VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT

M.Tech.,- Choice Based Credit System (CBCS) Syllabus **2018-2019**

TITLE OF THE COURSE: APPLIED STATISTICS

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, I Semester,

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM11**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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.

Module - 2

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.

Module - 3

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.

Module - 4

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.

Module - 5

Numerical Integration Gaussian Quadrature, Romberg Integration, Adaptive Quadrature.

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

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.

Text Book & 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.

TITLE OF THE COURSE: INFRASTRUCTURE PLANNING
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, I Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM12**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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.

Module - 2

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.

Module - 3

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.

Module - 4

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.

Module - 5

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

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.

Text Book & 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.

TITLE OF THE COURSE: CONSTRUCTION MATERIALS AND MANAGEMENT
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, I Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM13**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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.

Module - 1

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

Module - 2

Materials - Properties, storage, testing, acceptance criteria, applications, limitations, economic consideration of following materials.
Cement, concrete mixes, Bitumen, Emulsion, Cutback, Bitumen mixes,

Module - 3

Properties, storage, testing, acceptance criteria, applications, limitations, economic consideration of following materials. Construction chemicals and admixtures. Water proofing materials.

Module - 4

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

Module - 5

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

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.

Text Book & 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

TITLE OF THE COURSE: CONSTRUCTION EQUIPMENTS AND MANAGEMENT
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, I Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM14**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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.

Module - 1

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

Module - 2

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.

Module - 3

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

Module - 4

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

Module - 5

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.

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.

Text Book & 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

TITLE OF THE COURSE: PREFABRICATION AND CONSTRUCTION TECHNOLOGY
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, I Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM15**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objectives: The objective of this course is to make students to Understand types and design principles of RC Prefabricated structures and its design principles. Understand method of analysis and design of structural elements.

Module - 1

Types of RC Prefabricated Structures: Long wall and cross wall large panel buildings- One way and two way prefabricated slabs - Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells - Crane – Gantry systems.

Module - 2

Functional Design Principles: Modular coordination – Standardization - Disuniting, Diversity of prefabricates – Production – Transportation – Erection - Stages of loading and codal provisions Safety factors - Material properties - Deflection control - Lateral load resistance - Location and types of shear walls.

Module - 3

Floors, Stairs and Roofs: Types of floor slabs – Methods of Analysis and design example of cored and panel types and two-way systems - Staircase slab design - Types of roof slabs and insulation requirements - Description of joints, behavior and requirements - Deflection control for short term and long term loads - Ultimate strength calculations in shear and flexure.

Module - 4

Walls: Types of wall panels - Blocks of large panels – Curtain partition and load bearing walls Load transfer from floor to wall panels – Vertical loads Eccentricity and stability of wall panels –Use of Design curves -Types of wall joints, their behavior and design – Leak prevention, Joint sealents, sandwich wall panels.

Module - 5

Industrial Buildings: Components of single storey industrial sheds with crane gantry systems - Design aspects of R.C. Roof Trusses - Roof panels R.C. Crane - Gantry Girders - Corbels and columns and Wind bracing.

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

- Understand general principles of pre-fabrication.
- Plan simple buildings using various types of prefabricated elements.
- Design simple prefabricated elements
- Outline the various phases involved in precast/pre-fabricated technology
- Distinguish pre-engineered buildings from conventional units

Text Book & References:

1.L. Mokk, “Prefabricated Concrete for Industrial and Public Structures”, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. T. Koncz, “Manual of Precast Concrete Construction, Vol. I, II, III & IV”, Berlin, 1971.
3. B. Lewicki, “Building with Large Prefabricates”, Elsevier Publishing Company, Amsterdam, London, New York, 1998.
4. “Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete”, Netherland Betor Verlag, 2009.
5. Hass, A.M. “Precast concrete design and Applications”, Applied Science Publishers, 1983.
6. “Handbook on Precast concrete for buildings”, ICI Bulletin 02, Indian Concrete Institute, 2016
7. “National Building Code of India”, BIS, New Delhi, 2005

8. Marashev, V.I.Sigalov, E.Y.Baikov, U.N., “Design of RC Structures”, Mir Publishers, Moscow.
9. “SERC, Design & Construction of Prefabricated Residential & Industrial Buildings”, Organized by SERC, Chennai.
10. B.Leweicki, “Building with Large Prefabrication”, Elsevier Publishing Co.

TITLE OF THE COURSE: CONSTRUCTION MATERIALS LABORATORY
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, I Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEML16**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -02

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

Experiments

1. Tests on Cement
2. Tests on aggregate, gradation
3. Concrete mix design
4. Tests on Fresh Concrete
5. Tests on Harden Concrete
6. Tests on fiber reinforced concrete,
7. Tests related to self compacting concrete,
8. Non destructive tests- Rebound hammer test, Ultrasonic Pulse velocity test, Rebar Locator.
9. Tests on reinforcement steel, Corrosion tests.
10. Tests on bitumen, marshal mix design

NOTE: All tests to be carried out as per relevant latest Codes

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.

