

Scheme of teaching and examination for
Master of Engineering (Foundation Engineering)
Two Years Full Time Course

144/c

| Semester I | | | | | | | | | |
|--------------|-------------------------------|----------------|---|---|-----------------------|-----------------|----|---|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 1.1 | Advanced Soil Mechanics | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.2 | Shallow Foundations | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.3 | Rock Mechanics | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.4 | Ground Improvement Techniques | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.5 | Elective-1 | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.6 | Laboratory -1 | - | - | 8 | - | - | 2 | 2 | 4 |
| Total | | 20 | - | 8 | - | 20 | 12 | 2 | 34 |

| Semester II | | | | | | | | | |
|--------------|-------------------------------------|----------------|---|---|-----------------------|-----------------|----|---|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 2.1 | Deep Foundations | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.2 | Soil Dynamics & Machine Foundations | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.3 | Marine Geotechnical Engineering | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.4 | FEM in Geotechnical Engineering | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.5 | Elective-2 | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.6 | Laboratory-2 | - | - | 8 | - | - | 2 | 2 | 4 |
| Total | | 20 | - | 8 | - | 20 | 12 | 2 | 34 |

| Semester III | | | | | | | | | |
|--------------|--------------|----------------|---|----|-----------------------|-----------------|----|---|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 3.1 | Elective-3 | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 3.2 | Project | - | - | 8 | - | - | 2 | 2 | 4 |
| MFE 3.3 | Laboratory-3 | - | - | 8 | - | - | 2 | 2 | 4 |
| MFE 3.4 | Seminar | - | - | 8 | - | - | 2 | 2 | 4 |
| Total | | 4 | - | 24 | - | 4 | 8 | 6 | 18 |

| Semester IV | | | | | | | | | |
|--------------|--------------|----------------|---|----|-----------------------|-----------------|----|----|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 4.1 | Dissertation | - | - | 28 | - | - | 8 | 12 | 20 |
| Total | | - | - | 28 | - | - | 8 | 12 | 20 |

| | | | | | | | | |
|-----------------------------------|----|---|----|---|----|----|----|-----|
| Grand Total of all four semesters | 44 | - | 68 | - | 44 | 40 | 22 | 106 |
|-----------------------------------|----|---|----|---|----|----|----|-----|

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* Please see remarks at the end

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MFE 1.1 - ADVANCED SOIL MECHANICS

Idealised Concept of Soil - Darcy's law, Steady state 3-D flow in an isotropic soil, continuity equation, equation of state, governing differential equation, solution by numerical methods, matrix method, FEM for 2-D, Methods for reducing flow.

Transient Flow - 3-D flow through anisotropic soil of compressible fluid, through partially saturated soil, Terzaghi-Rendulic and Biot's equations, solution by numerical methods; consolidation of soils.

Introduction to Scharf-Christoffel method and drains.

Stress Distribution in Soil - Application of theory of elasticity, Boussinesq, Mindlin, Westergaards theories.

Contact Pressure - Factors affecting, effect of rigidity of footing and/ or superstructure, simplified elastic-plastic analysis, thin plate theory, numerical methods, use of FEM, and rafts on consolidating soil layer.

3-D stress representation. Octahedral stresses, Stress invariants.

Shear Strength of Soil - Pore pressure parameters, total and effective stress parameters; effect of intermediate principal stress, rate of strain, stress path.

Yield Criteria - Failure envelopes for soils, 3-D representation.

References :

Alam Singh, "Modern Geotechnical Engineering", International Book Traders.

Alam Singh., "Soil Engineering In Theory And Practice", Asia Publishing House

Braja.M.Das." Advanced Soil Mechanics", Mc.Grawhill Int. Students Edition.

Braja.M.Das." Introduction To Soil Mechanics", Galgotia Publication.

Karl Terzaghi And Ralph B. Peck, " Soil Mechanics In Engineering Practice, John Willey And Sons.

