Department of Civil Engineering

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

Proposed Curriculum for M.Tech Programme in CIVIL ENGINEERING—ENVIRONMENTAL GEOTECHNOLOGY (CED)

S1

S. No	Code	Title	L/T	P/S	Cr
1	CED601	Ground Improvement	3	0	3
2	CED602	Fundamentals of Soil Behaviour	2	0	2
3	CED603	Computer techniques in Environmental Studies	3	0	3
4	CED604	Waste Disposal Methods	2	0	2
5	CED691	Environmental Geotechnical Laboratory	1	2	2
6	***	Elective	3	0	3
7	***	Elective	3	0	3
8	***	Elective	3	0	3

Total credits = 12 (Core) + 9 or 6 (Electives)

S2

S. No.	Code	Title	L/T	P/S	Cr
1	CED611	Design of Engineered Landfills	2	0	2
2	CED612	Reinforced Earth and Geotextiles	3	0	3
3	CED613	Solid Waste Management and Regulatory rules	2	0	2
4	CED614	Ground water hydrology	3	0	3
5	CED692	Computational Geomechanics Laboratory	1	2	2
6	***	Elective	3	0	3
7	***	Elective	3	0	3
8	***	Elective	3	0	3

Total credits = 12 (Core) + 9 or 6 (Electives)

S3

S. No.	Code	Title	L/T	P/S	C
1	CED797	Seminar	0	2	1
2	CED798	Project			8
3	***	Elective	3	0	3
4	***	Elective	3	0	3

Total credits = 9 (Core)+ 0 to 6 (Electives)

S4

S. No.	Code	Title	L/T	P/S	C
1	CED 799	Project work and viva-voce			12

Total credits = 12 (Core)

Stipulations;

1. A minimum of 63 credits have to be earned for the award of M.Tech degree in this programme.
2. Students to register for six electives in three semesters together (two or three electives each in the first two semesters and a maximum of two in the third semester).Fourth semester is reserved for project work only.
3. Industrial Training (1 credit) during summer term is optional

List of Electives

CED 621: Advanced design of foundations

CED 622: Waste management

CED 623: Foundation Engineering for difficult and contaminated grounds

CED 624: Waste water engineering

CED 625: Analysis and design of earth retaining structures

CED 626:Landslide mitigation methods

CED 627:Ground water contamination

CED 628:Earth quake engineering

CED 629:Bio remediation technologies

CEC 612:Marine foundations

- Any other subject offered in the institute with the approval from the Programme Co ordinator

CED 601:GROUND IMPROVEMENT

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Vibration techniques, dynamic compaction, depth of treatment, environmental considerations, practical application of vibrotechniques and dynamic compaction

Module II (10 Hours)

Classification of stabilizing agents, stabilizing agents, stabilization process, drainage and compaction, deleterious effects of organic substances and sulphates on inorganic stabilization, lime stabilization , lime column method, bearing capacity and settlement of lime columns, slope stability, stability of trenches, laboratory and field investigations, lime-sand columns, stone columns

Module III (12 Hours)

Grouting techniques, chemical grouting, principles of injection, grout systems, grouting operations, applications, design methods, jet grouting, the jet grouting process, geometry and properties of soil used, properties of treated ground, application of jet grouting

Module IV (13 Hours)

Soil fracturing techniques for terminating settlements and restoring levels of buildings and structures, injection technology and its effects, typical examples, in situ soil mixing techniques, construction techniques, testing procedures

References:

1. Moscly, M.P. (1994) “A Text book on ground improvement”, Blackie Academic and Professional.
2. Raj, P. Purushothama, (2005) “Ground Improvement Techniques”, Laxmi Publications, New Delhi

CED 602:FUNDAMENTALS OF SOIL BEHAVIOUR

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (9 Hours)

Origin, nature and distribution of soil, description of individual particle, clay mineralogy, clay-water electrolytes, soil fabric and structure

Module II (12 Hours)

Effective stress principle, steady state flow in soil, effect of flow on effective stress, determination of coefficient of permeability, consolidation ,one, two, three and radial direction, variation of effective stress during consolidation, consolidation tests and determination of consolidation parameters

Module III (12 Hours)

Stress path, tri-axial and direct shear tests, shear behaviour of granular soils, factors affecting shear behaviour, determination of shear strength parameters, shear behaviour of fine grained soils, pore pressure parameters, UU,CU,CD tests, total and effective shear strength parameters, total and effective stress paths, water content contours, factors affecting shear strength- stress history, rate of loading, structure and temperature, anisotropy of strength, thixotropy ,creep, determination of in situ undrained strength.

