications
  8. Cases in Strategic Management, Amita Mital , Tata Mcgraw Hill
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**Semester II**  
**1Credit =15 Hrs.**  
**501 130 -Lab.Practice-II**

**Teaching Scheme**  
**Lectures: 4 hours/week**  
**Credits : 4**

**Examination Scheme**  
**Term work : 50 marks**  
**Oral : 50 marks**

**Lab Practice II**

The lab. practice-II will be based on completion of assignments / practicals / reports of site visits, confined to the courses in that semester.

The term work will consist of –

- i) Report of Laboratory experiments ---
    - 1) Plate Load Test,
    - 2) Standard Penetration Test,
    - 3) Cone Penetration Test,
    - 4) Field Vane Shear Test,
    - 5) Geophysical Methods , Reports of subsurface explorations, Interpretation of results of field and laboratory tests
  - ii) Stability analysis of slopes using software
  - iii) Visit reports of minimum two site visits, exploring the field aspects for various subjects
  - iv) Report on atleast one patent with its details studied in any subject of the semester.
  - v) Technical review and critique of a research article/paper on any of the topics related to the subjects learnt in semester-II
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**Semester II**  
**1Credit =15 Hrs.**  
**501131-Seminar – I**

Teaching Scheme  
Pract. 4 hrs./week

Examination Scheme  
Oral : 50 Marks,  
TW :: 50 Marks  
Credits 4

The seminar I shall be on state of the art topic of own choice approved by the guide  
Term work of the seminar should consist of spiral bound report ,preferably printed on both  
the sides of pages on any technical topic of interest associated with the post graduate course  
and should be submitted in a standard format having the following contents .

- i. Introduction
- ii. Literature Survey
- iii. Theoretical contents
- iv. Relevance to the present national and global scenario of construction industry
- v. Strengths and weaknesses of the particular area of seminar
- vi. R & D in the particular area
- vii. Field Applications / case studies / Experimental work / software application / Benefit  
cost studies – feasibility studies
- viii. Vendors associated
- ix. Conclusions
- x. References

Students should prepare a power point presentation to be delivered in 15 minutes and should  
be able to answer questions asked in remaining five minutes.

It is desired that based on the seminar work, a paper be prepared and presented in a state /  
national conference.

At the end of first year, the students are required to undergo through a field training of  
minimum 2 weeks duration. The presentation and separate report of the vocational training  
will be submitted along with report of seminar II.

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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER III**  
**1 Credit = 2 Modules = 15 Lectures**

**601 132 Geotechnical Earthquake Engineering**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In Sem Assessment: 50 marks**

**End semester Theory Exam: 50 Marks**

**Duration: 3Hrs**

**Module 1**

Seismology and Earthquakes – Internal structure of earth, Continental Drift and Plate Tectonics, Faults, Elastic Rebound Theory, Other sources of seismic activity, Geometric Notation, Location of Earthquake, Size of Earthquake

**Module 2**

Strong Ground Motion - Strong Motion measurement, ground motion Parameters, Estimation of ground Motion Parameters, Spatial Variability of Ground Motions

Seismic Hazard Analysis – Seismic Hazards, Identification and Evaluation of Earthquake Sources, Deterministic Seismic Hazard Analysis, Probabilistic Seismic Hazard Analysis.

Wave Propagation – Waves in Unbound Media, Waves in Semi-infinite Body, Waves in Layered Body, Attenuation of Stress Waves

**Module 3**

Dynamic Soil Properties – Representation of stress conditions by the Mohr Circle, measurement of Dynamic Soil properties, stress-strain behaviour of cyclically loaded soils.

Ground response analysis – 1-D ground response analysis, 2-d ground response analysis, 3-dD ground response analysis, Soil-structure interaction.