Scott R.F., "Principles Of Soil Mechanics" Addison-Wesley Publishing Company.

Scott C.R., "Development In Soil Mechanics" Associated Science Publications, London.

William Lambe T. & Robert V. Whitman, "Soil Mechanics", John Wiley & Sons.

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MFE 1.2 SHALLOW FOUNDATIONS

Bearing Capacity of Shallow Foundations - Modes of failure, theories, effects of inclination, eccentricity of load, base tilt, sloping ground, shape, roughness of base, ground water, adjacent footings and non-homogeneous soil conditions.

Settlement of Shallow Foundations - Types, calculation of initial distortion settlements, consolidation settlement, secondary compression settlement, permissible settlements.

Spread Footings - Location, proportioning for equal settlement, contact pressure, design principles.

Combined Footings - Types, design principles of rectangular, trapezoidal, strap footings, modulus of subgrade reaction, continuous footings on elastic foundation, special footings, construction practices.

Mat Foundations - Types, stability and settlement, design principles, elements of design and construction of shell foundation.

Floating Foundations - Concept, types, problems to be considered in design, design principles.

Retaining Walls - Influence of soil properties; earth and foundation Pressures, stability, design principles.

Slope Stability analysis and Land Slides - Mechanism, movements associated, causes and consequences, classification, monitoring.

References:

Bowls.J.F. " Foundation Analysis And Design", Mc.Grawhill Int. Students Edition.

Brahma.S.P. " Foundation Engineering", Tata Mcgraw Publishing Comp, N. Delhi.

Hans F.Winterkorn & Hsai-Yang Fang, "Foundation Engg. Handbook", Galgotia Book Source, New-Delhi.

Naik N.V. " Fondation Design Manual", Dhanpatrai And Sons, Delhi.

Nainan P.Kurian, "Design of Foundation Systems", Narosa Publishers.

Kaniraj, "Design Aids in Soil Mechanics and Foundation Engineering", Tata-Mc-Graw Hill, Ltd..

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MFE 1.3 - ROCK MECHANICS

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Introduction - Definition, scope, applications.

Properties of Rock and Rock Masses - Porosity, void index, permeability, ultrasonic, electrical resistivity, seismic, uniaxial compressive strength, elastic and dynamic constants, tensile strength, shear strength, I.S. approach, modes of failures, failure criteria - Griffiths, Navier-Coulomb, Mohr, behavior of rock mass.

Engineering Classification of Rocks and Rock Masses - Objects, intact rock classification on basis of strength, rock mass classification based on rock fabric, rating concept - RQD, NGI, CSIR system, comparison and application of classification systems.

Stability of Rock Slopes - Methods of analysis, limit equilibrium method, slope design charts, circular failure in heavily fissured rock slopes, wedge method of analysis.

In-Situ State of Stress - Introduction, stress measurement, bore hole deformation meters, bore hole inclusion stress meters, bore hole strain gauge devices, methods of improving properties of rock masses, pressure grouting, rock reinforcement, cable anchorages.

In-Situ-Tests - Necessity, plate bearing test - principle, techniques, dynamic methods, shear and permeability tests.

Geological Aspects of Rocks: Blasting, quarrying operations for construction works, Graphical Representation - Equal area and stereographic projections, pi-diagrams, uses, applications to stability of slopes, Remote Sensing

Rock Improvement Techniques: Rock bolting, cable anchorages, rock reinforcement, reticulated piles.

References :

Franklin and Dusseault, "Rock Engineering Applications"

Richard E. Goodman. "Rock Mechanics", John Wiley And Sons.

Alfreds R. Jumikis, "Rock Mechanics", Trans Tech Publications

Vutukuri V.S. Lama R.D. & Saluja S.S., Hand Book Of Mechanical Properties Of Rocks", Vol.1,2,3 & 4. Trans Tech Publications, Germany.

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MFE 1.4 GROUND IMPROVEMENT TECHNIQUES

Introduction - Ground improvement by geotechnical processes, principles of soil compaction.

