M. Tech Civil (Geotechnical Engineering) (1st Year)

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE3-101	Engineering Behaviour of Soil	3	1	-	40	60	100	4
MCIE3-102	Site Investigation and Ground Improvement	3	1	-	40	60	100	4
MCIE3-103	Soil Dynamics	3	1	-	40	60	100	4
MCIE3-104	Soil Mechanics Lab	-	-	4	60	40	100	2
Departmental Elective – I (Select any one)		3	1	0	40	60	100	4
MCIE3-156	Rock Mechanics							
MCIE3-157	Clay Mineralogy							
Departmental Elective – II (Select any one)		3	1	0	40	60	100	4
MCIE3-158	Structural Design of Foundations							
MCIE3-159	Optimization Techniques							
Total	**Theory = 5 Lab = 1**	**15**	**5**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 24 **Total Marks = 600** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCIE3-205	Advanced Soil Mechanics	3	1	-	40	60	100	4
MCIE3-206	Foundation Engineering	3	1	-	40	60	100	4
MCIE3-207	Foundation Engineering Lab	-	-	4	60	40	100	2
Departmental Elective – III (Select any one)		3	1	0	40	60	100	4
MCIE3-260	Pavement Design							
MCIE3-261	Earthen Dams							
Departmental Elective – IV (Select any one)		3	1	0	40	60	100	4
MCIE3-262	Geo-Environmental Engineering							
MCIE3-263	Computational Techniques							
Open Elective – I (Select any one)		3	1	0	40	60	100	4
Total	**Theory = 4 Lab = 1**	**15**	**5**	**4**	**260**	**340**	**600**	**22**

Overall

Semester	Marks	Credits
1st	600	22
2nd	600	22
Total	**1200**	**44**

ENGINEERING BEHAVIOR OF SOIL

Subject Code –MCIE3-101 **L T P C** **Duration - 45 Hrs**
3 1 0 4

UNIT-I (10Hrs)

Introduction, formation of soil, clay mineralogy, structures of common clay minerals. Identification and classification of soil, soil weight volume relationship, index properties of soils, surface tension and capillary phenomenon. Measurement of capillary rise in soil, soil moisture, soil-water potential, measurement of soil-water potential.

UNIT-II (11 Hrs)

Mechanism of swelling potential and pressure. Soil compaction, standard and modified Proctor compaction, theories of soil compaction; compaction control in field. Permeability, Darcys law, Theories of wells, flownets and their properties, seepage flownet in dams, flownet by relaxation method, seepage forces, uplift, piping phenomenon, problems.

UNIT-III (13 Hrs)

Introduction. Consolidation of soils. Terzaghis theory of one dimensional consolidation, application to geotechnical problems. Two and three dimensional consolidation of soils, secondary consolidation. Shear strength of soils; unsaturated soil Skempton pore pressure theory, compressibility of unsaturated soil, Rowes stress dilatancy theory. Different shear parameters; special consolidation and shear tests, application to geotechnical problems.

UNIT-IV (11 Hrs)

Elastic stresses in soil; Stress-strain behaviour of soils; Mohr Circle of Stress; Principal Stresses. Stress distribution in homogeneous, non-homogeneous, layered and anisotropic deposits. Effect of non-linearity. Review of classical earth pressure theories and trial wedge method for c-φ soils.

Recommended Books

1. J.H. Atkinson and P.L. Bransby, 'The Mechanics of Soils: An Introduction to Critical Soil Mechanics', McGraw Hill, **1978.**
2. J.H. Atkinson, 'An Introduction to the Mechanics of Soils and Foundation', McGraw- Hill Co., **1993.**
3. B.M. Das, 'Advanced Soil Mechanics', Taylor and Francis, 2nd Edn., **1997.**
4. D.M. Wood, 'Soil Behavior and Critical State Soil Mechanics', Cambridge University Press, **1990.**
5. R.F. Craig, 'Soil Mechanics', Van Nostrand Reinhold Co. Ltd., **1987.**
6. K. Terzaghi, and R.B. Peck, 'Soil Mechanics in Engineering Practice', John Wiley & Sons, **1967.**
7. T.W. Lambe and R.V. Whitman, 'Soil Mechanics', John Wiley & Sons, **1979.**

