INFRASTRUCTURE PLANNING

Subject Code: 16CEM11 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: Tostudy the necessity of infrastructure & its management, finance management Fundamentals & Evaluation and managerial economics.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Planning and development of problem solving skills in management.
- Understand the principles of financial fundamentals.
- Develop analytical skills.
- Summarize the solution of economic evaluation techniques.
- Understand the concepts of financial and Economics management.

Infrastructure: Definitions of infrastructure; typical infrastructure planning steps, Governing Features, Historical overview of Infrastructure development in India.Infrastructure Organizations & Systems.

Infrastructure Planning: Infrastructure Project budgeting and funding; Regulatory Framework; Sources of Funding, Procurement strategies; Scheduling and management of planning activities.

Financial Management Fundamentals: Time value of money, cash flow, Inflation - depreciation, taxes, inflation, Personnel cost - Equipment costs – overheads.

Financial Evaluation- Investment criteria, Project cash flows – elements and basic principles of estimation, financial estimates and projections, Cost of capital, Rate of return.

Construction Finance Management: Procurement and Efficient use of resources – Statement of Changes in Financial Position (SCFP), Preparation of SCFP on Working Capital Basis, Cash Basis, and Total Resources Basis – SCFP usefulness.

Economic Analysis– Concepts and Applications, Principles of methodologies for economic analysis of public works, Social welfare function, indifference curves and tradeoffs, Demand curves and price elasticities.

Evaluation Techniques: Net present value method, Benefit-cost ratio and internal rate of return; Shadow pricing; Accounting for risk and uncertainty.

References:

1 A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
2 J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
3 P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
4 J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, New York, 1996.
5 A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
6 J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
7 L. Squire and H. G.van der Tak, Economic analysis of projects, John Hopkins University Press, London, 1975.
8 T. J. Webster, Managerial economics: Theory and practices, Elsevier, New Delhi, 2003.

CONSTRUCTION MATERIALS AND MANAGEMENT

Subject Code: 16CEM12 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non weathering materials, and smart materials.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Planning and usage management of construction materials.
- Understand the behavior of materials.
- Develop material management skills.
- Summarize the solution of inventory techniques.
- Understand the concepts of usage standards and material management.

Conventional Materials - Properties, storage, testing, acceptance criteria, applications, limitations, economic consideration of following materials.
Soil , aggregates, steel and aluminum, polymers & plastics, Composites & wood

Bitumen, Emulsion, Cutback, Bitumen mixes.

Cement, concrete mixes.

Construction chemicals and admixtures.
Water proofing materials.

Special Materials - Marginal materials, Alternate & Sustainable materials geo-textiles and geo-synthetics, additives and admixtures, thermal insulation and acoustic absorption materials- water proofing materials and compounds, stabilizers, their environmental impact assessment

Planning and Management of Construction Materials: Classification of materials, materials usage standard, materials provisioning, materials inventory and management.

References:

1. Neville,A.M., Properties of concrete,Pearson Education Asia (P) Ltd, England, 2000.
2. Mehta, P.K and Montevic. P.J., Concrete- Microstructure, Properties and Materials, ICI.
3. Jackson, N., Civil Engineering Materials, Elbs, 1983.
4. Diamant, R.M.E., Thermal and Acoustic Insulation, Butterworths, 1986.

5. Koerner, R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill Co., .
6. Flinn, R.A and Trojan, P.K., Engineering Materials and their Applications, Jaico Publications House, Delhi, 1999.
7. Concrete Technology by M.S.Shetty
8. Building Materials by Ghosh

CONSTRUCTION EQUIPMENTS AND MANAGEMENT

Subject Code: 16CEM13 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: To study and understand the various types of equipments used for earthwork, pavers, dewatering, material handling conveyors and its applications in construction projects with maintenance management

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Planning and management of construction Equipments.
- Understand the selection of equipments used for construction.
- Develop equipment management skills.
- Summarize the solution of Equipment inventory.
- Understand the concepts of usage standards and equipment management.

Plants and Equipment for production of materials- Crushers, mixers, bituminous mixing plants, concrete mixing plants, transit mixers, advantages, choice, production rate calculation.

Construction Equipment – Operations, applications and performance of dozers, excavators, graders, compactors, pavers, haulers, crawler, wheel tractors, power shovels, pile driving equipments, hauling equipments, and drilling, blasting and tunneling equipment.

Miscellaneous Equipments - Equipment for: Dredging, tunneling, dewatering. Equipment for flooring-dewatering and floors finishing.Sprayers, kerb casting equipment, screening equipment.

Selection of Construction Equipment- Task considerations, cost considerations, engineering considerations, equipment acquisition options.

Management Of Construction Equipment: Need for mechanization of construction – planning and financing construction plant and equipment – Owning and operating equipment versus hiring – planning for infrastructure mechanization equipment management – equipment maintenance and repair, log maintenance, safety during operation, economical life of equipment.

References:

1. Peurifoy, R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co.,
2. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co.
3. Smith, R.C, Andres, C.K., Principles and Practive of Heavy Construction, Prentice Hall
4. SC Sharma ‘Construction equipment’

5. Chitkara, K. K. Construction Project Management: Panning, Scheduling and Control, Tata McGraw Hill Publishing Company, New Delhi,1998.
6. Frank harris, “Modern Construction Equipment & methods”, John Wiley & Sons

REPAIR AND REHABILITATION OF STRUCTURES

Subject Code: 16CEM14 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to investigate the cause of deterioration of concrete structures, to strategies different repair and rehabilitation of structures to evaluate the performance of materials for repair.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of problem solving skills.
- Understand the causes of deterioration of concrete structures.
- Design and Develop analytical skills.
- Summarize the principles of repair and rehabilitation structures.
- Understand the concepts of serviceability and durability.

General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods
Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects.
Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. **Techniques for Repair:** Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure.

Demolition-Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

References:

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical
3. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
4. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"-R&D Center (SDCPL)

ADVANCE FOUNDATION ENGINEERING

Subject Code: 16CEM151 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of advance foundation techniques.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills.
- Understand the principles of foundation engineering.
- Develop analytical skills.
- Summarize the solution of advance techniques.
- Understand the concepts to analyze the foundation engineering techniques.