Stabilization - Soil-cement mixtures, soil-asphalt mixtures, Intrusion grouting, vibrofloatation, well-pointing, electro-osmosis, stone column and drains, chemical admixtures.

Grouting - Chemical grouting, grouting equipment, grout volumes and grout pressures, grouting methods.

Geotextiles in soil engineering, geo-fabrics used in landfills and reinforced earth; soil nailing.

Ground water in excavations and methods of ground water control, selection of appropriate method.

Special types of equipments employed in foundation investigations and construction.

Lateritic soils & Black Cotton Soils- typical problems and remedies.

References:

Bell. F.G. " Foundation Engineering In Difficult Ground", Butterworths.

Hans F.Winterkorn & Hsai-Yang Fang, "Foundation Engg. Handbook", Galgotia Book Source, New-Delhi.

MFE 1.5 – ELECTIVE -1

(SEE LIST OF ELECTIVES ATTACHED)

MFE 1.6 - LABORATORY-1

It shall consist of Geotechnical experimentation as required for various projects. It shall also include instrumentation and modelling.

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MFE 2.1 DEEP FOUNDATIONS

Installation of piles - Types of piles, construction practices, effects of pile driving in clays and sands, effects of installing bored piles.

Load Capacity of Piles - Single piles, pile groups, piles to rock, SPT and static cone penetrometer, uplift resistance, negative friction, special types of piles, pile driving formulas, dynamic loads on piles, influence of earthquake forces.

Settlement Analysis of Single Piles - Methods of analysis, solutions for settlement and load distribution, simplified method to constructing load settlement curve, determination of soil parameters, validity of methods.

Settlement Analysis of Pile Groups - Analysis of group settlement, solutions for free standing groups, design charts, validity of methods.

Laterally Loaded Piles - Lateral resistance of single piles, conventional statical approach, Brom's and Brinch Hansen's methods, I.S. approach, socketed piles, battered piles, pile groups, methods of increasing lateral resistance, load deflection behaviour, modulus of subgrade reaction approach, pile groups, I.S. approach. Introduction to sheet piles, and diaphragm walls.

Special Piles - Piles in swelling and shrinking soils, lateritic soils, piles in soils undergoing lateral movement, micro piles, simple design and construction practices.

Pile Load Tests - Maintained loading test, constant rate of penetration test, method of equilibrium, I.S. approach, errors in measurements, lateral load test.

Design and construction aspects of well foundations, underpinning techniques.

References:

Hans F.Winterkorn & Hsai-Yang Fang, "Foundation Engg. Handbook", Galgotia Book Source, New-Delhi.1986.

Poulos H.G., And Davis E.H. " Pile Foundation Analysis And Design", John Willey And Sons.1984

Shembaga R.Kaniraj, "Design In Soil Mechanics & Foundation Engg." Tata Mc Grawhill Publication Co. Ltd.1989

Tomlinson M.J., "Foundation Design & Constructions",E.L.B.S & Pitman.1986.

Tomlinson M.J., "Pile Design & Construction Practice", A View Point Of Publication" & Pitman1986.

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MFE 2.2 SOIL DYNAMICS AND MACHINE FOUNDATION

Introduction: Types of machine foundations, General requirement, Types of motion, General limits of amplitude, Dynamic loads due to machines, Earthquake loading.

Theory of vibration: Modes of vibration, Vibration of single degree of freedom system, Vibration of multiple degree of freedom system

Dynamic soil properties: Evaluation of Natural frequency, Mass parameter, Soil stiffness, Dynamic elastic constants, Damping constant and damping factor, Coefficient of elastic uniform compression of soil – Barken's method, Dynamic bearing capacity – pseduo-static and dynamic analysis.

Wave propagation: Longitudinal and torsional vibrations in finite and infinite medium, Wave propagation in elastic half space.

Analysis and design of machine foundations: Reciprocating, Rotary, Impact and other types of machines.