SITE INVESTIGATION & GROUND IMPROVEMENTS

Subject Code – MCIE3-102 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT-I (12 Hrs)

Soil formation -Processes – Characteristics of major soil deposits of India. Necessity and Importance of soil exploration Method of sub surface exploration Test pits, Trenches, Caissons, Tunnels and drifts, Wash boring, Percussion drilling, Rotary drilling, Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes, Spacing and depth for various Civil engineering structures. Indirect method of exploration, Seismic method, Electrical resistivity, Resistivity sounding and profiling, Qualitative and quantitative interpretation of test results, Comparison of resistivity and seismic surveys, Shortcomings. Stabilization of bore holes, Different method of stabilisation of the bore holes, their relative merits and demerits.

UNIT-II (12 Hrs)

Ground water Observation: Different method of ground water observation: Time lag in observation, Sampling of ground water. Sampling: Source of disturbance and their influence, Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils, Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log. In situ Permeability. Pumping in test in a cased hole with open end, falling head packer test constant head packer test, Pump in out tests in a single test wall and open pit or unlined hole. Piezometer methods

UNIT-III (11Hrs)

Fields Tests: Standard penetration test, Dynamic cone penetration tests with and without bentonite mud slurry. Static cone penetration test, Surface sampling. Cyclic plate load test, large shear box test, Vane shear test, Pile load, Block resonance test, wave propagation test. Small size penetrometers, Pressure meter test and Diltometer test. Various corrections in the test results and interpretation of test results for design of foundations. Correlation among various test results. Precautions to be exercised during the execution of these tests. Preparation of bore hole log.

UNIT-IV (10 Hrs)

Introduction, Economic considerations, Consolidation by preloading and sand drains, Strengthening by granular columns and lime columns, Compaction by vibro - flotation, Blasting, Dynamic consolidation, Grouting techniques and principles grounds anchors, Reinforced earth construction Geo-Textiles Problems. Stabilization: Mechanical, Lime, Cement, Resins & Other Chemicals.

Recommended Books

1. P. Purushothama Raj, 'Ground Improvement Techniques', Tata McGraw Hill, New Delhi, **1995.**
2. B.C. Chattopadhyay and J. Maity, 'Ground Control and Improvement Techniques', PEEDOT, Howrah, **2011.**
3. Simon and Cayton, 'Site Investigation', 2nd Edn., Wiley-Blackwell, **1995.**

4. B.M. Das, 'Principles of Foundation Engineering', Thomson Brooks/Cole.
5. N.P. Kurien, 'Design of Foundation Systems: Principles & Practices', Narosa, New Delhi, **1992.**
6. G. Ranjan and A.S.R. Rao, 'Basic and Applied Soil Mechanics', New Age International Publishers.

SOIL DYNAMICS

Subject Code – MCIE3-103 **L T P C** **Duration – 45 Hrs**
3 1 0 4

UNIT-I (10 Hrs)

Introduction: Nature of dynamic loads, Stress conditions on soil, Elements under E.Q. loading (basic concepts only), Fundamentals of theory of vibrations-simple harmonic motion, Response of SDOF System-Vibration analysis procedure- Free and forced vibration with and without damping. Adverse effects of Seismic hazard and Site improvement methods for mitigation of earthquake hazards.

UNIT-II (09 Hrs)

Dynamic Bearing Capacity: General, Failure Zones & Ultimate Bearing capacity criteria for satisfactory action of footing. Introduction to bearing capacity and settlement analysis under earthquake loading- Seismic design considerations, Codal provisions.