Bearing Capacity & Settlement: Presumptive bearing capacity according to BIS, Factors affecting bearing capacity, Factors influencing selection of depth of foundation, types of shallow foundations, Settlement of Shallow Foundations: Immediate, consolidation, & differential settlements, Factors influencing settlement, Safe Bearing Capacity and Allowable Bearing Pressure.

Shallow Foundations: Principles of Design of foundation, Definition for Shallow and Deep foundation, Requirements for geotechnical and structural aspects of design, Proportioning of isolated footing, combined footing, Strap footing, Strip footing and Raft foundation.

Pile Foundations – Single Pile: Historical Development, Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests, Laterally Loaded Pile.

Pile Foundations – Group Effect: Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, Under reamed piles.

Well Foundations: Historical Development, Different shapes and characteristics of wells, Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies for tilts and shifts.

Drilled Piers & Caissons: Construction, advantages and disadvantages of drilled piers. Design concepts and Advantages and disadvantages of open, pneumatic and floating caissons.

Foundations On Expansive Soils: Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and Swell pressure, Free swell, Tests on expansive soils, foundation treatment for structures in expansive soil, CNS layer.

Machine Foundations: Basic definitions in vibration, free and forced vibrations, determination of natural frequency, types of Machine foundations, general criteria for design of machine foundation., vibration analysis of a machine foundation, degrees of freedom of a blockfoundation, vibration isolation and control.

References:

1. Soil Mechanics & Foundation Engineering – V.N.S. Murthy – Pub: Sai Tech.
2. Foundation Engineering – Braja M. Das – Cengage Learning.
3. Soil Mechanics Foundations – Dr. B.C. Punmia – Pub :Laxmi publications, pvt.Ltd.
4. Foundation Analysis and Design – Bowles J.E. (1996) – 5th Ed, McGraw Hill Pub. Co., New York.
5. Advanced Foundation Engineering – V.N.S. Murthy – Pub :Sai Tech.
6. Pile Foundation.-Chellies
7. Geotechnical Engineering.- P. Purushotham Raj
8. Geotechnical Engineering – Dr. C. Venkataramaiah – Pub : New age Publications.
9. Foundation Engineering – Dr. P.C. Varghese :- Pub : Prentice Hall of India.

ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION

Subject Code: 16CEM152 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: To study the design of energy efficient buildings which balances all aspects of energy, lighting,space conditioning and ventilation by providing a mix of passive solar design strategies and to learn the use of materials with low embodied energy.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of energy conservation techniques.
- Understand the fundamentals of energy conservation and energy efficiency.
- Design and Develop energy models for construction industry.
- Summarize the principles of energy usage and conservation skills.
- Select appropriate energy conservation to reduce the wastage of energy.

Fundamentals of Energy-Energy production systems-Heating, Ventilating and Air conditioning Solar Energy and conservation-Energy Economic Analysis-Energy Conservation And Audits Domestic Energy Consumption-Savings-Primary Energy use in Buildings ResidentialCommercial-Institutional And Public Buildings.

Energy Conservation: Energy and resource conservation-Principles, Design of green buildings-rating systems-LEED Standards-Evaluation Tools for Building Energy-Embodied and Operating Energy-Peak demandComfort and Indoor Air Quality-Visual and Acoustical Quality-Energy Efficient Design Strategies Contextual factors-Longevity and Process Assessment

Energy Efficiency: Energy in Building Design-Energy Efficient and Environmental Friendly Building- Climate, Sun and solar radiation-Psychometrics-Passive Heating and Cooling Systems-Energy Audit-Types of Energy audit-Analysis of results-Energy flow diagram-Energy consumption/Unit production Identification of wastage-Priority of conservative measures Maintenance of Energy Management Programme

Energy Management : Energy Management of Electrical Equipment-Improvement of Power Factor-Management of Maximum Demand- Energy Savings in Pumps-Fans-Compressed Air Systems-Energy Savings in Lighting Systems-Air Conditioning Systems-Applications-Facility Operation And Maintenance Facility Modifications-Energy Recovery Dehumidifier- Water Heat Recovery-Steam Plants and Distribution Systems- Energy Savings In Pumps-Fans-Compressed air systems- Applications

References:

1. Moore F., " Environmental control systems ", McGraw Hill, Inc., 1994.
2. Brown, G.Z, Sun, " Wind and Light: Architectural design Strategies ",
John Wiley &Sons., 1985.
3. Cook, J, " Award - Winning Passive Solar Design ", McGraw Hill, 1984.

ADVANCE STRUCTURAL DESIGN AND DETAIL

Subject Code: 16CEM153 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of structural design of different types of structures and to detail the structures. To evaluate the performance of structures.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of problem solving techniques.
- Understand the principles of structural design.
- Design and Develop analytical skills.
- Summarize the principles of structural design and detailing.
- Understand the structural performance.

Introduction : Introduction to limit state method of design; provisions in the Indian Standard codes for loading, wind loads and seismic loads, design and detailing of concrete structures.Examples of design using BIS handbook

Structural Analysis, Design and Detailing for:

* Columns with biaxial moments.
* Grid floors.
* Silos and bunkers.
*Flat slabs.
* Concrete Chimneys.
* Multi-storey building frame design.

References:

1. Dayaratnam, P: Reinforced Concrete Structures.
2. Jain, A.K. : Reinforced Concrete,Limit State Method of Design. NemChand & Bros.
3. Punmia, B.C.Reinforced Concrete Structures, Vol II., Laxmi Publications
4. Jain and Jaikrishna : Plain and Reinforced Concrete Vol II.
5. STAAD Pro- (Software)

COMPOSITE AND SMART MATERIALS

Subject Code: 16CEM154 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non weathering materials, and smart materials.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Planning and usage of construction materials.
- Understand the behavior of materials.
- Develop material manufacture skills.
- Summarize the models of material behavior techniques.

Introduction: Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic laminae, thermo – mechanical properties, micro – mechanical analysis, characterization tests. Classical composite lamination theory, cross and angle – play laminaes, symmetric, antisymmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories – first fly failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites.
Introduction to smart materials and structures – piezoelectric materials – coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysterics – creep – strain rate effects – manufacturing.