Text Book & 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.

TITLE OF THE COURSE: PROJECT MANAGEMENT IN CONSTRUCTION
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM21**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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.

Module - 2

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

Module - 3

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.

Module - 4

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.

Module - 5

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.

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.

Text Book & 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.

TITLE OF THE COURSE: ADVANCE CONCRETE TECHNOLOGY
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM22**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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.

Module - 1

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.

Module - 2

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.

Module - 3

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.

Module - 4

Construction techniques for reinforced concrete elements - materials, principles and procedures for beams, slabs, columns, foundations, walls and tanks, design and fabrication of formwork for R.C.C elements, features of slip forming and precautions, details of special shuttering required for lining of tunnel, procedures and precautions.

Module - 5

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

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

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.

Text Book & 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.

TITLE OF THE COURSE: PERSONAL AND FINANCIAL MANAGEMENT M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM23**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**
Credits -04			
Objectives: The objective of this course is to make students to learn principles of financial management and its Fundamentals.			
Module - 1			
Personal financial planning – meaning, objectives, process The concept of Time Value of Money and its application in financial planning			
Module - 2			
Personal tax planning – basics of tax assessment for an individual, deductions and reliefs available to an individual, avenues for tax savings for an individual			
Module - 3			
Life insurance – tools for financial planning, different schemes and their implications, benefits and limitations			
Module - 4			
The Housing Decision – factors to be considered, modes of finance, benefits and limitations, procedural and legal aspects			
Module - 5			
Other investment avenues such as stocks, bonds, mutual funds, real estate, etc., and financial planning Various financial institutions and modes of personal financing			
Course objectives: • Set financial goals and develop a financial plan • Apply time value of money principles to personal financial decisions • Prepare a personal budget • Choose a financial institution and types of accounts for personal needs • Calculate personal taxes and review strategies to minimize them			
Text Book & References: 1.Personal Finance with Connect Plus, 10th Edition, Jack R. Kapoor , Les R. Dlabay , Robert J. Hughes, TMH 2. 16 Personal Finance Principles Every Investor Should Know by Manish Chauhan, Network 18 3. Simplified Financial Management by Vinay Bhagwat, The Times Group			

TITLE OF THE COURSE: SMART CITIES
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM241**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objectives: The objective of this course is to make students to learn principles and concept of Smart cities.

Module - 1

Smart City: Concept, Elements Strategies Proposal Preparation, City Selection Process, Fund Release Challenges, Monitoring, Convergence with other Government Schemes, Scope of Smart City.

Module - 2

Smart Cities: challenges, initiatives benchmark and instruments. Components of Smart Village: Internet, devices, network. National & International policies for smart cities. Case studies on smart schools, smart traffic, smart ward, and smart safety.

Module - 3

Innovation economy (Innovation in industries, clusters, districts of a city; Knowledge workforce: Education and employment; Creation of knowledge-intensive companies); Urban Infrastructure (Transport, Energy/ Utilities, protection of the environment and safety); Governance (Administration services to citizens, participatory and direct democracy, services to the citizen, quality of life)

Module - 4

Understanding Inclusive Planning Definition and components; urban consultations; basic principles of urban consultation, process of urban consultations; urban strategic planning, good urban governance, subsidiary, equity, efficiency, transparency and accountability, civic engagement and citizenship, security; valuing difference and working with diversity; livable cities;

Module - 5

Planning interventions Inclusive zoning, development and building regulations, Slum Improvement; drafting strategic urban development plans – objectives and key actors; planning framework for actions, process of drafting the plan, key considerations; urban design and decision-making; city transport for all; water supply and sanitation, urban disaster management, management through decentralization.

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

- The importance and value of science and technology in innovation.
- The evolution of success and failure of new technology developments.
- The role of fundamental academic research, the value of intellectual property, technology driven product innovation and entrepreneurship, and incorporation of science and engineering in finished product.

Text Book & 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.

TITLE OF THE COURSE: PAVEMENT MAINTENANCE & MANAGEMENT SYSTEMS M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM242**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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

Module - 2

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.

Module - 3

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.

Module - 4

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.

Module - 5

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.

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 maintenance and its management.

Text & 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"- (2^{nd} Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.

TITLE OF THE COURSE: DISASTER MITIGATION & MANAGEMENT M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM243**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

Introduction To Disasters Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types Of Disasters – Earthquake, Landslide, Flood, Drought, Fire Etc – Classification, Causes, Impacts Including Social, Economic, Political, Environmental, Health, Psychosocial, Etc.- Differential Impacts- In Terms Of Caste, Class, Gender, Age, Location, Disability – Global Trends In Disasters: Urban Disasters, Pandemics, Complex Emergencies, Climate Change- Dos And Don'ts During Various Types Of Disasters.