UNIT-III (14 Hrs)

Dynamic response of Retaining wall: Seismic design consideration of Retaining Walls during Earth Quakes, Modification of Coulomb's Theory, Indian standard code of Practice. Liquefaction of Soils: Soil liquefaction - Criterion and Factor Affecting Liquefaction, Susceptibility, initiation and effects of soil liquefaction, Laboratory and Field methods for estimation of liquefaction potential- CSR and CRR. Liquefaction behaviors of dense sand.

UNIT-IV (12 Hrs)

M/C Foundations: Introduction, Design criteria for satisfactory M/C foundation as per IS codes, Methods of analysis- Linear elastic weightless spring and elastic half space theory approach. Design of Block Foundation for reciprocating engine and low speed machines. Vibration Isolation techniques & Screening of Waves.

Recommended Books

1. W. Day Robert, 'Geotechnical Earthquake Engineering Handbook', McGraw Hill, New York, **2007**.
2. S. Kramer, 'Geotechnical Earthquake Engineering', Pearson, New Delhi,**1995.**
3. K. Ishihara, 'Soil Behaviour in Earthquake Geotechnics', Oxford Science, NY, **1996**.
4. Lkuo Towhata, 'Geotechnical Earthquake Engineering', Springer, NY, **1995.**
5. Bharat Bhusan Prasad, 'Fundamentals of Soil Dynamics and Earthquake Engineering', PHI, **2005.**
6. S. Prakash and Puri, 'Foundations for Machines: Analysis and Design', Wiley, New York, **1988.**
7. Braja M. Das and G.V. Ramana, 'Principles of Soil Dynamics', Cengage Learning, **2010.**

8. Swami Saran, 'Soil Dynamics and Machine Foundations', Galgotia Publishers, New Delhi, **1997.**
9. V.N.S. Murthy, 'Soil Mechanics and Foundation Engineering', CBS Publishers & Distributors, New Delhi, **2009.**

SOIL MECHANICS LAB

Subject Code – MCIE3-104 **L T P C**
0 0 4 2

List of Experiments

1. Preliminary Soil Tests
2. Relative Density of sand Test
3. Proctor Compaction Test
4. Consolidation Test
5. CBR Test
6. Permeability of Clay/ Sand Soils.
7. Free Swell, Swell Potential, Swell Pressure Test
8. Analysis of cuts and slopes
9. Shear Strength Tests

ROCK MECHANICS

Subject Code – MCIE3-156 **L T P C** **Duration – 45 Hrs**
3 1 0 4

UNIT-I (12 Hrs)

Superficial deposits. weathering and erosion processes, Mechanism involved, Detailed description of the resulting geomorphologic feat covering weather effects river actions, Sea action, Wind action and ice action, their origin, Mechanism involved and engineering significance. Detailed geologic and physiographic account of extra peninsular India and Indo gangetic Plains.

UNIT-II (14 Hrs)

Study of important Rock: forming minerals, Quartz group, Mica, Feldspar group, Pyroxene group, Amphibole group and miscellaneous mine of common occurrence. Structures and texture of the main rock group geological and engineering characteristics of the important rock by: Microscopic study of important rock and minerals including preparation of thin sections. Geotectonics: North movement, Diastrophism, Oscstasy and central drafts, formation of major structural feature in rock folds. Faults, Joints and unconformities, their effects on cut crops mechanism involved, their engineering significance.

UNIT-III (11 Hrs)

Rock as constructional materials: sand and gravel characteristics of aggregates, Stability of slopes and cutting, Landslides and Landoidence. Geological exploration of engineering sites. Geological investigation in the case of Dams and Reservoirs Canals. Building foundation and

highways. Earthquakes: Mechanism involved; Geological consideration for construction; Reservoir related earthquakes.

UNIT-IV (8 Hrs)

Groundwater: Ground water investigation in Civil engineering, Ground water provinces in India. Geological Mapping: Interpretation of geological mapping sections.

