MAHATMA GANDHI UNIVERSITY

SCHEME AND SYLLABI

FOR

M. Tech PROGRAMME

IN

CIVIL ENGINEERING

WITH SPECIALIZATION IN

GEOMECHANICS & STRUCTURES

(2013 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN CIVIL ENGINEERING WITH SPECIALIZATION IN GEOMECHANICS & STRUCTURES

SEMESTER – II

Sl. No	Course No.	Subjects	Hrs/Week			Evaluation Scheme (Marks)					Credits (C)
						Sessional			ESE	Total	
			L	T	P	TA	CT	Sub Total			
1	MCEGS 201	Ground Improvement Techniques	3	1	0	25	25	50	100	150	4
2	MCEGS 202	Foundation Analysis And Design	3	1	0	25	25	50	100	150	4
3	MCEGS 203	Dynamics Of Soil And Design Of Machine Foundation	3	1	0	25	25	50	100	150	4
4	MCEGS 204	Special Foundations & Structural Design Of Foundations	3	1	0	25	25	50	100	150	4
5	MCEGS 205	Elective III	3	0	0	25	25	50	100	150	3
6	MCEGS 206	Elective IV	3	0	0	25	25	50	100	150	3
7	MCEGS 207	Civil Engineering Design Studio	0	0	3	25	25	50	100	150	2
8	MCEGS 208	Seminar II	0	0	2	50	0	50	0	50	1
Total			**18**	**4**	**5**	**225**	**175**	**400**	**700**	**1100**	**25**

Elective – III (MCEGS 205)		Elective – IV (MCEGS 206)	
MCEGS 205 - 1	Ground Water Engineering	MCEGS 206 - 1	Modern Construction Practices
MCEGS 205- 2	Marine Geotechnical Engineering	MCEGS 206 - 2	Environmental Geotechinics
MCEGS 205 - 3	Applied Soil Mechanics	MCEGS 206 - 3	Analysis And Design of Pavements
MCEGS205 - 4	Advanced Steel Structures	MCEGS 206 - 4	Earthquake Analysis And Design of Structures

L – Lecture, **T** – Tutorial, **P** – Practical

TA – Teacher's Assessment (Assignments, attendance, group discussion, Quiz, tutorials, seminars, etc.)

CT – Class Test (Minimum of two tests to be conducted by the Institute)

ESE – University End Semester Exam will have to be conducted by the institute through concerned affiliating University

MCEGS 201 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	1	0	4

Module 1

Introduction, Economic considerations Engineering properties of soil,, weak and compressible deposits.

In situ densification – Vibrofloatation, Compaction pile , Vibro Compaction Piles Dynamic Compaction, Blasting Preloading with and without vertical drains. Compressibility, vertical and radial consolidation, preloading methods. Types of Drains, Design of vertical Drains, construction techniques. Stone Column: Function Design principles, load carrying capacity, construction techniques, settlement of stone column .

Module 2

Ground Improvement by Grouting techniques, types of grout, desirable characteristics, grouting pressure, grouting methods. 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.

Soil Stabilization: Lime stabilization-Base exchange mechanism, Pozzolanic reaction, lime-soil interaction, lime columns. Cement stabilization: Mechanism, amount, age and curing. Fly-ash – Lime Stabilization, Soil Bitumen Stabilization. deleterious effects of organic substances and sulphates on inorganic stabilization lime-sand columns, stone columns .

Module 3

Soil Reinforcement: Mechanism, Types of reinforcing elements, reinforcement-soil interaction, Reinforcement of soil beneath the roads, foundation. 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

Module 4

Geosynthetics: Types and functions, Materials and manufacturing process, Testing and valuations Design and construction of geosynthetics , reinforced soil retaining

structures, walls and slopes. 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. 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. Moscly, M.P, "Ground Improvement", Blackie Academic and Professional, Glasgow, 1994
2. Raj, P. Purushothama, "Ground Improvement Techniques", Laxmi Publications, New Delhi, 2005
3. Van Impe, W.F, "Soil Improvement Techniques & their Evolution", AA Balkema, 1989.
4. Nayak N. V., Foundation Design Manual, Dhanpat Rai and Sons, Delhi, 1982
5. Ingold T.S , "Reinforced Earth",Thomas Telford Ltd, London , 1982
6. Mandal J.N, "Reinforced Soil and Geotextiles", Oxford and IBH Publishers Co. Pvt. Ltd, New Delhi, 1988
7. Robert M. Koerner, "Designing with Geosynthetics", Prentice Hall, Englewood Cliffs, 1990
8. Venkatappa Rao G, Surry GVS Narayana Raju, "Engineering with Geosynthetics", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 1990

MCEGS 202 FOUNDATION ANALYSIS AND DESIGN

L	T	P	C
3	1	0	4

Module 1

Soil -Structure Interaction

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

Module 2

Shallow Foundation

Bearing capacity- Mayerhoff, Hansen and Vesic – bearing capacity factors, effect of water table, shape of foundation, inclination. Settlement immediate and consolidation –pressure bulb distribution.