Vibration isolation and control: Isolation techniques, Active and passive isolation, Force and motion isolation, Methods of isolation machine foundation, Vibration isolation materials.

References:

Barken D. D. "Dynamics of Bases and Foundations" Mc. Graw Hill Book Co. Inc.1979.

Bowles J. F. "Foundation Analysis and Design" Mc. Graw Hill Inc Student Edition.1982.

Kasmalkar B. J. "Foundation Engineering" Pune Vidyarthi Prakasan, Pune1975.

Sreenivasulu P. and Vaidhyanathan C. V.: "Handbook of Machine Foundations" Tata Mc. Graw Hill, New Delhi1987.

Swami Saran "Soil Dynamics and Machine Foundation" Galgotia Book House, New Delhi1990.

Winterkorn H. F. and Fang H. Y. "Foundation Engineering Handbook" Galgotia Book House, New Delhi1986.

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MFE 2.3 - MARINE GEOTECHNICAL ENGINEERING

Marine Deposits - Ocean environment, nature, origin, formation of marine deposits, classification, carbonate sediments, coral reef deposits, oil wells, hydrates and other minerals.

Site Investigation Techniques - Shallow and deep penetration sampling techniques, submersible drilling and sampling techniques, sample disturbances, in-situ testing of soils, laboratory testing techniques, interpretation problems and applications.

Engineering Properties of Marine Deposits - Strength and deformation behaviour, influence of cementation and crushing on engineering behavior; liquefaction of soils.

Foundations For On-Shore Structures - Wave action on breakwaters and piles, stability of rock-mound and vertical wall breakwaters, on-shore piles design principles, anchored bulkhead, types, methods of analysis, design principles, anchorages, construction practices.

Off-Shore Structures - Introduction, classification, forces acting, submarine pipe lines, stability, installation techniques, ocean bed anchors, geotechnical considerations, sulphate action on concrete piles in marine environment.

Gravity Structures - Types, installation techniques, forces acting, design principles, bearing capacity, sliding, overturning, settlement, liquefaction and scour.

Jacket Type Structures - Types, forces acting, dynamic stresses, axial capacity, wave equation. Smith's idealization, basic equations, soil parameters, effect of set up, solutions from wave equation analysis, reliability, lateral capacity, p-y curves construction practices.

Anchorage and stability aspects of semi-submersibles, tension leg platforms and spars.

References:

Byerrum.L. " Geotechnical Problems Involved In Foundation Of Structure In The North Sea", Geotechnical Volume 23, NO.3.1989

College Of Engg., Goa(1980), Winter School On Design & Construction Of Offshore Structures, Jan, 1980

George P.. & Wood D., "Offshore Soil Mechanics" Cambridge University Press.1978

Noorany L , " Classification Of Marine Sediments", Sd. Geotechnical Engineers Series.1987.

Noorany Grizffinsky S.F. " Engineering Properties Of Submarine Soil", State Of Art Review, Journal Of SMFE, Volume 96, Sm.5., 1982.

Noorany I. " Under Water Soil Sampling And Testing- A State Of Art Review, Ascm-Stp 501.,1982.

Quinn A.D. " Design And Construction Of Ports And Marine Structures", McGrawhill Int. Students Edition ., 1978.

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MFE 2.4 FEM IN GEOTECHNICAL ENGINEERING

Theory : Finite difference and numerical integration techniques. Application to stresses, contact pressure, and settlement of rafts, piles, and pile raft systems.

Soil as Winkler's model and elastic continuum. Application to foundations and pile interaction. Soil as simplified elastic-plastic material. Raft as thin plate. Method of characteristics.

Finite element method. Derivation of required matrices for CST elements. Isoparametric and interface elements. Assembly and solution techniques, computerization. Beam element with 3 degree of freedom. Sub-structuring. Introduction to application of FEM to soil-foundation-structure interaction. Introduction to non-linear problems. 2-D seepage through porous media.