Module IV (12 Hours)

Critical state model

Introduction models and soil mechanics, use of models in engineering, elasticity, soil elasticity, plasticity and yielding, yielding of metal tubes in combined tension and torsion, elastic-plastic model for soil, elastic volumetric strains, a particular elastic- plastic model

References:

1. Mitchell, J. K. (1993), "Text book in fundamentals of soil behaviour", 2nd Ed, John Wiley &Sons, New York
2. Holtg,R.D and Kovacs W.D.(1981), "An Introduction to Geotechnical Engineering" , Prentice hall CO, N.J.
3. Hough, B. K (1957), "Basic Soil Engineering" The Ronald Press Co, New York.

CED603: COMPUTER TECHNIQUES IN ENVIORNMENTAL STUDIES

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (9 Hours)

Basics concepts of continuum mechanics and Elasticity, Continuum mechanics, indicial notation, equation of motion, stress-strain tensors, compatibility conditions, Linear elasticity, solution schemes.

Module II (12 Hours)

Elastostatic plane problems – Airy function for isotropic plane problems, Isotropic elastic plane problems in cylindrical coordinates, examples of infinite plane problems, particular solutions for concentrated forces
Elastostatics with Displacements as unknowns field equations for plane problems- solution schemes for large plane and space, Homogeneous half plane and space, Concentrated force inside a half space, Boussinesq, flamant, Kelvin, Cerrutti, Mindlin, problems

Module III(12 Hours)

Flow theory, perfect plasticity models, Tresca, Von Mises, Coulomb, Drucker- prages models, Generalized stress- strain relations for perfect plasticity models, Hardening plasticity models, Generalized stress-strain relations for hardening plasticity models, Modified cam-clay model, Generalized cap models

Module IV (12 Hours)

Elastic solution of cylindrical cavity in isotropic media, Elastic solution of spherical cavity in isotropic media, Elastic solution of cylindrical cavity semi infinite half space, Elastic solution of spherical cavity in a semi infinite half space, Elastic- perfectly plastic solution of cylindrical cavity, Elastic- perfectly plastic solution of spherical cavity, Geotechnical applications- in situ soil testing, pile foundation, tunneling, Darcy's law, continuity equation, Governing equation, Flow in unsaturated soil. Consolidation theory- Introduction, Terzaghi's consolidation theory, Biot's multidimensional consolidation theory

References

1. P. Karasudhi (1991), "Foundations of Soil Mechanics", Kluwer Academic Publishers
2. W.F Chen and E. Mizuno (1990), "Nonlinear Analysis in Soil Mechanics", Elsevier
3. H.S YU (2000); "Cavity Expansion methods in Geomechanics", Kulwer Academic Publishers
4. R.O Davis & A.P.S Selvadurai (1996): "Elasticity and Geomechanics", Cambridge university press
5. D.M Wood (1996), "Soil Behaviour and Critical State Soil Mechanics", Cambridge University Press.

CED604: WASTE DISPOSAL METHODS

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (12 Hours)

Waste Water Disposal

Disposal on Land- Disposal by Irrigation- Sewage Farming-Disposal by Infiltration-preparation of land for Infiltration-regulation of infiltration-Pretreatment of Industrial waste before disposal on land- Wider aspects of wastewater disposal on land- prevention of water pollution, Enhancement of agricultural production, Augmentation of water resources, Prevention of saltwater intrusion

Module II (12 Hours)

Waste Water Disposal

Disposal on Surface Waters- Disposal on streams- stream sanitation- Hydrological and climatological factors of stream sanitation- Organic self purification- Microbial self purification- Efficient use of self assimilative capacity of streams- Disposal of waste water on lakes- Disposal of waste water on Sea

Disposal of Sewage Sludge- sludge digestion- biogas generation-agricultural applications of digested sludge

Module III (12 Hours)