**Module 4**

Local Site effects and design ground motions – effects of local site conditions on ground motion, Design parameters, Development of design parameters, Development of ground motion time histories

**Module 5**

Liquefaction – Liquefaction phenomenon, Evaluation of liquefaction hazards, Liquefaction Susceptibility, Initiation of liquefaction, Effects of liquefaction,

Seismic Slope stability – Types of earthquake induced landslides, Earthquake induced landslide activity, Evaluation of slope stability analysis, Seismic slope stability analysis.

**Module 6**

Stability of earthen dam during earthquake – Types of damage, Response analysis of embankment dams – visco-elastic response analysis, Jai Krishna approach, Seed and Martin approach, Development of deformation analysis – Goodman and Seed approach, Seed approach to non-free-draining and cohesive soils, Design recommendations and precautions Analytical methods of dynamic analysis for earth dam and embankments

**Module 7**

Seismic design of Retaining wall – Dynamic response of retaining walls, Seismic pressure on retaining walls, seismic displacement of retaining walls, Seismic design considerations , Soil improvement for remediation, Reinforcement techniques, Grouting of soil improvement.

**Module 8**

Bearing capacity of foundations , analysis for earthquake, earthquake induced settlement, mitigation of earthquake effects.

**Recommended Books:**

- 1) Geotechnical Earthquake Engineering, Steven L. Kramer, Prentice Hall Publication, 1996
- 2) Geotechnical Earthquake Engineering Hand Book, R. W. Day McGraw Hill Publication, 2001
- 3) Geotechnical Engineering Investigation Manual, R. E. Hunt, McGraw Hill Publication, 2005
- 4).Soil Dynamics & Machine Foundation, Swami Saran, 2<sup>nd</sup> edition, Galgotia

Publications Pvt. Ltd., New Delhi, 1999.

e5) Seismic Design Handbook, F. Naeim, 2<sup>nd</sup> edition, Kluwer Academic Publ., 20

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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER III**  
**1 Credit = 2 Modules = 15 Lectures**

**601133 Geoenvironmental Engineering**

**Teaching Scheme**

**Lectures: 4 hours/week**

**Credits 4**

**Examination Scheme**

**In Sem Assessment: 50 marks**

**End semester Theory Exam: 50 Marks**

**Duration: 3Hrs**

**Module 1**

Identification, Characterization and regulatory requirements for disposal of hazardous, non-hazardous and domestic waste

**Module 2**

Sources and effects of subsurface contamination, Physical, Chemical and biological characteristics of solid waste, Soil-waste interaction

**Module 3**

Cation exchange reactions and effect of pollutants on soil properties

Erodability of soil in relation to moisture content, Containment transport, Laboratory and field evaluation of permeability, Factors affecting, Design of dewatering.

**Module 4**

Waste management – Recycling, Composting, Incineration, and various disposal methods, Site selection, Leachate collection and detection system

**Module 5**

Types of landfills – Silting criteria, Waste containment principle, Types of barrier materials, Planning and design aspects relating to waste disposal in landfills

**Module 6**

Landfills – Ash ponds and Tailing ponds and in rocks, Environmental monitoring around landfills – Detection, Control and remediation of subsurface containment,

**Module 7**

Engineering properties and Geotechnical reuse of waste, Demolition of waste etc., Reclamation of old waste dumps, Regulation, Case studies

**Module 8**

Single and double lined landfill, Applications of Geosynthetics in waste disposal design, Landfill construction, Construction quality control and performance monitoring.

**Recommended Books:**

1. Geotechnical Practices for Waste Disposal, D.E Daniel, Chapman and Hall, London, 1993
2. Geo-environmental Engineering Principles and Application, L.N. Reddy and H.F. Inyang, Marcel Dekker Inc., 2000
3. Introduction to Environmental Geotechnology, Hsai-Yang Fang, CRC Press, 1997
4. Geotechnical and Geoenvironmental Engineering Handbook, R. K Rowe, Kluwer Academic Publishers, 2001.
5. Waste Containment Systems, Waste stabilization and Landfills, Design and Evaluation, H. D. Sharma and S. P. Lewis, John Wiley and Sons, 1994.

