

B.TECH.-IV (CIVIL) (With Effect from August 2009)**SEVENTH SEMESTER**

Sr. No.	Course	Course Code	Teaching Scheme Hours per Week			Credits	Examination Scheme				
			L	TU	PR		Theory	TU	TW	Pract	Total
							Marks	Marks	Marks	Marks	Marks
1	Highway Engineering	CE401	3	-	2	4	100	-	20	30	150
2	Municipal Wastewater Engineering	CE403	3	-	2	4	100	-	20	30	150
3	Town Planning	CE405	3	-	0	3	100	-	-	-	100
4	Design of Concrete Structures	AM407	3	1	2	5	100	25	20	30	175
5	ES I *	-	3	-	-	3	100	-	-	-	100
6	Seminar	CE409	-	-	2	1	-	-	20	30 ⁺	50
7	Project Preliminaries	CE411	-	-	4	2	-	-	40	60	100
Total contact hours per week = 28			Total Credit = 22			Total Marks = 825					

* Students have to opt one subject from group of Elective Subject I.

EIGHTH SEMESTER

Sr. No.	Course	Course Code	Teaching Scheme Hours per Week			Credits	Examination Scheme				
			L	TU	PR		Theory	TU	TW	Pract	Total
							Marks	Marks	Marks	Marks	Marks
1	Water Resources Engineering-II	CE402	3	-	2	4	100	-	20	30	150
2	Professional Practices	CE404	3	1	-	4	100	25	-	-	125
3	Heavy Construction & Project Management	CE406	3	1	-	4	100	25	-	-	125
4	Concrete Technology	AM408	2	-	2	4	100	-	20	30	150
5	ES II *	-	3	-	-	3	100	-	-	-	100
6	Project (CED/AMD)	CE 412	-	-	8	4	-	-	80	120	200
Total contact hours per week = 28			Total Credit = 23			Total Marks = 850					

* Students have to opt one subject from group of Elective Subject II.

- **HIGHWAY PLANNING AND ADMINISTRATION** (03 HOURS)
History of road development, Road planning in India, Highway administration, Highway project preparation, surveys and investigations, project estimates.
- **HIGHWAY GEOMETRICS** (06 HOURS)
Design controls & criteria, Cross sectional elements, Sight distance considerations, Design of horizontal and vertical alignment
- **HIGHWAY MATERIAL AND CONSTRUCTION** (10 HOURS)
Sub grade soil investigation and properties, Desirable properties of aggregates and bitumen, Testing of aggregates, binders and mixes, IRC specifications for materials, Construction of low-cost roads, WBM, WMM, Types of bituminous surfaces and C.C. roads, IRC specification for construction, Tools, Equipments and Plants, Highways in hilly region, waterlogged areas and other area specific issues.
- **PAVEMENT DESIGN** (09 HOURS)
Types of pavements, Design factors and analysis, Design of flexible and rigid pavements, various design methods, IRC code of practice.
- **HIGHWAY MAINTENANCE** (05 HOURS)
Pavement evaluation, Surface and sub-surface drainage, Maintenance of bituminous and concrete roads, Concepts of overlay design, Pavement Management System.
- **TRAFFIC ENGINEERING** (12 HOURS)
Basic parameters, Traffic studies, Different traffic control devices, Signs, markings, signals, Traffic management and regulation, Concepts of at-grade & grade separated intersections, highway capacity, level of service.

PRACTICALS:
(A) Test on subgrade soil and road aggregates

1. Determination of C.B.R. value of Subgrade Base Course
2. Determination of Abrasion & Attrition Value
3. Determination of Impact & Crushing value
4. Determination of Flakiness & Elongation Indices

(B) Tests on bituminous binder

5. Determination of ductility
6. Determination of softening point
7. Determination of penetration value
8. Determination of viscosity

(C) Traffic studies

9. Mixed Traffic Volume Study.
10. Speed studies of fast and slow vehicles.
11. Driver Test – I
12. Driver Test – II

BOOKS RECOMMENDED:

1. Kadiyali L. R., "Principles and Practice of Highway Engineering", Khanna Technical Publications, Delhi. 2005
 2. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee 1987
 3. Yoder C.J., Witizak M.W., "Principles of pavement design", John Willey & Sons, 1978
 4. Matson, Smith, Hurd, "Traffic Engineering", Mc Graw Hill Book Co., 2002
- Pignataro L.J., "Traffic Engineering-Theory & Practice", John Willey & Sons, 1985

B.TECH. IV (CIVIL) SEMESTER - VII**L T P C****CE 403: MUNICIPAL WASTEWATER ENGINEERING****3 0 2 4**

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- **WASTEWATER GENERATION, COLLECTION AND CONVEYANCE (10 Hours)**
Wastewater Quantity - Classification of wastewater - Sewerage system for domestic wastewater and storm water - Collections, and appurtenances - Design and layout of sewerage systems - Maintenance of sewerage systems - Physical, Chemical & Biological characteristics and their significance.
 - **PRIMARY TREATMENT OF WASTEWATER (10 Hours)**
Objectives of Wastewater treatment- Treatment methods: Unit Operations and Processes Design criteria - Design of primary treatment System
 - **SECONDARY TREATMENT OF WASTEWATER: (12 Hours)**
Concepts of Biological treatment and removal mechanism – Aerobic and Anaerobic systems - Design of suspended and attached growth processes – Introduction to extended aeration processes and waste stabilization pond - Design of anaerobic system.
 - **SLUDGE HANDLING (05 Hours)**
Quantity and quality of sludge, Methods of sludge treatment: sludge digestion and drying beds – Disposal of sludges.
 - **WASTEWATER DISPOSAL (05 Hours)**
Alternative disposal methods - Self purification of stream - Standards for disposal alternatives, natural purification of polluted streams.
 - **HOUSE DRAINAGE & ENVIRONMENTAL SANITATION : (03 Hours)**
General principles - House drainage system - traps and sanitary fitting - Low cost sanitation system

(Total Contacts hours:45 Hours)

PRACTICALS:

1. Determination of solids.
2. Determination of pH.
3. Measurement of colour.
4. Determination of carbonate, bi-carbonate and hydroxide alkalinity.
5. Determination of oil and grease.
6. Determination of phosphorus as PO_4^{-3} .
7. Determination of sulphate.
8. Determination of Biochemical Oxygen Demand of wastewater.
9. Determination of Chemical Oxygen Demand of a given sample.

BOOKS RECOMMENDED:

1. Metcalf and Eddy, "Wastewater Engineering": Treatment, Disposal Reuse", Tata McGraw Hill Ed. New Delhi, 1995.
2. G.L. Karia and R.A. Christian, "Wastewater Treatment Concepts & Design Approach", Prentice-Hall of India Pvt. Ltd., New Delhi, 2006.
3. Manual on Sewerage and Sewage Treatment, CPH and EE Organisation, Ministry of works and housing Govt. of India, New Delhi, 1991.
4. McGhee, T. J., "Water Supply & Sewerage", McGraw Hill International Edition, New Delhi, 1991.
5. H. S. Peavy, D. R. Row and G. Tchobanoglous, "Environmental Engineering", McGraw Hill International Edition, New Delhi, 1995.

B. Tech. IV (Civil) Semester – VII**L T P C****CE 405 TOWN PLANNING****3 0 0 3**

- **TOWN PLANNING CONCEPT, EVOLUTION & DEVELOPMENT:** (06 Hours)
Significance of town planning, Planning in Ancient, Medieval, Modern Periods, Contribution of noted urban planners, Planning legislation and administration, National Planning Institutions.
- **URBAN SETTLEMENT CLASSIFICATION & STRUCTURE:** (06 Hours)
India's Urbanization, Growth theories, urban form, Activity system, Land use and density structure, Town classification, Multinuclei urban development.
- **URBAN SURVEYS & APPLICATIONS:** (05 Hours)
Significance of surveys, Types, Planning parameters, Analysis and Applications.
- **URBAN PLANNING & DESIGN:** (05 Hours)
Objectives & principals, Conventional and system approach in planning, Land use planning, Neighborhood planning, Development plan and control regulations, T.P. Scheme norms & methodology, New towns, Metro regions, Issues & concept of urban design, Zonal planning.
- **ENVIRONMENTAL PLANNING:** (06 Hours)
Concept, Issues of developing nations, Industrial & transportation Planning, Infrastructure, Water, Drainage, Storm Water Planning, waste disposal site selection criteria.
- **URBAN CENTER & RENEWAL:** (06 Hours)
CBD components, Town centers, National urban renewal missions & Programme, Industries types, Sites for industries.
- **INDUSTRIES:** (04 Hours)
Types, location, environmental consideration.
- **HOUSING:** (07 Hours)
Planning of residential area in T.P. Scheme, byelaws, density, Building forms, Neighborhood housing, Issues of MIG, EWS & slum housing, Low cost housing

BOOKS RECOMMENDED:

1. Modak N.V. and V.N. Ambdekar, "Town and Country Planning and Housing", Orient Longman Ltd., New Delhi. (1995)
2. Hiraskar G.K. "Fundamentals of Town Planning", Dhanpat Rai & Sons, Delhi (1993).
3. Gallion A.B. and Simon Eisner, "The Urban Pattern", CBS Publishers, Delhi (1984).
4. Govt. of Gujarat, "Gujarat Town Planning Act", (1976) (Amendment-1999)
5. Reading Materials-Institute of Town Planners, India, New Delhi. Vol I to XI (2005)

- **INTRODUCTION** (Hours – 07)
Loads – Methods of Design – Reinforcement Detailing & Bending
- **BEAMS** (Hours – 06)
Singly and doubly reinforced beams – Flanged beams (Tee & Ell beams) – Shear criteria – Development length and torsion – Design of simply supported and continuous beams
- **SLABS** (Hours – 06)
Design of one way and two way slabs
- **COLUMNS** (Hours – 06)
Design of axially loaded short and long columns
- **FOOTINGS** (Hours – 05)
Design of isolated sloped footings
- **STAIRCASE** (Hours – 06)
Design of simple stair case - Dog legged stair case
- **INTRODUCTION TO EARTHQUAKE RESISTANT DESIGN** (Hours – 06)
Introduction to CAD & application of software to above mentioned topic
- **RELEVANT IS CODE**
All the design will be as per the relevant IS code ,Seismic coefficient method,(IS:456, IS:875, IS:1893, IS:13920)SP :22,SP34.