Composting- Fundamentals of microbial degradation - Operational sequences and technical equipment in facilities for composting - Quality and application of compost

Sanitary Land Fill - Methods and fundamentals for waste pretreatment prior land filling - Landfill technology - Long-term behaviour of landfills - Recultivation and aftercare of landfill sites

Module IV (9 Hours)

Other methods for solid waste disposal- Incineration- technology description-air emission and public perception issues- Open Dumping of waste- Ocean Dumping

Disposal of Hazardous and Special Wastes- Containment Technologies- Vapour Extraction- Bioremediation- Medical waste-treatment and disposal options

Waste Recycling- waste water recycling- resource recovery from waste

Reference

1. U. N. Mahida, “Water Pollution and Disposal of waste water on land”, TMH
2. Clarence J. Velz, “Applied Stream Sanitation”, Wiley-Interscience
3. Metcalf and Eddy, “Waste Water Engineering- Treatment, Disposal and Reuse”, TMH
4. Subijoy Dutta, “Environmental Treatment Technologies for Hazardous and Medical wastes- Remedial Scope and Efficacy”, TMH.

CED691: ENVIRONMENTAL GEO TECHNICAL LABORATORY

L	T	P	Cr
1	0	2	2

Pre-requisite: Nil

1. Permeability tests – constant and variable head
2. Swell and shrinkage test for soils
3. Test for compressibility
4. Test for determination of shear strength
5. Introduction to testing of geotextiles
6. Determination of total soluble solids, Organic matter
7. Determination of calcium carbonate, PH, soluble sulphates in soil.
8. Chemical tests for determination of cation exchange capacity
9. Chemical tests for leachate analysis, Iron, Manganese, chloride
10. Introductory tests for determination of surface area

Reference:

IS 2720 : Method of test for soil (relevant parts)

CED 611: DESIGN OF ENGINEERED LAND FILLS

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Environmental- geotechnical application , introduction ,basic considerations of ground improvement systems ,load environmental factor design criteria, load factor design criteria and approaches , environmental load factor design criteria, soil structure , structural soil interaction , soil foundation structure interactions, load factor of safety and allowable condition, bearing capacity of granular soil, friction forces and angle between two materials.

Module II (12 Hours)

Liners, different types, properties of liners, clay liners, geo-synthetic liners, composite liners, design aspects

Module III (12 Hours)

Reclaiming potentially combustible sites , Introduction to combustion process, combustion tests , use of combustion potential tests, Land fill gases , principal gases and their properties, Gas monitoring ,Data assessment and remedial solutions .

Module IV (11 Hours)

Establishment of new landscapes, Introduction, plant requirements, soil cover, soil fertility, site preparation, Establishing grass cover, Establishing trees and shrubs, Maintenance

References

1. Hsai –yang Fang(1997) “Introduction to Environmental Geotechenology” CRC press Newyork
2. Cairmey .T. (1993) “Contominated land problems and solutions”, Blackie Academic & Professional, New York.

CED 612: REINFORCED EARTH AND GEOTEXTILES

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (11 Hours)

Geosynthetics and Reinforced soil structures, Testing of Geosynthetics

Module II (12 Hours)

Types and functions, Materials and manufacturing process, Testing and Evaluations, Principles of soil reinforcement, Design and construction of geosynthetics , reinforced soil retaining structures, walls and slopes, codal provision, Bearing capacity improvement

Module III (12 Hours)

Geosynthetics in pavements, Embankments on soft soils, Geosynthetics in roads and railways, separators, drainage and filtering in road pavements, railway tracks, overlay design and constructions, trench drains

Module IV (10 Hours)

Geosynthetics in Environmental control, liners for ponds and canals, covers and liners for landfills, material aspects and stability considerations, landfills, occurrences and methods of mitigation, Erosion causes and techniques for control

References

1. Robert m. Koerner (1990), “Designing with Geosynthetics”, Prentice Hall, Englewood Cliffs
2. G Venkatappa Rao, Gvs Surry Narayana Raju, (1990) “Engineering with Geosynthetics”, Tata mcgraw Hill Publishing Company Ltd, New Delhi
3. T.S Ingold (1982), “Reinforced Earth”,Thomas Telford Ltd, London
4. J.N Mandal (1988) “Reinforced Soil and Geotextiles”, Oxford and IBH Publishers Co. Pvt. Ltd, New Delhi.