Applications to problems such as stress distribution and deformations in isotropic and anisotropic soil and rock media, stress and deformations around excavations and built-up embankments, one dimensional consolidation, stress distribution around openings in intact and fissured rock.

Yield line theory applied to foundation, beams and rafts.

References:

C.S. Desai & John F. Abel, "Introduction To F.E.M.", East West Edition, 1992.

Kalus Jurgon Bathe And Edward L. Wilson, " Numerical Methods In Finite Element Analysis", Prentice Hall Indian Private Limited, 1989.

Krishnamurthy C.S., " Finite Element Analysis", Tata Mcgrawhill. Student Edition, 1991.

G.Gudehus, "Finite Element in Geomechanics", Wiley Eastern Publications, London, 1999.

Bowles J. F., "Foundation Analysis and Design" Mc. Graw Hill Inc Student Edition, 2000.

MFE 2.5 ELECTIVE -2 (SEE LIST OF ELECTIVES ATTACHED)

MFE 2.6 Laboratory-2

Introduction and familiarisation with proprietary softwares relating to geotechnical engineering and civil engineering that are in use by the industry. Laboratory modelling and solutions based on geotechnical engineering softwares.

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MFE 3.1 ELECTIVE -3 (SEE LIST OF ELECTIVES ATTACHED)

MFE 3.2 Project

This shall include a detailed study on a certain relevant topic in Geotechnical engineering which could lead to further expansion in the form of a Dissertation in Semester IV.

MFE 3.3 Laboratory -3

This shall consist of laboratory and field experimental studies, sampling observations from a wide variety of cases in Geotechnical engineering.

MFE 3.4 Seminar

This shall be a comprehensive study on any field of interest or the latest advances in Geotechnical engineering.

MFE 4.1 Dissertation

This shall include a detailed and exhaustive research and study on any one specific topic that shall contribute more towards the field of geotechnical engineering. Typed and bound project report shall be submitted for examination.

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LIST OF ELECTIVES

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EL-1-1 ENGINEERING GEOLOGY

Site investigation:

Preliminary reconnaissance survey, surface and subsurface explorations and logging of boreholes for engineering purposes.

Rocks in geotechnical studies:

A) rock excavations: types of rock excavations, rock reinforcement and stability of rock slopes. B) construction materials and aggregates.

C) discontinuities in rock masses. D) rock weathering.

Groundwater and geotechnical problems

Influence of groundwater on dams, tunnels, failure of landmasses and instability of slopes. Underground storage of oil, gas and water, disposal of waste materials, groundwater contamination.

Remote sensing and gis: principles, electromagnetic energy, sources, radiation and its interaction with various materials. Types of remote sensing and their advantages and limitations.

Case histories on engineering geological investigations.

Practical work:

Problems on structural geology. Completion of outcrops, Electrical resistivity survey.

References:

F.G. Bell, "Fundamentals of Engineering Geology", Aditya Books Pvt. Ltd., New Delhi, 1992.

F.G. Bell, "Engineering Geology and Geotechnics", Butter Worth and Co. Ltd., London, 1980.

Franklin & Dusseault, "Rock Engineering Applications", McGraw Hill Publishing Co., New Delhi, 1992.

Freeze and Cherry, "Ground water", Prentice Hall Inc., Eaglewood Cliffs, New Jersey, 1979.

Floyd F. Sabins, "Remote Sensing, Principles and interpretations", Second Edition, W.H. Freeman and Co. Ltd., New York, 1986.

EL-1-2 : SOIL EXPLORATION AND FIELD TESTING

Principles of Exploration, Geophysical and sounding methods, Modern methods of boring and sampling, Preservation and transportation of samples, Sampling records, Soil profiles, Various types of Field Tests, Instrumentation, Investigation below sea/ river bed, Offshore Investigation, Interpretation of exploration data and report preparation.

References:

Hanna T.H., "Field Instrumentation In Geotechnical Engg." Trans Tech. Publications, Germany, 1988.

