

# Structural Engineering

## Unit 1

Three dimensional elasticity problems, Torsion of open section, Thermal Stresses, Fracture mechanics. Kirchoff and Mindlin theory of plates, higher order shear deformation theories, classical theories of skew plates, Shell surfaces, bending theory of shells.

## Unit 2

Mechanics of modern materials, laminated composites, functionally graded materials. Application to plate and shell structures. Structural dynamics, Forced and Damped vibration, modal analysis, response spectra, seismic design of multistoried buildings, codal provisions.

## Unit 3

Finite Element Method, 2D and 3D applications in plane and three dimensional elasticity problems. Analysis of plate and shell structures. Applications using proper software. Nonlinear analysis of structural elements. Material and geometric nonlinearity. Applications for beam, plates and shells.

## Unit 4

Multi- variable and Multi-objective optimization. Non linear and non traditional techniques of optimization. Design for reliability, reliability based optimization. Stability Analysis: Beam column, buckling of frames. Lateral buckling of beams, torsional buckling, energy criterion and energy based methods, dynamic stability

### Reference Books:

1. Timoshenko and Goodier - Theory of Elasticity, McGraw-Hill Publications
2. S. Crandall, N. Dahl and T. Lardner - Mechanics of Solids, McGraw Hill Publications
3. Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering, Prentice-Hall Publications
4. R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications
5. R.C. Roy - Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications
6. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Graw Hill.
7. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill

8. Chandrashekhara K., Analysis of Plates, New Age International Edition
9. J.N. Reddy – An Introduction to the finite element method – Tata McGraw Hill Publishing Co. Ltd
10. C.S. Krishnamoorthy – Finite Element Analysis – Theory & Programming - Tata McGraw Hill Publishing Co. Ltd
11. Zienkiewicz & Taylor - The Finite Element Method 4th Edition – Vol – I & II – McGraw Hill International Edition
12. Robert D. Cook, D.S. Malkus, M.E. Plesha – Concepts & Applications of Finite Element Analysis – John Wiley & Sons.
13. Timoshenko S.P. and Gere J.M., Theory of Elastic Stability, Mc Graw Hill,
14. Ashwini Kumar, Stability of Structures , Allied Publishers Ltd
15. R. Ranganathan, Reliability Analysis and Design of Structures, Mc Graw Hill.
16. M.Sathyamoorthy, ‘Nonlinear Analysis of Structures’, CRC Press, New York
17. S.S.Rao, ‘Engineering Optimisation- Theory and Practice’, New Age International.
18. U. Kirsch, ‘Optimum structural design’, McGraw –Hill, New York

# HYDRAULIC ENGINEERING

## Unit 5

Water resources systems analysis, design and management for water supply, irrigation, drainage, hydropower, food control, droughts. Surface and ground water hydrology, stochastic hydrology, physical and numerical modeling, use of finite difference, finite element and boundary element methods.

## Unit 6

Instrumentation and monitoring of hydraulic systems, computer simulation and optimization of hydrosystems. Computational fluid dynamics, coastal hydrodynamics, watershed management, application of numerical methods.

## Unit 7

Ground water systems planning and management, ground water pollution investigation. Hydroinformatics, multi criterion decision support system, applications of ANN and GA.

## Unit 8

Hydraulics of spillways and energy dissipators, pressure fluctuations in hydraulic jump, static and dynamic uplift pressures in stilling basins. Remote sensing and GIS applications, Dam break analysis using softwares.

### Reference Books:

1. Principles of water resources planning and management – Goodman
2. Applied hydrology – Linsley Kolhar and Paulhas (McGraw Hill)
3. Computational fluid dynamics – Anderson
4. Neural network fundamentals with graphs, algorithms, applications – Bose N.K. and Liang P (McGraw Hill)
5. Practical handbook of GA applications, Vol I – L. Chambers (CRC Press)
6. Hydraulics of spillways and energy dissipators – R. M. Khatsuria (Marcel Dekker Publisher, New York)
7. Energy dissipators and hydraulic jump – W. H. Hager (Kluwer academic publishers, Netherland)
8. Hydrodynamics of coastal zones – Massel S.R.