CED 613:SOLID WASTE MANAGEMENT AND REGULATORY RULES

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (11 Hours)

Nature and characteristics of solid and industrial wastes, prevention versus control of industrial pollution trends in waste generation and management, waste reduction legislation and management, waste reduction goals, making producers and retailers responsible for waste, special waste legislation.

Module II (12 Hours)

Federal regulation, introduction, resource conservation and recovery act, clean air and water act, federal aviation administration guidelines.

Module III (12 Hours)

Role of environmental protection agency in municipal solid waste management, local government effects, federal role in municipal solid waste management, EPA's role in MSW management, EPA activities in municipal solid waste management, federal legislation of waste management

Module IV (10 Hours)

Health and safety
The sources of law relating to contaminated land, integrated waste management

References

1. Frank Kreith (1994) Hand book of solid waste management, Mc Graw Hill, New York

CED 614:GROUND WATER HYDROLOGY

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Occurrence of ground water: origin - rock properties affecting ground water vertical distribution - geologic formations as aquifers -types of aquifers - aquifer parameters-ground water basins - springs - ground water in permeable regions - ground water balance - ground water flow - Darcy's law - laplace equation - potential flow lines - flow net - steady radial flow into a well - well in uniform flow - steady flow in leaky aquifer - aquifer with percolation - seepage under a dam -unsteady flow - general equation - confined and unconfined aquifers

Module II (13 Hours)

Ground water and well hydraulics: steady unidirectional flow - steady radial flow in to a well - well in uniform flow - steady flow with uniform discharge - unsteady radial flow in to a well - confined, unconfined and leaky aquifers - well near aquifer boundaries - multiple well system - partially penetrating wells - characteristics well losses - pumping tests - non equilibrium equation for pumping tests - Thies' method - Jacob method - Chow's method

Module III (13Hours)

Tube wells: design - screened wells - gravel packed wells - well loss-selection of screen size - yield of a well - test holes - well logs - methods of construction - dug wells -shallow tube wells - deep wells - gravity wells - drilling in rocks - screen installation - well completion - well development - testing wells for yield - collector - or radial wells - infiltration galleries - well point system - failure of tube wells

Module IV (9Hours)

Quality of ground water: ground water samples - measurement of water quality- chemical, physical and bacterial analysis - quality for domestic use - quality for agricultural use - pumps - shallow well pumps - ground water investigation - geographical investigation - electrical resistivity method - seismic refraction method - gravity and magnetic method - test drilling - resistivity logging - potential logging - artificial recharge - recharge by water spreading - sewage recharge - recharge through pits, shafts and wells

References

1. Todd D.K., *Ground Water Hydrology*, John Wiley
2. Garg S.P., *Ground Water & Tube wells*, Oxford & IBH
3. Raghunath H.M., *Ground Water Hydrology*, Wiely
4. Raghunath H.M., *Hydrology*, Wiely Eastern

CED 621:ADVANCED DESIGN OF FOUNDATIONS

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module 1 (10 Hours)

Soil - Structure Interaction

Introduction to Soil - Structure interaction problems - Contact pressure distribution – factors influencing Contact pressure distribution beneath rigid and flexible footings – concentrically and eccentrically loaded cases – contact pressure distribution beneath rafts - Modulus of sub grade reaction – Determination of modulus of sub grade reaction – Factors influencing modulus of subgrade reaction

Module II (10 Hours)

Pile Foundations

Introduction – Estimation of pile capacity by static and dynamic formulae – Wave equation method of analysis of pile resistance – Load - Transfer method of estimating pile capacity – Settlement of single pile – Elastic methods.

Laterally loaded piles – Modulus of sub grade reaction method – ultimate lateral resistance of piles.

Pile Groups – Consideration regarding spacing – Efficiency of pile groups – Stresses on underlying soil strata – Approximate analysis of pile groups –Settlement of pile groups - Pile caps –Pile load tests – Negative skin friction.