6. Geoenvironmental Engineering, H. D. Sharma and K. R. Reddy, John Willey and Sons, 2004.
  7. Geoenvironemntal Engineering, R N Yong and H R Thomas, Thomas Telford, 1997.
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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**SEMESTER III**  
**1 Credit = 2Modules =15 Lectures**

**601 134 Elective III**

Select any combination having total of 5 credits from following technical / interdisciplinary courses ---

Code	2 Credits Course	Code	1 Credit Course	Code	Audit Course (No Credit Course)
601134 A	Earth Pressure & Retaining Structures	601134E	Restoration and conservation of old structures	601134 H	Chess
601134B	Soil Stabilization	601134F	Foreign Language	601134 I	Abacus
601134C	Special Geotechnical Constructions	601134G	Safety Practices in construction.		
601134D	Soil Dynamics & Machine Foundations.				

**601134 -A --Elective-III Earth Pressure and Retaining Structures ( 2Credit course)**

**Module 1**

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.

**Module 2**

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.

**Module 3**

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.

#### **Module 4**

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.

#### **Recommended Books:**

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
  2. Karl Terzaghi, Theoretical Soil Mechanics, Chapman and Hall, 1954.
  3. R.F. Scott, Principles of soil Mechanics, Addison Wesley, World Student Edition, 1963.
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### **601 134 B --Elective-III Soil Stabilization ( 2Credit course)**

#### **Module 1**

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.

#### **Module 2**

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.

#### **Module 3**

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,

#### **Module 4**

Bituminous stabilization, electrical and thermal stabilization.

#### **Recommended Books:**

1. Manfred R. Hausmann: Engineering Principles of Ground Modifications, McGraw Hill International.
  2. Physical & geotechnical properties of soils – Josep h E.Bowels, Tata Mc.- Grawhill
  3. Advanced soil mechanics- Braja M.Das, Tata Mc.- Grawhill
  4. Proceedings of the Conference on Soil Stabilization, Massachusetts Institute of Technology, June 18-30, 1959.
  5. K.B. Woods, D.S. Berry and W.H. Goetz, Highway Engineering Handbook, 1960.
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### **601134 C- Elective-III Special Geotechnical Constructions ( 2Credit course)**

#### **Module 1**

Diaphragm walls, Ground (soil and rock) anchors, Soil nailing,

#### **Module 2**

Screw piles, Secant pile walls, Gabbian walls, Deep soil mixing walls,

#### **Module 3**

Geofoams and Geocells.

#### **Module 4**

The state of the art study of following topics with respect to types, uses and applications --

- 1)Construction techniques/ methods
- 2)Equipments, machineries required
- 3)General design considerations
- 4)Analysis and quantitative design solution
- 5) Important case studies (in India and abroad)

**Recommended Books:**

1. Construction of Diaphragm wall: I. Hajal, J. Morton and Z. Regele, series in engineering publications
2. Foundation Engineering Handbook: Chapter no. 26, H. Y. Fang, CBS Publishers (2004).
3. FHWA Reports and Publication
4. Relevant IS codes and paper from various referred journals and proceedings

**601134 D-Elective-III Soil Dynamics and Machine Foundations.( 2 credit course)**

**Module 1**

Theory of vibrations – Introduction to dynamic loading, Vibratory motions, Harmonic motion, Single degree of freedom system- free and forced vibrations, damped and un-damped vibrations, Systems with two degree of freedom, Un-damped dynamic vibration absorbers.

**Module 2**

Wave propagation- vibrations in rod (infinite and finite) - Longitudinal and torsional vibrations, Wave propagation in an infinite homogeneous isotropic elastic medium, Wave propagation in elastic half space.

Dynamic soil properties- different laboratory tests and field tests, Factors affecting the modulus of soil, Dynamic bearing capacity of shallow foundation, Dynamic analysis- Triandafilidis's solution, Wallace's solution, Chummar's solution.