Recommended Books

1. M.T. Maruthesha Reddy, 'A Textbook of Applied Engineering Geology', New Age International (P) Limited, Publishers, **2007.**
2. D.P. Krynine, 'Principles of Engineering Geology and Geotechnics', CBS Publishers & Distributors-New Delhi.
3. D.S. Arora, 'Geology for Engineers', Mohindra Capital Publishers, Chandigarh.
4. J.M. Treteth, 'Geology of Engineers', Princeton, Von. Nostrand.

CLAY MINERALOGY

Subject Code – MCIE3-157 **L T P C** **Duration – 45 Hrs**

3 1 0 4

UNIT-I (13 Hrs)

Clay Minerals, Identification of Clay Minerals, Atomic bonds: Primary and Secondary types; Study of clay forming minerals; Base exchange capacity;

UNIT-II (14 Hrs)

Specific Surface (Ss), Interaction of Water and Clay Minerals, Interaction of Clay Particles, Clay water electrolyte system; Gouy-Chapman diffuse double layer theory; Structure of clays; Principle of electro-osmosis;

UNIT-III (8 Hrs)

Soil stabilization; Consolidation and strength characteristics of clay in light of clay mineralogy;

UNIT IV (10 Hrs)

Clay mineral identification: Differential thermal analysis, X-ray diffraction technique and scanning electron microscopic studies.

Recommended Books

1. R.D. Holtz and W.D. Kovacs, 'An Introduction to Geotechnical Engineering', Prentice Hall, **1981**.
2. J.K. Mitchell, 'Fundamentals of Soil Behavior', 2nd Edn., John Wiley & Sons, **1993**.
3. J. Israelachvili, 'Intermolecular and Surface Forces', 2nd Edn., Academic Press, **1991**.
4. S.L. Kramer, 'Geotechnical Earthquake Engineering', Prentice Hall, **1996**.
5. T.W. Lambe and R.V. Whitman, 'Soil Mechanics, SI Version,' John Wiley & Sons, **1979**.
6. J.C. Santamarina, K.A. Klein and M.A. Fam, 'Soils and Waves', John Wiley & Sons, **2001**.
7. H. Van Olphen, 'An Introduction to Clay Colloid Chemistry', Reprint Edn., Krieger Publishing Company, **1991.**
8. P.P. Xanthakos, 'Surry Walls as Structural Systems', 2nd Edn., McGraw-Hill, Inc, **1991**.

STRUCTURAL DESIGN OF FOUNDATION

Subject Code – MCIE3-158 **L T P C** **Duration – 45 Hrs**
3 1 0 4

UNIT-I (12Hrs)

Shallow Foundation: Design of footing e.g. isolated footing in B.B.C. and steel grillage, combined footings of rectangular, Trapezoid cantilever types. Mat or raft foundation for dry and saturated soil, floating foundations.

UNIT-II (8 Hrs)

Deep Foundation: Design of Piles, Pile caps and pile foundations buildings, Design of retaining structures.

UNIT-III (13 Hrs)

Earth Retaining Structures: Design of retaining walls for dry and saturated back fills with surcharge loads. Retaining walls resting on piles, Design of bridge abutments, Design of sheet piles used for coffer dams, Design of sheeting bracing in excavation trenches, Special Structures

UNIT-IV (12 Hrs)

Design of foundation for transmission Design of basement walls, Bridges structures Analysis and Design: Design of walls foundation and caissons of different types, Design of bridge piers resting on piles.

Recommended Books

1. Pillai & Menno, 'Advanced RCC Design', Tata McGraw Hill.
2. P.C. Varghese, 'Limit State Design of Reinforced Concrete', Prentice-Hall of India Pvt. Ltd.
3. N. Krishna, 'Advanced Reinforced Concrete Design', CBS Publisher Publication, **2013.**

OPTIMIZATION TECHNIQUES

Subject Code – MCIE3-159 **L T P C** **Duration – 45 Hrs**
3 1 0 4

UNIT-I (13 Hrs)

Optimisation Technique: Calculus of several variables, Implicit function theorem, Nature of singular points, Necessary and sufficient conditions for optimisation, Elements of calculus of variation, Constrained Optimisation, Lagrange multipliers, Gradient method, Dynamic programming.