Module III (12 Hours)

Introduction to Machine Foundations

Introduction - nature of dynamic loads - stress conditions on soil elements under earthquake loading - dynamic loads imposed by simple crank mechanism - type of machine foundations - special considerations for design of machine foundations – Criteria for a satisfactory machine foundation - permissible amplitude of vibration for different type of machines - methods of analysis of machine foundations - methods based on linear elastic weightless springs - methods based on linear theory of elasticity (elastic half space theory) - degrees of freedom of a block foundation - definition of soil spring constants - nature of damping - geometric and internal damping - determination of soil constants - methods of determination of soil constants in laboratory and field based on IS code provisions.

Module IV (13 Hours)

Design of Machine Foundations

Vertical, sliding, rocking and yawing vibrations of a block foundation - simultaneous rocking, sliding and vertical vibrations of a block foundation - foundation of reciprocating machines - design criteria - calculation of induced forces and moments - multi-cylinder engines - numerical example (IS code method)

Foundations subjected to impact loads - design criteria - analysis of vertical vibrations - computation of dynamic forces - design of hammer foundations (IS code method) - vibration isolation - active and passive isolation - transmissibility - methods of isolation in machine foundations.

References

1. Lambe and Whitman, *Soil Mechanics*, Wiley Eastern., 1976.
2. Das B.M., *Advanced Soil Mechanics*, Mc. Graw-Hill, NY, 1985.
3. Winterkorn H.F. and Fang H.Y. Ed., *Foundation Engineering Hand Book*, Van-Nostrand Reinhold, 1975.
4. Bowles J.E., *Foundation Analysis and Design* (4^{th} Ed.), Mc.Graw –Hill, NY, 1996
5. Poulose H.G. and Davis E.H., *Pile foundation Analysis and Design*, John-Wiley & Sons, NY, 1980.
6. Leonards G. Ed., *Foundation Engineering*, Mc.Graw-Hill,NY, 1962.
7. Bowles J.E., *Analytical and Computer Methods in Engineering* Mc.Graw-Hill,NY, 1974.
8. Shamsher Prakash, *Soil Dynamics*, McGraw Hill.
9. Alexander Major, *Dynamics in Soil Engineering*
10. Sreenivasalu & Varadarajan, *Handbook of Machine Foundations*, Tata McGraw Hill
11. IS 2974 - Part I and II, *Design Considerations for Machine Foundations*
12. IS 5249: *Method of Test for Determination of Dynamic Properties Of Soils*

CED622:WASTE MANAGEMENT

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Muncipal waste management, Methods of characterizing municipal solid waste, Materials and products in municipal solid waste by weight, Discards of Muncipal solid waste by volume, Local and regional solid waste management planning

Module II (11 Hours)

Environmental perspective, issues in source reduction, recycling and composting, incineration issues, Environmental concerns of landfilling, reducing the amount of garbage, deoxidation methods, methods of collection of recyclables, processing methods, Comparative recycling economics

Module III(13 Hours)

Composting of Muncipal solid wastes, Principle, technology, Economics, Marketing principles and methods, Environmental, public and industrial health considerations, land filling methods

Module IV (11Hours)

Industrial waste management and Audit, Nature and characteristics of industrial wastes, Tools to clean process, reuse, recovery, source reduction, raw material substitution, toxic use reduction and process modification case studies of various industries eg: diary, distillery, sugar, pulp, papers, iron, steel, metal plating, refineries, thermal power plant

References

1. Frank Kreith (1994) Handbook solid waste management. Tata McGraw hill
2. Tchobanoglons G (1993) Integrated solid waste Management. Tata McGraw Hill

CED 613:FOUNTATION ENGINEERING FOR DIFFICULT AND CONTAMINATED GROUNDS.

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I(12 Hours)

Site investigations, planning of investigation programmes, geophysical methods, electrical resistivity and seismic refraction methods, methods of investigations direct methods, semi direct,
Methods and indirect methods, drilling methods, measurement of water table, field tests, in situ
Permeability tests , SPT,DCPT,SCPT, insitu vane shear test , pressure meter test , plate load test ,Codal provisions

Module II (12 Hours)

Shallow foundation, Design consideration, factors of safety, allowable settlements, bearing capacity theories, layered soils, choice of shear strength parameters, bearing capacity from N values, static cone tests, plate load tests

Module III (12 Hours)