McKinsky et al, "Mining Geology", Prentice Hall India, New Delhi, 1992.

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EL-2-1 REINFORCED EARTH AND GEOSYNTHETICS

Historical background, Principles, Concepts and mechanism of Reinforced Earth, Design considerations for reinforced Earth and reinforced soil structures, geosynthetics- their manufacture, properties, functions, testing and their applications in reinforced earth structures, Design of Reinforced soil structures like retaining walls, embankments, foundation beds, landfills etc, Case histories of applications.

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.

References:

C. Gomes, "Geotechniques for Roads, Rail tracks and Earth Structures", W. Eastern Pub., 1976.

G.V. Rao, "Geosynthetics in Geotechnical engg.", Tata-McGraw Hill Publishing Company Ltd. New Delhi, 1998.

Publication Co. Ltd., New Delhi, 1992.

B.C. Punmia, "Soil Mechanics", Laxmi Publications Pvt. Ltd., New Delhi, 1990.

EL-2-2 EARTHDAM ENGINEERING

Factors influencing design of earth dams, types of earth dams, control of pore pressures within the dam and foundation, critical study of earth dam failures, embankment settlement during and after construction, differential settlement and cracks, construction pore pressures and control, seepage analysis, various methods of constructing flow nets, methods of foundation treatment, critical evaluation of methods of stability analysis, dams with impervious membranes of manufactured materials like reinforced concrete, steel plate and asphaltic concrete, embankment construction procedures, equipment, methods of quality control, measuring instruments, performance observations, seismic design, slope protection, rock fill construction.

References:

J.L. Sherard et. al., "Earth and Earth-rock Dam", John Wiley, 1963.

W.P. Creager, J.D. Justin and J. Hinds, "Engineering for Dams", John Wiley, 1945.

Geotechnical features of major dams in India -Special publication on the occasion of IV International Association of Engineering Geology, 1982.

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EL-3-1 GEOTECHNICAL EARTHQUAKE ENGINEERING

Original mechanism of earth quakes, recording and analysis of accellerograms.
Seismic regionalization, behaviour of various vibration system, earthquake excitation, forced vibration.

Strong Ground Motion, Earthquake Hazards Related to Geotechnical Engineering, Wave Propagation, Liquefaction, Seismic Slope Stability, Behaviour of reinforced slope under seismic condition, Seismic Design of Retaining Walls, Force based Pseudo-Static Pseudo-Dynamic Analysis, bearing capacity and settlement, Seismic Design of Pile Foundations, Seismic Uplift Capacity of Anchors, Soil Improvement for Remediation of Seismic Hazards, Recommendations of Seismic Design Codes related to Geotechnical Earthquake Engineering.

References:

Donald P. Coduto, "Geotechnical Engineering, Principles and Practices", Wiley Eastern Co. Ltd., Singapore, 1988.
James L. Stratta, "Manual of Seismic design", Thomson Asia Pvt. Ltd., Singapore, 1994.
Hans F. Winterkorn & Hsai-Yang Fang, "Foundation Engg. Handbook", Galgotia Book Source, New-Delhi, 2001.
IS:1893 and other relavant codes.

EL-3-2 SOILSTRUCTURE INTERACTION

Contact pressure distribution, soil-foundation, models. Nature and complexity of soil structure interaction.

Analysis of rafts and foundations, soil foundation structures interaction pertaining to various types of foundation. Determination of pile capacities, negative skin friction and group action of piles considering stress-strain characteristics of real soils; Anchor piles and determination of pull-out resistance; Well foundations.

Applications of numerical methods, effect of a stratification, time effects.

Application of FEM, types of finite elements.

References:

Desai C.S., "Soil Structure Interaction & Simulation Problems". Finite Elements In Geomechanics", John Wiley & Sons, 1971.
Selvadurai A.P.S., "Elastic Analysis Of Soil Foundation-Interaction", Elsevier Scientific Publication Co. Amsterdam., 1987.