Module - 2

Approaches To Disaster Risk Reduction Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non structural measures in DRR, Factors affecting Vulnerabilities, , Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Rehabilitation measures and long term reconstruction.

Module - 3

Inter-Relationship Between Disasters And Development Factors Affecting Vulnerabilities, Differential Impacts, Impact Of Development Projects Such As Dams, Embankments, Changes In Land-Use Etc.- Climate Change Adaptation- IPCC Scenario And Scenarios In The Context Of India – Relevance Of Indigenous Knowledge, Appropriate Technology And Local Resource

Module - 4

Disaster Risk Management In India Hazard And Vulnerability Profile Of India, Components Of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional Arrangements (Mitigation, Response And Preparedness, Disaster Management Act And Policy – Other Related Policies, Plans, Programmes And Legislation – Role Of GIS And Information Technology Components In Preparedness, Risk Assessment, Response And Recovery Phases Of Disaster – Disaster Damage Assessment.

Module - 5

Disaster Management: Applications And Case Studies Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, south India Tsunami, Bihar floods, Plague Surat, Landslide in North East, Heat waves of AP& Orissa, 278 Cold waves in UP. Bengal famine, best practices in disaster management, Local Knowledge Appropriate Technology and local Responses, Indigenous Knowledge, Development projects in India (dams, SEZ) and their impacts.

Course objectives:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between

vulnerability, disasters, disaster prevention and risk reduction.

- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of Institutional processes in the country.
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Text Book & 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.

TITLE OF THE COURSE: URBAN HYDROLOGY, STORM DRAINAGE AND MANAGEMENT M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM244**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objectives: The objective of this course is to make students to learn principles of urban hydrology, storm drainage and management

Module - 1

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.

Module - 2

Storm water 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.

Module - 3

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.

Module - 4

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.

Module - 5

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).

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 concepts urban hydrology, storm drainage and management.

Text Books & References :

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.

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

TITLE OF THE COURSE: ANALYSIS AND DESIGN OF PAVEMENT

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester,

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM251**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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

Module - 2

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

Module - 3

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

Module - 4

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.

Module - 5

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)

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.

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

TITLE OF THE COURSE: ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester,

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM252**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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.

Module - 1

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 Residentia lCommercial-Institutional And Public Buildings.

Module - 2

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 demand Comfort and Indoor Air Quality-Visual and Acoustical Quality-Energy Efficient Design Strategies Contextual factors-Longevity and Process Assessment

Module - 3

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

Module - 4

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

Module - 5

Energy 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

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.

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.

TITLE OF THE COURSE: ADVANCE STRUCTURAL DESIGN AND DETAIL M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM253**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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.

Module - 1

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.

Module - 2

Structural Analysis, Design and Detailing for: Multi-storey building frame design and Grid floors.

Module - 3

Structural Analysis, Design and Detailing for: Silos and bunkers.

Module - 4

Structural Analysis, Design and Detailing for: Flat slabs.

Module - 5

Structural Analysis, Design and Detailing for: Concrete Chimneys.

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.

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)

TITLE OF THE COURSE: COMPOSITE AND SMART MATERIALS
M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester,
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM254**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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.

Module - 1

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.

Module - 2

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.

Module - 3

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

Module - 4

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.

Module - 5

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.

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.

Text Book & 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.

TITLE OF THE COURSE: PROJECT MANAGEMENT LAB M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, Ii Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEML26**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -02

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

Experiments

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 Software's-

MS Project & Primavera Working on Practical Projects.

Modeling / Handling actual practical project management projects.

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 management methods by software's.

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"

TITLE OF THE COURSE: CONSTRUCTION QUALITY AND SAFETY MANAGEMENT M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, III Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM31**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objectives: The objective of this course is to make students to learn principles of construction quality and safety management.

Module - 1

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.

Module - 2

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.

Module - 3

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.

Module - 4

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.

Module - 5

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

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.

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.

TITLE OF THE COURSE: PROFESSIONAL PRACTICE M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, II Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM32**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objectives: The objective of this course is to make students to understand the responsibilities & liabilities of the Profession & the process of Contract management.

Module - 1

Profession: Idea of profession and essential difference among profession, trade and business. Profession of Construction management, its essential tenets, duties and liabilities. Types and extent of services offered by architects, scale of fees, stages of payment, and contract between client and Contractor. Code of Professional Conduct,.

Module - 2

Practice: Types of firms, proprietorship, partnership, associate ship, and private limited concerns. Advantages and disadvantages of each type of firms. Various means of building client base and gaining projects. Constructional competitions, procedure of conduct of such competitions. Administration and basic accounting procedures. Taxes and implications of service tax. Implication of GATS on the profession in India.