Deep foundations , types of soils , construction methods, Axial capacity of single piles , dynamic formulae, skin friction and end bearing in sands and clays ,Axial capacity of groups, settlement of single piles and groups, uplift capacity , Negative skin friction, pile load test ,pile integrity tests

Module IV (9 Hours)

Caissons, Foundation in difficult soils, expansive soils, chemically aggressive environment, soft soils, fill, regions of subsidence

References

1. Joseph E. Bowles (1996) “Foundation Analysis and Design”, McGraw Hill Companies, Inc. New York
2. Ninan P Kurian (1992) “Design of foundation System”, Narosa Publishing House, New Delhi
3. SWAMI SARAN (1996). “Analysis and Design of Substructures”, oxford & IBH PUBLISHING CO PVT. LTD, New Delhi
4. M.J Tomlinson(1975) “Foundation Design and construction”, PITMAN PUBLISHING LIMITED, LONDON

CED 614:WASTE WATER ENGINEERING

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Waste water treatment-objectives, methods-An overview-Effluent and sludge disposal and reuse. Waste water characteristics-(Physical, Chemical and biological)-waste water composition-variation in concentration of waster water loading Data-Flow rates-Analysis of waste water flow rate Data.

Module II (12 Hours)

Waste water Treatment-methods and design classification and application of waste water treatment methods, elements of plant analysis and design, other important considerations. Fundamentals of process Analysis-Reactions and reaction kinetics.

Module III (12 Hours)

Physical Unit Operations-Screening flow measurement, Grit removal, Flow equalization, mixing, plain sedimentation, flocculation, (sedimentation aided with coagulation), Floation, Granular medium filtration, chemical Unit processes-Chemical precipitation, Gastransfer, absorption, disinfection-by various methods-odour control Design facilities for physical chemical treatment of waste water.

Module IV (11Hours)

Biological waste water treatment-Microbial metabolism, Kinetics of biological growth, suspended growth biological treatment, attached growth biological treatment, Design facilities for the biological treatment of waste water.

References

1) Metcalf and Eddy, Text book on waste water Engineering, Tata Mc Graw hill publishing and co.1994
2) Syed.R Qasim-waste water treatment plants-planning, Design and operation, CBS college Publishing.1998
3) New processes of waste water treatment and recovery, edited by G.Mattock by Ellishorwood Ltd.1996

CED615: ANALYSIS AND DESIGN OF EARTH AND EARTH RETAINING STRUCTURES

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I(10Hours)

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, Effect due to wall friction and wall inclination, Graphical methods, Earthquake effects

Module II (12 Hours)

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, anchorages. Cofferdams, diaphragm walls.

Module III(13 Hours)

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 IV (10 Hours)

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 provision, underground structures in soils, pipes, conduits, Trench less technology, Tunnelling techniques, cut and cover method, shield tunneling

References

1. Gregory . P. Tschebotarioff (1978) "Foundations, Retaining and Earth Structures", Mc Graw-Hill Kogakusha
2. Shamsher prakash, Gopl & Ranjan, Swami Saran (1979), "Analysis and design of foundations and retaining structures", Sarita Prakashan New Delhi
3. W.C. Huntington (1957) "Earth pressure and retaining walls", John Wiley & Sons, Inc, London.

CED615: LAND SLIDE MITIGATION

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Natural and manmade disasters, Description of development by disasters, factors affecting disasters, characteristics of particular hazards and disasters, earthquakes, Tsunamis, Tropical cyclones, floods, Draughts, Environmental pollution, Deforestation.

Module II (12 Hours)

Environmental hazards, Typology, Assessment and response, Environmental Hazards Revisited issues, Natural trends, Disasters, Human induced Hazards, responses, the strategies and the scale of disaster.

Module III (12 Hours)

Risk assessment and Management, objectives of assessment, Evolving objectives of assessment, Assessment of different disaster types, Destructive capacity, Disaster due to hydrological and meteorological phenomena.

Module IV (11 Hours)

Targeting mitigation where it has most effect, Actions of reduced risk, Classification measures, Disaster mitigation as a development theme, Disaster risk appraisal, Disaster risk reduction planning, Appraisal of disaster mitigation needs, Disaster mitigation needs, Disaster risk reduction planning.