Actuators and sensors: single and dual actuators – pure extension, pure bending – bending extension relations – uniform strain beam model – symmetric induced strain actuators – bond

Shearing force – Bernoulli Euler (BE) beam model – embedded actuators.
Assymetric induced strain actuators in uniform strain and Euler – Bernoulli models. Uniform strain model – energy principle formulation – BE model – single and dual surface bonded actuators – Extension – bending and torsion model.

Introductions to control systems: Open loop and close loop transfer functions – stability criteria – deflection control of beam like structures – using piezoelectric sensors and actuators – shape memory alloys.

References:

1. Mechanics of Composite Materials and Structures by M. Mukhopadhya- Universities Press 2009
2. RobartM.Jones, “Mechanical of Composite Materials”- McGraw Hill Publishing Co.
3. Bhagwan D Agarvalm, and Lawrence J Brutman, “Analysis and Performance of Fiber Composites”- John Willy and Sons.
4. Crawley, E and de Luis, J., “Use of Piezoelectric actuators as elements of intelligent structures”- AIAA Journal, Vol.20, No.10, Oct 1987, PP 1373-1385.
5. Crawley, E and Anderson, E., “Detailed models of Piezoceramic actuation of beams” - Proc. of the 30th AIAA/ASME/ASME/ASCE/AHS/ASC – Structural dynamics and material conference, AIAA, Washington DC, April 1989.

CONSTRUCTION MATERIALS LABORATORY AND QUALITY PRACTICE

Subject Code: 16CEM16 **IA Marks: 20**
Practical / Week: 03 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles and designof experiments. To investigate the performance of various construction materials.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of experimental skills.
- Understand the principles of design of experiments.
- Design and Develop analytical skills.
- Summarize the testing methods of equipments.

Concrete mix design, Tests on fiber reinforced concrete, Tests on concrete with different binders, Tests related to self compacting concrete, Non destructive tests- Rebound hammer test, Ultrasonic Pulse velocity test, Rebar Locator. Tests on reinforcement steel, Corrosion tests. Tests on bitumen, marshal mix design, tests on aggregate, gradation.

References:

1. Raju N Krishna, (2004) “Design of concrete mixes”, CBS Publishers, New Delhi.
2. Gahlot P S, “Concrete mix design”, Indian society for technical education, Mysore.
3. Krishnamurthy S ,Bhattacharjee B, “Concrete mix design and recent technology of placing concrete”, Indian society for technical education, Mysore.
4. Kishore Kaushal, (1992) “Method of concrete mix design with chemical admixtures and for pumped concrete”, Standard Publishers, Delhi.
5. RathoreShailendra Singh, (2003) “Computer aided concrete mix design”, Allied Publishers Delhi.
6. “Fibre reinforced concrete”, SERC, 1987.
7. Raj Baldev, (1997) “Practical non destructive testing”, Narosa Publishing House Delhi.
8. Maldague Xavier P V, Moore Patrick O, (2001) “Non destructive testing Handbook”, American Society for Non-destructive Testing, USA.

ADVANCE CONCRETE TECHNOLOGY

Subject Code: 16CEM21 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of concrete mix design to differentiate between different types of concrete to characterize high performance concrete.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of problem solving techniques.
- Understand the principles of concrete mix design.
- Design and Develop analytical skills.
- Summarize the light weight concreter, fiber reinforced concrete.
- Understand the concepts of HPC.

Principles of concrete mix design : concrete materials, mix proportioning and early age properties, strength, permeability and durability.

Concrete mix design procedures : IS/ACI British Standards, mix design procedures using fly ash, fibers and design of high performance concrete.

Concreting operations - practices and equipment, batching; mixing; transporting; shuttering and staging; placing and compacting; curing, accelerated curing; finishing and jointing.

Properties and techniques of construction: for concrete, admixtures, polymers, epoxy resins, pozzolanic materials and fly ash, fibre reinforced concrete, light weight concrete, heavy weight concrete, foam concrete, high performance concrete.

Inspection and quality control of concrete construction - stages, principles, checklist, statistical controls, procedures.

Special cement and concrete -Advances in concrete construction; Non-destructive evaluation of concrete structures; Cement-based composites; Special concrete operations, shotcrete, grouting, under water concreting,hot and cold weather concrete, pumpable concrete, ready mixed concrete.

Construction techniques for reinforced concrete elements - materials, principles and procedures for beams, slabs, columns, foundations, walls and tanks, design and fabrication of

formwork fo r R.C.C elements, features of slip forming and precautions, details of special shuttering required for lining of tunnel, procedures and precautions.

Pre-stressed concrete construction-principle, methods, materials, tools and equipment for the construction of pre-stressed concrete, segmental precast elements, post tensioning.

References:

1. Gambhir, M.L. , Concrete Technology, Tata McGraw Hill, New Delhi
2. Orchard, Concrete Technology, Applied Science Publishers Ltd. London
3. Neville, Brooks, Concrete Technology, Addison – Wesley, England
4. Neville A.M., Properties of Concrete, The English Language Book Society and India
5. Publishing , London
6. Raina V.K., Concrete for Construction , Tata-McGraw Hill Publishing Co. Ltd. New
7. Delhi.
4. Swamy, . New Concrete Materials, Surrly University Press, London
5. Young, Concrete, Prentice Hall Inc. New Jersey.
6. Waddell, et.al: Concrete Construction Handbook, McGraw Hill Inc.
7. Sood, Hemant et al.; Laboratory manual in Concrete technology M/S CBS
8. Publications and Distributors, New Delhi.
9. Sood, Hemant; Jyoti P.M. ; Software on Concrete Mix Design ConMD – 2000,
11. Shetty, M.S.' Concrete Technology, M/S S. Chand & Co. Ltd. New Delhi
12. Mehta P. Kumar &Monteiro, Paulo J.M., Concrete Microstructure , Properties and Materials, M/S Indian Concrete Institute, Chennai.