UNIT-II (10 Hrs)

Basics of engineering analysis and design, need for optimal design, formulation of optimal design problems, basic difficulties associated with solution of optimal problems.

UNIT-III (10 Hrs)

Numerical methods for nonlinear unconstrained and constrained problems, sensitivity analysis, Linear post optimal analysis, sensitivity analysis of discrete and distributed systems.

UNIT-IV (12 Hrs)

Introduction to variation methods of sensitivity analysis, shape sensitivity, Introduction to integer programming, dynamic programming, stochastic programming and geometric programming, Introduction to genetic algorithm and simulated annealing.

Recommended Books

1. S.S. Rao, 'Engineering Optimization – Theory and Practice', New Age International.
2. K. Deb, 'Optimization for Engineering Design – Algorithms and Examples', Prentice Hall.
3. U. Kirsch, 'Optimum Structural Design', McGraw Hill.
4. J.S. Arora, 'Introduction to Optimum Design', McGraw Hill.
5. S. Rajeev and C.S. Krishnamoorthy, 'Discrete Optimization of Structures using Genetic Algorithms', Journal of Structural Engineering, Vol. 118, No. 5, 1223- 1250, **1992.**
6. R.T. Hafta and Z. Gurdal, 'Elements of Structural Optimization', 3rd revised and expanded Edn., Kluwer Academic Publishers, **1996.**

ADVANCED SOIL MECHANICS

Subject Code: MCIE3-205 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT-I (13 Hrs)

Stability analysis of slope -effective vs. total stress analysis, Stability Analysis of Slope: Effective and total stress approach, shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical conditions.

UNIT-II (11 Hrs)

Sheet Pile Structures: Cantilever sheet piling, Anchored sheet piling: Free and fixed earth support methods of Analysis

UNIT-III (10 Hrs)

Soil Anchors: Inclusions and Installation Techniques, Design of Soil Anchors, Application Criteria: Advantages and Limitations.

UNIT-IV (11 Hrs)

Braced cuts, Arching action of soil and its application, coffer dam's analysis and design.

Recommended Books

1. B.M. Das, 'Advanced Soil Mechanics', Taylor and Francis.
2. R.F. Scott, 'Principles of Soil Mechanics', Addison & Wesley.
3. R.O. Davis and A.P.S. Selvadurai, 'Elasticity and Geomechanics', Cambridge University Press, New York.
4. James K Mitchell, 'Fundamentals of Soil Behaviour', John Wiley and Sons.
5. D.M. Wood, 'Soil Behaviour and Critical State Soil Mechanics', University of Glasgow.

FOUNDATION ENGINEERING

Subject Code – MCIE3-206 **LT P C** **Duration - 45 Hrs**
3 1 0 4

UNIT-I (10 Hrs)

Shallow Foundation: Bearing capacity factors. Effect of foundation shape, eccentricity and inclination of load, Influence of soil compressibility and water table

UNIT-II (11 Hrs)

Deformation Modulus and Settlement: Tsytovich equivalent stratum, Settlement of footings on stratified deposits. Influence of adjacent footings. Allowable total and differential settlement of structures. Methods of proportioning, Raft foundations, semi-empirical methods. Foundations on swelling soils

UNIT-III (13 Hrs)

Deep Foundations: Modes of failure. Bearing capacity and settlement of pile foundation. Types of piles. Allowable load, Pile Load test. Dynamic and static formulae. Bearing Capacity factors. Pile group bearing capacity and settlement. Interference, Behavior of piles under lateral loading. Winkler's assumption. Pile resistance and deflection under lateral loads, elastic method, Broms method.