Bearing capacity of foundation based on in-situ tests. Design of spread footing, column footing , combined footing.

Mat foundations on cohesive and cohesion less soil- rigid beam analysis- Winkler model

Module 3

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.

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, Under reamed piles.

Module 4

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

Well foundation- Design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts.

References :

1. Lambe and Whitman, “Soil Mechanics”, Wiley Eastern,1976.
2. Winterkorn H.F. and Fang H.Y. Ed., “Foundation Engineering Hand Book”, Van-Nostrand Reinhold, 1975.
3. Bowles J.E., “Foundation Analysis and Design” (4Ed.), Mc.Graw Hill, NY, 1996
4. Poulose H.G. and Davis E.H., “Pile foundation Analysis and Design”, John-Wiley & Sons, NY, 1980.
5. Kurien N.P. Design of Foundation Sytems : Principles & Practices, Narosa,1992
6. Leonards G. Ed., “Foundation Engineering”, Mc.Graw Hill,NY, 1962.
7. Fleming,W.G.K , Weltman A.J, Randolph M.F, Elson W.K, " Piling Engineering", Blackie Academic & Professional, 1994

MCEGS 203 **DYNAMICS OF SOIL AND DESIGN OF MACHINE FOUNDATION**

L	T	P	C
3	1	0	4

Module 1

Introduction to Soil Dynamics

Vibration of elementary systems- free and forced vibration with and without damping, Analysis of systems with Single degree and multi-degree of freedom. Natural frequencies of continuous systems, resonance . Effect of vibration on soil properties.

Module 2

Bearing capacity of dynamically loaded foundations .Nature of dynamic loads -stress conditions on soil elements under earthquake loading -methods of analysis of machine foundations -methods based on linear elastic weightless springs methods based on linear theory of elasticity (elastic half space theory) -nature of damping -geometric and internal - Elastic Constants of soil and their experimental determination.

Module 3

Design of Machine Foundations

Type of machine foundations special considerations for design of machine .

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)

Module 4

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. Bowles J.E., “Foundation Analysis and Design” (4Ed.), Mc.Graw Hill, NY, 1996
2. Shamsher Prakash, “Soil Dynamics”, McGraw Hill, 1981
3. Das B M, “Principles of Soil Dynamics”, Thomsons Engineering, 1992.
4. Saran S., “ Soil Dynamics and Machine Foundations”, Galgotia Publications Private Ltd.,1999
5. Sreenivasalu & Varadarajan, “Handbook of Machine Foundations”, Tata McGraw Hill ,2002
6. A Major, “Vibration Analysis and Design of Foundations for Machines and Turbines: Dynamical Problems in Civil Engineering”, Akademiai Kiado Budapest Collets Holding Ltd, 1962
7. IS 2974 -Part I and II, “Design Considerations for Machine Foundations”
8. IS 5249: “Method of Test for Determination of Dynamic Properties Of Soils”

MCEGS 204 SPECIAL FOUNDATIONS & STRUCTURAL DESIGN OF FOUNDATIONS

L	T	P	C
3	1	0	4

Module 1

Introduction to Limit State Design of reinforced concrete in foundations; Soil pressure for structural design; structural design of spread footings, isolated footings, combined footings, column pedestals, column footings, strap footings, strip footings under several column.

Module 2

Structural design of mat foundations – beam and slab rafts – combined piled raft foundations (CPRF) – circular and annular rafts – Analysis of flexible beams on elastic foundations – ACI method for the analysis of beams and grids on elastic foundations – Analysis of flexible plates on elastic foundations.

Module 3

Structural design of different types of piles – under reamed pile foundations – Design of pile cap – pile foundation – Design of large dia socketed piles – in filled vireneel frame foundations – steel column bases.

Structural design of well foundation

Module 4

Special foundations.Design of foundation for towers – Steel towers – foundation to water tank, chimneys – Shells for foundations – hyperbolic paraboloid (Hyper) foundations – Design of conical shell foundatiions.