PROJECT MANAGEMENT IN CONSTRUCTION

Subject Code: 16CEM22 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of Project management, schedule management, and its Fundamentals.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Planning and development of problem solving skills in project management.
- Understand the principles of schedule development and management fundamentals.
- Develop analytical skills.
- Summarize the solution of risk techniques.
- Understand the concepts of resource leveling and its management.

Introduction to project management processes - Initiating, Planning, Executing, Controlling, and Closing processes; Project Integration Management - Project plan development, Project plan execution, and Overall change control; Project Scope Management - Initiation, Scope planning, Scope definition, Scope verification, and Scope change control;

Project Time Management - Activity definition - work breakdown structure, Activity sequencing – scheduling logic, precedence diagramming method, arrow diagramming method, Activity duration estimation,

Schedule development and analysis - critical path method, program evaluation and review technique, production curves, line-of-balance method, Duration compression, Resource constrained scheduling, Schedule control; Project Cost

Management - Resource planning, Cost estimating, Cost budgeting, and Cost control – earned value method; Project Resource Management - Resource aggregation,

Resource leveling – method of moments, double moments, Resource allocation; Time-cost Tradeoff; Project Quality Management - Quality planning, Quality assurance, and Quality control;

Project Risk Management - Risk identification, Risk quantification, Risk response development and control; Project Procurement Management - Procurement planning, Solicitation planning, Solicitation, Source selection, Contract administration, and Contract

References:

1 T. Hegazy, Computer-based construction project management, Prentice Hall, New Jersey, 2002.

2 S. M. Levy, Project management in construction, 5th ed., McGraw Hill, New York, 2007.

3 PMI, A guide to the project management body of knowledge, 3rd ed., Project Management Institute, Pennsylvania, 1996.

4 M. Mawdesley, W. Askew and M. O'Reilly, Planning and controlling construction projects, Addison Wesley Longman Limited, Essex, 1997.

5 J. Kelly, S. Male and D. Graham, Value management of construction projects, Blackwell Publishing, Oxford, 2003.

DISASTER MITIGATION AND MANAGEMENT

Subject Code: 16CEM23 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of concrete mix design to differentiate between different types of concrete to characterize high performance concrete.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of problem solving techniques.
- Understand the concept of physical hazards and concepts.
- Design and Develop analytical skills.
- Summarize the Environmental Hazards & Disasters and its management.
- Understand the Indian specifications for Disasters management.

Environmental Hazards & Disasters- Environmental disasters and environmental stress.Types of environmental hazards & Disasters, Earthquake Hazards- Causes of earthquakes, distribution of earthquakes, effects of earthquakes, earthquake hazards in India, human adjustment, perception & mitigation of earthquake. Cyclones -- Tropical cyclones & local storms,, destruction by cyclones, causes , distribution, human adjustment, perception & mitigation. Cumulative atmospheric hazards/ disasters- floods, droughts, cold waves, heat waves Conventional earthquake resistant design, Seismic base isolation method, retrofitting, Training, demonstrations and exhibitions, Information management (Safety, emergencies, management and planning, design, response, user experience problems and case studies, Proper land use practices, long term disaster preparedness measures. Precautions after a major earthquake, Preparedness for medical supply Emergency care (First aid, Home remedies), Disposal of dead bodies (Human and Cattle), Care for old and orphans.
Physical hazards/ Disasters-Soil erosion and sedimentation-- mechanics & forms of soil erosion and sedimentation, factors & causes of soil erosion and sedimentation, conservation measures of soil erosion. Chemical hazards/ disasters-release of toxic chemicals, nuclear explosion.

Approaches in Disaster reduction / Management-
Pre- disaster stage (preparedness) - Preparing hazard zonation maps, predictability/ forecasting & warning, preparing disaster preparedness plan, Land use zoning, preparedness through (IEC) Information, education & communication pre-disaster stage (mitigation), Disaster resistant house construction, population reduction in vulnerable areas, awareness Emergency Stage - Rescue training for search & operation, immediate relief, assessment surveys

Post disaster stage- Rehabilitation, Political administrative aspect, social Aspects, economic, environmental aspects.

Disaster Management- An integrated approach for disaster preparedness, mitigation & awareness.Meteorological observatory, Seismological observatory, Hydrology Laboratory, Industrial Safety inspectorate, Institution of urban & regional planners, Chambers of Architects, Engineering Council, preparedness of various govt departments, Education on disasters, Community involvement Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilation (Infrasturerehabilation, Housing rehabilation, Social rehabilation), Role of volunteers, Emergency operation centres, Information system, Danger zone restrictions, Cooperation with local authority, Coordination for international relief, Role of government, NGO's, Bussiness and donors, Role of remote sensing in relief operations, Information management and related technologies in engineering and disaster management. The design and management of Disaster Information Resource Network, Asian Disaster Preparedness Centre, Regional data base, Contacts and Sources, CD - ROM Library for Natural Disaster Management, Regional Disaster Documentation Centre, Non GovernmentalOrganisations.

India Specific Land Subsidence, Coastal Erosion, Cyclone , failure of hill slopes,Ecological planning for sustainability & sustainable development in India, sustainable rural development, Role of Panchayats in disaster mitigations Environmental policies& programmes - Institutions & National Centres for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

References:

1 .R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi

2 Savinder Singh Environmental Geography, PrayagPustakBhawan

3 Kates,B.I& White, G.F The Environment as Hazards, oxford, New York

4 R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi

5 H.K. Gupta (Ed) Disaster Management, Universiters Press, India

6 Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi

7 A.S. Arya Action Plan For Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi

8 R.K. Bhandani An overview on Natural &Man made Disaster & their Reduction CSIR, New Delhi

9.M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi

10 Disaster Mitigation Experiences &Reflectios by PardeepSahni, AlkaDhameja, and Uma Medury.

11 Disaster Management Report by Department of Agriculture and Cooperation, Govt. of India.

ANALYSES AND DESIGN OF PAVEMENT

Subject Code: 16CEM24 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of design of pavements

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills in pavement design.
- Understand the principles of pavement design and analysis.
- Develop analytical skills.
- Summarize the solution of design techniques.
- Understand the concepts of pavement design by various methods.