**Module 3**

Types of machine foundations, General requirements of machine foundation, Design criteria. Foundations of reciprocating machines- modes of vibrations, Linear elastic weightless spring method, elastic half space method, Effect of footing shape on vibration response, Dynamic response of embedded block foundation.

Foundation of impact type machines- dynamic procedure for hammer foundations,

**Module 4**

Foundation of rotary machine – design criteria, Two dimensional analysis - Resonant method, Amplitude method and combined method.

Vibration isolation- methods of isolation in machine foundations, Isolating materials and their properties

Constructional details of machine foundations

**Recommended Books:**

1. Handbook of Machine Foundation, Srinivasunlu and Vaidyanathanan, Springer Netherlands, 2008.
2. Soil Dynamic and Machine Foundation, Swami Saran, Second edition, Galgotia Publication, 2009.
3. Vibrations of Soils and Foundations, F. E. Richards J. R. Hall and R. D. Woods, PHI, 1970.
4. Vibration Analysis and Foundation Dynamics, N. S. V. Kameswara Rao, Meeler Pub.,

- 1998.
5. Foundation for Machines: Analysis and Design, Samsher Prakash and V. K. Puri, John Wiley & Sons, 1998.
  6. Soil Dynamics, Samasher Prakash, MGH, 1981.
  7. IS:2974(Part I to Part IV) : 1992; Code of Practice for Design and Construction of Machine Foundations
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**601 134 –E - Elective III -- Restoration and conservation of old structures  
(1 Credit course)**

**Module 1**

Principles of Repair and Retrofitting, Terminology in Repair, Restoration, Strengthening and Rehabilitation, Criteria for Repair, Restoration and Retrofitting; Repair Materials; In-situ testing methods for RC and masonry structures; Seismic Hazard Evaluation;

**Module 2**

Techniques of repair and retrofitting of masonry buildings; Seismic evaluation of RC building- Demand capacity method, pushover analysis and performance based approach; Techniques of Repair and Retrofitting in RC buildings; Retrofitting of buildings by seismic base isolation and supplemental damping;

Retrofitting of heritage structures; retrofitting of bridges; Case studies in retrofitting.

**Reference Books:**

1. Pankaj Agrawal & Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall India.
  2. Duggal S. K., Earthquake Resistant Design of Structures, Oxford University Press 2007
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**601 134 –F- Elective III Foreign Language -- French-III  
(1 Credit course)**

**Module 1:**

French Grammar and Vocabulary: Unit-1, Lesson 4 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 4 of the Text Book, Revision & speaking practice

**Module 2:**

Advance Vocabulary, Writing & Speaking, Exercise of Unit-1, Lesson 4 of the Text Book & workbook , Practicing Simple conversation in French, Revision & practice of conversation (Simple questions & answers)

**Reference:** Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke  
Jumelage-I workbook by Roopa Luktuke

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**601 134 –G-Elective III Safety Practices in Construction  
(1 Credit course)**

**Module 1:**

Introduction to Construction Safety And Safety Technology--Introduction to construction safety; historical background and current perspective; Government's policy in industrial

safety; safety & health legislation in India, Construction Sites (Safety) Regulations; Codes of practice; Potential hazards/risks associated with construction sites and high risk activities such as the use of hoist, Working at height and working in confined space. Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitations – Merits and demerits – Steel structures – Concrete structure.

Workplace ergonomics including display screen equipment and manual handling, personal protective equipment, first aid and emergency preparedness, fire safety, electrical hazards.

**Module 2:**

Construction Safety Management and Accident Prevention

Safety training; safety policy; safety committees; safety inspection; safety audit; reporting accidents and dangerous occurrences.