UNIT-IV (11 Hrs)

Well Foundations: Design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts. CASSIONS: Types and design.

Recommended Books

1. B.M. Das, 'Principles of Foundation Engineering', Thomson Brooks/Cole.
2. J.E. Bowles, 'Foundation Analysis and Design', McGraw-Hill Book Company.
3. H.G. Poulos, and E.H. Davis, 'Pile Foundation Analysis and Design', John Wiley and Sons, New York.
4. N.P. Kurien, 'Design of Foundation Systems: Principles & Practices', Narosa, New Delhi **1992.**
5. H.F. Winterkorn and H.Y. Fang, 'Foundation Engineering Hand Book', Galgotia Book Source.

FOUNDATION ENGINEERING LAB

Subject Code – MCIE3-207 **LT P C**
0 0 4 2

1. Field Investigation by Auger Boring
2. Pile Load Test
3. Plate load test
4. Standard Penetration Test
5. Static Cone Penetration test
6. Dynamic cone Penetration test
7. Soil test Repots
8. Field CBR test

PAVEMENT DESIGN

Subject Code – MCIE3-260 **L T P C** **Duration - 45 Hrs**
3 1 0 4

UNIT-I (13 Hrs)

Types of pavement structure, Functions of pavement components, Factors affecting pavement design. Design wheel load, Strength characteristics of pavement materials. General design considerations, Methods for design of flexible pavements; Group Index method, California Bearing Ratio (CBR) method, California Resistance Value method, Triaxial Test method, Burmister method, McLeod's method.

UNIT-II (11 Hrs)

General design considerations, Methods for design of rigid pavements; Westergard's method, F.A.A. method, IRC recommendations for design of concrete pavements, method, Types of joints and their design in cement concrete pavements. Thickness design for Airport pavement, LCN system of pavement design, design of airport pavement overlays.

UNIT-III (10 Hrs)

Types of highway construction and their selection, materials for construction, construction procedure of different highways: Earth roads, Gravel roads, WBM roads, Bituminous pavements, Cement concrete pavements, Low cost roads, Introduction to various equipment used for highway construction.

UNIT-IV (11 Hrs)

Need for highway maintenance, Pavement failures their causes and remedial measures. Typical flexible and rigid pavement failures, Types of highway maintenance: Routine, periodic and special type, materials used for maintenance of different pavements, Strengthening of existing pavements, Maintenance management system.

Recommended Books

1. E.J. Yoder, ‘Principals of Pavement Design’.
2. Khanna and Justo, ‘Highway Engineering’.
3. S.K. Sharma, ‘Principles, Practice and Design of Highway Engineering’.
4. M.G. Lay, ‘Handbook of Road Technology’.
5. Yang and Huang, ‘Pavement Analysis and Design’.
6. D. Croney and P. Croney, ‘The Design and Performance of Road Pavements’.

EARTHEN DAMS

Subject Code – MCIE3-261 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT-I (12 Hrs)

Historical Development, selection of dam site, types of embankment dams, choice of type of dam, components of a dam, free board, slope protection, cause of failure, criteria for safe design. Foundation Exploration and Materials for Embankments: Methods of investigations, properties of ground, field and laboratory tests, suitability criteria for materials. Seepage through Dam Section and its Control: Fundamentals of seepage flow, Laplacian equation and

flow net. Determination of top flow line and discharge through dam, seepage force and its effects, critical conditions in earth dam; end of construction, steady seepage, rapid draw down. Drainage of Embankment: Horizontal drain, chimney drain, design of filter, use of impervious core in seepage control

UNIT-II (12 Hrs)

Control of Seepage Trough Foundation: General consideration, treatment of foundation; trench cut off partial cutoff, grout cutoff, upstream impervious blanket, design of relief well, liquefaction of soil, mechanism of densification. Instrumentation in Earth Dam: Measurement of pore pressure, movement of dam and seepage, Instruments for measuring horizontal and vertical movement. Piezometers; types, choice for location, Instruments for measuring seepage.