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and strains in flexible pavements:

Stresses and strains in an infinite elastic half space - use of Boussinesq's equations- Burmister's two layer and three layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors

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

Stresses in rigid pavements: Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

Rigid pavement design: Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements;
Use of relevant software in flexible pavement design (KENLAYER, Asphalt Institute, Design Guide 2002) and concrete pavement design (KENSLAB, HIPERPAVE)

References:

1. Yoder and Witczak, "**Principles of Pavement Design"-** John Wiley and sons Inc(second edition) 1975
2. Yang, "**Design of functional pavements"-**McGraw Hill Book Co.
3. Huang, "**Pavement Analysis**"- Elsevier Publications
4. David Croney, Paul Croney, "**Design & Performance of Road Pavements"-**McGraw hill Book Co.
5. W.Ronald Hudson, Ralph Haas and Zeniswki "**Modern Pavement Management"-** McGraw Hill and Co
6. IRC 37-2001, IRC 81-1997, IRC 58 – 2002, IRC 59 – 1976, IRC 101-1988, Indian Roads Congress
7. Khanna and Justo "**Highway Engineering**"- Nemchand& Bros, Roorkee

STATISTICS AND NUMERICAL ANALYSIS FOR CONSTRUCTION

Subject Code: 16CEM251 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of statistics and numerical analysis and its application in construction.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of problem solving techniques.
- Understand the concept of statistics and numerical analysis.
- Design and Develop analytical skills.
- Understand the application of statistics and numerical analysis in construction.

Various Statistical Measures. - Basic probability, sample space, events, axioms of probability conditional probability, independent events. Random variables, continuous/Discrete random variables, exception, valance,convenience, conditional distributions, moment generating functions.

Multiple regressions.Distributions, Bernoulli, Binomial, Poisson, Uniform, Normal, Exponential, Chisquare T and F.

Sample statistics, empirical distributions, and goodness of fit, sampling from normal populations.

Parameter estimation, moment method, maximum likelihood, interval estimated. Hypothesis Testing, Significance Intervals.

Numerical Methods Basic: Summary of basic concepts from Linear algebra and numerical analysis, Matrices, Operation counts, Matrix Norms, Type of Errors in Numerical computation.

Numerical Integration Gaussian Quadrature, Romberg Integration, Adaptive Quadrature.

Matrix Factorization And Linear System :

Cholesky Factorization, QR factorization by House holder matrices Lufactorization and Gaussian elimination, partial pivoting, error Analysis (statement of result) soling triangular system by substitution, solving full systems by factorization. Lu-factorization for banded and sparse matrices, storage schemes, Iterative Methods, Jacobi, Gauss – Seidal and SOR Iterations, Conjugate gradient method, preconditioning.

Introduction to: Spss / Sas software / Matlab Statistical Tool Box,Use Of Mathematical Software

References:

1. Miller, Freund Hall ‘Probability and Statistics for Engineers’ –, Prentice India Ltd.
2. Pipes and Harvill ‘Applied Mathematics for Engineers and Physiscists’-. McGraw Hill International Edition.
3. Sampling techniques-Cochran, Wiley Series.
4. Numerical methods, E. Balaguruswami, McGraw Hill publication.
5. Numerical Methods: Problems & Solutions, Jain Mk ,IyengarSrk,JainRk, Wiley Eastern Ltd.

PAVEMENT MAINTENANCE & MANAGEMENT SYSTEMS

Subject Code: 16CEM252 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of pavement maintenance andmanagement system.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills in pavement maintenance and management system.
- Understand the principles of pavement maintenance and management system.Fundamentals.
- Develop analytical skills.
- Summarize the solution of maintenance techniques.
- Understand the concepts of pavement maintenanceand its management.

Introduction: Introduction to Pavement Maintenance Management System, Components of Pavementcomponents of pavement management systems, pavement maintenance measures, planning investment, research management Maintenance Measures, PMMS objectives.

Requirements and Evaluation of flexible pavements – Design requirements, factors affecting structural condition of flexible pavements, structural behavior and evaluation of structural condition of pavements. Design methods for flexible pavements, design of overlays by Benkelman Beam Rebound Deflection Technique.
Pavement Serviceability concepts, Evaluation of riding quality by psycho- physical method. Pavement Maintenance Measures, Implementation of Maintenance management programs.

Pavement Performance Evaluation: general concepts, serviceability, pavement distress survey systems, performance evaluation

Pavement Performance Prediction: concepts, modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models. Functional condition deterioration models, unevenness prediction models and other models, comparison. Modeling in rehabilitation budget planning, case studies, Problems.

Ranking and Optimization Methodologies: Recent developments, sample size selection, economic optimization of pavement maintenance and rehabilitation.

Design alternatives and Selection: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, reliability concepts in pavement engineering, life cycles costing, analysis of alternate pavement strategies based on distress and performance, case studies and Problems.

Expert systems and Pavement Management: role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge – based expert systems, case studies.

References:

1. Ralph Hass, Ronald Hudson and Zanieswki, "Modern Pavement management"- Krieger Publications.
2. W. Ronald Hudson, Ralph Haas and WaheedUddin, 'Infrastructure Management'- McGraw Hill
3. Proceedings of North American Conference on Managing Pavement.
4. Proceedings of International Conference on Structural Design of Asphalt Pavements.
5. NCHRP, TRR and TRB Special Reports.
6. Freddy L Roberts, Prithvi S Kandhal et al, "Hot Mix Asphalt Materials, mixture design and construction"- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.

REUSE & RECYCLE TECHNOLOGY

Subject Code: 16CEM253 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: To promote innovative technologies to reduce waste, recycle and reuse.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of problem solving techniques.
- Understand the principles of recycle and reuse of materials .
- Design and Develop analytical skills.
- Summarize the waste materials.
- Understand the concepts of recycling

Waste as a Resource- Resource Economics, Disposable Materials, Recovery, Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse. Waste Analysis: Sampling, Composition, Categorization, Determination of Waste Properties, Ash and Fineness Analysis, Energy Content.

System Design: Design of Recycling Systems, Collection System, Process Train Design andComplexity, Product Design of Recycling, Conveyance, Transport Safety, Efficiency of Operation Systems.