Accident Prevention: Principles of accident prevention; job safety analysis; fault tree analysis; accident management

**References**

1. Accident Prevention Manual for Industrial Operations, NSC, Chicago, 1982.
  2. Fulman, J.B., Construction Safety, Security, and Loss Prevention, John Wiley and Sons, 1979.
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**601 134 –H Elective III -CHESS  
(Audit course--Non Credit course)**

**Module 1**

Introduction of chess game, What is chess board, the place of chess board , Chess pieces position & its moves, The concept of attacking, , The concept check with different pieces, Mate/Checkmate, Castling, Pawn Promotion, Notation, Stalemate, Pointing

**Module 2**

End game, attacking a piece, Opening principles, Piece exchange, Pin, Defining the draws in Chess

**Reference:** As specified by the instructor

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**601 134 –I--Elective III ABACUS  
(Audit course--Non Credit course)**

**Module 1**

Introduction of Abacus, addition & subtraction with help of help of small friends, big friends & big family, Concept of visualization, Multiplication & Division

**Module 2**

Additional & Subtraction with decimal concept, Determine cube root & square root

**Reference:** As specified by the instructor

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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**  
**SEMESTER III**  
1Credit =15 Hrs.  
**601 135-Seminar – II**

Teaching Scheme  
Pract. 4 hrs./week

Examination Scheme  
Oral : 50 Marks,  
TW :: 50 Marks  
Credits 4

Seminar II shall be on the topic relevant to latest trends in the field.

Term work should consist of ---

- I)** Spiral bound report preferably, printed on both the sides of paper on the topic of dissertation work and should be submitted in a standard format having the following contents.
- i) A report on training undergone on a construction project site/organization/for a period of minimum 15 days, including the data collection necessary for the project work.
  - ii) A report on the topic of dissertation, containing the following:
    - a) Literature review and problem statement formulation.
    - b) Research Methodology and proposed schedule of completion of project work.Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.
- II)** Spiral bound report preferably, printed on both the sides of paper on vocational training of 2 weeks
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**University of Pune**

**M.E. (Civil) (Geotechnical Engineering)--2013Course**

**SEMESTER III**

**1 Credit = 2Modules =15 Lectures**

**601 136 Project Stage I**

Teaching Scheme  
Pract. 8 hr./week

Examination Scheme  
Oral: 50 Marks,  
TW ; 50 marks  
Credits 8

The project work will start in semester III, and should preferably be a live problem in the industry or macro-issue of industry and should involve scientific research, design, collection, and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The dissertation stage I report should be presented in a standard format, in a spiral bound hard copy, preferably printed on both the sides of paper, containing the following contents.

- i. Introduction including objectives, limitations of study.
- ii. Literature Survey, background to the research.
- iii. Problem statement and methodology of work
- iv. Theoretical contents associated with topic of research
- v. Field Applications, case studies
- vi. Data collection from field/organizations or details of experimental work/analytical work
- vii. Part analysis / inferences
- viii. Details of remaining work to be completed during the project work stage II
- ix. References

Students should prepare a power point presentation to be delivered in 25 minutes and should be able to answer questions asked in remaining five minutes.(It is preferred that at least one paper on the research area be presented in a conference or published in a referred journal.)

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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013Course**

**SEMESTER IV**

1Credit =15 Hrs.

**601 137-Seminar – III**

Teaching Scheme  
Pract. 5 hrs./week

Examination Scheme  
TW: 50 Marks  
Oral / Presentation-100 marks  
Credits : -5

Term work should consist of a spiral bound report on the topic of dissertation work,preferably typed on both the sides of pages and should be submitted in a standard format.

Seminar III will be assessed based on the requirements of completion of project work for the project stage II.

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

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**University of Pune**  
**M.E. (Civil) (Geotechnical Engineering)--2013 Course**  
**SEMESTER IV**  
**1 Credit =15 Lectures**

**601 138 Project work Stage II**

Teaching Scheme  
Pract. 20 hrs./week

Examination Scheme  
Oral/Presentation : 50 Marks  
TW : 150 Marks  
Credits : - 20

The final dissertation should be submitted in black bound hard copy as well as a soft copy on CD.

(The due weight will be given for the paper(s) on topic of project presented in a conferences or published in referred journals.)

The Term Work of Dissertation of semester IV should be assessed jointly by the pair of internal and external examiners, along with oral examination of the same.

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