PRACTICALS:

1. Design of rectangular, T, L beam of Singly / Doubly Reinforced types.
2. Design of one way simply supported slab.
3. Design of two way simply supported slab.
4. Design of one way continuous slab.
5. Design of two way continuous slab for different boundary conditions.
6. Design of footing
7. Design of Stair case
8. Application of different softwares.

BOOKS RECOMMENDED:

1. Pillai SU, and Menon D, "Reinforced Concrete Design", 2nd edition, Tata Mc Graw Hill Publication Ltd, New Delhi. 2006
2. Sinha S. N. "Reinforced Concrete Design", 2nd edition, Tata & Graw Hill Publishing Co., Ltd, New Delhi, 2006.
3. Shah H J, "Reinforced Concrete", Vol-I 6th Edition, Charotar Publishing House, Anand (2007)
4. Park R and Paulay T, "Reinforced Concrete Structures", John Wiley & Sons, New Delhi, 2005.
5. Jain A K, "Reinforced Concrete – Limit State Design" Nem Chand & Bros, Roorkee (2005).

LIST OF ELECTIVE SUBJECTS
B.E. – IV (CIVIL) SEVENTH SEMESTER
ELECTIVE GROUP – I

Sr. No.	Code	Subject
1	CE413	Urban Transportation Planning
2	CE415	Rural Planning & Development
3	CE417	Water & Waste Water Treatment
4	CE419	Computational Fluid Dynamics
5	CE423	GPS and Applications
6	CE425	Computer Aided Design In Civil Engineering
7	CE 427	Alluvial River Hydraulics
8	AM429	Design of Industrial Structures
9	AM431	Design of Advanced Concrete Structures
10	AM433	Design of Precast & Prestressed Structures
11	AM435	Design of Tall Structures
12	AM437	Ground Engineering
13	AM439	Planning and Design of Earthen Dams

• INTRODUCTION**(04 HOURS)**

Urban transportation in India, need for planning, land use and traffic & their interrelation, transportation planning process, systems approach.

• TRANSPORTATION SURVEYS**(06 HOURS)**

Study area, zoning, inventory, classificational studies, cordon surveys, screen line surveys, O – D surveys, traffic impact studies, survey methods, sampling.

• DEMAND FORECASTING**(15 HOURS)**

Trip generation factors, trip generation models, rates, trip distribution and models, Assignment techniques, modal split, mode choice modeling, land use transport interaction models, Lowry and other models.

• PUBLIC TRANSPORTATION PLANNING**(10 HOURS)**

Classification of public transportation system, Rapid transit, Para-transit, City bus services, transport demand, planning & scheduling bus route network, public transportation in India issues.

• EVALUATION OF TRANSPORTATION PLANS**(10 HOURS)**

Transport economics fundamentals, Economic evaluation, Environmental Impact Assessment, HDM-IV

BOOKS RECOMMENDED:

1. Kadiyali L. R., "Traffic Engineering and Transportation Planning", Khanna Publishers, Delhi. 2002.
2. Das Animesh, Chakraborty Parth, "Introduction to Transportation Engineering", Prentice Hall Of India Pvt. Ltd., New Delhi, 2003
3. Papacostas C. S. , " Fundamentals of transportation engineering ", Prentice Hall Of India Pvt. Ltd., New Delhi, 2002
4. Hutchinson B.G., "Principles of Urban Transportation Systems Planning", Mc Graw Hill Publishers, 1974
Khisty C.J., Lall B.K., "Transportation Engineering – An Introduction", Prentice Hall, NJ, 2005

B. Tech IV (CIVIL)	SEMESTER-VII	L	T	P	C
CE 415 RURAL PLANNING AND DEVELOPMENT (ES-I)		3	0	0	3

- RURAL PLANNING :** **(08 Hours)**
 India's rural scenario- Planning issues, Urban Rural Differentiation- socio-economic structure - nature and scope, water supply and drainage planning, issues of tribal rural area
- PLANNING APPROACH:** **(13 Hours)**
 Classifications based on use and geography, topography and demography, agricultural and rural resources, ecological planning, integrated approach in planning and development, water supply and drainage planning
- REQUIREMENTS OF RURAL AREAS :** **(08 Hours)**
 Economic aspects, social aspects, educational factors affecting rural set up- rural development resources, development approach , India's rural development policy and Programme co-ordination, cultural issues in planning
- DEVELOPMENT OF INFRASTRUCTURE :** **(08 Hours)**
 Rural Industrialization, low cost rural technology, rural infrastructural facilities, village-plan amenities, rural waste disposal techniques, Alternative sources of energy environmental issues
- RURAL HOUSING :** **(08 Hours)**
 Housing materials, Application and durability, rural building forms, rural building plans, rural Building services

BOOKS RECOMMENDED:

1. Rakesh Upadhyaya, "Integrated Rural Development in India", Himalaya Publishers House. (1989).
2. Khatkar R.K., "Rural Development", Northern Book Centre, New Delhi (1989).
3. Venkata Reddy, "Rural Development in India", Himalaya Publishers House. (1996)
4. Arora R.C., "Integrated Rural Development", S, Chand & Co. Ltd., New Delhi. (1994)

B. E. IV (CIVIL) SEMESTER – VII**L T P C****CE 417 : WATER AND WASTE WATER TREATMENT (ES-I)****3 0 0 3**

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- **INTRODUCTION (06 Hours)**
Objectives of water and waste-water treatment - classification of treatments, parameters commonly employed to indicate pollution strength – standards for water quality and wastewater disposal – Self purification of water bodies – Simple Mathematical models.
 - **WATER TREATMENT PROCESSES (12 Hours)**
Theory and design of Sedimentation, Coagulation, Clariflocculator, Filtration, Disinfection and Aeration
 - **WASTEWATER TREATMENT PROCESSES (12 Hours)**
Introduction to process selection and analysis - Measurement of wastewater flow - Variation in wastewater flow – Equalisation – Neutralization - Secondary treatment units and their design concepts - Wastewater disinfection.
 - **NATURAL WASTEWATER TREATMENT SYSTEMS (04 Hours)**
Aquatic Plant Systems, Constructed Wetlands and Vermi-culture
 - **ADVANCED WATER TREATMENT PROCESSES (05 Hours)**
Ion-exchange, reverse osmosis, adsorption, ultra-filtration, electro-dialysis. Desalination
 - **RECLAMATION AND REUSE OF WASTEWATER (06 Hours)**
Tertiary treatment for removal of residual organics, removal of nutrients, recycling and reuse of wastewater.
(Total Contact Time: 45 Hours)
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BOOKS RECOMMENDED:

1. Metcalf and Eddy, "Wastewater Engineering Treatment, Disposal, Refuse, T.M.H. Edition, New Delhi, 1995.
2. Manual on Water Supply & Treatment 3rd Ed. Pub: CPH & Env. Engg. Organization, Ministry of Urban Development, Govt. of India, New Delhi, 1991.
3. H. S. Peavy, D. R. Rowe & G. Tchobanoglous "Environmental Engineering" , Mc Graw Hill Int., New Delhi, 1985.
4. Manual on Wastewater Treatment 3rd Ed. Pub: CPH & Env. Engg. Organization, Ministry of Urban Development, Govt. of India, New Delhi, 1991.
5. T. J. McGhee, "Water Supply and Sewerage" Pub: Mc Graw Hill Int., New Delhi, 1991.

- **Equations of Fluid Dynamics**

Basic Concepts - Eulerian, Lagrangian methods of describing fluid motion, acceleration and deformation of fluid particle, vorticity. Laws governing fluid motion, continuity, Navier-Stokes & energy equations. Boundary layer equation, Euler equations, potential flow motions, Bernoulli's equation and vorticity transport equation. Initial and boundary conditions. Classification of equation of motions- hyperbolic, parabolic, elliptic.

- **Mathematical Preliminaries :Numerical integration**

Review of linear algebra, solution of simultaneous linear algebraic equations-matrix inversion, solvers-direct methods, elimination methods, ill conditioned systems, Gauss-Seidel method, successive over relaxation method.

- **Grid Generation**

Transformation of co-ordinates. General principles of grid generation- structured grids in 2-D & 3-D, algebraic grid generation, differential equation based grid generation, elliptic grid generation, algorithm, Grid clustering, Grid refinement, Adaptive grids, Moving grids. Algorithms, CAD interfaces to grid generation. Techniques for complex and large problems, Multi block methods.

- **Finite Difference Discretisation**

Elementary finite difference coefficients, basic aspects of finite difference equations, consistency, explicit- implicit methods, errors and stability analysis. Stability of elliptic and hyperbolic equations. Fundamentals of fluid flow modeling-conservative property, upwind scheme, transporting property, higher order upwinding. Finite difference applications in heat transfer-conduction, convection.