Energy Recovery: Combustion, Energy Losses, Energy Recovery Analysis, Emission Control, Residue Control, In-plant Operations, Refuse Derived Fuel-cogeneration and tri generation concepts.

Water Reuse: Direct and Indirect Reuse, Intentional Reuse, Groundwater Recharge, Case studies of Water Reuse, Close Cycle and Open Cycle Reuse, Recreational Reuse.Reuse of Industrial Effluents: Urban Effluent Reuse for Agriculture in Arid and Semiarid Zones, Uses of in Pisciculture, Groundwater Recharge using treated Domestic wastewater.

Metals Recovery: Ferrous Metals, Properties, Principles of Magnetic Field-ferrous Material Interactions, Magnetic Separation Equipment, Non-ferrous Metal Separation, Eddy-Current Separation – Theory and Types, Extraction of Material from a Bed. Reuse of construction waste, Demolished concrete, RAP material, Recycled aggregates.

Health Aspects of Water Reuse: Guidelines for Evaluating Recreational Water Reuse, Resource Conservation and Recovery Act.

References:
1 Takashi Asano, Water Reuse: Issues, Technologies, and Applications, , McGraw-Hill Prof

Med/Tech, 2007
2 Mackenzie Davis, and Susan Masten, "Principles of Environmental Engineering & Science",McGraw Hill ,2 nd edition, 2008.
3 Henry, J. G. and G. W. Heinke, "Environmental Science and Engineering", 2nd edition, Prentice Hall, Inc., Upper Saddle River, NJ, 1996.
4 Kiely, G, "Environmental Engineering", Irwin/McGraw-Hill Book Co., Singapore, 1999
5 Vogler, Jon, Work from Waste – Recycling Wastes to Create Employment, Intermediate Technology Publications, 1981
6 McHarry, Jan, Reuse Repair Recycle, Gaia Books Ltd. 1993.

URBAN HYDROLOGY, STORM DRAINAGE ANDMANAGEMENT

Subject Code: 16CEM254 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of urbanhydrology, storm drainage and management
Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills.
- Understand the principles of urban hydrology, storm drainage and management.
- Develop analytical skills for storm water modeling.
- Summarize the solution of advance management techniques.
- Understand the conceptsurban hydrology, storm drainage and management.

Urban Hydrologic Process : Process of urbanization – Water in Urban ecosystem – Urban water subsystems – Urban hydrologic cycle.Impact of urbanization on urban runoff and stream flow quantity – Impact of urbanization on quality of runoff and stream flow – Erosion due to urban runoff.

Stormwater Modeling: Analysis of hydrologic changes due to urbanization- Approaches to study – Data collection and analysis – Probabilistic and statistical approaches. Modelling of urban water quantity – Types of models – Rainfall, Runoff modeling ; urban watershed modeling (quantity) – Rational Method (or coefficient method), Runoff hydrograph, unit hydrographs – 10 min synthetic unit hydrograph – Linear reservoir model (Viessman) – Chen and Shubinski model – QUURM Model – TVA model. Urban watershed modellingfor water quality of runoff and stream water quality.

Urban Drainage Systems : Sanitary and combined sewer systems – components – Design considerations for fixing sewer capacity – Infiltration into and exfiltration from sewers -causes Infiltration inflow analysis – Field investigations – Control measures.

Design consideration of the components of the sewer systems – Performance of the sewer system both under dry weather flow condition and under storm water impact - Sewer sediment.

Storm Water Management: Urban storm runoff quantity and quality management – Mitigation of damaging effects of urban storm runoff

Structural and non-structural control measures – Storm water management models.

Urban Drainage Systems Maintenance: Maintenance management of UDS and its subsystems – Drainage system – Storm drain conveyance system – Pump stations – Open channel – Illicit connections and discharges – Spill response – Other considerations (limitations and regulations).

Text Books :

1. Stephenson.D, " Stormwater Hydrology and Drainage ", Elsevier Publications, 2nd Edition, 1981
2. Hall.J.M, "Urban Hydrology", Elsevier Applied Science Publishing Company, 1st Edition, 1984.
3. Overtens D.E., and MedowsM.E., "Storm water Modelling" Academic Press, 2nd Edition. 1976.

References :

1. Grigg, N.S, "Urban Water Infrastructure Planning, Management, and Operations", John Wiley & Sons, 2nd Edition, 1986.
2. Viessman W.I., Knapp J.W., Lewis G.L., and Henbrough, T.E., "Introduction to Hydrology" Harper and Row Publishing Company, 2nd Edition , 1977.
3. "Manual of Sewerage and Sewage Treatment", Ministry of works and Housing, Government of India, 2006

PROJECT MANAGEMENT LAB

Code: 16CEM26 **IA Marks: 20**
Practical / Week: 03 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of project management by softwares.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of Design and development of experimental skills.
- Understand the principles of design of experiments.
- Design and Develop analytical skills.
- Summarize the mangement methods by softwares.

Spread sheet programming. Programming management problems such as price forecasting, regression analysis, inventory models, Operation Research and project management problems. Database Management using popular DBMS like Access.Introduction to Project Management Softwares- MS Project & Primavera Working on Practical Projects.

Modelling / Hadling actual practical project management projects.

References:

1. Raina V.K., (1988), "Construction Management practice", Tata – McGraw Hill publishing co. Ltd.
2. Punmia B.C. and Khandelwal K.K., (1989), "Project Planning and Control with PERT. and CPM", Laxmi Publication II Edn..
3. K KChitkara, (1999), "Construction Project Management", Tata- McGraw Hill publishing co. Ltd.Publication.
4. Rain Diana, “Training Guide to Microsoft Access”, BPB Publications, New Delhi
5. Step by step Microsoft access(CD ROM),PHI Delhi
6. User Manual- MS Project & Primavera P6
7. Ang and Tang, (1984) "Probability concepts in engineering planning and design", Vol. I and II, Wiley International.
8. Kottegoda N.T., Rosso Renzo, (1998) "Statistics, Probability and Reliability for Civil and Environmental Engineers", Mc-Graw Hill International.
9. AICTE Continuing Education Programme, "Quantitative Methods in Construction Management"

CONSTRUCTION QUALITY AND SAFETY MANAGEMENT

Subject Code: 16CEM41 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of construction quality and safety management.
Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills.
- Understand the principles of construction quality and safety management.
- Develop analytical skills to maintain quality.
- Summarize the solution of advance quality and safety management techniques.