UNIT-III (11 Hrs)

Stability Analysis of Slope: Effective and total stress approach, shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical conditions, stability during earth quake, Indian standard Code s of practice. Quality Control in Construction: Method of compactions, quality control of compaction in the field, borrow area control.

UNIT-IV (10 Hrs)

Rock fill Dams: Typical sections, Problems of design. Different types of membranes. Settlement of rock fill dams. Construction methods. Case Studies of Dam Failures: Failure of Panshet Dam, Nanak Sagar Dam, Sampana Dam.

Recommended Books

1. J.L. Sherard, R.J. Woodward, S.F. Gizienski, and W.A. Clevenger, 'Earth and Earth –Rock Dams Engineering Problems of Design and Construction', John Wiley and Sons, New York, **1963.**
2. R.F. Craig, 'Soil Mechanics', Chapman and Hall (ELBS).
3. C. Justin and Hinds, 'Engineering for Dams', Vol. 2 & 3.
4. S. Leliavsky, 'Design of Dams for Percolation and Erosion', Chapman and Hall.

GEO-ENVIRONMENTAL ENGINEERING

Subject Code – MCIE3-262 **L T P C** **3 1 0 4** **Duration: 45 Hrs**

UNIT-I (12 Hrs)

Industrialization and Urbanization, Pollution, Control and remediation. Contamination: Surface contamination, Contamination transport, Soil-a Geotechnical trap, Effect of subsurface contamination, Detection of polluted zone, Monitoring and Effectiveness of designed facilities.

UNIT – II (12 Hrs)

Contaminants of Solid Waste in Landfills: Waste contaminants, landfills, types, shape and size of landfills. Liner and liner system, Cover and cover system, Stability of landfills. Land fill construction & operation, sustainable waste management. Contaminants of Slurry wastes: Slurry transported wastes, slurry ponds, operation, Embankment construction and raising, Design aspects, Environmental Impact and control.

UNIT – III (11 Hrs)

Vertical Barriers for Contaminant: Contaminated sites, Types of barriers, Soil-Bentonite slurry trench walls, Cement-Bentonite slurry trench walls, construction material and design aspects.

UNIT – IV (10 Hrs)

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

Recommended Books

1. R.K. Rowe, 'Geotechnical and Geoenvironmental Engineering Handbook', Kluwer Academic Publications, London.
2. L.N. Reddi, and H.I. Inyang, 'Geoenvironmental Engineering Principles and Applications', Marcel Dekker, Inc., New York, **2000.**
3. M.D. LaGrega, P.L. Buckingham and J.C. Evans, 'Hazardous Waste Management', McGraw-Hill New York, **2001.**
4. H.D. Sharma and K.R. Reddy, 'Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies', John Wiley & Sons, Inc., USA, **2004.**

COMPUTATIONAL TECHNIQUES

Subject Code – MCIE3-263 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT-I (12 Hrs)

Equations: Rotts of Algebraic, Transcendental equations, Solution of linear simultaneous Equations by different methods using - Elimination, Inversion, Gauss - Jordan methods. Homogeneous Problems and Eigen Value Problems, Nonlinear Equations, Interpolation

UNIT-II (12 Hrs)

Finite Difference Technique: Initial and Boundary Value Problems of Ordinary and Partial differential equations, Solution of Various types of Plates.

UNIT-III (11 Hrs)

New Marks Method: Solution of determinate and indeterminate Structures by using NewMark's Procedure. Statistical Methods: Method of Correlation and Regression Analysis.

UNIT-IV (10 Hrs)

Initial Value Problems: Galerkin's Method of Least Square, Initial Value problem by Collocation points, Runga Kutta Method. Newmark's Implicit and Explicit Solutions for Non Linear Problems and Convergence Criteria.