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List of Electives for Semesters I, II & III

Elective -1 :

- EL-1 - 1 Engineering Geology.
- EL-1 - 2 Geotechnical Exploration and Field Testing

Elective - 2

- EL-2 - 1 Re-inforced Earth and Geosynthetics
- EL-2 - 2 Earthdam Engineering

Elective -3

- EL-3 - 1 Geotechnical Earthquake engineering
- EL-3 - 2 Soil Structure Interaction

Note: List of Electives shall be updated as and when the expertise is available in the relevant areas.

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Scheme of teaching and examination for
Master of Engineering (Foundation Engineering)
Two Years Full Time Course

| Semester I | | | | | | | | | |
|--------------|-------------------------------|----------------|---|---|-----------------------|-----------------|----|---|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 1.1 | Advanced Soil Mechanics | 4 | - | - | 3 | 4 | 1 | 1 | 6 |
| MFE 1.2 | Shallow Foundations | 4 | - | - | 3 | 4 | 1 | 1 | 6 |
| MFE 1.3 | Rock Mechanics | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.4 | Ground Improvement Techniques | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.5 | Elective-1 | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 1.6 | Laboratory -1 | - | - | 8 | - | - | 2 | 2 | 4 |
| Total | | 20 | | 8 | | 20 | 10 | 4 | 34 |

| Semester II | | | | | | | | | |
|--------------|-------------------------------------|----------------|---|---|-----------------------|-----------------|----|---|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 2.1 | Deep Foundations | 4 | - | - | 3 | 4 | 1 | 1 | 6 |
| MFE 2.2 | Soil Dynamics & Machine Foundations | 4 | - | - | 3 | 4 | 1 | 1 | 6 |
| MFE 2.3 | Marine Geotechnical Engineering | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.4 | FEM in Geotechnical Engineering | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.5 | Elective-2 | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 2.6 | Laboratory-2 | - | - | 8 | - | - | 2 | 2 | 4 |
| Total | | 20 | | 8 | | 20 | 10 | 4 | 34 |

| Semester III | | | | | | | | | |
|--------------|--------------|----------------|---|----|-----------------------|-----------------|----|---|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 3.1 | Elective-3 | 4 | - | - | 3 | 4 | 2 | - | 6 |
| MFE 3.2 | Project | - | - | 8 | - | - | 2 | 2 | 4 |
| MFE 3.3 | Laboratory-3 | - | - | 8 | - | - | 2 | 2 | 4 |
| MFE 3.4 | Seminar | - | - | 8 | - | - | 2 | 2 | 4 |
| Total | | 4 | | 24 | | 4 | 8 | 6 | 18 |

| Semester IV | | | | | | | | | |
|--------------|--------------|----------------|---|----|-----------------------|-----------------|----|----|-------|
| Subject Code | Subject | Hours per week | | | Scheme of Examination | | | | |
| | | L | T | P | Theory (Hrs) | Marks / Credits | | | |
| | | | | | | Theory | IA | O | Total |
| MFE 4.1 | Dissertation | - | - | 28 | - | - | 8 | 12 | 20 |
| Total | | - | - | 28 | | - | 8 | 12 | 20 |

| | | | | | | | | |
|-----------------------------------|----|---|----|--|----|----|----|-----|
| Grand Total of all Four Semesters | 44 | - | 68 | | 44 | 36 | 26 | 106 |
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List of Electives for Semesters I, II & III

Elective -1 :

- EL-1 -1 Engineering Geology.
- EL-1 -2 Geotechnical Exploration and Field Testing

Elective - 2

- EL-2 - 1 Re-inforced Earth and Geosynthetics
- EL-2 - 2 Earthdam Engineering

Elective -3

- EL-3 - 1 Geotechnical Earthquake engineering
- EL-3 - 2 Soil Structure Interaction

Note: List of Electives shall be updated as and when the expertise is available in the relevant areas.

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