Quality and concept of QM - Necessity for improving quality,, concept of quality control, quality assurance, quality management and total quality management , Total quality management concepts; ISO9000 documentation; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment; Material Quality Assurance; Specifications and Tolerances.
Quality Planning - Quality policy, objectives and methods in construction industry - consumers satisfaction -, time of completion - statistical tolerance.
Codes and standards quality manuals - documents - contract and construction programming - inspection procedures -processes and products - total QA / QC programme and cost implication.
Managing Quality in various projects stages from concept to completion by building quality into design of structures, Inspection of incoming material and machinery In process quality inspections and tests.
Reliability & Probability testing, reliability coefficient and reliability prediction - selection of new materials - influence of drawings, detailing, specification, standardization - bid preparation - construction activity, environmental safety and social factors -natural causes and speed of construction - life cycle costing - value engineering and value analysis.
Quality Assurance Department -and quality control responsibilities of the line organization, developing quality culture in the organization, training of people,

Construction accidents -importance, causes of accident, safety measures, construction industry related laws. human factors in safety – legal and financial aspects of accidents in construction – occupational and safety hazard assessment.
Safety Programmes - elements of safety programmes, job-site assessment, safety meetings, safety incentives, contractual obligations, safety in construction contracts

Safety in Design- safety culture - Safe Workers- Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company Activities and Safety - Safety Personnel - Sub-contractual Obligation - Project Coordination and Safety Procedures - Workers Compensation , Safety issues; Injury accidents and their causes; Safety program components; Role of workers, Supervisors, Managers and Owners; Safety Procedures for various construction operations; Safety audits; Safety laws.

Safety Management - safety and first line supervisors, safety and middle managers, top management practices, safety audit, safety equipment planning and site preparation, safety system of storing construction materials Excavation - blasting- timbering-scaffolding- safe use of ladders- safety in welding. First- aid- Fire hazards and preventing methods.

References:

1. James, J.O Brian, Construction Inspection Handbook - Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tenah, Jose, M. Guevara, Fundamentals of Construction Management and Organization, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M, Quality Planning and Analysis, Tata McGraw Hill, 1982.
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 1993.
5. Clarkson H. Ogiesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. IS, IRC, Other codes
7. Jimmy W. Hinze, *Construction Safety, Prentice Hall Inc., 1997*
8. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, *Construction Safety and Health Management, Prentice Hall Inc., 2001.*
9. Hand Book on Construction Safety Practices, SP 70, BIS 2001.

ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

Subject Code: 16CEM421 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles of environmental impact and its management.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills.
- Understand the principles of environmental impact by construction.
- Develop analytical skills to reduce impact on environment.
- Summarize the solution of impact on environment and management techniques.

Introduction – Environment and its interaction with human activities.Environmental imbalances, basic concepts of E.I.A., Element ofE.I.A. Environmental attributes, Indicators – Screening and ScopingEnvironmental Impact Statement (E.I.S).

Environmental Setting – Environmental Inventory, environmentalindicators – Parameters, Indicators for terrestrial subsystems,Indicators for aquatic subsystems, socio-economic indicators,indicators for health and nutrition.

Environmental Impact Assessment methodologies – Importantconsideration for choosing a methodology ; categorization ofmethodologies. Review criteria, Environmental Management Plan(EMP). Step by step procedure for preparing on E.I.A.Prediction and Assessmentof Impacts on the Air Environment, on thesurface water environment, on vegetation & wild life.

Public participation in Environmental Decision making, practical consideration in preparing EIA and Statements, salient features of project activity.
Prediction and Assessment of impacts on soil and groundwaterenvironment;On the biologicalenvironment, on the socio –economic environment**.**

Prediction and Assessment of impacts on the cultural environment.Decision methods for evaluation of alternatives, public participation.

Environmental Audit – Environmental legislation, objectives Environmental Audit, types, audit protocol, evaluation of audit data and preparation of audit report**.**

Preparation of Impact Assessment for some industries and case studies – standard and mandatory requirements**.**EIA for various civil engineering projects.

References:

1. Canter L.W. Mc. Graw Hill Publication Publication Co., 1st Edition 1996
2. Jain, R.K. , Urban, L.V. Stray, G.S. "Environmental Impact Analysis" Van Nastrand Reinhold Company, 2nd Edition, 2004
3. Anjaneyulu, VallManickam., Environmental Impact Assessment Methodologies, B.S. Publications, 1st Edition, 2000
4. Ran J.G. & Wooten, D.C., Environmental Impact Assessment" McGraw Hill Publication Company, 2nd Edition, 1999
5. Methodologies, Guidelines for the integrated Environmental evaluation of water Resources Development, UNESCO/UNEP, Paris, 1990.
6. Betty Bowers Mariott, "A Practical Guide on Environment
Impact Assessment"

STEEL AND COMPOSITE CONSTRUCTION TECHNOLOGY

Subject Code: 16CEM422 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles and design of steel and composite construction technology.
Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills.
- Understand the design principles of steel and composite construction technology.
- Develop analytical skills of composite structures.
- Summarize the solution of problem solving skills.
- Understand the concepts steel detailing, fabrication, erection and construction.

Introduction: Materials, classification and properties Structural steel sections and data Behavior of steel structures: Steel water tanks, Chimneys and Stacks, Bridge Structures, Building Frames, Steel Space grids.

Structural Steel Detailing: Symbols, layout drawings, shop detail drawings, assembly marking.

Structural steel fabrication: Methods - tools, equipment and practices, Punching, Reaming and drilling, cutting Operations, fittings, fasteners, bolting, riveting and welding, Assembly, inspection, cleaning, sand blasting and painting: Transportation of fabricated components, Storage and handling.