Recommended Books

1. M.K. Jain, S.R.K. Iyenger, R.K. Jain, 'Numerical Methods, Problems, and Solutions'.
2. G. Dahlquist and A. Bjorck, 'Numerical Methods'.
3. S.A. Tenkolsky, W.T. Vellerling, B.P. Flannery, 'Numerical Recipes in Fortran' W.H. Press.
4. Syal & Gupta, 'Computer Programming & Numerical Analysis'.

RETAINING AND UNDERGROUND STRUCTURES

Subject Code – MCIE3-364 **L T P C** **Duration: 45 Hrs**
3 1 0 4

UNIT – I (12 Hrs)

Sheet Pile Walls: Retaining structure – Selection of soil parameters – Analysis and design of cantilever and anchored sheet pile walls. Deadman and continuous anchor. Diaphragm and bored pile walls – Design requirements.

UNIT – II (12 Hrs)

Supported Excavations: Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos

UNIT – III (11 Hrs)

Design Of Reinforced Earth Retaining Wall: Reinforced earth retaining wall – principles, Concepts and mechanism of reinforced Earth – Design consideration of reinforced earth – Materials used in reinforced earth - Geotextile – Geogrids, Metal strips, facing elements.

UNIT – IV (10 Hrs)

Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis

Recommended Books

1. J.N. Mandal, 'Reinforced Soil and Geo-Textile' Proceedings FIGC- Oxford and IBH Publishing Company Private Ltd., New Delhi, **1988.**
2. J.L. Sherard, R.J. Woodward, S.F. Gizienski, and W.A. Clevenger, 'Earth and Earth –Rock Dams Engineering Problems of Design and Construction', John Wiley and Sons, New York, **1963.**
3. R.F. Craig, 'Soil Mechanics', Chapman and Hall (ELBS).
4. C. Justin and Hinds, 'Engineering for Dams', Vol. 2 & 3.
5. S. Leliavsky, 'Design of Dams for Percolation and Erosion', Chapman and Hall.

CONSTRUCTION PLANNING & SCHEDULING

Subject Code – MCIE-365 **L T P C** **Duration - 45 Hrs**
3 1 0 4

UNIT-I (13 Hrs)

Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control. Planning and decision making Nature of planning, steps in planning, types of planning, levels of planning- planning process, decision making

UNIT-II (11 Hrs)

Pre-tender planning; contract planning; planning and scheduling construction jobs by bar charts, Work-study, work breakdown structure, Planning and scheduling construction jobs by critical path network techniques; allocation of resources. Time estimates, Applications of CPM/PERT, statical concepts, scheduling, monitoring, updating.

UNIT-III (11 Hrs)

Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques, application of digital computers, Material management purchases management and inventory control, Human Resource Management. Resource planning-leveling and allocation.

UNIT-IV (10 Hrs)

Time-cost Optimization: Direct cost, indirect cost, total cost; purpose, stages and methods of cost control techniques of time cost optimization, Man-Material-Machinery-Money optimization. Cost functions, cost control, time-cost trade off.

Recommended Books

1. R.L. Peuripo, 'Construction Planning Equipment and Methods', Tata McGraw Hill.
2. K.K. Chitkara, 'Construction Project Management: Planning Scheduling and Control' Tata McGraw Hill Publishing Company, New Delhi, **1998.**
3. Calin M. Popesc, Chotchal Charoenngam, 'Project Planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications', Wiley New York, **1995.**
4. Chris Hendrickson and Tung Au, 'Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders', Prentice Hall Pittsburgh, **2000.**
5. J. Moder, C. Phillips and E. Davis, 'Project Management with CPM, PERT and Precedence Diagramming', Van Nostrand Reinhold Company, **1983.**
6. E.M. Willis, 'Scheduling Construction Projects', John Wiley & Sons, **1986.**
7. D.W. Halpin, 'Financial and Cost Concepts for Construction Management', John Wiley & Sons, New York.