- **Finite Volume Method**

Introduction, application of FVM in diffusion and convection problems, NS equations- staggered grid, collocated grid, SIMPLE algorithm. Solution of discretised equations using TDMA. Finite volume methods for unsteady problems- explicit schemes, implicit schemes.

- **Finite Element Method:**

Introduction. Weighted residual, and variational formulations. Interpolation in 1D- 2D cases. Application of FEM to 1D and 2D problems in fluid flow and heat transfer.

BOOKS RECOMMENDED

1. Ferziger J. H., Springer P. M.; Computational Methods for Fluid Dynamics; Verlag Berling
2. Anderson J. D. Jr. Computational Fluid Dynamics; Mc Graw Hill, 1995
3. Patankar S. P. Numerical Heat Transfer and Fluid Flow,
4. Sunderarajan T and Muralidhar K, Computational Fluid Flow and Heat Transfer 2nd edition, Narosa Publishing
5. Bates, Lane and Ferguson, Computational Fluid Dynamics – Application in Environmental Hydraulics, John Wylie & Sons Lts, 2005.

B. TECH. IV SEMESTER - VII**L T P C****CE 423: GPS AND APPLICATIONS (ES-I)****3 - - 3**

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- **INTRODUCTION** (05 Hours)
Geodesy - Earth surface - Datum – Co-ordinate systems - Projection systems
 - **GLOBAL POSITIONING SYSTEM** (10 hours)
Introduction - Segments of GPS system - GPS receivers and its components - Different types of GPS systems
 - **METHODS OF OBSERVATIONS** (07 hours)
Absolute positioning - Relative positioning - Differential GPS - Kinematic GPS
 - **ERRORS AND CORRECTIONS** (05 hours)
Types of errors - Accuracy and precision - Basic statistical concept - Least square model
 - **APPLICATIONS OF GPS** (08 hours)
General applications - Engineering applications - Special applications - Innovative applications - 3D modelling
 - **GPS AND INFORMATION TECHNOLOGY** (10 hours)
GPS-GIS integrated system - GPS and Remote Sensing - Web based development - Real life projects - Use of GPS software
- (Total Contact Time: 45 Hours)**
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BOOKS RECOMMENDED:

1. Agrawal N.K., "Essentials of GPS ", Spatial Network Pvt. Ltd., Hydrabad (2004).
2. Anderle R, "The Global Positioning System", Royal Society of London, U.K. (1988).
3. Kulkarni M.N., "Proceedings of CEP Training Course on The Global Positioning System and its Applications, IIT Bombay, Mumbai (2003)
4. Leick, "Global Positioning Systems" Academic Press.
5. Kulkarni M.N., "Proceedings of CEP Training Course on Global Positioning system and its Application in Atmospheric and Ionospheric Studies, IIT Bombay, Mumbai (2007)

B. Tech. IV (CIVIL) SEMESTER - VII	L	T	P	C
CE 425 COMPUTER AIDED DESIGN IN CIVIL ENGINEERING (ES-I)	3	0	0	3

- **BASICS :** (06 Hours)
Role of CAD in Civil Engineering, programming languages, Introduction to Civil Engineering Software's, Data processing
- **BUILDING DESIGN AND URBAN PLANNING:** (08 Hours)
Building planning, drawing generation, interior design, landscaping, Application of AutoCAD and 3D home preparation of TP Scheme
- **WATER RESOURCES ENGINEERING:** (06 Hours)
Programming and spreadsheet applications in the analysis and design of water resources systems such as Reservoir planning, Dam design and river training works.
- **TRANSPORTATION ENGINEERING:** (08 Hours)
Programming and spreadsheet applications in the design and analysis of transportation systems, pavement design and related planning aspects
- **ENVIRONMENTAL ENGINEERING:** (06 Hours)
Programming and spreadsheet applications in the design and analysis of water and waste treatment, management and disposal systems, Simulation Techniques
- **GEOGRAPHICAL INFORMATION SYSTEM:** (06 Hours)
Basics of GIS, GIS applications in the above mentioned areas.
- **RECENT ADVANCES IN COMPUTER APPLICATIONS:** (05 Hours)
Applications of artificial intelligence, expert systems, Neural networks, Fuzzy logic, Genetic Algorithms, Simulated Annealing etc.

BOOKS RECOMMENDED:

- 1.0 Computer aided architectural design, Lee Kaiman, (1989)
- 2.0 AutoCAD 13 , BPB Publications (1991)
- 3.0 Genetic Algorithms, David E. Goldberg (1985)
- 4.0 C++, Neural Networks and Fuzzy logic, V.Rao, H Rao, BPB (1996)

B. Tech. IV (Civil Engineering), VII semester**L T P C****CE 427 : ALLUVIAL RIVER HYDRAULICS (ES-I)****3 0 0 3**

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- **ORIGIN AND PROPERTIES OF SEDIMENTS (4Hours)**
Scope of sediment transport in alluvial stream problem, origin of sediments, individual and bulk properties of sediments.
 - **INCIPIENT MOTION OF SEDIMENTS (4Hours)**
Semi-theoretical and empirical approaches for critical tractive stress of uniform and non-uniform sediments.
 - **REGIMES OF FLOW (7Hours)**
Regimes of flow like ripples, dunes, washing out of dunes, standing wave and anti-dunes, prediction of regimes of flow in alluvial streams, importance of regimes of flow, resistance law in loose boundary channel, form resistance and grain resistance, preparation of stage-discharge curve of alluvial streams.
 - **TRANSPORT OF SEDIMENTS IN ALLUVIAL STREAMS (10Hours)**
Modes of sediment transport in alluvial rivers, Einstein's approach for bed load transport of sediments, Roorkee approaches for transport of uniform and non-uniform sediments. Samaga's approach for transport of suspended load for uniform and non-uniform sediments, design of stable channels based on sediment transport concept.
 - **HYDRAULIC GEOMETRY OF ALLUVIAL RIVERS (5Hours)**
Stages of alluvial streams, dependent and independent variables in alluvial river problems, shape of streams in plan and cross section.
 - **VARIATION OF BED LEVEL OF ALLUVIAL STREAMS (10Hours)**
Continuity equation of sediments, aggradation, degradation and their locations in alluvial streams, rotational and parallel degradation, aggradation and degradation models of alluvial streams, mechanism of local scour around bridge piers.
 - **SILT CONTROL IN HYDROPOWER PROJECTS (5Hours)**
Preventive and curative silt control measures in power canals, design aspects of desilting chambers in hydropower projects.

BOOKS RECOMMENDED

1. Garde R. J. and Ranga Raju K. G., "Mechanics of sediment transportation and alluvial stream problems", Third edition, New Age International (P) Limited, New Delhi, 2000.
2. Raudkivi, A. J., Loose boundary hydraulics, Pergamon Press, Oxford (U. K.), 2nd edition, 1976.
3. Yalin, M. S. "Mechanics of sediment transport", Pergamon Press, Oxford (U K), 1971.
4. Garde R. J., 'River morphology, New Age International Publisher, New Delhi-110042, 2006.
5. Garde R. J., 'History of fluvial hydraulics, New Age International Publisher, New Delhi-110042, 1995.

B. Tech. – IV (Civil), Semester - VII

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AM 429 :DESIGN OF INDUSTRIAL STRUCTURES (ES-I)

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- **PLANNING OF INDUSTRIAL STRUCTURES** (Hours -10)
Classification of industries and local regulations - Factors affecting planning - General Aspects - Civil Engineering Aspects - Light and Ventilation.
 - **DESIGN OF INDUSTRIAL STRUCTURES** (Hours -08)
Types of Loads - Structural configurations - Components of a typical industrial building and overview of design procedure - Analysis of industrial buildings and Gable frames - Analysis of columns supporting Crane Girders
 - **LARGE SPAN STRUCTURES IN INDUSTRIES** (Hours -08)
Cable roofs - Types of cable roofs - Analysis of a cable subjected to concentrated loads and uniformly distributed load, Complexities in the analysis of a cable roof, Overview of deep beams, Virrendel Girder, Castellated Girders - Introduction to earthquake forces
 - **SILOS AND BUNKERS** (Hours -08)
Concept of Angle of Repose - Pressure distribution - Dynamic loads - Stability of bunkers - Foundations.
 - **FOUNDATIONS FOR INDUSTRIAL STRUCTURES** (Hours -08)
Machine foundations - General requirements - Design criteria - General analysis - Design of a block foundation for vertical compressor - Vibration Isolation - Foundations for Chimney and Microwave Towers
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TUTORIALS

1. Design of Industrial Building.
2. Design of Silo / Bunkers
3. Design of Machine Foundation.

RECOMMENDED BOOKS

1. Srinivasula P. "Hand Book of Machine Foundation", First Edition, Tata McGraw Hill Publications, New Delhi., 2000
2. Ramchandra, "Design of Steel Structures", Seventh Edition, Standard Book House, New Delhi,2000.
3. Raghupati M., "Design of Steel Structures", First Edition, Tata McGraw Hill Publication, Delhi, 2003.
4. Dayaratnam P. "Design of Steel Structures" Wheel's Publishers, Allahabad, 1995.
5. Anand Arya & Ajmani J. L., "Design of Steel Structures", Forth Edition, Nemchand & Bros., Roorkee, U.P. , India, 2004.
6. Lambert F.W. , "The Theory & Practical Design of Bunkers", The British Constructional Steelwork Association Ltd., London, UK, 2000.