9. Ground water systems planning management – Robert Willis Hager, W.H. (1992). “Energy dissipators and hydraulic jump”. Kluwer academic publishers, Netherland.
10. Hager, W.H., Bremen, R. (1989). “Classical hydraulic jump : post jump depths”. *J. Hydr. Res.*, 27(5), 565-581.
11. Jeppson, R.W. (1970). “Graphical solution to hydraulic jump”. *J. Hydr. Engg., ASCE*, 96(1), 103-108.
12. Khatsuria R. M. (2005). “Chapter 20- Hydraulic jump stilling basins”. *Hydraulics of spillways and energy dissipators*. Marcel Dekker Publisher, New York.
13. Fox and McDonald, “ Introduction to fluid Mechanics”, John Wiley
14. R. H. F. Rao, “ Fluid Dynamics”, Charles E Morn’ll Books Inc. 1967
15. I. H. Shames, “Mechanics of Fluids”, McGraw Hill, 1962
16. Y. L. Steeter, “Fluid Dynamics”, McGraw Hill, 1948
17. Vallentine - Hydrodynamics
18. S. W. Yuan – Fluid Mechancis.

# GEOTECHNICAL ENGINEERING

## Unit 9

### **Advanced Geotechnical Engineering**

Stress distribution under earth embankments and evaluation of settlement profile. Field problems to monitor movement of slopes, foundations, etc.

### **Advanced Foundation Engineering**

Foundations in difficult soils: expansive soils, chemically aggressive environment, soft soils, fill, regions of subsidence.

## Unit 10

### **Rockmechanics and Tunelling**

Deformation characteristics of rocks and its measurement. Instrumentation, Underground excavation and subsidence. Bearing capacity of homogeneous as well as discontinuous rocks.

### **Soil Dynamics and Geotechnical Earthquake Engineering**

Soil behaviour under dynamic loads. Seismic response, strong ground motion, its parameters and their estimation, seismic hazard analysis, local site effects and design ground motion, seismic slope stability

## Unit 11

### **Finite Element Methods in Geotechnical Engineering**

Stress deformation analysis: One-, Two, Three-dimensional formulations; Discretization; Analysis of foundations, dams, underground structures and earth retaining structures.

### **Geoenvironmental Engineering**

Landfills, in ash ponds and tailing ponds, and in rocks. Detection, control and remediation of subsurface contamination; Engineering properties and geotechnical reuse of waste.

## Unit 12

### **Soil Structure Interaction**

Elastic and plastic analysis of stress distribution on yielding bases. Analysis of conduits. Interaction analysis of piles and pile groups. Elastic continuum and elastoplastic analysis of piles, Non-linear load-deflection response.

### **Geotechnics for Infrastructure**

Exploration studies for different Infrastructure Projects, Investigation reports, Analysis and required measures

**Reference Books:**

- Aki K and Richards P G (2002), Quantitative Seismology, University Science Books
- Bowles J E (1996), Foundation Analysis and Design, McGraw Hill.
- Das B M (1997), Advanced Soil Mechanics, Taylor and Francis.
- Das B M (1993), Principles of Soil Dynamics, Brooks/Cole
- Coduto D P (2001), Foundation Design: Principles and Practices, Prentice -Hall
- Kaniraj S R (1988), Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill
- Poulos H G and Davis E H (1980), Pile Foundation Analysis and Design, John Wiley and Sons
- Koerner R M (1997), Designing with Geosynthetics, Prentice Hall
- Karl Terzaghi (1954), Theoretical Soil Mechanics, Chapman and Hall,.
- Rock Mechanics in Engineering Practice: Stag and Zienkiewez, John Willey & Sons
- J.C. Jagger and N.G.W. Cook(1971), Fundamentals of Rock Mechanics, Methuen and Co., London.
- Sarsby R (2000), Environmental Geotechnics, Thomas Telford
- Hsai-Yang Fang, Introduction to Environmental Geotechnology, CRC Press.
- Kramer S L (1996), Geotechnical Earthquake Engineering, Prentice Hall
- Prakash Shamsheer and Puri V K (1988), Foundations for Machines; Analysis and Design, John Wiley and Sons
- Wolf J P (1985), Dynamic Soil-Structure Interaction, Prentice-Hall