Module - 3

Contract: General Principles, types of contract, definitions of various terms used in the contract document. Contract document, contents and sections dealing with various aspects of contract management. Conditions and Scope of Contract and the role of an architect in ensuring a positive completion of a contract. **Contract Management:** Overview of procedures in contract management.

Module - 4

Supervision & Contract Administration: Site visits, site meeting, co-ordination with various agencies, site book, site instructions, clerk of works and site office. Bill checking, quality auditing, handover procedures and final certification. Disputes in contract and architect's role in resolving such disputes. Case studies from practice highlighting disputes in contract and methods adopted to solve such disputes.

Module - 5

Byelaws and easements: Building byelaws, National Building Code, floor area ratio, floor space index, floating FAR, zoning regulations. Easements, various easement rights, architect's role in protecting easement rights. Laws related to Property and Land: Land tenure, types of land holdings, land registration, easement rights, covenants, trespass and nuisance etc.

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

- Achieve Knowledge of problem solving skills.
- Understand the principles of Construction Practice.
- Develop analytical skills to supervision and administration.
- Summarize the techniques of byelaws and easements.

References:

1. “Professional Practice for Architects & Engineers”by Roshan Namavathi
2. “Legal and Contractual Procedures for Architects”by Bob Greenstreet
3. AJ Legal Handbook 4) “Professional Practice”by KG Krishnamurthy and SV Ravindra.

TITLE OF THE COURSE: RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, III Semester, [As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM331**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objective: To study the resources required for construction like material, equipment, labour, time and comprehend the effective management of the same towards fruitful completion of the project.

Module - 1

Resource Planning- Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control- Types of resources, manpower, Equipment Material, Money, Time Systems approach in resource management, Characteristics of resources- Resources Utilization, measurement of actual resources required-Tools for measurement of resources

Module - 2

Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution.
Equipment: Planning and Selecting By Optimistic Choice With Respect To Cost, Time Source and handling

Module - 3

Labour: Labor, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour
Cost control- Cash flow and cost control, objectives of cost, time and quality.

Module - 4

Personnel Management-Personnel time management and planning- Managing time on the project-forecasting the future, Critical path measuring the changes and their effects.

Module – 5

Cost Analysis-Time-cost trade off Computer application in resource leveling- examples resource list, resource allocation graph, Resource loading- Cumulative cost ETC -Value Management.

References:

1. Andrew, D. Szilagg, Hand Book of Engineering Management, 1982.
2. A.K.Jain ,“Construction Management & Machinery ”,Standard Publisers Distributors,2010.
3. Glenn, A. Sea's and Reichard, H Clough, “Construction Project Management ”,John Wiley and Sons, Inc, 1979
4. Harvey, A. Levine, “Project Management using Micro Computers”, Obsome McGraw Hill C.A. Publishing Co., Inc. 1988
5. James, A., Adrain, “Quantitative Methods In Construction Management”, American Elsevier Publishing Co., Inc., 1973.
6. Frederick E Gould, “Managing the Construction Process-Estimating, Scheduling & Project Control”,Dorling Kindersely India Pvt. Ltd.,2012

TITLE OF THE COURSE: STEEL & COMPOSITE CONSTRUCTION TECHNOLOGY

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, III Semester,

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM332**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

Objectives: The objective of this course is to make students to learn principles and design of steel and composite construction technology.

Module - 1

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.

Module - 2

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.

Module - 3

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

Module - 4

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

Module - 5

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.

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.

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

TITLE OF THE COURSE: BRIDGE AND GRADE SEPARATED STRUCTURES M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, III Semester, [As per Choice Based Credit System (CBCS) scheme]			
Course Code	**18CEM333**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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.

Module - 2

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

Module - 3

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.

Module - 4

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.

Module - 5

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 .

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.

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,

TITLE OF THE COURSE: ECO-FRIENDLY CONSTRUCTIONS

M.Tech., – INFRASTRUCTURE ENGINEERING AND MANAGEMENT, III Semester,

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CEM334**	**CIE Marks**	**40**
Number of Lecture Hours /Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits -04

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

Module - 1

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.

Module - 2

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,

Module - 3

Eco-friendly Materials: Straw-Bale, Bamboo, Agro-Industrial Waste, Innovative Materials Developed by CBRI, SERC, Structural Properties Of Alternate Building Materials, Earthen Finishes , Earth Plasters, Earth Floors.

Module - 4

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

Module - 5

Cost Effective Construction Equipments Brick moulding machine, Stabilized 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.

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.

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 Building Methods ”, Softcover, Wiley & Sons Australia, Limited, John, Rajeeva SJ,2005
4. Eugene Eccli- “Low Cost, Energy efficient shelter for owner & builder”, Rodale Press, 1976