B. Tech. – IV (Civil), Semester - VII	L	T	P	C
AM 431 :DESIGN OF ADVANCED CONCRETE STRUCTURES (ES – I)	3	-	-	3

- **DESIGN OF MEMBERS SUBJECTED TO TORSION**
Semicircular beam with slab, torsion factor, stresses due to torsion in concrete beams, reinforcement due to torsion, applications.
 - **FLAT SLAB**
Components, Direct design method, equivalent frame method, shear in flat slab, reinforcement detailing.
 - **DOMES**
Nature of stresses in spherical domes, analysis, stresses due to wind load.
 - **PORTAL FRAMES & BUILDING FRAMES**
Analysis & design of rectangular portal frame, with vertical loads, design of hinge at the base. Frames – Substitute frames, frames subjected to horizontal forces, portal method, cantilever method, factor method. Introduction to earthquake forces
 - **BUNKERS & SILOS**
Janssen's theory, Airy's theory, Hopper bottom, Design of beans.
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TUTORIALS

1. Design of Circular Beams
2. Design of Flat Slab
3. Design of Domes
4. Analysis & Design of Building Frame
5. Design of Bunker / Silo.

BOOKS RECOMMENDED:

1. Mallick S.K. and Gupta A.P. , '**Reinforced Concrete**', Oxford and IBH Publishing Company, New Delhi, (1998).
2. Vazirani V.N. and Ratwani M.M., '**Concrete Structures**', Khanna Publishers, New Delhi, (1998).
3. Safarian S.S. and Harris E.C. '**Design and Construction of Silos and Bunkers**', Van Norstrand Co., New York,(1998).

B. Tech. – IV (Civil), Semester - VII
AM 433: DESIGN OF PRECAST AND
PRESTRESSED CONCRETE STRUCTURES (ES-I)

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3	-	-	3

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- **PRINCIPLES AND GENERAL FEATURES OF PRECAST CONSTRUCTION** (Hours – 12)
Advantages and Disadvantages, Type standardization and Component Standardization, Construction principles, Manufacture of precast components and material properties
 - **DESIGN CRITERIA** (Hours – 10)
Precast structural elements such as beam - Column, Slab and Roof.
 - **ANALYSIS AND DESIGN** (Hours – 10)
Prestressed concrete building components
 - **DESIGN OF PRESTRESSED** (Hours – 10)
Concrete poles and sleepers
Joint design, Detailing, Earthquake forces.
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TUTORIALS

1. Design of Precast Beam
2. Design of Precast Column
3. Design of Precast Slab
4. Design of Prestressed Beam
5. Design of Prestressed Column
6. Design of Prestressed Slab
7. Design of Prestressed Concrete Pole
8. Design of Prestressed Concrete Sleepers

BOOKS RECOMMENDED

1. Koncz, I.T., Manual of precast concrete construction, Vol. 1,2,3, Bauverlag GMBH, Berlin (2003).
2. Grover C.W., Structural precast concrete, Asia Publishing House, Bombay (2003).
3. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Publishing Co. Ltd., New Delhi (2006).
4. Lin T.Y., Burns, N.H., Design of prestressed concrete structures, John Wiley & Sons, New York.
5. Dayaratnam. P, "Prestressed Concrete" Oxford – 1 BH Publication, New Delhi (2006).

B. Tech. – IV (Civil), Semester - VII

L T P C

AM 435 :DESIGN OF TALL STRUCTURES (ES – I)

3 - - 3

• **HIGH TENSION TRANSMISSION LINE TOWER**

Various forces acting on tower, classification of tower – Various type of span – Effect of ice coated cable – Sag tension calculation – Type of Bracing patterns – Foundation – Different condition for design – Joint's in tower. I.S. Code provisions .

• **T.V./ MICROWAVE TOWER**

Self supporting – Guyed tower – Concept of solidarity ratio – Stability and foundation design – Limiting criteria for tall / short tower – Concept of dynamic analysis – Approximate dynamic analysis – Stack (Shaft) supported tower – Concept of mode shapes – Tower mounted on building, it's I.S. code provision – Concept of multipurpose tower – Trestles and Masts – Concept of multi purpose tower – wind turbine tower.

• **TALL CHIMNEY**

Types of chimney – Free standing, Guyed with fixed base, Pin base – Stability of chimney, Concrete and steel – Foundation design – Conceptual design – Concept of Earthquake force – Multipurpose chimney – Forces acting on chimney – Concept of vortex induced vibration – It's remedial measures – Cooling tower.

• **MULTISTORIED BUILDING**

Planning of tall structure, Different between multistoried building and Ultra High Rise building – Forces acting on normal multistoried building and additional forces acting on Ultra high rise building – Earthquake forces calculation for building – Concept of approximate cantilever method – Wind force calculation for building – Structural configuration required for tall building, with field example – Some provision of I.S. : 1893 (Earthquake code) for building - Types of Foundation used for building – Shear core application – Application of self compacting concrete & high strength material like epoxy, FRC etc.

BOOKS RECOMMENDED

1. Taranath "Multistoried building".
2. Pankaj Agrawal & Manish Shrikhande, "Earthquake Engineering".
3. Edmund Booth, Oye Arup & Partners (1994), "Concrete Structures in Earthquake Regions", First Edition, John Wiley & Sons, New York, U.S.A.
4. Nainan P. Kurian (1994), "Design of Foundation Systems", 2nd revised edition, Narosa Publishing House, New Delhi-17.
5. Manhar S. N. (1985), "Tall Chimneys Design & Calculations", Tata McGraw Hill, New Delhi, (First edition)
6. Krishna Raju (1988), "Advanced Reinforced Concrete", 2nd edition, CBS Publishers, Oxford pergamon Press.

-
- **EXPLORATION TECHNIQUES** (Hours – 7)
Objectives – Methods – Suitability – Sub soil investigation – Bore log – Penetration tests – Geophysical methods – Report preparation. .
 - **FOUNDATION ON EXPANSIVE SOIL** (Hours – 7)
Properties – Problems – Identification – Classification – Remedial measures – case studies
 - **FOUNDATION ON COLLAPSIBLE SOIL** (Hours – 7)
Definition – Types of collapsible soil – Physical parameters for identification – Procedure for calculating collapse settlement – case histories of stabilization of collapsible soil.
 - **FOUNDATIONS FOR MACHINES** (Hours – 7)
Classification – General requirements – Dynamic parameters of Soil – Foundations for reciprocating and impact type machines – Vibration isolation.
 - **PRELOADING AND SAND RAIN** (Hours – 7)
Precompression – general considerations – sand drains and its application – prefabricated vertical drains.
 - **EARTHQUAKE GEOTECHNIQUES** (Hours – 7)
Types – Seismic waves – location of earthquake – factors influencing ground motion – Liquefaction evaluation of liquefaction susceptibility
-

RECOMMENDED BOOKS

1. B M Das (2005), “Principles of foundation Engineering” PWS publishing
2. Gullhati S K & Datta M (2005) “Geotechnical Engineering”, Tata McGraw Hill Publishers Co. Ltd, New Delhi
3. R W Day (2001), “Geotechnical Engineering, Portable Handbook” Mc Graw Hill Publishers, New York, USA.
4. Hasuman M R (1990), “Engineering Principles of Ground Modification”, Mc Graw Hill Publishing Co, New York, USA
5. P. Purushottoma Raj, (1995) “Geotechnical Engineering”, Tata McGraw Hill Publishing Co, Ltd New Delhi
6. F.H. Chen, “Expansive Soil” Tata Mc Graw Hill Publishing Co. Ltd, New York.

-
- **TYPES OF EARTH DAMS**
Types, Components and their functions, free board, selection of site.
 - **BORROW AREA SURVEY**
Selection of borrow pits, programme of exploration, qualitative and quantitative estimates of soils available, borrow pit zoning and allocations.
 - **EXPLORATION OF SUBSOIL FOR FOUNDATION**
Programme of exploration, covering extent, depth, methods and cost, stages of explorations, foundation profile, ground water survey, engineering properties of each stratification in profile, special techniques of field explorations.
 - **FAILURE & DAMAGES**
Review of natural failures, differential settlement failures, slides in embankment and foundations, earthquake, reservoir's ware action piping etc.
 - **STABILITY ANALYSIS**
Applications of Swedish and Bishop's simplified method, total and effective stress analysis, methods of estimating pore pressure during construction and drawdown, selection of design parameters and design conditions, factor of safety of upstream and down stream slopes.
 - **FOUNDATION DESIGN**
Techniques of seepage control, drainage, and improving the insitu strength, relative merits, control of piping and liquification.,Applications of geotextiles.
-

BOOKS RECOMMENDED

1. Sherard J. L. 'Earth and rock fill dams' John Wiley.
2. Anderson M. G. and Richard K. S. 'Slope stability' John Wiley 1987.
3. McCarthy D.F. "Essentials of Soil Mechanics and Foundation" ,Practice Hall, London – 1988.
4. Chowdhary R.N. "Slope Analysis", E.I. Sevier, London – 1978.
5. Nayak N. V. "Foundation Design Manual" Dhanpatirai & Sons, Delhi – 1985.