References

Analysis and Design of Earth and Earth Retaining Structures

1. Gregory.p.Tschebotraioff(1978) “Foundations, Retaining and Earth Structures”, McGraw-Hill, Kogakusha.
2. M & A. ReimberT(1974) “Retaining Walls, Anchorages and Sheet Piling”, Transtech Publications, Switzerland.
3. Shamser Prakash, Gopla Rangen, Swami Saran(1979), “Analysis and Design Of Foundations and Retaining Structures”, Saritha Prakashan Newdelhi
4. W.C HUNTINGTON (1957), “Earth Pressure and retaining walls”, John Wiley & Sons, Inc, London

CED 616:GROUND WATER CONTAMINATION

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (11 Hours)

Introduction, Capillarity, Capillary measurements, Hydraulic conductivity, measurements of Hydraulic conductivity, Factors affecting conductivity results

Module II (12 Hours)

Infiltration, Percolation and retention, Mass transport phenomenon in moist fine grained soils, creeping flow, nature of pore fluid in soil, soil energy conductivity, osmosis and reverse osmosis phenomena, Soil water suction and diffusivity, moisture migration, Diffusion phenomena

Module III(12 Hours)

Radiation effects on water, characteristics of radioactivity, radioactive decay process, Environmental geotechnical aspects of radiation, Flow through porous media, wet lands, saltwater intrusions, Estuaries

Module IV (10 Hours)

Liquid waste control, Relationship between solid and liquid wastes, Landfill design technology, Laboratory tests for compacted garbage and hydraulic conductivity of compacted garbage, Design of waste control systems, factors effecting the stability of waste control system, Dynamic load effects on waste control systems.

References

1. Hsai-Yang Fang(1997) Introduction to Environmental Geotechnology – CRC Press, New York

CED617: EARTH QUAKE ENGINEERING

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I(10 Hours)

Fundamentals of vibration, system with a single degree of freedom, system with two degree of freedom, dynamic properties of soil , laboratory tests and results, field test measurements, correlation between the properties.

Module II (12 Hours)

Internal structures of earth, continental drifts and plate tectonics, elastic rebound theory, ground motion parameters, estimation of ground motion parameters, seismic hazard analysis, local site effects and design of Ground motions

Module III (13 Hours)

Liquefaction, liquefaction related phenomena, evaluation of liquefaction hazards, liquefaction susceptibility Initiation of liquefaction, Effects of liquefaction.

Module IV (10 Hours)

Dynamic ultimate bearing capacity, seismic design considerations of sub structures, shallow foundations, deep foundations

References

1. Steven . C. Kramer(2004), A text Book on Geotechnical Earthquake Engineering (2004) . Prentice hall International series
2. B . M. Das (1993). A text Book on principles of soil Dynamics, Brooks, code.
3. S Prakash (1981), A text Book on soil Dynamics , Tata McGraw hill.

CED 618: BIOREMEDIATION TECHNIQUE

L	T	P	Cr
3	0	0	3

Pre-requisite: Nil

Module I (10 Hours)

Pollution and Biomonitoring, chemical and biological pollution monitoring, the necessity of combining Biological and chemical monitoring, Algal assay approaches to pollution studies in aquatic systems

Module II (13 Hours)

Toxicity testing of hazardous wastes by aquatic and terrestrial bioassays, traditional approaches and limitations, soil and sediment leaching media, diatoms indicators of water quality, bioindicators of environmental monitoring and pollution control.

Module III (13 Hours)

Bio drainage – land and water use for sustainable development, salts in soil and water, plant mechanism of absorbing and transporting water, mineral absorption by plants, principles of bio drainage planning and design, bio drainage management aspects

Module IV (9 Hours)

Biotechnical and soil bioengineering stabilization – bioengineering stabilization methods, biotechnical stabilization methods.

References

1. Rana B.C (1995), “Pollution and bio monitoring”, Tata McGraw Hill Publishing Co.
2. Kapoor A.S (1999), “Bio drainage”, Tata McGraw Hill Publishing Co.
3. SP 69, Special publication, ASCE.