Erection of steel structures :Erection equipment, erection tools, methods of erection, section sequence field connections, detailing to facilitate erection. Specifications, Estimating and costing steel work.Fire protection of steel construction **Maintenance** and repair of steel structures

Composite Constructions Introduction to composite construction, basic concepts, types of composite**,** Constructions Steel concrete composite, Analysis and of composite beams Composite floors.

Shear connectors: functions & types Steel concrete composite columns, columns subjected to axial loads and moments. Encased composite construction of beams and columns, concepts and design.

References:

1. Ramachandra, ‘Design of steel structures’, Standard Book House, New Delhi
2. Bryan E.R., ‘The stressed skin design of steel buildings’
3. Malhotra M.M. ‘Design of Steel Structures’

4. BreskerBoro, ‘Design of steel Structures’
5. Dayaratnam, ‘Design of Steel Structures’.
6. IS:11384, IRC-22
7. Composite Structures, G M Sabnis
8. “Composite Construction, Design for Buildings”, Viest et al., 1997, ASCE/McGraw-Hill, Inc.
9. “Handbook of Structural Steel Connection Design and Details” Edited by Akbar Tamboli, McGraw Hill

BRIDGE AND GRADE SEPARATED STRUCTURES

Subject Code: 16CEM423 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: The objective of this course is to make students to learn principles and design of bridge and grade separated structures.

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills.
- Understand the design principles of bridge construction technology.
- Develop analytical skills of caissons and RE panels.
- Summarize the solution of problem solving skills.
- Understand the concepts geometry, substructures, superstructures and composite construction.

Geometry -Traffic lane, road way, footpaths, and clearance for vehicles, kerb, crash barrier, parapet, lighting, horizontal and vertical alignment, super-elevation, drainage

Substructures- soil exploration techniques. piling methods, pile types, pile testing, Pile concreting.

Caissons or well foundations: Caisson construction and sinking methods,- bed preparation, supporting structures, excavation method, de-watering for freeing a 'hanging' caisson, pneumatic sinking of caissons, methods of staining and bottom plugging

Superstructure - reinforced concrete superstructure, prestressed concrete superstructure,- composite and steel superstructure, special superstructures. Slab, T-beam and Box girder deck slab construction: Slab type, T-beam and box-girder bridges Decks Construction methods. Span lengths -deck and stiffening system.

Segmental Construction, Cantilever Construction and Successive Launching- Precast segmental construction for long-span bridges- cables and their profiling - deck section - soffit surface -deflection and pre-camber - expansion joint - bearings - aesthetics. Cable-stayed bridge construction - Construction methods - cable configuration - towers - multi span cable stayed bridges - stay tendons - aerodynamic stability.

Composite Construction -steel - concrete composite construction - theory of composite structures -Introduction to steel - concrete - steel sandwich construction.

RE Panel Structures - geosynthetics, functions and applications, reinforced retaining walls, construction methods, benefits .

References:

1. Chew Yit Lin, Michael, Construction Technology for Tall Buildings, Singapore University Press, World Scientific, Hong Kong,
2. Victor.D.J, Essentials of Bridge Engineering, Oxford IBH
3. Ponnuswamy.S, Bridge Engineering, Tata McGraw Hill

4. Raina V.K. Concrete Bridge practice, Tata McGraw Hill Publishing Co.
5. Derrick Beckett, An Introduction to Structural Design of Concrete Bridges, Surry University Press, Oxford Shire
6. Fleming. W. G. K., et al., Piling Engineering, Surrey University Press, London.
7. E.C. Hambly, Bridge deck behaviour, Chapman and Hall, London

8. N.KrishnaRaju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.

9. IRC: 5, Standard specifications and code of practice for road bridges, Sections I to V,IndianRoads Congress, New Delhi.

10. Indian railway standard code of practice for the design of steel or wrought iron bridge carrying Rail, road or pedestrian traffic, Govt. of India, Ministry of Railways,

ECO-FRIENDLY CONSTRUCTIONS

Subject Code: 16CEM424 **IA Marks: 20**
No. of lecture Hours/ Week: 04 **Exam Hours: 03**
Total No. of Lecture Hours: 52 **Exam Marks: 80**

Objectives: To study and understand the function of materials used for constructing eco friendlyconstructions and generate substantial cost savings

Course outcome: on completion of this course, students are able to

- Achieve Knowledge of problem solving skills for eco friendly construction.
- Understand the principles of eco friendly construction planning.
- Develop analytical skills for cost effective construction techniques.
- Summarize the solution of eco friendly construction and management techniques.

Eco-friendly Planning:-Energy Efficient Shelters, Housing Options Today, Site Planning and Use of On-Site Resources, Smaller Houses that Utilize Space and Materials More Efficiently, Working With Nature, Better Window Planning, Balancing Energy and Aesthetic Needs.

Eco-friendly Materials: Construction materials –locally available building materials- Soil, Fly ash, Ferrocement, Lime, Fibres, Stone Dust, Red mud, Gypsum,Alternate Wood, Polymer-ADOBE,Cob Rammed Earth, Light Clay, Straw-Bale, Bamboo, Agro-Industrial Waste, Innovative Materials Developed by CBRI, SERC, Structural Properties Of Alternate Building Materials, Earthen Finishes , Earth Plasters, Earth Floors.

Cost Effective Construction Techniques: Construction Techniques-Innovative Techniques developed by CBRI, SERC for foundation, superstructure, roofing, pre-fabricated construction techniques, advantage of pre-fabrication areas where pre-fabrication can be introduced, modular contained earth, earth bag construction

Cost Effective Construction EquipmentsEquipments-Brick moulding machine, Stablilised soil block making machine and plants for the manufacturing of concrete blocks, M.C.R. tile making machine, Ferrocement wall panel & Roofing channel making machine, R.C.C. Chaukhat making machine.

References:

1. Givoni, “Man, Climate, Architecture”, Van Nostrand, New York, 1976.
2. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery,John Wiley &Sons,2005
3. Lynne Elizabeth, Cassandra Adams “Alternative Construction : Contemporary Natural BuildingMethods ”, Softcover, Wiley & Sons Australia, Limited, John,2005
4. Eugene Eccli- “Low Cost, Energy efficient shelter for owner & builder”, Rodale Press, 1976