CE 402: WATER RESOURCES ENGINEERING - II**3 - 2 4**

- **HYDRAULICS OF ALLUVIAL CHANNELS** (04 Hours)
Incipient motion condition of sediments, Shield's diagram, regimes of flow, resistance law, transport of sediments
- **CANAL IRRIGATION** (04 Hours)
Classifications of canals, alignment of canal, design of lined canal to carry clear and sediment laden water, design of unlined canal to carry sediment laden water (regime approaches) and clear water (tractive stress approach), cross section of irrigation channels, necessity, advantages, disadvantages, suitability and types of lining, economics of canal lining, management of irrigation canals, maintenance of irrigation channels .
- **DIVERSION HEADWORKS** (05Hours)
Design aspects of subsurface flow on permeable foundation, Bligh's, Lane's and Khosla's theories for design of floor for subsurface flow, Planning and layout of the diversion headwork, component parts of diversion headwork, types of weir & barrages, causes of failure of weirs and their remedies, silt control, location of headworks.
- **CANAL REGULATION STRUCTURES** (04Hours)
Necessity, location and types of canal falls, design aspects of Sarda type fall, functions and design aspects of head regulator and cross regulator, canal escapes, canal outlets.
- **CROSS-DRAINAGE STRUCTURES** (04Hours)
Types of cross-drainage structures, selection of suitable type, classification of aqueducts, design aspects of cross-drainage structures.
- **RESERVOIR PLANNING & SEDIMENTATION** (05Hours)
Types of reservoirs, investigations for reservoir planning, site selection, storage zones, yield, mass inflow curve, determining capacity of reservoir, apportionment of total cost of a multipurpose reservoir, determination of life of reservoir, control of sediment, reservoir losses, control of evaporation loss.
- **DAMS** (02Hours)
Types of dams, their advantages and disadvantages, selection of site for dam, site investigations.
- **GRAVITY DAM** (04Hours)
Design of gravity dam, principal and shear stresses, failure of dam and its stability, elementary & practical profile of the gravity dam, joints, galleries, shafts, foundation treatment.
- **EMBANKMENT DAMS** (05Hours)
Types of embankment dams, factors affecting design of embankment dam, causes of failure of embankment dams, criteria of design of earth dams, computation of free board in embankment dam, seepage analysis of homogenous and zoned dams, seepage control through embankment dam and its foundation, stability analysis of the earth dam
- **SPILLWAYS AND ENERGY DISSIPATION** (04Hours)
Types of spillways, design aspects of ogee spillway, spillway gates, jump-height curve and tail water curves, different types of energy dissipaters.

- **RIVER TRAINING AND FLOOD CONTROL**

(04Hours)

Methods of river training and flood control

PRACTICALS:

1. Numerical problems on water requirements of crops
2. Design of diversion headworks
3. Design of canal regulation structures
4. Design of cross drainage works
5. Numerical problems on reservoir and sedimentation
6. Design of gravity dam
7. Design of embankment dam
8. Design of spillway
9. Design of energy dissipators

BOOKS RECOMMENDED

1. USBR, Design of Gravity Dams, Design manual for concrete gravity dams, , Denver, Colorado, (1976).
2. Sherad J L, Woodward R J Gizienski, S C and Clevenger W A, Earth and Earth and Rock fill dams, John Wiley and Sons Inc.,USA, (1963).
3. Creager William P., Justin Joel D, Hinds Julian, Engineering for dams, Nem Chand and Bros, Roorkee (U P), (1995).
4. Asawa G L, Irrigation Engineering, New Age International (P)Ltd, New Delhi, (1996).
5. Garg S K, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi, (1999).
6. Varshney R S , Gupta S C and Gupta S L, Theory and design of Irrigation Structures Vol II, Nem Chand Bross, Civil Lines, Roorkee-247667, India, (1993).

- **OFFICE PRACTICE** (04 HOURS)
Organisational set up, working of professional firms, office procedures, construction contracts, legal aspects, professional charges, role of architect, developer, builder and contractor.
 - **TENDERING AND CONTRACTING** (12 HOURS)
Tender and tendering process, types of tenders, Dynamics of contracting, contract documents, condition of contract, Indian contract act, improper work and defect liability period, liquidated damages, contract breach, certificates and payments, duties and liabilities.
 - **ARBITRATION & EASEMENT** (08 HOURS)
The purpose of arbitration, the powers and duties of arbitrator, arbitration and building contract. Types of arbitration, fire insurance, easement characteristics types.
 - **VALUATION** (13 HOURS)
Definition, market value, freehold and leasehold, sinking fund, depreciation methods of valuation, rental method of valuation, land and building based development method of valuation.
 - **P.W.D. ACCOUNTS AND PROCEDURE OF WORKS** (04 HOURS)
Organisation set up, classification of work, execution of work, book keeping, measurement book, store procedure, mode of payments, public works accounting system.
 - **ENTREPRENEURSHIP DEVELOPMENT** (02 HOURS)
Concept need and scope of entrepreneurship, characteristic of entrepreneurship, forms of business organization.
 - **IPR AND PATENT ACT** (02 HOURS)
Importance and scope, forms of IPR, patents, copy rights, trademarks, relevant acts.
-

BOOKS RECOMMENDED:

- 1) Patil B.S., "Civil Engineering Contracts". Vol. – I, Orient Longman Publication, 1998.
 - 2) Dutta. B.N., "Estimating & Costing in Civil Engineering", USB Publishers, Bombay, 1996.
 - 3) Roshan Nanavati, "Professional Practice", Lakhani Book Depot, Mumbai.
 - 4) Guha Thakurta S.K., Shah K.R., "Manual of Construction Project Management", Multi-tech Publishing Co., Mumbai, 2002
- Holdon, Fish, Smith, "Top Management Organization & Control", Mc-Graw Hill, 1999.

B. Tech. IV (CIVIL) SEMESTER VIII**L T P C****CE 406: HEAVY CONSTRUCTION AND PROJECT MANAGEMENT****3 1 0 4**

-
- **CONSTRUCTION PROJECTS:** **(04 Hours)**
Construction Industry in India - Project Categories - Project Planning & Organization Systems - Heavy Construction Projects

 - **HEAVY CONSTRUCTION EQUIPMENTS:** **(12 Hours)**
Types & characteristics - Equipment Capacities & Costs - Machine Power - Dozers, Scrapers – Excavators - Trucks & hauling equipment - Draglines & Clamshells - Pile Driving Equipments

 - **CONSTRUCTION OF HEAVY FOUNDATIONS:** **(08 Hours)**
Pile Foundation - Caissons, Cofferdams, Raft Foundation

 - **PROJECT FINANCE & APPRAISAL:** **(04 Hours)**
Need & Types of Appraisals - Finance Source and Methods – Major Financing Bodies - Economic Evaluation - Time Value of Money - Discounted and Non-discounted Cash flow Methods

 - **PROJECT MANAGEMENT:** **(17 Hours)**
Bar Charts - Network Elements - Network Development – PERT, CPM, PD Techniques - Network Updating - Resource Allocation - Leveling & Smoothing - Time–Cost Analysis - Project Cost Control - Quality Control Methods - Construction Safety, HR practices in construction, MIS in construction.

BOOKS RECOMMENDED:

1. Chitkara, K.K., Construction Project Management: Planning, Scheduling & Controlling, Tata McGraw - Hill Publishing Co. Ltd., New Delhi. (1998)
2. Jagman Singh, Heavy Construction Planning, Equipment and Methods, Oxford & IBH Publishing Co., New Delhi. (1997)
3. Peurifoy, R.L., Construction Planning, Equipment, and Methods, Tata McGraw - Hill Publishing Co. Ltd., New Delhi. (2002)
4. Seetharaman, S., Construction Engineering & Management, Umesh Publications, New Delhi. (2000)
5. Vohra, N.D., Quantitative Techniques in Management, Tata McGraw - Hill Publishing Co. Ltd., New Delhi. (1990)

- **PROPERTIES OF CEMENT**

Manufacturing of Portland cement - Chemical composition of Portland cement - Hydration of cement and action of gypsum - Setting of cement - Physical and chemical test for cement as per IS:4031, IS:269 - Different types of cement - Chemical composition - Important properties and applications - Admixtures – Accelerators - Retarder water reducing agents – Plasticizers - Water proofing compounds - Pumping aids.

- **PROPERTIES OF AGGREGATES**

Classification of aggregates - Important physical properties - Mechanical properties - Specific gravity, bulk density - Moisture content - Water absorption of aggregates - Sieve analysis - Grading curves - Fineness modulus - Gap Grading, Deleterious Substances in aggregates, alkali aggregate reaction, Maximum size of aggregates.

- **FRESH CONCRETE**

Definition of workability, factors affecting workability - Measurement of workability - Slump test, compacting factor test -, Segregation and blending of concrete - Mixing of concrete - Types of mixtures - Vibration of concrete - Types of vibrators - Internal external surface and table vibrators - Concreting in hot and cold weather - Ready mixed concrete - Pumped concrete - Pre placed aggregate concrete - Vacuum processed concrete - Shotcrete or guniting.

- **STRENGTH OF CONCRETE**

Factors affecting strength of concrete - Different methods of Curing and Steam Curing at Atmospheric Pressure and High Pressure Curing - Warm water method.

- **TESTING OF HARDENED CONCRETE**

Need for testing, Compression test – Cube, cylinder - Prism and equivalent cube test - Effects of various factors on test results e.g. end conditions – Capping - Moisture content - Height/Diameter ratio - Shape of specimen - Rate of loading - Size of specimen - Comparison of strength of cubes and cylinders - Flexure test - Split tensile test - Non-destructive testing, needs and applications - Rebound hammer test – Ultrasonic Pulse Velocity test - Test cores.

- **MIX DESIGN**

Definition and need for designing mixes - Methods of mix design - IS method of mix design in detail with examples.

- **SPECIAL CONCRETE**

Polymer Concrete - Fibre Reinforced Concrete - Light Weight Concrete - High Density Concrete - Use of Silica Fume & Metacaoline in Concrete - Flyash Concrete

PRACTICALS

1. Properties of fine and coarse aggregate.
2. Properties of cement
3. Mix Design, Casting of at-least two mixes, testing of 7 days & 28 days cubes.
4. Workability, Slump Test, Compacting factor.
5. Effect of admixtures
6. Effect of curing
7. Use of Plasticizers

BOOKS RECOMMENDED

1. Neville A.M. (1973) "Properties of Concrete" 3rd ed., Pitman Publishing Company, Bath, U.K.

2. Shetty M. S.(1986)–“Concrete Technology”,Theory and Practice” 2nd ed., S.Chand & Company, New Delhi.
3. Gambhir M. L. (1986) “Concrete Technology” 1st Ed., Tata McGraw Hill Company, New Delhi.
4. Shanthakumar ” Concrete Technology”
5. G E Troxell & H E Davis, “ Composition and Properties of Concrete, “ Mc Graw Hill Publication

LIST OF ELECTIVE SUBJECTS
B.E. – IV (CIVIL) EIGHTH SEMESTER
ELECTIVE GROUP – II

Sr. No.	Code	Subject
1	CE414	Traffic Engineering
2	CE416	Housing
3	CE418	Municipal Solid Waste Management
4	CE422	Hydropower Engineering
5	CE424	Building Maintenance
6	CE426	Entrepreneurship Development
7	CE428	Construction of Bridges and Tunnels
8	CE432	Coastal Engineering & Marine Structures
9	AM434	Design of Bridge Structures
10	AM436	Computer Aided Design of Structures
11	AM438	Rehabilitation and Strengthening of Structures
12	AM442	Advanced Structural Analysis
13	AM444	Ground Improvement Techniques
14	AM446	Rock Mechanics

- **INTRODUCTION** **(02 HOURS)**
 Scope functions and administration, traffic issues in Indian Cities.
- **TRAFFIC STUDIES AND ANALYSIS** **(12 HOURS)**
 Road-user characteristics, vehicle characteristics, traffic flow characteristics, different traffic studies and analysis for volume, speed and delays, origin and destination, parking and accident, presentation & interpretation, traffic forecasting.
- **TRAFFIC GEOMETRICS** **(12 HOURS)**
 Basic geometric elements, design of intersections, rotary intersections, grade separated intersections, design of parking and terminal facilities.
- **TRAFFIC FLOW STUDY** **(04 HOURS)**
 Vehicular stream models, car following model, Q- K -V models, highway capacity, level of service, shock wave phenomenon, queuing.
- **TRAFFIC CONTROL, REGULATION & MANAGEMENT** **(15 HOURS)**
 Traffic control, regulations & management for vehicles, drivers and flow , traffic control devices, markings, signage, signals, channelisation, design of traffic signal system, urban traffic management techniques, street lighting, Introduction to Intelligent Transportation System.

BOOKS RECOMMENDED:

1. Kadiyali L. R., "Traffic Engineering and Transportation Planning", Khanna Publishers, Delhi, 2002.
2. Pignataro L. J., "Traffic Engineering - Theory and Practice", John Willey & Sons, 1985.
3. Davies E., "Traffic Engineering Practice", E. and F. Span Ltd., London, 1987
4. O'Flaherty C.A., "Highways, Traffic Planning & Engineering", Edward Arnold, UK, 1997
5. Matson, Smith, Hurd, "Traffic Engineering", Mc Graw Hill Book Co., 2002

B. Tech IV (CIVIL) SEMESTER-VIII	L	T	P	C
CE 416 HOUSING (ES-II)	3	1	0	4

- **HOUSING IN INDIAN CONTEXT :** **(10 Hours)**
Urban and rural settlements, urbanization housing demand, problems of housing in urban and rural areas, Building forms, quality, distribution, rural and social housing schemes, housing activities in five year plans
- **HOUSING POLICY & FINANCE :** **(06 Hours)**
National Housing policy- objectives, housing in private and public sector, housing financing institutes, role of HUDCO, HDFC, State Housing Boards.
- **HOUSING REGULATIONS:** **(08 Hours)**
T.P. Schemes and housing, group housing, byelaws and regulations, high-rise, row house regulations, Housing legislation scheme approval procedure.
- **HOUSING ECOFRIENDLY DESIGN :** **(10 Hours)**
Housing & Environment: Environmental Factors, Climate and Comfort – Elements of Climate, Tropical Climates, thermal comfort, daylight. Housing for hot – dry and warm humid climates. Framing of Housing for different income groups, housing densities. Mass Housing layouts, plot and cluster based schemes, mixed development, Neighborhood planning - Standards, development guide lines.
- **HOUSING PROJECTS :** **(06 Hours)**
Framing of requirements, development of housing layouts, preparations of project, documentation estimation, housing analysis, project analysis and estimate, mixed housing development: pattern of mixed mixed development, development of housing societies, apartment layouts, typical case studies; mass housing projects, Industrial township
- **SLUM HOUSING :** **(05Hours)**
Causes, effect and remedial measures, transit camps, unauthorized construction, substitute building materials, slum up gradation, site and service schemes, Low cost housing schemes, Low cost techniques. Environmental and Health aspects, public participation

REFERENCES:

1. F. Gibberd, "Town Design", Architectural Press, London. (1988)
2. Modak and Ambdekar, "Town and Country Planning and Housing", Orient Longman Ltd., Bombay. (1995)
3. Heggode, D. and Cherunilam, F., "Housing In India", Himalaya Publishing House. (1990)
4. Koenigshurger, O. H., "Manual of Tropical Housing & Building", Orient Longman Ltd., Chennai. (1986)

B. E. IV (CIVIL) SEMESTER – VIII	L	T	P	C
CE 418 : MUNICIPAL SOLID WASTE MANAGEMENT(ES-II)	3	0	0	3

- **INTRODUCTION** **(06 Hours)**
Sources and classification of solid wastes – Sampling and characteristics - generation rates - solid waste management systems and planning.
 - **COLLECTION, TRANSFER AND TRANSPORT** **(09 Hours)**
On site handling and storage Planning of Collection routes - Transfer stations- Transport methods,
 - **TREATMENT PROCESSES** **(09 Hours)**
Process techniques - Mechanical and chemical volume reduction - Component separation- Drying and dewatering, Incineration and pyrolysis
 - **RESOURCE RECOVERY** **(06 Hours)**
Materials processing -Recovery systems - Recovery of chemical and biological conversion products – Composting - Recovery of energy from conversion products.
 - **DISPOSAL METHODS** **(10 Hours)**
Land filling methods – Components and Design of Landfill – ocean disposal
 - **BIOMEDICAL AND HAZARDOUS WASTE** **(05 Hours)**
Characteristics and types of hazardous waste – Biomedical waste handling and disposal.
- (Total Contact Time: 45 Hours)**

BOOKS RECOMMENDED:

- 1 Tchobanoglous G., “Solid Wastes - Engineering Principles And Management Issues”, Mc Graw Hill Book Company, 1977.
- 2 Neal Hommer, “Solid Waste Management and Environment” Prentice Hall, New Jersey, 1988.
- 3 Dewan J.M. And Sudarshan K.N., “Solid Waste Management”., Discovery Publ. House, New Delhi, 1996.
- 4 Charles A. Wantz, “Hazardous waste Management”, Mc Graw Hill Book Company, 1998.
- 5 Manual on “Solid Waste Management”, Ministry of Environment & Forest, New Delhi, 2000.

- **INTRODUCTION** (3 Hours)
Sources of energy, hydroelectric power vs. other sources of power estimation of water power potential.
- **HYDROPOWER TERMS** (4 Hours)
Load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, Load prediction.
- **HYDROPOWER PLANTS** (8 Hours)
Run-off-river plants, valley dam plants, diversion canal plants, low-and high-head plants. Pumped storage plants with their efficiencies, study of some typical hydropower Plants.
- **SURFACE POWER PLANTS** (8 Hours)
Surface power stations, criteria for determining their size, lighting and ventilation.
- **UNDERGROUND POWER PLANTS** (8 Hours)
Types and location of underground power station, its components, types of layout, limitations of underground power plants.
- **PENSTOCKS AND WATER HAMMER** (7 Hours)
Types of penstocks and their design criteria, economical diameter of penstock, valves, bends, manifolds, effect of water-hammer in penstock, types and design of surge tanks.
- **GATES & VALVES** (7 Hours)
Design principles of gates for low and high heads, different types of gates and valves with their characteristics and suitability.

BOOKS RECOMMENDED

1. Dandekar and Sharma," Water Power Engineering", Vikas Publishing House, New Delhi,1996.
2. Varshney R.S," Hydropower Structures", Nem chand and Bros., Roorkee (U.P.), 1992.
3. Deshmukh M.M.," Water Power Engineering", Dhanpat Rai Publications, New Delhi, 1998.
4. Barrows H. K., "Water Power Engineering", McGraw Hill Book Co., New York.,1943
5. Ivan E Houk, "Irrigation Engineering Vol-II," John Willy & Sons, New York, 1951

- **DURABILITY OF BUILDINGS:** (10 Hours)
Terminology of maintenance and repairs-Life expectancy of buildings – Methods and estimate for checking building strength and durability-Effect of environmental elements on buildings – Effect of chemical agents on buildings and building materials – Effect of pollution on buildings – Damage by biological agents like plants, trees, algae, fungus, moss, insects etc.
- **FAILURE AND REPAIR OF BUILDINGS:** (10 Hours)
Definitions of building failure – Functional, structural and aesthetical failures – Case studies – Methodology or investigation of failures – Diagnostic testing methods and equipments – Effect of fire on buildings.
Repair of cracks in concrete and masonry – grouting, guniting, etc. – Repair and strengthening of concrete buildings – Foundation repair and strengthening – Underpinning – Leakage of roofs and methods of repair.
- **MAINTENANCE OF BUILDINGS:** (10 Hours)
Preventive and corrective maintenance- Reliability engineering principles and its application in selection of systems of buildings – Routine maintenance of buildings – Maintenance cost – Specifications for maintenance works – Construction details for prevention of dampness – Termite proofing – Fire protection – Maintenance of flooring, roofing and services-maintenance of joints
- **REHABILITATION:** (05 Hours)
Analysis-planning-Cost estimates-Tender-Methodology-construction Methods-Modern materials for repairs
- **CONSERVATION:** (10 Hours)
Historical buildings – Conservation movement – Materials and methods for conservation work – Case studies.