References:

1. Bowles J.E., “Foundation Analysis and Design” (4Ed.), Mc.Graw Hill, NY, 1996
2. P.C.Varghese, “Design of Reinforced Concrete Foundations”, PHI – LTD – New Delhi, 1998
3. Kurien N.P., “Design of foundation systems – Principles and Practices” ,Narora Publishing house – New Delhi (third edition),1992
4. Shamsher prakash, Gopal Ranjan, & Swami Saran, “Analysis and design of foundations and retaining structures”, Sarita Prakashan, New Delhi , 1979

MCEGS 205-1 GROUND WATER ENGINEERING

L	T	P	C
3	0	0	3

Module 1

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 2

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 3

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 4

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 , 1980

2. Garg S.P., “Ground Water & Tube wells”, Oxford & IBH , 1993
3. Raghunath H.M., “Ground Water”, New Age International Pvt. Ltd.,1987
4. Schwartz F. W. & Zhang H., “Fundamental of Ground Water”, John Willey & Sons,2003

MCEGS 205-2 MARINE GEOTECHNICAL ENGINEERING

L	T	P	C
3	0	0	3

Module 1

Introduction to Marine Geotechnical Engineering:

Scope of marine geotechnical engineering - Marine classification, properties of marine sediments - 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 2

Offshore Soil Investigation: Planning and site exploration. Offshore-drilling. Sampling techniques. Laboratory testing, In situ testing methods and geophysical methods. In-situ determination of strength of submarine soils - Penetrometer, piezocone, vane and pressure meter techniques -

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

Module 3

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 4

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., 1985
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

MCEGS 205-3 APPLIED SOIL MECHANICS

L	T	P	C
3	0	0	3

Module 1

Earth Pressure: Fundamental relationships between the lateral pressures and the strain with a back fill. Rankine and Coulomb theories. Assumption and conditions. Point of application of passive earth pressures.

Design of retaining wall: Gravity wall, stability criteria. External stability,and internal stability. Reinforced earth retaining structures- Recent advances in Earth retaining structures.

Module 2

Theory of arching in soils and its applications in tunnel, conduits, silos.

Braced excavation: Types, Construction methods, Pressure distribution in sands and clays, stability, bottom heave, seepage. Braced excavations, Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays. Reinforced soil walls, Elements, construction methods.

Module 3

Bulkheads: Definition and assumptions, conditions of end supports and distribution of active earth pressure and bulkheads, bulkheads with free and fixed earth supports, equivalent beam method, Improvements suggested by Rowe, Tschebotarioff's method, Anchorage of bulkheads and resistance of anchor walls. Diaphragm walls, Bored pile walls.

Cellular Cofferdams : stability and design of cellular cofferdams. TVA method,The Cummings Method.

Module 4

Slope stability**:** Stability analysis of natural slopes. stability analysis models. Stability analysis of finite and Infinite slopes: concept of factor of safety. Culman friction circle, Swedish, modified Bishop, Janbu's method and limit state analysis of slopes.

Design of earth embankments and slopes ,Prestressed ground anchors, soil nailing.

References:

1. Gregory. P. Tschebotarioff ,“Foundations, Retaining and Earth Structures”, Mc Graw Hill , 1978.
2. Das B. M., “Principles of Foundation Engineering”, Thomson, Indian Edition, 2003.
3. Shamsher prakash, Gopal Ranjan, & Swami Saran, “Analysis and design of foundations and retaining structures”, Sarita Prakashan New Delhi, 1979
4. Bowles J.E., “Foundation Analysis and Design” (4Ed.), Mc.Graw Hill, NY, 1996
5. Craig R F, “Soil Mechanics”, Chapman and Hall(ELBS) ,2004
6. Nainan P Kurian, “Design of foundation systems: principles and practices” ,Narosa publish House New Delhi, 1992

MCEGS 205-4 ADVANCED STEEL STRUCTURES

L	T	P	C
3	0	0	3

Module 1

Review of loads on structures- Dead, Live,wind and Siesmic loads as per IS 800-2007-Design of purlins, louver rails Gable column and Gable wind girder-Analysis and Design of Gable frames-Design of moment resisting base plates.