# **Environmental Engineering**

## **Unit 13**

### **Water Treatment**

Water Quality: Requirement, Standards, Stream & Effluent standards. Water quality indices. Water purification, physical, chemical processes. Unit operations, unit processes. Aeration, Sedimentation, Coagulation & flocculation, Filtration: Adsorption, adsorption, Ion Exchange Membrane Processes, RO, Ultrafiltration, Electrolysis, Disinfection

### **Wastewater Treatment**

Waste waters-Sources, nature, characteristics, Analysis:- BOD progression & its formulations, Fundamentals of Process Kinetics, Zero order, First order, Second order Reactions, Different Reactors based on type of flow, Design of W/W treatment systems- Primary, secondary and tertiary; ASP, Nitrification-denitrification, Ponds and aerated Lagoons, Attached Growth Biological Treatment Systems: TF, RBC, Activated Biofilters etc., Expanded /fluidized bed reactors, USAB, Expanded granular bed reactors,. Sludge Digestion: anaerobic and aerobic, Waste water reclamation and reuse, Effluent disposal.

## **Unit 14**

### **Air Quality Monitoring and Control Techniques**

Air pollutants: Sources, classification, Combustion Processes, pollutant emission, Effects on Health, vegetation, materials, atmosphere, Reactions of pollutants Scales of AP studies, effects as per scales, Air sampling, pollution measurement methods, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, Removal of gaseous pollutants. Particulate emission control; bioscrubers, biofilters, Indoor air quality

### **Models for Water and Air Quality**

Introduction to Mathematical Models: Modelling approaches to water quality - classification and considerations in selecting models, Model requirements and limitations. D.O. Models for Streams: DO model for streams, Streeter - Phelps model - oxygen 'sag' curve, Benthic oxygen demand, Study of Mathematical Models, Models for Estuary and Lakes, Air quality models : Gaussian dispersion model, Regional air quality models

## **Unit 15**

### **Environmental Management and Impact Assessment**

Environmental management, problems and strategies; Future strategies; multidisciplinary environmental strategies, Environmental impact assessment (EIA), Sustainable development (SD), initial environmental examination (IEE), environmental impact statement (EIS), environmental appraisal, environmental audit (EA); Environmental impact factors and areas of consideration, measurement of environmental impact,

SWM: Waste Management -Sources, Classifications, Characteristics, Generations, Onsite Handling and Storage, Collection, Transfer Recycling and Disposal Techniques of

Municipal Solid Waste (MSW), Economic Evaluation of the Systems. Hospital Waste Management.

## Unit 16

Remote Sensing, GIS and GPS Techniques and their applications in Environmental Studies. Softwares in Environmental Engineering. Pollutant Transport Mechanisms and Modelling, Hazardous Waste Management, Waste Minimisation Techniques, Environmental Risk Management

### Reference Books:

1. Manual on water supply and Treatment ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999.
2. Manual on Sewerage and Sewage Development ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1993.
3. B.A. Hauser, " Practical Hydraulics Hand Book ", Lewis Publishers, New York, 1991.
4. M.J. Hammer, " Water and Wastewater Technology ", Regents/Prentice Hall, New Jersey, 1991.
5. Wastewater Treatment and Reuse: Metcalf and Eddy.
6. Air Pollution: Stern
7. Wastewater Treatment for Pollution Control; Arceivala and DR. Asolekar
8. Industrial Wastewater Treatment: Nelson – Numero
9. Industrial Wastewater Treatment: Dr. A. D. Patwardhan
10. Kiely, G., Environmental Engineering. McGraw Hill, 1996. ISBN: 007091272
11. Wanielist, M., Kersten, R., and R. Eaglin.. Hydrology: Water Quantity and Quality Control. Wiley Interscience, 1996. ISBN: 0471072591
12. Zipparro, V.J., Davis' Handbook of Applied Hydraulics Fourth Edition. McGraw Hill, 1993. ISBN: 0070730024
13. Franzini, J., Freyberg, D., Linsley, R., and G. Tchobanoglous, Water Resources Engineering. McGraw Hill, 1991. ISBN: 0070380104
14. Reed, S.C. and Crites, R.W., Natural Systems for Waste Management and Treatment. McGraw Hill, 1996. ISBN: 0071346627
15. Eckenfelder, W.W. (Jr.), Industrial Water Pollution Control, (2nd Ed). McGraw-Hill, 1989. ISBN: 007018903X.
16. Guyer, H.H., Industrial Processes and Waste Stream Management. Wiley Interscience, 1998. ISBN: 0471299847.
17. Bishop, P., Pollution Prevention: Fundamentals and Practice. McGraw Hill, 2000. ISBN: 0073661473
18. American Water Works Association, Water Treatment Plant Design, (3rd Ed.). McGraw-Hill, 1997. ISBN: 0070016437.
19. American Water Works Association, Water Quality and Treatment: A Handbook of Community Water Supplies. McGraw Hill, 1998. ISBN: 0070015406
20. Kawamura, S., Integrated Design and Operation of Water Treatment Facilities. Wiley and Sons, 2000. ISBN: 0471350931
21. Nyer, E.K., Groundwater Treatment Technology, (2nd Ed.). Wiley Interscience, 1992. ISBN: 0471284149.



# CONSTRUCTION MANAGEMENT

## Unit 17

### **Essentials of Construction Management-**

CPM ,PERT networks, Cost / Resource based networks, scheduling, monitoring and updating, resource planning and allocation, LOB, network crashing, time cost trade off..

### **Computer Application in Construction Management-**

Softwares for .Precedence network analysis, CPM, ,PERT, GERT, decision tree analysis,

## Unit 18

### **Financial Aspects of Construction Projects**

Means of Finance, Working Capital Requirements, Project Cash Flow Projections and Statements, Project Balance Sheet, Profit Loss Account Statements, Concept of Debt Equity Ratio, Tax – Need and types

### **Risk Management**

Introduction, Principles, types, origin, risk control, Use of mathematical models: Sensitivity Analysis, Break Even Analysis, Simulation Analysis, Decision Tree Analysis, Risk identification, analysis and mitigation of project risks, Role of Insurance in Risk Management.

## Unit 19

### **Construction Techniques**

Introduction to construction operations, erection work, automation processes and specialEquipments for Infrastrucure Projects- Dams, bridges, ports, harbours,flyovers  
Recent trends in construction techniques

### **Material Management:**

Material planning, accounting and material reconciliation. Systems of material classification. Deterministic and probabilistic models and applications, ABC analysis, replenishment and replacement policies, VED analysis, lead time demand, purchase planning, EOQ model. Wastage audit at site, Site waste material management plan.  
Computer applications based upon available softwares

## Unit 20

### **Equipment management :**

New trends and construction equipment of future.Planning and selection of equipments, for earthmoving, hauling, hoisting, conveying, pneumatic, pumping, aggregate production, concrete production, pile driving, tunnelingand road construction applications.

Equipment procurement, purchase, import of equipment, procedural formalities for Import

### **8. Operations Research in Construction-**

Decision Theory, Game Theory, Linear Programming, Non linear programming  
**Reference Books-**

1. Construction Engineering and Management by. S. Seetharaman, Umesh Publications, New Delhi
2. Total Project Managemtn- the Indian Context by P. K. Joy Macmillan India Ltd.
3. Financial Managemnt by Prasanna Chandra, Tata Mc Graw Hill Publicaitons
4. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi
5. Materials Management – Gopalkrishnan and Sunderasan, Prentice Hall Publications
6. Construction Planning, Methods & Equipment: Puerifoy – Tata McGraw Hill
7. Operations Research- Hamdy A. Taha
8. Engineering Optimisation- S. S. Rao