BOOKS RECOMMENDED:

1. Philip. H. Perkins, "Concrete Structure–Repair, Water proofing and Projection". (1987)
2. S. M. Johnson, "Deterioration Maintenance & Repair of Buildings", McGraw Hill Pub. (1990)
3. Raikar R. N., "Technology of Building Repairs", Raikar Pub., Bombay. (1994)
4. Eldridge H. J., "Common defects in Buildings", HMSO. Publishers. (1986)
5. National Building Code. (2002)

- **INTRODUCTION :** (08 Hours)
 Objectives, Entrepreneurship terminology, Historical development and principles, Need & Scope in changing economy, Risks factors, Characteristics of an entrepreneur, Relevance and benefits of Small Scale Industry.
- **HUMAN ENGINEERING :** (06 Hours)
 Entrepreneur and Society, Attitude towards work; Self –assessment and goal setting, Leadership, Resource mobilization, Motivation, Understanding Human behaviour, social aspects of production process
- **SETTING UP AN INDUSTRY :** (10 Hours)
 Forms of business organization/ ownership , merits and demerits, Formation of a Company, procedures and formalities , Sources of information, Govt polices, Incentives, Subsidies , Industrial development agencies and their functions, State & National level institutions for Small Scale Industry ,case studies.
- **PROJECT PLANNING :** (10 Hours)
 Identification of opportunities and constraints Market survey; Techno - Economic feasibility studies and economic analysis ,Pay back period, Return on Investment, Cost-benefit analysis and Break-even analysis , Financial viability, sources of Finance for Industry, Assessment of fixed and working capital requirements, Financial Ratios, Project Scheduling.
- **MARKETING :** (06 Hours)
 Components of Marketing Management, Market survey and analysis, arrangements, strategies and assistance to small industry, Consumer behaviour, Market feedback; Projections, Predictions and Forecasts.
- **LEGAL ASPECTS:** (05 Hours)
 Industrial legal provisions, industrial aspects of Indian penal code

BOOKS RECOMMENDED:

1. "Hand book for New Entrepreneurs "– EDII, Ahmedabad. (1998)
2. P. Saravanavel, "Entrepreneurial Development ". (1994)
3. T.R. Banga , "Project Planning and Entrepreneurship Development ". (1991)

B.TECH. IV (CIVIL) SEMESTER –**L T P C****CE 428 : CONSTRUCTION OF BRIDGES AND TUNNELS (ES-II)****3 0 0 3**

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- **INTRODUCTION** **(06 Hours)**
History of bridge development – Components & classification of bridges – Bridge loadings – History of tunneling - Classification of tunnels
 - **SITE INVESTIGATION & PLANNING** **(08 Hours)**
Location of bridges and tunnels, Criteria for selection of site – Alignment – Hydrological, geological & geotechnical investigations – Economic span of bridge
 - **TUNNEL SURVEYING** **(06 Hours)**
Preliminary surveys – Setting out – Transfer of alignment – Curves – Adjustment at tunnel meeting points
 - **TUNNELING METHODS** **(12 Hours)**
Classification of soil strata – Sequence of operations – Tunneling in soft strata – Driving tunnels in rocky strata - Blasting – Drilling patterns – shafts
 - **VENTILATION & SAFETY** **(08 Hours)**
Natural and mechanical ventilation – Dust prevention & control – ventilation shafts and equipments – Safety Programmes – Scaling & mucking
 - **TUNNEL LINING** **(03 Hours)**
Necessity – Lining materials – Design of lining – Types of lining – Ground support
 - **TUNNEL DRAINAGE** **(02 Hours)**
Control of ground water, Pre-drainage – Dewatering – Permanent drainage
- (Total Contact Time: 45 Hours)**
-

BOOKS RECOMMENDED:

1. Peurifoy R.L., "Construction Planning, Equipment and Methods", Tata McGraw Hill Publication, New Delhi, 2003.
2. Vazirani V.N. and Chandola S.P., "Transportation Engineering" Vol. III, Khanna Publishers, New Delhi, 1987.
3. Srinivasan R., "Harbour, Dock and Tunnel Engineering", Charotar Publishing House, Anand, 2006.
4. Ahuja T.D. and Birdi G.S., "Roads, Railways, Bridges and Tunnels Engineering", Standard Book House, Delhi, 2004.
5. Ponnuswamy S., "Bridge Engineering", Tata McGraw Hill Publication, New Delhi, 2001.

- **INTRODUCTION** (04Hours)
 Man-ocean interaction, effects of ocean on ecology and climate, ocean as a source of food and means of communication, minerals in ocean, ocean for disposal of wastes.
- **THEORY OF OCEAN WAVES** (05Hours)
 Formulation of wave motion problem, assumption made in two dimensional cases, small amplitude wave theory, orbital motion and pressure, wave energy, finite amplitude wave theory, Stocke's wave theory (third order), mass transport, Gerstner theory, solitary wave theory, generation of waves, wave forecasting, decay of waves.
- **GENERATION OF WAVES** (06Hours)
 Relationship among wave dimensions, wind and fetches, generation of waves, wind waves in shallow water, limited width of wave field, decay of swell, wave forecasting procedures and their reliability, surface wind velocity and fetch determination, S.M.B and P.N.J methods.
- **REFLECTION, REFRACTION AND DIFFRACTION OF WAVES** (08Hours)
 Reflection of waves, clapotis or standing waves, superposition of waves, refraction, refraction diagrams, wave fronts and orthogonal methods, diffraction of waves around semi infinite break waters, detached break water of finite length, diffraction through openings.
- **WAVE FORCES ON STRUCTURES** (07Hours)
 Forces on vertical walls due to non breaking waves, breaking waves and broken waves base on linear theory, forces on circular cylinders.
- **SHORES AND SHORE PROCESSES** (06Hours)
 Long term and short term changes of shores, factors influencing beach characteristics , beach wave interaction, beach profile modification , littoral drift, stability of shores, shore erosion due to sea level, on shore and off shore transport, long shore transport, interaction of shore structures, shore erosion in kerala, mud banks.
- **SHORE PROTECTION WORKS** (05Hours)
 Description and effects of break waters, sea walls, groynes of various types, beach nourishment, design of sea walls, break waters, tetra pod, tribar etc.
- **PORT PLANNING AND MARINE STRUCTURES** (04Hours)
 Harbour types and features, ship Features related to port planning, site investigation & selection, port layout, on-shore and offshore structures, cargo handling equipments, Navigational aids.

BOOKS RECOMMENDED

1. Robert, L. Weigel, "Oceanographical Engineering", Prentice Hall Inc.(1964)
2. Arthar, T.I., "Estuary and coastline hydrodynamics ", McGraw Hill Book Co.(1964)
3. Robert M.Sorensen, "Basic Coastal Engineering" , Springer, (2006)
4. Alonzo Def. Quinn, "Design and Construction of Ports and Marine Structures", McGraw Hill Book Company.(1972).
- 6 Henry F. Cornik, "Dock and Harbour Engineering Vol.-I to IV", Charles Griffin & Company Ltd., London.(1988)

B. Tech. – IV (Civil), Semester - VIII**L T P C****AM 434 :DESIGN OF BRIDGE STRUCTURES (ES –II)****3 - - 3**

- **Introduction** (Hours -08)
Different types of bridges – Impact factor – Indian Road Congress Loads – Wind Load – Centrifugal forces – Economic span length – Foundation for bridges - Abutments
 - **Solid Slab Bridges** (Hours -06)
Slabs spanning in one direction – Slabs spanning two directions- Check for shear stresses
 - **Tee Beam and Deck Slab Bridges** (Hours -07)
General features – Courbon’s Method – Guyon – Massonet Method – Hendry Jaegar Method – Eccentric and Multiple concentric loads.
 - **Prestressed Concrete Bridges** (Hours -08)
Pre-tensioned and post-tensioned prestressed concrete bridges – Concordant cable profile – Design of End Block.
 - **Balanced Cantilever Bridges** (Hours -08)
Segmental construction – Cast in place and precast balanced cantilever – Box section – Hinged or continuous beam system – Deck cabling arrangement.
 - **Steel Bridges** (Hours -05)
Plate girder bridge – Steel Trussed bridges – Composite bridges, Design of foundation, caissons & pile.
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RECOMMENDED BOOKS

1. Krishna Raju N. “Design of Bridges” – Oxford IBH Publication House, New Delhi, 2006
2. Rakshit K. S. “Design and Construction of Highway Bridges”. New Central Book Agency – Pune, 2004.
3. Raina V. K “Concrete Bridge Practice – Analysis, Design and Economics”. Tata McGraw Hill Publication Co. Ltd., New Delhi, 2004.
4. Heins C.P. and Lawrie R.A. “Design of Modern Concrete Highway Bridges”, John Wiley & Sons., New York, USA, 2000.
5. Victor D J, “Essentials of Bridge Engineering” Oxford IBH Publication – New Delhi, 2000.

B. Tech. – IV (Civil), Semester – VIII**AM 436 : Computer Aided Design of Structures (ES-II)**

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- **COMPUTER BASED STRUCTURAL ANALYSIS AND DESIGN : AN OVERVIEW** (Hours – 02)
Concept of Structural design process – Role of Computers in Structural Design process – Advantages of Computer Aided Design (CAD)
 - **COMPUTER PROGRAMMING FOR STRUCTURAL ENGINEERS** (Hours – 08)
Introduction to MATLAB for engineers – Development of Computer Programmes for solving set of simultaneous equations – Development of Computer programmes for analysis of simply supported beam element – Determination of beam fixed end moments – Beam flexural and shear stresses etc.
 - **COMPUTER ASSISTED STRUCTURAL ANALYSIS AND MODELLING** (Hours-12)
Modelling of Structural elements like truss – beam – frame and grid using structural design software – Developing structural models using Graphical User Interphase (GUI) – Understanding preprocessing and post processing phases for solving analysis problem – Solution errors and model correctness.
 - **INTRODUCTION TO COMPUTATIONAL TOOLS FOR STRUCTURAL ENGINEERS** (Hours-10)
Spreadsheet tool for engineers – Programming with Excel / VBA – Developing Spreadsheets for the design of structural elements
 - **COMPUTER ASSISTED DESIGN OF STRUCTURES** (Hours-10)
Introduction to integrated analysis and design process using structural design software packages – Modelling building structures – Analysis and design of building structures for gravity and lateral loads.
-

BOOKS RECOMMENDED

1. Balfour, J A D (1992) "Computer Analysis of Structural Frameworks", 2nd Edition, Blackwell Scientific Publication, Oxford, UK.
2. Shah, V L (1998) "Computer Aided Design in Reinforced Concrete" 3rd Edition, Structures Publishers, Pune.
3. Davies, S. R. (1995) "Spreadsheets in Structural Design", Longman Scientific and Technical, UK.
4. Liengme, B. V. (2000) "A Guide to Microsoft excel for scientist and engineers", 2nd edition, Butterworth Heinemann, NY, USA.
5. Pratap Rudra (2006) "Getting started with MATLAB 7: A quick introduction for scientist and Engineers", Indian Edition, Oxford University Press, New Delhi

B. Tech. – IV (Civil), Semester – VIII

L T P C

**AM438: REHABILITATION AND STRENGTHENING OF
STRUCTURES (ES-II)**

3 - - 3

- **CAUSES FOR DISTRESS IN STRUCTURE**

Effect of sulphate & chlorides on concrete & steel components - Effect of salty environment on masonry components - Effect of chemical & industrial fumes on superstructures - Effect of Sea water and water vapour on underground & on ground structures - Frost damages - Effect of moisture movement and leakage on concrete components - Effect of temperature & other environmental factors

- **MAINTENANCE & REPAIR OF STRUCTURES**

Need for maintenance and repairs - Inspection of Structures for repairs and maintenance - Methods for repairs - Materials and methodology for repairs - Use of high performance materials - Cost of repairs and maintenance - Implementation and Documentation for maintenance and repair.

- **REHABILITATION OF DISTRESSED STRUCTURES**

Inspection and testing of distressed structures - Cracks in concrete members - Corrosion of reinforcement Techniques for rehabilitation of concrete structures - Use of polymer and epoxy based materials - Fibre reinforced composite for repairs - Use of steel plates and angles - Encasing of columns by other materials - Sprayed concrete crack filling protective coatings - Anticorrosive paints.

- **PREVENTIVE MEASURES FOR DURABILITY OF STRUCTURES**

Measures to be taken into consideration during construction and while designing a structure - Proper selection and specification for materials - Use of high performance materials and modern techniques for making structure durable.

BOOKS RECOMMENDED

1. Ted Kay (1992) "Assessment and Renovation of Concrete Structure" ed. John Wiley & Sons, Inc. New York.
2. Mallett G.P. (1994) "Repair of Concrete Bridges" Pub – Thomas Telford Services Ltd., Quay, London E 144 JD.
3. Rakshit K.S. (1994) "Construction Maintenance & Repair of Highway Bridges".
4. Naville A. M. (1973) "Properties of Concrete" 2nd edition, Pitman Publishing Company, Bath, U.K.

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- **FIXED ARCHES**
Analysis of fixed arches using elastic centre method - Effect of yielding of support - Change in temperature and rib shortening - Influence lines
 - **BEAMS CURVED IN PLAN**
Statically indeterminate cases, bow girder, circular and semicircular beams supported symmetrically.
 - **BEAMS ON ELASTIC FOUNDATION**
 - **STIFFNESS AND FLEXIBILITY METHOD**
Introduction to flexibility method - Comparison of stiffness and flexibility method, choice of method
 - **3 – DIMENSIONAL STRUCTURES**
Stiffness method of analysis for 3 – D truss and frames
 - **APPLICATIONS OF FINITE DIFFERENCE METHOD**
Deflections for determinate and indeterminate beams using finite difference method for various load cases.
 - **INTRODUCTION ON TO FINITE ELEMENT METHOD**
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TUTORIALS

1. Fixed Arch
2. Beams curved inplan
3. Beam on Elastic Foundation
4. Stiffness Method
5. Flexibility Method
6. Finite Different Method
7. Finite Element Methods.

BOOKS RECOMMEND

1. S. Utkn, C.H. Norris & J.B. Wilbur, "Elementary Structured Analysis" – McGraw Hill, N.J. 1991.
2. Reddy C. S. "Basic Structural Analysis", Tata McGraw Hill, New Delhi, 1983.
3. Beanfait F.W. "Computer Methods of Structural Analysis" etal. Prentice Hall, N.J. 1970.
4. Krishna Raju N. & Gururaja D.R. "Advanced Mechanics of Solids & Structures", Narosa Put House, New Delhi, 1997.
5. Cook R.D. "Finite Element Modelling for Stress Analysis", John Wiley & Sons, 1995.

B. Tech. – IV (Civil), Semester – VIII**AM 444 : GROUND IMPROVEMENT TECHNIQUES (ES-II)**

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- Introduction, Role of ground improvement in foundation engineering, Drainage techniques, Well point, Suitability of methods of stabilization
 - Insitu densification of granular and consolidation of cohesive soils, Dynamic compaction, Compaction by sand piles, Blasting, Dynamic consolidation, Pre loading with sand drains.
 - Stone columns, Methods of installation, Stabilisation of Soft clays with lime piles.
 - Earth reinforcement, Geo-synthetics, Geo-textile Applications of reinforced earth.
 - Grouting and stabilisation, Suspension and solution grout, Injection methods, Electrochemical stabilisation, Stabilisation with cement, lime and chemicals, stabilisation of expansive clays.
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BOOKS RECOMMENDED

1. Hausmann M.R. 'Engineering Principles of Ground Modification' McGraw Hill Publishing Company, New York - 1990
2. Rolt Hammond – 'Modern Foundation Methods' Oxford & IBH Publishing Co.
3. Gullhati S K & Datta M (2005) "Geotechnical Engineering", Tata McGraw Hill Publishers Co. Ltd, New
4. Jones JFP Colin – 'Earth Reinforcement & Soil Structures' Butter worths, London.
5. Mandal J. N. – 'Geo-synthetics World' Wiley Eastern Limited.

B. Tech. – IV (Civil), Semester – VIII
AM 446 : ROCK MECHANICS (ES-II)

L	T	P	C
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- Scope of rock mechanics, Object of rock exploration, Methods of rock exploration, Rock quality designation, Geophysical prospecting , Problems of rock mechanics , Rock classification.
 - Defects in rock mass – Joints, Faults, Folds.
 - Rock properties – Physical and Mechanical properties of rock, Factors influencing wave velocity, In-situ determination of elastic properties of rocks by dynamic method, Creep and its measurement, Rheology and rheological models
 - Improvement in properties of Rock mass – Necessity, Grouting, Rock bolting, Cable anchorage.
 - In-situ tests – Necessity, Requirements of in-situ tests, Plate load test, Pressure tunnel test, Bore hole test.
 - Strength test - Compressive strength test, Tensile strength test, Test for internal stress in rock, Indirect methods, Flexural strength of rock
-

BOOKS RECOMMENDED

1. Jumikis A. R. – Rock Mechanics, Trans Tech. Publication, Rock Part – 1979.
2. Ziemkiewicz & Stag – Rock Mechanics in Engineering Practice, London, Jhon Willy & Sons.
3. Goodman R. E., Introduction to Rock Mechanics – Jhon Wiley, London, 1989.
4. Arogyaswamy R. N. P. – Geo-technical Application in Civil Engineering – Oxford & IBH, London, 1991.
5. Brady and Brown “ Rock Mechanics for under mining “” Third edition Springer

B. Tech. – IV (Civil), Semester – VIII

CE 412 : Project

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The Project topic is covered in two parts. Project Preliminaries will be covered during seventh semester. The work is assigned to the batch of students immediately after the six semester examination. Thus, the candidate starts working on the given problem during the summer vacation prior to commencement of seventh semester.

The preliminary work involved is related to state-of-art literature review, identification of area and finalization of the specific problem, with clearly defined title. The presentation of the preliminaries is address as the 1st stage seminar of the proposed project work. The group of students is expected to present the plan of action and review of the published work related to the area.

After obtaining the approval along with necessary notification form the jury, the (candidates group) proceeds for the second stage of the project work.

The second stage of project work, which can be termed as the core part can be carried out at any of laboratories of the Institute OR any industry, Centre of excellence Places with whom prior permission is obtained through MOU.