Types of connections-Design requirement of bolted and welded connections-seated connections-unstiffened and stiffened seated connections-framed connections-moment resistant connections-split beam connections-semi rigid connections

Module 2

Design of self supporting chimney-design of base plates, foundations and anchor bolts-Guyed steel chimney-Guy ropes-Stresses due to wind. Along with load calculation-Gust factor method

.**Module 3**

Theory of plastic bending-plastic hinge concept-mechanism method-Application to continuous beam and portal frames-Plastic moment distribution-Limit state Design-ultimate and serviceability limit states-Limit state design of axially loaded members-Design of beams

Module 4

Behaviour of compression elements-Effective width for load and deflection determination-Behaviour of stiffened and unstiffened elements. Design of compression and tension members-Concept of lateral buckling-Design of beams-Deflection of beams-Design of beam webs.

References :

1. Subramanian.N, “Design of Steel Structures”, Oxford University Press, 2008.
2. Lynn S. Beedle, “Plastic Design of Steel Frames”, John Wiley and Sons, New York, 1990.
3. Salmon C G,Johnson J E ,”Steel Structures –design and behavior”, Harper and row,1980.
4. Teaching resource for structural steel design ,INSDAG Kolkotta,2001

5. Duggal S K, “Limit state design of steel structure”, TMH publications, 2000
6. Rhodes J., ”Design of cold formed steel members” ,Elsevier Science Publishers, 1991.

MCEGS 206-1 MODERN CONSTRUCTION PRACTISES

L	T	P	C
3	0	0	3

Module 1

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers, Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment

Module 2

Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment, Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters

Module 3

Sub structure construction-Box jacking - pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - piling techniques- auger, DMC, drilling - driving well and caisson - sinking cofferdam - cable achoring and grouting - driving diaphragm walls, sheet piles - laying operations for built up offshore system - shoring for deep cutting - large reservoir construction with membrances and earth system - well points - dewatering and stand by plant equipment for underground open excavation.

Module 4

Super Structure construction- Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures

References:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., “Construction Planning, Equipment and Methods”, 5th Edition, Mc Graw Hill, Singapore, 1995
2. Sharma S.C., “Construction Equipment and Management”, Khanna Publishers, New Delhi, 1988.
3. Deodhar, S.V.” Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 1988.
4. Dr.Mahesh Varma, “Construction Equipment and its planning and Application”, Metropolitan Book Company, New Delhi. 1983.
5. Robertwade Brown, “Practical foundation engineering hand book”, Mc Graw Hill Publications, 1995
6. Patrick Powers. J., “Construction Dewatering: New Methods and Applications”, John Wiley & Sons, 1992
7. Jerry Irvine, “Advanced Construction Techniques”, CA Rocketr, 1984

MCEGS 206-2 ENVIRONMENTAL GEOTECHINICS

L	T	P	C
3	0	0	3

Module 1

Introduction: Forms of waste, engineering properties (determination and typical values),. Selection of waste disposal sites: Site selection – selection criteria and rating; Solid waste disposal: Ash Disposal facilities- Dry disposal, waste disposal, Design of ash containment system, Stability of ash dykes; Reclaiming potentially combustible sites , 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 2

Subsurface contamination and Contaminant transport through porous media: mechanisms- advection and dispersion .

Contaminants of Solid Waste in Land fills: Types- Dry cell, wet cell, bioreactor, Design- clay liners, geosynthetic clay liners for waste containment, cover and gas collection system. Stability of land fills. Land fill Instruction & operation, sustainable waste management. Remediation: Principle- planning, source control, soil washing, bioremediation.

Module 3

Geotechnical Reuse of Waste materials: Waste reduction, use in geotechnical construction, waste characteristics, transportation consideration, Engineering properties of Wastes, Waste material in Embankment and Fills.

Module 4

Contaminants of Slurry wastes: Slurry transported wastes, slurry ponds, operation, Embankment construction and raising, Design aspects, Environmental Impact and control. Vertical Barriers for Contaminant: Contaminated sites, Types of barriers, Soil-Bentonite slurry trench walls, Cement-Bentonite slurry trench walls, construction, material and design aspects

References :

1. Reddy K. R. and H D Sharma, " Geoenvironmental Engineering: Site Remediation, waste containment, and emerging waste management technologies", John Willey, 2004.
2. Yong R N., "Geo Environmental Engineering: Contaminated Ground: Fate of pollutions and Remediation", Thomson Telford, 2000.
3. Reddy L N and Inyang H.I., "Geoenvironmental Engineering: Principles and Applications", Marcel Dek, 2000
4. Hsai yang Fang "Introduction to Environmental Geotechenology", CRC press Newyork , 1997
5. Cairmey .T. "Contaminated land problems and solutions", Blackie Academic & Professional, 1993
6. Ayyar ,R.S.R "Soil Engineering in relation to Environment", LBS ,Thiruvananthapuram, 2000
7. Sivapullaiah ,P.V, " Environmental Geotechnics", IISC ,Bangalore, 1985