## TOWN & COUNTRY PLANNING

### Unit 21

**Historic Development & Planning Theory**-Origin ,evolution and contemporary developments in planning.,Formation of metropolitan areas &impacts of Industrial Revolution,Socio-economic & technological,impacts of growth of population; rural-urban migration,Characteristics of the urban environment: Land uses, physical structure ,The interim and comprehensive plans: Structure Plan, Master Plan, Zonal Development Plan - their purpose and contents,Surveys, analyses and design methods and practices in comprehensive planning,Residential Areas : Neighborhood and Sector Planning, Planning of New Towns in India and abroad.

**Spatial & Environmental Aspects of Planning**-Environmental degradation and its impact,environmental impact assessments ,principles of environmental approach to planning. Indicators of sustainability in planning & development of settlement,Environmental design w.r.t natural resource management. Environmental impacts of traffic; energy issues in transportation; transportation safety.Spatio-environmental Planning principles and techniques.

### Unit 22

**Transportation & Utility Services**-Transportation systems;Land use-transportation inter-relationships; transportation planning process;Traffic management.,Recent innovations in technologies and its probable impacts,Transport policies and evaluation of transportation proposals,Water supply systems,Waste water disposal systems&Solid wastes collection and disposal,Reuse and recycle Techniques,Planning for urban electrical distribution system and communication systems,Economic feasibility tests.

**Planning Administration & Professional Practices**-Planning legislation ,Constitutional basis and provisions relating to land, Evolution of planning laws,Land Acquisition Act of India, MRTP Act 1966,UDPFI Guidelines (implications of 73rd and 74th amendment of the constitution),EPA, Conservation of natural resources, Conservation and Management of Ancient Monuments and Archaeological sites and ruins., Land Development Control,Urban Arts Commission Act, Transportation, Landscape, Housing and slum clearance legislation. ,Role in interdisciplinary groups

### Unit 23

**Social formation & Housing**.Housing problems: Urbanization and Industrialization,Slums and squatters settlements - problems and possibilities,Residential layouts, housing densities, neighborhood unit, community facilities,Social aspects : built environment and human behavior, Evaluation of user's satisfaction,Finance for housing: priority in the national plans - role of public and private agencies, role of cooperatives

and various institutions, Cost reduction techniques in housing, Housing norms and standards.

**Rural & Urban Planning** Decentralized planning: conceptual framework; Dimensions of District and Block planning : their spatial disparities and sectoral variations; identification of spatial units under decentralized planning, Infrastructure planning with application of forecasting techniques, Resource mobilization and credit planning; organizational aspects; participatory planning approach; training needs and plan execution, Rural development schemes and programs, Plan financing, monitoring and evaluation of rural development schemes , Urban design: Design Survey, Modern Techniques, Issues in urban design; Principles of urban spatial organization; Conservation with historic preservation. Case studies from India and abroad., Urban renewal: Designing Central Business District (CBD) and Business Improvement District (BID) , Growth and trends of metropolitan development, Components of a metropolitan plan , Multi-nuclei developments: hierarchy of urban centers and their functional linkages, Metropolitan region and problems, Case studies of metropolitan planning in India and abroad.

## Unit 24

**Remote Sensing and GIS in Planning & Disaster management**-Aerial photography, Application of aerial photography in town planning studies, Satellite remote sensing. , Application of remote sensing in regional studies, G.I.S applications in planning and its role in remote sensing , Disaster, Prevention, Preparedness (Warning), Relief

**Quantitative Method in Planning** -Survey, analysis and projections in City Planning; Ranking and Scaling; Applications of Probabilistic Modeling in City Planning; Applications of Queueing Theory in City Planning; Applications of Network Models in City Planning; Simulation in the Urban Context. Implementation Problems.

### Reference Books :

1. K.S.Rangwala and P.S.Rangwala,. “Town Planning ”, Charotar Publishing House, 15th Edition, 1999.
2. Michael Hord, R. Remote sensing methods and application, John Wiley and Sons, New York, 1986.
3. National Building Code of India- Part-III.
4. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws.
5. KA. Ramegowda, Urban and regional planning , University of Mysore
6. M/s DVan, The urban pattern, city planning and design.
7. Time saver standards for site planning, Mc Graw Hill Book company
8. John Rate life, An Introduction to town and country planning, London
9. The art of home landscaping – Mc Graw Hill Book company
10. Harvey M. Rubenstein , A Guide to site and Environmental planning, Newyork
11. The Small Town Planning Handbook by: [Thomas L. Daniels](#), [John W. Keller](#), [Mark B. Lapping](#).

# **TRANSPORTATION ENGINEERING**

## **Unit 25**

Regional analysis and development concepts, the role of transportation planning in the overall regional system, Methodology and models for regional transportation system, Planning and implementation framework. Introduction, Basic for traffic engineering, Planning and design of facilities, Travel forecasting principles and techniques, Design Hourly volumes and speed, Highway capacity and performance characteristics, Parking, simulation in Traffic engineering design.

## **Unit 26**

Theory of uninterrupted and interrupted traffic flow, Traffic Planning Process, Demand Analysis, Transportation Economics, capacity & Delay analysis, The planning process, Sequential demand analysis Models of trip generation, distribution, traffic assignment, and modal split. Introduction to transportation systems, transportation innovations, social and economic impacts of transportation; Decision makers and their options, demand modeling and predictions; Modelling transportation technologies;

## **Unit 27**

Analysis of network flows; Transportation network; Network theory, wardrops external principle of traffic assignments, evaluation of impacts; Basic physics of transportation; Concepts in transportation models and location models. Materials for road construction; Specifications and tests; Macadam construction, surfacing and surface treatment; Asphalt mix design pavement structure Sub grade evaluation; , Construction and maintenance of concrete pavement, Construction of interlocking block pavements, Quality control tests; Construction of various types of joints. Types of pavement structures, Factors affecting design and performance of pavements, Estimation of layer thicknesses, Pavement drainage, Stresses and strains in flexible pavement, 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.

## **Unit 28**

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. Highway alignment

study, controls for selection of Alignment, Engineering Surveys, Geometric design of highways: cross-sectional elements, horizontal and vertical alignments, Geometric Design of Intersections – rotaries, Safety; Characteristics and design considerations for freeways/expressways; At-grade intersections - types, design considerations; Grade separations and interchanges - structures, interchange types and general design considerations.

***Reference Books:***

1. D. Salvo Perspectives in Regional Transportation Planning, Laxington Books, USA, 1974.
2. Mishra ,Sundaram and Prakash Rao, Regional Development Planning in India, Vikas Publishing House Pvt. Ltd., 1974.
3. G.J. Pingnataro, Principles of Traffic Engineering, Mc Graw-Hill, 1970.
4. Wohl and Martin, Traffic System Analysis for Engineering and Planners, Mc Graw Hill, 1983.
5. Ronald D. Drew, Traffic Flow Theory, Mc Graw Hill, 1964.
6. Manheim, Analysis of Transportation Systems, MIT, USA, 1980.
7. R.G. Weilson, Entropy in Urban and Regional Transportation, McGraw-Hill, 1980.
8. Miller and Mayor, Decision Analysis and Decision Making Oriented Urban Transportation, McGraw-Hill, 1984.
9. Hails, J.R. Ed., Applied Geomorphology and Engineering, Downden, Hutchinson and Ross, Stroudsburg, 1976.
10. Coats, D.R. Ed., Environmental Geomorphology and Landscape Conservation, Vols. II and III Downen, Hutchinson and Ross, Stroudsburg, 1973.
11. Yoder and Witzech, Pavement Design, McGraw-Hill, 1982.
12. Sharma and Sharma, Principles and Practice of Highway Engg., Asia Publishing House, 1980.
13. Teng, Functional Designing of Pavements, Mc Graw - Hill, 1980.
14. Asce Journal papers.