CEC 612:MARINE FOUNDATIONS

L	T	P	Cr
3	0	0	3

Module I (15 Hours)

Introduction to Marine Geotechnical Engineering

Scope of marine geotechnical engineering - Marine and submarine soils - Classification of marine soils - Relative distribution of marine soils in the different marine regions - General characteristics of marine deposits in some specific locations and in the Indian sub-continent.

Sedimentological characteristics of marine soils:

Structure of marine soils - Cementation bonding - Morphology and genesis of marine and submarine sediments - Post-depositional changes - Effect of calcium carbonate in marine deposits.

Engineering behaviour of marine soils:

Fine and coarse-grained deposits - Strength and deformation behaviour of fine- and coarse-grained marine deposits - Effect of cementation - Strength and deformation behaviour under static and cyclic loading

Module II (10 Hours)

Offshore Soil Investigation:

General characteristics of offshore soil exploration - Sampling using free corer, gravity corer, tethered systems and manned submersibles - Deep penetration sampling using wire line techniques - In-situ determination of strength of submarine soils - Penetrometer, piezocone, vane and pressure meter techniques - General reconnaissance procedure for installation of fixed structures (gravity and piled type), floating structures, sea bed anchors and submarine pipelines.

Module III (10 Hours)

Foundations for Gravity Structures:

Types of gravity structures - Installation techniques - Movement of gravity structures - Settlement of soil beneath gravity structures - Stress distribution beneath gravity structures - Stability of gravity structures under static and cyclic loads

Foundations for jacket type structures:

Types - Installation techniques - Design considerations - Axial and lateral load capacity of piles - Lateral load deformation behaviour of piles - Calculation of bearing capacity of piles - Design of piles subjected to lateral loads - Reese-Matlock method & *p-y* curves method.

Module IV (10 Hours)

Foundations for jack up platforms:

Types of jack up platforms - Piles and mat supported - Spud cans - Different types - Techniques for installation and removal of jack up - Stability of jack up platforms - Determination of penetration of supports - Stability under lateral loads - Stability under static and cyclic load effects.

Sea bed anchors, submarine pipe lines

General introduction to sea bed anchors , moorings , submarine pipe line etc., - general design considerations (brief outline only) – geotechnical aspects in the design and installation of sea bed anchors, moorings, submarine pipelines etc

References

1. Chaney, F. Marine geotechnology and nearshore/offshore structures, ASTM, STP-, 1986.
2. Chaney, R. C & Demars, K. R., Strength Testing of Marine Sediments - Laboratory and In-situ Measurements, ASTM, STP -883, 1985.
3. George, P & Wood, D., Offshore Soil Mechanics, Cambridge University Press.
4. Le Tirant, Sea Bed Reconnaissance and Offshore Soil Mechanics for the Installation of Petroleum Structures , Gulf Publ. Co., 1979.
5. Poulos, H. G & Davis, E. H., Pile Foundation Analysis and Design, John Wiley, 1980.
6. Numerical Methods in offshore Piling, Proc, Conf. Inst. of Civil Engineers, London, 1980.

CED 692: COMPUTATIONAL GEOMECHANICS LABORATORY SYSTEM

L	T	P	Cr
1	0	2	2

Pre-requisite: Nil

To familiarize and give hands on training to students in the following areas of Civil Engineering Application software

1. Drafting and documentation
2. Surveying – terrain mapping, computation of areas & volumes
3. Structural Analysis and Design
4. Water resources
5. Geotechnical Engineering
6. Road/Railway system
7. Environmental Engineering
8. Estimation and costing
9. Project management

Recommended packages:

- Auto CAD, MicroStation, MS Office, Matlab, Grapher/Sigma plot
- Moss, AutoCivil, Intergraph
- ASAP, Staad
- Water CAD, Flow master
- Win log, Geoslope, Beurcap
- MS – Project

Third Semester (S3)

CED 698: SEMINAR

L	T	P	Cr
0	0	2	1

0 to 6 Credits elective
8 credit Project

The students are expected to give a seminar on relevant topic related to environmental geotechnology either a research or a case study ,covering various aspects like scope of the problem , methodology used for the study conclusions arrived at etc.

CED 699: PROJECT (S4)

L	T	P	Cr
0	20	20	20

8 credits in 3 rd semester and 12 credits in 4 th semester. The subject of study should be based on the latest works on going in the field of geotechnical and or environmental engineering.