MCEGS 206-3 ANALYSIS AND DESIGN OF PAVEMENTS

L	T	P	C
3	0	0	3

Module 1

Conventional aggregates and their evaluation, Bituminous binders- Properties, testing and applications; Bituminous mixes- Design, testing and evaluation; Materials for cement concrete and semi-rigid pavements, Design of mixes for stabilized roads ; Non-conventional and new pavement materials- their application and limitations.

Module 2

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and strains in flexible pavements: Stresses and strains in an infinite elastic half space , use of Boussinesq's equations - Burmister's two layer and three layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors

Module 3

Flexible pavement design methods for highways and airports: Empirical, semi-empirical and theoretical approaches; Development, principle, design steps of the different pavement design methods including AASHTO, Asphalt Institute, Shell Methods.

Module 4

IRC method of pavement design; Stresses in rigid pavements: Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses. Rigid pavement design: Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements.

References :

1. Atkins & Harold, “Highway Materials, Soils, and Concretes”, Prentice Hall – Pearson, 2003
2. Richard Kim Y., “Modeling of Asphalt Concrete”, Mc Graw Hill Professional., 2008
3. Relevant IRC, ASTM, AASHTO and other Codes, Manuals and Specifications
4. Lavin P.G., “Asphalt Pavements” 1st Ed, Taylor and Francis, 2007

MCEGS 206-4 EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES

L	T	P	C
3	0	0	3

Module 1

Engineering Seismology (Definitions, Introduction to Seismic hazard, Earthquake Phenomenon), Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation.

Module 2

Dynamics of Structures (SDOFS/ MDOFS), Response Spectra - Average Response Spectra - Design Response Spectra, Evaluation of Earthquake Forces as per codal provisions, Effect of Earthquake on Different Types of Structures, Lessons Learnt From Past Earthquakes

Module 3

Structural Systems - Types of Buildings, Causes of damage, Planning Considerations, Philosophy and Principle of Earthquake Resistant Design, Guidelines for Earthquake Resistant Design, Earthquake Resistant Earthen Buildings, Earthquake Resistant Masonry Buildings - Design consideration – Guidelines.

Earthquake Resistant Design of R.C.C. Buildings - Material properties - Lateral load analysis - Design and detailing – Rigid Frames – Shear wall – Coupled Shear wall.

Module 4

Mathematical modeling of multistoried RC Buildings – Capacity based design. Vibration Control - Tuned Mass Dampers – Principles and application, Basic Concept of Seismic Base Isolation – various Systems- Case Studies, Important structures.

References :

1. Pankaj Agarwal and Manish Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall of India, 2006
2. S K Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press, 2007.
3. Course Notes "Design of Reinforced Concrete Buildings", IIT Kanpur, June 1999.

4. Paulay,T and Priestly, M.N.J., “A seismic Design of Reinforced Concrete and Masonry buildings”, John Wiley and Sons, 1991.
5. Bruce A Bolt, “Earthquakes” W H Freeman and Company, New York, 2004
6. Bungale S.Taranath, "Structural Analysis and Design of Tall Buildings” , Mc Graw Hill Book Company, New York, 1999.
7. Steven C. Kramer, “A text Book on Geotechnical Earthquake Engineering”, Prentice hall International series, 2004
8. Das B . M., “A text Book on principles of soil Dynamics”, Brooks, Code, 1993.

MCEGS 207 CIVIL ENGINEERING DESIGN STUDIO

L	T	P	C
0	0	3	2

Application of software packages like PLAXIS, ANSYS, SAP, STRUDS, etc in modeling, simulation, analysis , design and drafting of structural components for raft foundation, retaining wall, pile foundation, beams, columns , slopes and embankments using the concepts given in theory papers. The student has to practice the packages by working out different types of problems. The student has to carry out a mini project work which will be evaluated for internal assessment.

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MCEGS 208 SEMINAR – II

L	T	P	C
0	0	2	1

Each student shall present a seminar on any topic of interest related to the core / elective courses offered in the first semester of the M. Tech. Programme. He / she shall select the topic based on the references from international journals of repute. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted.