



JSS MAHAVIDYAPEETHA



JSS SCIENCE AND TECHNOLOGY UNIVERSITY
SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU

Scheme of Teaching, Examination and Syllabus
for
M.Tech (I to IV Semester)
in
INFRASTRUCTURE ENGINEERING AND
MANAGEMENT

Department Of Construction Technology and
Management

2017-18

SALIENT FEATURES OF THE SCHEME FOR I TO IV SEMESTERS

M.Tech. (INFRASTRUCTURE ENGINEERING AND MANAGEMENT)

1. The total credits in I & II Semester are 28 per semester.
2. Total contact hours per week in the first two semesters are 36 each
3. All subjects of 5 credits are assigned with 4 lecture hours and 2 tutorial hours.
4. Electives are introduced in I & II Semesters with two electives in each semester.
5. Laboratory subjects are introduced, one each in I & II Semester of 1.5 credits, respectively.
6. In the III Semester, a practical training in Industry / exploration research is assigned for 4 credits.
7. In the IV Semester, there are totally 40 credits for M.Tech thesis dissertation work.
8. Number of credits from I to IV Semesters are as follows
 - a. I Semester = 28
 - b. II Semester = 28
 - c. III Semester = 18
 - d. IV Semester = 26

TOTAL = 100

9. Grading system

| Marks | Grade |
|----------|-------|
| 90 – 100 | S |
| 75 – 89 | A |
| 66 – 74 | B |
| 56 – 65 | C |
| 50 – 55 | D |
| 45 – 49 | E |
| < 45 | F |

10. Notations in the Scheme

| | |
|-----|--------------------------------|
| CIE | Continuous Internal Evaluation |
| SEE | Semester End Examination |
| L | Lecture |
| T | Tutorial |
| P | Practical/Project |

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DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT**

Scheme of Teaching and Examination

I Semester M.Tech. (INFRASTRUCTURE ENGINEERING AND MANAGEMENT): 2017-18

| Sl. No | Subject code | Course title | Teaching department | Credits | | | | Contact hours / Week | Marks | | | Exam duration in hrs | |
|--------|--------------|--|---------------------|----------------------|---|-----|-------|----------------------|-----------|--------------------|-------|----------------------|---|
| | | | | L | T | P | Total | | CIE | SEE | Total | | |
| 1 | CTI 110 | Infrastructure Planning and Management | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 | |
| 2 | CTI 120 | Infrastructure Contract Management | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 | |
| 3 | CTI 130 | Infrastructure Project Management | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 | |
| 4 | CTI 14* | Elective –I | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 | |
| 5 | CTI 15* | Elective-II | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 | |
| 6 | CTI 16L | Infrastructure Engineering Laboratory | CT&M | 0 | 0 | 1.5 | 1.5 | 3 | 50 | - | 50 | - | |
| 7 | CTI 17S | Seminar | CT&M | 0 | 0 | 1.5 | 1.5 | 3 | 50 | - | 50 | - | |
| | | | | Total credits | | | | 28 | 36 | Total marks | | 600 | - |

*Electives

| Sl. No. | Subject Code | Subject | Sl. No. | Subject Code | Subject |
|---------|--------------|--|---------|--------------|---|
| 1. | CTI 141 | Remote Sensing and GIS | 1. | CTI 151 | Statistical Methods for Engineers |
| 2. | CTI 142 | Geotechniques for Infrastructure | 2. | CTI 152 | Quality and Safety Management |
| 3. | CTI 143 | Construction Techniques and Equipments | 3. | CTI 153 | Retrofitting and Rehabilitation of Structures |

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Scheme of Teaching and Examination

II Semester M.Tech. (INFRASTRUCTURE ENGINEERING AND MANAGEMENT): 2017-18

| Sl. No | Subject code | Course title | Teaching department | Credits | | | | Contact hours / Week | Marks | | | Exam duration in hrs |
|--------|--------------|--------------------------------------|---------------------|----------------------|---|-----|-----------|----------------------|--------------------|-----|------------|----------------------|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| 1 | CTI 210 | Infrastructure Economics | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 |
| 2 | CTI 220 | Valuation and Value Engineering | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 |
| 3 | CTI 230 | Disaster Mitigation and Management | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 |
| 4 | CTI 24* | Elective –I | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 |
| 5 | CTI 25* | Elective-II | CT&M | 4 | 1 | 0 | 5 | 6 | 50 | 50 | 100 | 03 |
| 6 | CTI 26L | Infrastructure Management Laboratory | CT&M | 0 | 0 | 1.5 | 1.5 | 3 | 50 | - | 50 | - |
| 7 | CTI 27S | Seminar | CT&M | 0 | 0 | 1.5 | 1.5 | 3 | 50 | - | 50 | - |
| | | | | Total credits | | | 28 | 36 | Total marks | | 600 | - |

Electives

| Sl. No. | Subject Code | Subject | Sl. No. | Subject Code | Subject |
|---------|--------------|--|---------|--------------|--------------------------------------|
| 1. | CTI 241 | Environmental Impact Assessment | 1. | CTI 251 | Project Procurement System |
| 2. | CTI 242 | Advanced and Sustainable Materials in Infrastructure | 2. | CTI 252 | Management Information System |
| 3. | CTI 243 | Computational Methods in Infrastructure Engineering | 3. | CTI 253 | Financial Implications and Marketing |

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Scheme of Teaching and Examination

III Semester M.Tech. (INFRASTRUCTURE ENGINEERING AND MANAGEMENT): 2017-18

| Sl. No | Subject code | Course title | Teaching department | Credits | | | | Contact hours | Marks | | | Exam duration in hrs |
|--------|--------------|---|---------------------|----------------------|---|----|-----------|---------------|--------------------|-----|------------|----------------------|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| 1 | CTI 31T | Practical Training in Industry / Exploration Research | CT&M | 0 | 0 | 4 | 4 | – | 100 | – | 100 | – |
| 2. | CTI 32P | Project Work (Phase-I) | CT&M | 0 | 0 | 14 | 14 | – | 100 | – | 100 | – |
| | | | | Total credits | | | 18 | – | Total marks | | 200 | – |

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Scheme of Teaching and Examination

IVSemester M.Tech. (INFRASTRUCTURE ENGINEERING AND MANAGEMENT): 2017-18

| Sl. No | Subject code | Course title | Teaching department | Credits | | | | Contact hours | Marks | | | Exam duration in hrs |
|--------|--------------|-------------------------|---------------------|----------------------|---|-----------|----------|--------------------|-------|------------|----------|----------------------|
| | | | | L | T | P | Total | | CIE | SEE | Total | |
| 1 | CTI 41P | Project Work (Phase-II) | CT&M | - | - | 26 | 26 | - | 100 | 200 | 300 | 3 |
| | | | | Total credits | | 26 | - | Total marks | | 300 | - | |

INFRASTRUCTURE PLANNING AND MANAGEMENT

Sub Code: CTI 110

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study challenges and various strategies involved in infrastructure planning.
 - To study infrastructure management systems in present and future directions.
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1. **Introduction To Infrastructure:** Definition of Basic Terminologies, Role of Infrastructure In Economic Development, Types of Infrastructure, Measurement Of Infrastructure Capacity, Bases For Quantification Of Demand And Supply Of Various Types Of Infrastructure, Indian Scenario In Respect Of Adequacy And Quality
2. **Infrastructure Planning:** Goals And Objectives Of Infrastructure Planning, Identification And Quantification Of The Casual Factors Are Influencing The Demand For Infrastructure, Review And Application Of Techniques To Estimate Supply And Demand For Infrastructure, Use Of Econometric, Social And Land Use Indicators And Models To Forecast The Demand And Level Of Service Of Infrastructure And Its Impact On Land Use.
3. **Strategies for Infrastructure Projects:** Risk Management Framework For Infrastructure Projects, Shaping The Planning Phase Of Infrastructure Projects To Mitigate Risks, Designing Sustainable Contracts, Sustainable Development Of Infrastructure, Information Technology And Systems For Successful Infrastructure Management, Innovative Design And Maintenance Of Infrastructure Facilities.
4. **Challenges in Infrastructure Planning:** Mapping And Facing The Landscape Of Risks In Infrastructure Projects, Economic And Demand Risks, Socio-Environmental Risks, Cultural Risks In International, Infrastructure Projects, Legal And Contractual Issues In Infrastructure, Challenges In Construction And Maintenance Of Infrastructure
5. **Infrastructure Project Implementation:** Capacity Building and Improving the Government's Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management – Infrastructure Management Systems and Future Directions.

References:

1. Goodman, Alvin S. and MakarandHastak. Infrastructure Planning Handbook: 2006.
2. Revelle, C.S., Whitlatch, E.E. and Wright, J.R. Civil and Environmental SystemsEngineering; Prentice Hall, 2004.
3. Hudson, W.R., Haas, R. and Uddin, W. Infrastructure Management; McGraw Hill, 1997.
4. Verma S.P. ed. "Infrastructure in India's Development: Power, Transport and Communication", Institute of Public Administration, New Delhi, 2004.

Course Outcome: At the end of the course the student has the ability to

- Use the knowledge to plan the development of infrastructure projects (CO1).
- Exemplify the scope, principles, norms, accountabilities of infrastructure planning (CO2).
- Use the knowledge to plan the strategies for successful implementation of infrastructure projects (CO3)
- Summarize the challenges and remedies for a successful infrastructure implementation (CO4).
- Develop management system for infrastructure (CO5).

INFRASTRUCTURE CONTRACT MANAGEMENT

Sub Code: CTI 120

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the various processes involved in construction contracts.
- To study the process of resolving disputes in construction contracts.

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1. **Introduction** - Construction Industry -Infrastructure And Real Estate Landscape In India; Basic Concept – Terms, Essentials Of A Valid Contract The Communication, Acceptance And Revocation, Competency.
 2. **Forms Of Organization** - Proprietorships, Partnerships, Joint Ventures, Corporations, PPP- (Public Private Partnership),SPV (Special Purpose Vehicle)
 3. **Tendering And Contractual Procedures** - Public Bids And Private Bids, Advertisements, RFQ/RFQ, Preparations, Submissions, Acceptance, Withdraws, Rejection, Deposits, Bonds And Insurance.
 4. **Contract** –Introduction-Indian Contract Act-1872, Provision Of The Act, Classification Of Contracts, Contract Documents, Types Of Contract, Concession Agreements, Concessionaire& Authority, Fidic Conditions, Breach Of Contract, Termination Of Contract.
 5. **Specifications, Contract Laws & Legal Framework Of Construction** - Specification Writing for major civil works including those of excavation, concrete, reinforced steel, masonry, laws pertaining to environment & pollution control clearances, rehabilitation & resettlement act, RERA (real estate regulation act)
 6. **Construction Claims-Types-Preparation And Presentation-** Alternative Dispute Resolution Methods-Negotiations, Mediations, Conciliation, Dispute Resolution Boards, Arbitration, Litigation.

References:

1. Construction Contracts by Jimmie Hinze, 2nd Edition, McGraw Hill, 2001.
2. Contracts and the Legal Environment for Engineers and Architects by Joseph T. Bockrath, 6th Edition, McGraw Hill, 2000.
3. Govt of India, Central Public Works Department, "CPWD Works Manual 2003.
4. Civil engineering Contracts and estimates by B.S.Patil 3rd edition
5. Law relating to Building and Engineering Contracts in India by Gajera, G.T., Butterworths.

Course Outcome: At the end of the course the student has the ability to

- Interpret concepts in contracts (CO1).
- Exemplify the various forms of organization (CO2).
- Formulate and evaluate tenders (CO3).
- Summarize the concepts construction claims (CO4).
- Write specifications for tenders (CO5).

INFRASTRUCTURE PROJECT MANAGEMENT

Sub Code: CTI 130

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the construction project phases, processes and common attributes,
- To study project management functions, techniques and feasibility for planning, scheduling and controlling of construction project.
- To study the project selection process and implementation of construction projects.
- To be conversant with Cost- Time relationship and review of a project.

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1. **Construction Projects** Introduction, Concept, Project Categories, Characteristic Of Projects, Project Life Cycle Phase.
 2. **Project Management** Project Management Function, Role Of Project Manager, Organising For Construction - Principles Of Organization, Type Of Organization Structure.
 3. **Project Feasibility** Introduction, Significance In Feasibility Report- Technical Analysis, Financial Analysis, Economic Analysis, Ecological Analysis, Flow Diagram For Feasibility Study Of A Project.
 4. **Project Selection:** Project Cash Flow, Time Value Of Money, Cost Of Capital, Appraisal Criteria, Analysis Of Risk, Special Decision Situation, Risk Analysis, Social Cost Benefit Analysis, Multi-Project And Constraints, Options And Flexibility, Qualitative Factors, Strategic Aspects, And Organizational Considerations.
 5. **Implementation:** Project Management, Project Planning, Project Control, Networks Techniques For Project Management, Development Of Project Network, Determination Of Critical Path, Pert Model, CPM Model And Network Cost System.
 6. **Time Cost Relationship** Direct And Indirect Cost, Step In Optimization Of Cost, Related Problem.
 7. **Review:** Project Review and Administrative Aspects, Performance Evaluation And Abandonment Analysis.

References:

1. Project Management by Ahuja H.N., John Wiley, New York, 1999.
2. Critical Path Methods in Construction Practice by Antil J.M. and Woodhead R.W., John Wiley, Canada, 1999.
3. Project Management in Construction by Levy Sidney, McGraw Hill Professional, New York, 2000.
4. CPM in Construction Management by O'brien James, McGraw Hill, New York, 1999. Project management – A systems approach to planning, scheduling and controlling by Harold. K, John Wiley & Sons, New Jersey.
5. Construction Project Management – Planning, Scheduling and Controlling by Chitkara K.K., Tata McGraw Hill, New Delhi, 2000.
6. Projects: Planning, Analysis, Selection, Financing, Implementation, and Review by Prasanna Chandra, Tata McGraw-Hill Education, 2013
7. A Management Guide to PERT/CPM by Jerome D. and Ferdinand K., Prentice-Hall of India, New Delhi.

Course Outcome: At the end of the course the student has the ability to

- Interpret project phases, WBS and common attributes of construction project. (CO1)
- Summarize project management functions, techniques and feasibility of construction project. (CO2)
- Evaluate project selection process and construct the network diagram, identify the critical path and calculate project duration, floats using different project network techniques. (CO3)
- Interpret time & cost relationship and review of the project. (CO4)

REMOTE SENSING AND GIS

Sub Code: CTI 141

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objective:

- The students are introduced to the fundamentals of remote sensing and GIS. .
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- 1. EMR and Its Interaction With Atmosphere:** Definition Of Remote Sensing And Its Components – Basic Principles Of Remote Sensing – Electromagnetic Energy Electromagnetic Spectrum- Wave Length Regions And Their Application In Remote Sensing – Characteristics Of Solar Radiation – Basic Radiation Law – EM Radiation And Atmosphere – Interaction Of EM Radiation With Earth Surface
- 2. Platforms and Sensors:** Types Of Platforms-Orbit Types, Sun Synchronous And Geo Synchronous- Passive And Active Sensors-Resolution Concept-Payload Description Of Important Earth Resources And Meteorological Satellites-Airborne And Spaceborne TIR And Microwave Sensors.
- 3. Data Entry, Storage and Analysis:** Data Models-Vector And Raster Data-Data Compression-Data Input By Digitization And Scanning-Attribute Data Analysis-Integrated Data Analysis-Modelling In GIS
- 4. Geographic Information System:** Introduction-Maps-Definitions-Types Of Map Projections-Map Analysis-Basic Components Of GIS-Standard GIS Software-Data Type-Spatial And Non-Spatial(Attribute Data)-Measurement Scales
- 5. Image Interpretation And Analysis:** Types Of Data Products-Types Of Image Interpretation-Basic Elements Of Image Interpretation- Visual Interpretation Keys-Digital Image Processing-Pre-Processing-Image Enhancement Techniques-Multispectral Image Classification

References:

1. Higher Surveying by B. C. Punmia Ashok K Jain and Arun K Jain, Lakshmi Publication..
2. Remote Sensing & Interpretation by Lille Sand, Wiley Publications.
3. AnjiReddy,M.(2001),Textbook of Remote Sensing and GIS,Second Edition, BS Publications, Hyderabad.
4. Remote Sensing Principles and Interpretation by Floyd F. Sabins, W.H. Freeman and Co., (NY).
5. Peter A.Burrough, Rachael A Mc Donnell, Principles of GIS, Oxford University Press.

Course Outcome: At the end of the course the student has the ability to

- Attribute the energy interactions in the atmosphere and earth surface features (CO1).
- Summarize the software/hardware requirements for implementing a GIS project (CO2).
- Organize spatial and attribute data for solving spatial problems (CO3).
- Retrieve the information content of remotely sensed data and interpret the images for preparation of thematic maps (CO4).

GEOTECHNIQUES FOR INFRASTRUCTURE

Sub Code: CTI 142

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To introduce the students about infrastructure management, the advanced techniques in geotechnical engineering and its influence in infrastructure management.
- To introduce the students to the relevance of bearing capacity, shear strength, settlement, design of shallow and deep foundations and some special problems in geotechnical engineering.

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1. **Basics Of Soil Mechanics:** Soil As Complex Construction Material, Three Phase System And Definitions, Index Properties Of Soil, Shear Strength Of Soil, Compaction Of Soil – Factors Influencing, Laboratory Tests For Compaction, Field Compaction.
 2. **Soil Exploration Technique:** Modern methods of soil investigations, Geophysical Methods; soil resistivity methods , seismic refraction methods, stress below ground due to loads
 3. **Bearing Capacity Of Soils:** Modes Of Failure, Terzaghi's And Generalized Bearing Capacity Equations, Factors Influencing Bearing Capacity, Field Tests For Bearing Capacity
 4. **Shallow and deep foundation:** Types of shallow foundation and design principles; types of deep foundation- classification of piles and test on piles.
 5. **Stability of slopes:** Limit equilibrium method, Method of slices, Simplified Bishop method, Stability Charts. Soil behavior under dynamic loads ,Machine foundation: classification, definitions, design principle in brief, Barken's method.
 6. **Reinforced Earth Technique:** Principles, Concepts And Mechanism Of Reinforced Earth. Materials. Design Consideration For Reinforced Earth Structures-Retaining Walls, Embankments, Bearing Capacity Problems And Pavements. Reinforced Earth Construction For Control Of Heaves. Soil Nailing. Design Examples.

References:

1. Bowles. J. E. " Foundation Analysis and Design", 5th edition, The McGraw-Hill companies, Inc, New York, 1996.
2. Das. B.M., "Principles of Foundation Engineering", Thomson Brooks / Cole Publishing Company, Singapore 2004.
3. Tomlinson. M.J., "Foundation Design and Construction", ELBS, London.
4. Swamy Saran, "Analysis and Design of Sub Structures", Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi, 1996,
5. Relevant IS Codes of Practice.
6. Varghese P.C. "Foundation Engineering" Prentice Hall of India, New Delhi 2005.
7. Winterkorn H.F. and Fong H.Y. "Foundation Engineering Hand Book", Galgotia Book Source, New Delhi 2000.

Course Outcome: At the end of the course the student has the ability to

- Use knowledge of geotechnical engineering in solving bearing capacity and settlement problems (CO1).
- Infer and apply various Techniques in Soil Exploration (CO2).
- Infer and organize the problems related with foundations with design principles (CO3).
- Exemplifying slope stabilization techniques (CO4)
- Implement the principles of reinforced earth. (CO5).

CONSTRUCTION TECHNIQUES AND EQUIPMENTS

Sub Code: CTI 143

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study various conventional and modern methods of construction equipment for earthwork, material handling and other miscellaneous purposes.
- To study the working of the equipments mentioned above and apply scientific principles for effectively utilizing them.

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1. **Introduction to mechanization:** Definition, advantages and limitations of mechanization, Indian scenario and Global scenario
 2. **Conventional And Modern Methods Of Construction:** Building Elements, Different Stages Of Construction, Types Of Form Works, Elements Of Pre-Casting And Prefabricated Construction, Use Of Pre-Stressing.
 3. **Sub Structure Construction:** Box Jacking, Pipe Jacking, Under Water Construction Of Diaphragm Walls And Basement, Piling Techniques, Shoring For Deep Cutting, Dewatering For Underground Open Excavation.
 4. **Super Structure Construction:** Buildings Vacuum Dewatering Of Concrete Flooring, Concrete Paving Technology Large Span Structures, Launching Techniques For Heavy Decks, In-Situ Pre-Stressing In High Rise Structure.
 5. **Mechanization:** Construction Equipments Such As Cranes, Hoists, Mixers, Vibrators, Scaffolding, Shuttering, Conveyors, Etc., Their Characteristics, Performance And Application To The Building Process. Excavating Equipments, Earthmoving Equipments, Conveying Equipments, Hauling Equipments, Power Requirement, Cycle Time, Resistances, Output Shovel Truck Performance, Performance Characteristics Of Equipments And Sand Making Machines, Highway Equipments.

References:

1. Mahesh Varma, (1987), "Construction Equipment and its Planning and Application" Metropolitan Book Co. (P) Ltd.
2. R. L. Peurifoy, W. B. Ledbeffe, (1985), "Construction Planning, Equipment and Methods", McGraw Hill Book Company.
3. James F. Russell, (1985), "Construction Equipment" Reston Publishing Company, Inc..
4. Prof. S. S. Ataev, (1985), "Construction Technology" Mir Publishers Moscow.
5. M. Antill and Paul W.S. Ryan, (1982), "Civil Engineering Construction" McGraw Hill Book Co ; Sydney.
6. Lindley R. Higgins, (1982), "Practical Construction Equipment Maintenance and Reference Guide" McGraw Hill Book Company.
7. Back Volumes of Civil Engg and Construction Review, India. Williams H.P.: Model Solving in Mathematics Programming.

Course Outcome: At the end of the course, the students will have the ability to

- Use the conventional and modern methods of construction of building elements and types of form works, elements of pre-casting and prefabricated construction (CO1).
- Choose Mechanized construction equipments cranes, hoists, mixers, vibrators, scaffolding, shuttering, conveyors their characteristics, performance and application to the building process (CO2).
- Decide excavating, earthmoving equipments, conveying equipments and hauling equipments (CO3).
- Recommend Drilling, blasting & processing equipments. Asphalt and concrete plants & equipments (CO4).
- Recommend Forklifts and related equipments- portable material bins, conveyors - equipment used in demolition – chain pulley blocks (CO5).

STATISTICAL METHODS FOR ENGINEERS

Sub Code: CTI 151

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the concepts of Statistical methods and its applications in Engineering.
- To study the effect of estimation theory, testing of hypothesis, correlation and regression, randomized design, and multivariate analysis.

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1. **Estimation Theory:** Estimators: Unbiasedness, Consistency, Efficiency And Sufficiency – Maximum Likelihood Estimation – Method Of Moments.
 2. **Testing Of Hypothesis:** Tests Based On Normal, T, X² And F Distributions For Testing Of Means, Variance And Proportions – Analysis Of R X C Tables – Goodness Of Fit.
 3. **Correlation And Regression:** Multiple And Partial Correlation – Method Of Least Squares – Plane Of Regression – Properties Of Residuals – Coefficient Of Multiple Correlation – Coefficient Of Partial Correlation – Multiple Correlation With Total And Partial Correlations – Regression And Partial Correlations In Terms Of Lower Order Co-Efficient.
 4. **Design Of Experiments:** Analysis Of Variance – One-Way And Two-Way Classifications – Completely Randomized Design – Randomized Block Design – Latin Square Design.
 5. **Multivariate Analysis:** Random Vectors And Matrices – Mean Vectors And Covariance Matrices – Multivariate Normal Density And Its Properties – Principal Components: Population Principal Components – Principal Components From Standardized Variables.

References:

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, Eleventh Edition, 2002
2. J.E. Freund, "Mathematical Statistical", 5th Edition, Prentice Hall of India, 2001.
3. Jay L.Devore, "Probability and statistics for Engineering and the Sciences", 5th Edition, Thomson and Duxbury, Singapore, 2002.
4. Murray.R. Spiegel and Larry J. Stephens, "Schaum's Outline- Statistics", Third Edition, Tata McGraw-Hill, 2000.
5. R.A.Johnson and C.B.Gupta, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
6. Richard A.Johnson and Dean W.Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6th Edition, 2007.

Course Outcome: At the end of the course, the students will have the ability to

- Solve various problems in estimation theory. (CO1).
- Idealize and design testing of hypothesis (CO2).
- Conduct correlation and regression analysis (CO3).
- Conduct multivariable analysis and experiments (CO4).

QUALITY AND SAFETY MANAGEMENT

Sub Code: CTI 152

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To introduce the concept of Quality Management System in Infrastructure.
- To introduce the concept of benchmarking process in construction industry.
- To incorporate the knowledge of various causes, effects of accidents in construction.
- To acquire the knowledge of safety programmes and safety standards.

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1. **Introduction To Quality Management:** Evolution Of Quality Management, Concepts Of Product And Service Quality, Dimensions Of Quality, Deming's, Juran's, Crosby's Quality Philosophy, Quality Cost.
 2. **Process Quality Improvement:** Introduction To Process Quality, Graphical And Statistical Techniques For Process Quality Improvement, Graphical Tools For Data Representation, Quality Control Tools, Sampling, Sampling Distribution, And Hypothesis Testing, Regression, Control Charts, TQM, Leadership, Lean And JIT Quality Philosophy, Benchmarking, Process Failure Mode And Effect Analysis (PFMEA), Service Quality, Six Sigma For Process Improvement, ISO 9001 And QS 9000, Quality Audit, Quality Circles.
 3. **Benchmarking:** Sources Of Benchmarking, Process Of Benchmarking, Step Model For Benchmarking, Types Of Benchmarking, Code Of Conduct For Benchmarking, Internal And External Benchmarking, Advantages Of Benchmarking.
 4. **Construction Accidents and Safety:** Accident- Causes, Effects And Safety Measures, Legal Requirements, Responsibility Of The Employers, Reporting Occurrence Of Accidents, Reporting Occurrence Of Hazards, Action To Be Taken By The Site-In-Charge In Case Of Accidents.
 5. **Designing For Safety:** Safety Clause In A Typical Contract Document, Scheme For Safety, Breach Of Safety Regulations, General Safety Condition, Safety Culture, Company Activities And Safety, Project Co-Ordination And Safety Procedures, Workers Compensation.
 6. **Safety Programmes:** Safety programmes and Standards: Safe Working Environment, Safety Clauses In Contract Documents, Safety Programme, Safety Policy, Safety Department, Safety Officers, Safety Records, Safety Training, Standards For Safety In Construction, BIS Standards, American National Standards.

References:

1. Total Quality Management for Engineers by Mohammed Zairi, Aditya Books Pvt. Ltd., New Delhi. 1992.
2. Total Quality Management by B. Janakiraman and R.K. Goopal, Prentice-Hall of India Private Limited, New Delhi.
3. Construction Safety Management, NICMAR Publications, Hyderabad, October 2003.
4. Quality in the Construction Project by Fox, Arthur J., and Holly A. Cornell, American Society of Civil Engineers, New York, Latest Edition.
5. Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
6. Quality Assurance in Construction 2nd Edition by Thorpe, Brian, Gower, Aldershort, 1996.

Course Outcome: At the end of the course the student has the ability to

- Interpret Quality Management System and Quality control in Construction Projects, (CO1).
- Assess Total Quality Management, ISO certification and benchmarking process (CO2).
- Classify the various causes and effects of accidents, various safety measures to be adopted in construction (CO3).
- Exemplify the various aspects of safety programmes and safety standards (CO4).

RETROFITTING AND REHABILITATION OF STRUCTURES

Sub Code: CTI 153

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study different methods for assessing structural strength of structure.
- To study effect on durability, serviceability of structure.
- To study different types of damages and retrofitting techniques affected structures.

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1. **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.
 2. **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.
 3. **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.
 4. **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.
 5. **Techniques For Repair:** Rust Eliminators And Polymers Coating For Rebar During Repair Foamed Concrete, Mortar And Dry Pack, Vacuum Concrete, Guniting and Shot Crete Epoxy Injection, Mortar Repair For Cracks, Shoring And Underpinning.

References:

1. R.T.L. Allen & S.C. Edwards (Ed), "Repair of Concrete Structures", Blackie, 1987.
2. Releur Workshop – "Testing during Concrete Construction" – Chapman & Hall, 1991, Rexom&Maihaganom – Et FN Spon, 1986.
3. Chemical Admixtures for Concrete
4. John M. Bungey – "The Testing of Concrete in Structures, Survey Univ Press (Dh & Hall) 1982,
5. Newman P.E., "Structural Renovation of Buildings, "Methods, Details & Design Examples" – McGraw Hill, 2001.
6. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
7. Dr. R. Jagadeesh, - "Rehabilitation of Renovation and Reconstruction Bedle", ASCE /ACI Journal.

Course Outcome: At the end of the course the students has the ability to

- Assess and test the strength of structural concrete (CO1).
- Interpret the impact on serviceability and durability due to various exposures and design (CO2).
- Choose appropriate materials and chemicals for repair and restoration of structural elements (CO3).
- Summarize and take appropriate measures for damage control of affected structures (CO4).

INFRASTRUCTURE ENGINEERING LABORATORY

Sub Code: CTI 16L

Contact Hrs: 3 /week

Credits: 0: 0: 1.5

Course Objective:

- This course provides a thorough knowledge of material selection through the material testing based on specification.
-

1. Mix design of concrete as per IS method for concrete.
2. Fresh and Harden properties of Self Compacting concrete.
3. Experimental Investigation on effect of minerals and chemical admixtures on the properties of the in concrete.
4. Non Destructive Testing on the properties of concrete.
5. Fatigue Test on construction materials.
6. Experimental Investigation on Building comfort conditions.
7. Tests On Bitumen
8. Detailing of RC and Steel Structures.

References:

1. Bungey, J.M., Millard and Grantham M.G. – Testing of Concrete in Structures, 4th Edition, Taylor and Francis, London, 1982,
2. Neville, A.M., Properties of Concrete – Longmans, 4th Edition, 1995
3. Sidney Mindess and Frances Young, J., Concrete, PH NJ, 1981.
4. IS: 10262-2009 – Concrete Mix Proportioning – Guideline, BIS, New Delhi, 2009.
5. Relevant National, International codes, Technical Papers and Internet Information for Special Concrete.

Course Outcome: At the end of the course the students has the ability to

- Test the concrete mix designed as per IS methods.
- Interpret the various tests on hardened concrete and bitumen.
- Study detailing of RC and Steel.

INFRASTRUCTURE ECONOMICS

Sub Code: CTI 210

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study principles in the Economics of Infrastructure and Issues related to development of physical as well as social infrastructure with special focus on Infrastructure.

-
1. **Introduction to Economics in Infrastructure:** Definition of basic terminologies, Role Of Infrastructure in economic development, types of Infrastructure, Measurement of Infrastructure capacity, bases for quantification of demand and supply of various types of Infrastructure.
 2. **Time value of money:** Nominal and effective value of interest, simple interest, compound interest , present worth comparison, Present worth equivalence, Annual worth analysis, comparison of deferred investments, future worth comparison, pay back comparison, problems on rate of return method, Benefit cost analysis and Break even analysis.
 3. **Nature of Infrastructure:** components of infrastructure - social and physical infrastructure, finance for infrastructure as a public good, special characteristics of public utilities, the peak load-off load problem, pricing of infrastructure: marginal cost pricing and other methods of pricing. Economic model for infrastructure development
 4. **Economic valuation of properties :** Definition, Purpose, Cost-Price-Value, Different forms of value, Gross income, Net income, outgoing, Types of outgoing, Years purchase, Capital Cost, Capitalized value, Sinking fund – Depreciation - Methods of depreciation, Mortgage, lease, Fixation of rent on buildings, Problems.

References:

1. Misra and Puri , Indian Economy Himalaya Publishing Co., Mumbai , 2013
2. Ahuja, H. L. , Advance Economic Theory, S. Chand and Co., New Delhi. 2011.
3. Crew, M A and P R Kleindorfer, Public Utility Economics, Macmillan, London. Indian Council of Social Science Research, Economics of Infrastructure Vol. VI, New Delhi, 1976.
4. Parikh K S (2012): India Infrastructure Report 2012, Oxford University Press, New Delhi., 2012.
5. Pancharukhi, P R , Economics of Health: A Trend Report in ICSSR, A Survey of Research in Economics, Vol. VI, Infrastructure, Allied Publishers, Delhi, 1980.
6. Banga & Sharma, "Industrial Organization & Engineering Economics", Khanna Publishers, 2003.
7. Prasanna Chandra, "Projects - Planning Analysis Selection Implementation & Review ", Fourth Edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 1995

Course Outcome: At the end of the course the student has the ability to

- Explain the scope, principles, norms and accountabilities of infrastructure Economics (CO1).
- Organize the time value of money of infrastructure funding (CO2).
- Summarize Nature and Pricing of infrastructure economy (CO3).
- Organize and implement the Various Aspects of Economic evaluation of infrastructure (CO4).

VALUATION AND VALUE ENGINEERING

Sub Code: CTI 220

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objective:

- To study concepts of valuation and need of value engineering.
-

1. **Quantities:** - Principles- Study Of Drawings, Taking Out Quantities, Quantity Adjustment.
2. **Valuation:** Introduction-Basic Concepts And Definition- Purpose Of Valuation-Capital Cost-Sinking Fund- Landed Properties- Free Hold And Leasehold Properties- Different Types Of Lease
3. **Methods of Valuation:** Process Of Valuation And Methods Of Valuation- Depreciation And Methods Of Estimating Depreciation Problems.
4. **Value Engineering:** Introduction - Concept And Definition, Objectives Of Value Engineering, Advantages Of Value Methodology , Scenario Of Value Engineering With Context To India, Origin Of Value Engineering Quantity Surveying And Value Engineering, Team Of Value Engineering And Its Quality, Applicability To Mega Projects, Value Engineering And Project Management
5. **Value Analysis:** Concept, Job Planning And Its Importance In Value Engineering, Various Phases Of Value Engineering -Information Phase, Function Phase, Creative Phase, Evaluation Phase, Investigation Phase And Implementation Phase.

References:

1. Estimation and Costing in Civil Engineering (Theory and Practice) by Dutta, B.N. UBS Publishers Private Ltd., New Delhi.
2. Civil Engineering Contracts and Estimates by B. S. Patil. Universities Press Private Ltd, Hyderabad.
3. Value Engineering by Iyer S.S, New Age International publishers 1996.
4. Value Engineering by Zimmerman Larry W., Hart Glen P, CBS Publishers, New Delhi, 1988
5. Value Analysis in Design and Construction by O' Brien, J.J. - Mc Graw Hill

Course Outcome: At the end of the course the student has the ability to

- Exemplify basic concepts in taking out quantities (CO1).
- Interpret the concept for need in valuation (CO2).
- Classify methods of valuation and depreciation (CO3).
- Infer the concept of value engineering (CO4).
- Explain the need and phases of value engineering (CO5).

DISASTER MITIGATION AND MANAGEMENT

Sub Code: CTI 230

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study basic conceptual understanding of disasters and its relationships with development.
 - To study aspects to prevent and control public health consequences of disasters.
 - To study about enhancement of awareness in disaster risk management institutional processes in India.
-

1. **Disaster:** Definition Classification, Natural and Anthropogenic, Accidents, Disaster Profile Of India. Geo-Climatic And Social Conditions
2. **Risk Assessment:** Contingency Planning, Major Natural Disasters, Earthquake, Cyclone, Flood, Epidemics, Check List-Agencies, Personnel, Equipment, Materials, Services and Time Management, Diagnosis, Damage Assessment Parameters.
3. **Concept for Earthquake Resistant Design:** Repair Strategies, Bracing Foundation Isolation, Dampers, Ductility Provisions, Design Concept for Extreme Loading
4. **Materials For Repair And Restoration** Classification, Bending Agents, Adhesives Grout Fillers, Reinforcements Polymer Infrastructure Fibers, Etc., Tools For Repairs – Drills Grouting Shotcreting, Expansion Bolts.
5. **Fire Resistance:** Fire Rating – Fire Damage Assessment And Restoration Measures For Concrete And Steel Structures, Retrofitting And Strengthening Of Structures, Need, Strategies And Techniques Retrofitting Steel And Concrete Bridges. Retrofitting Of Buildings of Earthquake Resistance.
6. **Special Topics:** Architectural Restoration – Cracks And Waterproofing, Demolition Of Structures.

Reference Books:

1. R.T.L. Allen & S.C. Edwards (Ed), "Repair of Concrete Structures", Blackie, 1987.
2. Releur Workshop – "Testing during Concrete Construction" – Chapman & Hall, 1991, Rexom & Maihaganom – Et FN Spon, 1986.
3. Chemical Admixtures for Concrete
4. John M. Bungey – "The Testing of Concrete in Structures, Survey Univ Press (Dh & Hall) 1982,
5. Newman P.E., "Structural Renovation of Buildings, "Methods, Details & Design Examples" – McGraw Hill, 2001.
6. Dr. R. Jagadeesh, - "Rehabilitation of Renovation and Reconstruction Bedle", ASCE /ACI Journal.

Course Outcome: At the end of the course the students has the ability to

- Interpret significance of Disasters (CO1).
- Exemplify the impact of various disasters on Infrastructure (CO2).
- Execute the appropriate restoration techniques (CO3).
- Summarize and take appropriate measures for assessing damage of earthquake and fire affected structures (CO4).

ENVIRONMENTAL IMPACT ASSESSMENT

Sub Code: CTI 241

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the fundamentals of Environmental management (EM) and ecosystem environmental policies, legislations and international treaties.
- To study the concept of environmental impact assessment (EIA) and the preparation of EIA report.
- To study the life cycle assessment (LCA), various EM system standards, issues and techniques relating to EM, environmental design and economics.

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1. **Principles Of Environment:** Introduction To Environmental Management (EM), Participants In EM, Ethics And The Environment, International Environmental Movement, Environmental Concerns In India, Ecology And The Environment.
 2. **Policy And Legal Aspects Of EM:** Introduction To Environmental Policies, Environmental Policies And Programmes in India, Environmental Laws And Legislations, Environmental Legislations In India.
 3. **Environmental Impact Assessment (EIA):** Introduction To EIA Parameters, Evolution Of EIA, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure In India.
 4. **Life Cycle Assessment (LCA):** Life Cycle Assessment And Its Purpose, Evolution Of Life Cycle Assessment, Stages In LCA Of A Product, A Code Of Good Conduct For LCA, Procedures For LCA, Different Applications Of LCA.
 5. **Environmental Management System Standards:** Introduction to Environmental Management Systems (EMS), EMS Standards: ISO 14000, Implementation Of EMS Conforming To ISO 14001, Benefits Of Implementing ISO 14001: An Indian Scenario, OHSAS 18001 And Its Comparison With ISO 14001 And ISO 9001, BS 18004:2008.
 6. **Environmental Design And Economics:** Introduction Environmental Design (ED), ED For Buildings, ED For Developmental Planning, Economics And The Environment, Economics Of Natural Resources, Environmental And Regional Economics, Ecological Economics, Traffic Assessment.

References:

1. Ramachandra T.V., 2006. Management of Municipal Solid Waste, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.
2. Ramachandra T.V., 2006. Soil and Groundwater Pollution from Agricultural Activities, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.
3. Vijay Kulkarni and Ramachandra T.V., 2006. Environmental Management, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.
4. Kulkarni V and Ramachandra T V, 2009. Environmental Management, TERI Press, New Delhi

Course Outcome: At the end of the course Students has the ability to

- Summarize fundamentals of Environmental management (EM) and ecosystem environmental policies, legislations and international treaties.(CO1)
- Explain the concept of environmental impact assessment (EIA) and the preparation of EIA report.(CO2)
- Exemplify the life cycle assessment (LCA), various EM system standards, issues and techniques relating to EM.(CO3)
- Interpret environmental design and economics of natural resources. (CO4)

ADVANCED AND SUSTAINABLE MATERIALS IN INFRASTRUCTURE

Sub Code: CTI 242

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the current scenario of infrastructural materials.
- To study the professional knowledge required to analyze and design infrastructure materials in view of sustainability.

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1. **Advanced Cement Composites** Introduction, Infrastructure Degradation, Material Issues, and Construction Materials -Portland Cements Aggregates, Chemical Admixtures, Mineral Admixtures, Nano-Technology in Cement Concrete.
 2. **Special Concretes.** High-Strength Concretes, Ultra-High-Strength Concretes, Fiber Reinforced Concretes, Self-Compacting Concrete, High-Durability Concrete, Silica Fume Concrete, Self Compacting Concrete, Fiber Reinforced Plastics and Concrete, Light Weight Concrete, Polymer Modified Concretes, Transparent Concrete, 'Green' Concrete.
 3. **Composites Materials for construction** : Types Of Steels & Alloys Of Steels, Properties And Advantages Of Aluminium And Its Products, Types Of Plastics, Properties & Manufacturing Process , Advantages Of Reinforced Polymers, Types Of FRP, FRP On Different Structural Elements, Applications Of FRP. Building Materials From Agro And Industrial Wastes
 4. **Sustainable Materials-** Necessity and Importance Of Sustainable Construction Materials. Material Composition And Properties Lighter Weight Materials, Embodied Energies And Emissions, Lifetime Energies, Heat-Absorbing Or Releasing Materials, Using Waste In New Materials, Healthy Materials, Using Recycled Materials.

References:

1. Advanced civil infrastructure materials by Hwai Chung Wu, Woodhead Publishing Limited, First published 2006.
2. Properties of Concrete- Neville, A.M. - ELBS Edition, Longman Ltd., London-2011.
3. Concrete- P.K. Mehta, P J M Monteiro,- Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute Chennai)-2013.
4. Ashby, M.F. and Jones.D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
5. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
6. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999

Course Outcome: At the end of the course, the students will have the ability to:

- Interpret the requirements of advanced concrete materials (CO1).
- Idealize and design special concrete (CO2).
- Exemplify the methodology of different composite materials (CO3).
- Summarize the Sustainable Construction Materials in infrastructure (CO4).

COMPUTATIONAL METHODS IN INFRASTRUCTURE ENGINEERING

Sub Code: CTI 243

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objective:

- To understand the hardware and software requirements of computer, programming, optimization techniques, inventory models and scheduling techniques applied to construction engineering.
-

1. **Introduction:** Overview Of Information Technology Applications In Construction – Construction Process – Computerization In Construction – Computer Aided Cost Estimation.
2. **Optimization Techniques:** Linear, Dynamic And Integer Programming - Branch And Bound Techniques – Application To Production Scheduling, Equipment Replacement, Material Transportation And Work Assignment Problems – Software Applications
3. **Inventory Models:** Deterministic and Probabilistic Inventory Models - Software Applications.
4. **Scheduling Application:** PERT And CPM - Advanced Planning And Scheduling Concepts – Computer Applications – Case Study, BIM and BMS.
5. **Other Problems:** Sequencing Problems – Simulation – Enterprises – Introduction To ERP Systems.

References:

1. Billy E.Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, Mc Graw Hill, 2008.
2. Feigenbaum,L., Construction Scheduling with Primavera Project Planner Prentice Hall Inc., 2002.
3. Ming Sun and Rob Howard, “Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, 2004.
4. Paulson, B.R., Computer Applications in Construction, McGraw Hill, 1995.

Course Outcome: At the end of the course students will have the ability to:

- Exemplify Computer applications in Infrastructural engineering (CO1).
- Explain different optimization techniques (CO2).
- Infer and carry out the life cycle assessment (LCA) of infrastructure (CO3).
- To carry out the scheduling application in various aspect of infrastructure (CO4).

PROJECT PROCUREMENT SYSTEMS

Sub Code: CTI 251

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To provide functional knowledge of Materials Management, Materials Procurement, Inventory Control as well as Warehousing for both construction as well as service sector.
- To provide theoretical and practical exposure for application of such concepts.

-
1. **Integrated Material Management:** meaning, functions and advantages, selective control, material planning and budgeting, price forecasting, purchasing under uncertainties, purchasing capital equipments, source selection, Control Costs, Negotiation.
 2. **Materials Procurement and Classification:** Introduction to material procurement and classification, need and usage of classification, single-dimensional classification, multidimensional classifications, materials codification, usage of codification, codification types.
 3. **Storage and Warehousing:** storage and warehousing concepts, receipt, warehouse type, layout, issue of materials and updating of records, manpower and equipment;
 4. **Inventory Management:** different inventory costs, static risk model, eoq, practical systems, - p and q systems, probability base inventory control, or techniques in material management, statistical methods and application of computers, inventory systems for different demand situations, deterministic models, economic order quantity (eoq) under different situations of pricing, demand and delivery.
 5. **Vendor Management, ERP Systems & Invoicing:** -Vendor Training, Vendor Portal, ERP Systems, Purchase Requisitions, Purchase Orders, General Clauses in Purchase Agreements, Taxes computed while Invoicing and Way Bills

References:

1. Arnold, Chapman: Introduction to Materials Management: Pearson, 5th edition, 2008
2. Gopal Krishnanan P., Sundaresan M., (1992) "Material Management Integrated Approach", Prentice Hall India, New Delhi.
3. Datta A.K., (1988) "Material Management and Inventory Control: Principles and Practice", Jaico Publishing House, Bombay.
4. Shah N.M., (1988) "Integrated Concept of Material Management", Tata Mc Graw Hill.
5. Michael R. Leenders, Fearn, (1977) "Purchasing and Material Management", D.B. Tarporevale Sons and Co., Bangalore.
6. Tersine, Richard J., (1994) "Principles of Inventory and Material Management", Prentice Hall International.
7. Zipkin, Paul H., (2000) "Foundations of Inventory Management", McGraw Hill International

Course Outcome: At the end of the course students will have the ability to:

- Interpret basic knowledge of materials Management and purchase management (CO1).
- Explain materials procurement and its codification along with standardization (CO2).
- Summarize storage and warehousing concepts (CO3).
- Summarize inventory control management (CO4).

MANAGEMENT INFORMATION SYSTEMS

Sub Code: CTI 252

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the fundamentals of project management and organization structures of the project.
- To study the concept quality and value of information, importance, application and development of MIS in the complex projects

-
1. **Management:** Definition, Functions, Levels, Role Of Different Levels Of Management In Planning, Decision Making And Control.
 2. **Information:** Definition, Attributes And Value Of Information, Types Of Decision And Value Of Information, Age Of Information.
 3. **System:** Definition, Description, Types Of Systems, Decoupling And Control Of Systems, Stress In Systems.
 4. **MIS:** Definition, Characteristics, Problems, Classification Computer Hardware And Software For MIS, Database, DBMS.
 5. **MIS In Practice:** Transaction Processing Systems, Information Reporting Systems, Decision Support Systems, Expert Systems And Office Automatic Systems.
 6. **Project Planning, Analysis And Design Of MIS:** MIS As System, Software Development Life Cycles, Feasibility Study, Requirement Analysis, Data Flow Diagram And Data Dictionary, Process Description. Software Requirement Specifications, Systems Design, Structures Charts, Input-Output Design Development- Testing, Implementation and Maintenance of MIS- Case Studies.

References:

1. Gordan Davis B., (1989) "Management Information Systems. Conceptually foundation, Structure and Development", McGraw Hill Book Company, International Edition.
2. Parker Charles S., (1989) "Management Information Systems: Strategy and Action", McGraw Hill Publication Company.
3. Arora Asok, (1999) Bhatia Akshaya, "Information Systems for managers", Excel Books, New Delhi.
4. Sadgopan S., (1998) "Management Information Systems", Prentice Hall India Ltd., New Delhi.
5. Murdick Robert C., Ross Joel E., (1990) "Management Information Systems for Modern Management", Prentice Hall India Ltd., New Delhi
6. Scott George C., (1986) "Principles of Management Information Systems", McGraw Hill Book Company, International Students Limited

Course Outcome: At the end of the course students will have the ability to:

- Explain roles and responsibility in the organization structures of the project (CO1).
- Distinguish the quality and value of information in the organization (CO2).
- Exemplify importance and application of MIS in the complex projects (CO3).
- Interpret development, testing and implementation of MIS in the organization (CO4).

FINANCIAL IMPLICATIONS AND MARKETING

Sub Code: CTI 253

Contact Hrs: 4+2 /week

Credits: 4: 1: 0

Course Objectives:

- To study the fundamentals of Financial System and Services.
- To study the concept of Fund raising for a project through various Financial Services.
- To understand the basic concept of various types of Funds, Legal and Institutional Arrangements.

1. **Introduction:** Overview Of Financial Systems In India – Structure, Regulation Role And Functions Of Financial Systems – Financial Instruments – Financial Markets – Capital Markets & Money Markets – Interlink Between Money Market & Capital Market – Characteristics Of Financial Markets – Functions Of Stock Exchange – Introduction To Forex.
2. **Financial Services:** Objectives Of Financial Services – Types Of Financial Services – Capital Market Services & Money Market Services – Intermediaries: Banking Financial Corporations , Non Banking Financial Corporation & Insurance Corporations- Financial Services Sector Problems And Reforms.
3. **Venture Capital:** Venture Capital: Growth Of Venture Capital In India- Financing Pattern – Legal Aspects And Guidelines For Venture Capital – Leasing- Types Of Leases – Leasing Vs Borrowing - Credit Rating : CRISIL, ICRA & Care – Factoring, Forfeiting- Bill Discounting – Types Of Factoring Arrangements – Factoring In Indian Context.
4. **Mutual Funds:** Mutual Funds: Concepts And Objectives – Functions And Portfolio Classification- Guidelines For Mutual Funds – Working Of Public And Private Mutual Funds In India – Debt Securitization – Demat Services – Need And Operations –Role Of NSDL & CSDL.
5. **Legal And Institutional Arrangements:** Regulatory & Legal Framework Of Government In Banking-- Role Of RBI –Functions Of Stock Exchange - Listing & Formalities In Stock Exchange – Laws Governing SEBI -- Role Of SEBI – Laws Governing Non Banking Financial Corporations – Laws Pertaining Anti- Money Laundering.

References:

1. Ramachandra T.V., 2006. Management of Municipal Solid Waste, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.
2. Ramachandra T.V., 2006. Soil and Groundwater Pollution from Agricultural Activities, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.
3. Vijay Kulkarni and Ramachandra T.V., 2006. Environmental Management, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.
4. World Bank. (1991). Environmental Assessment Sourcebook. Washington, D.C. Vol. 1: Policies, Procedures, and Cross Sectoral Issues World Bank Technical Paper 139. Vol. 2: Sectoral Guidelines. World Bank Technical Paper 140. Vol. 3: Guidelines for Environmental Assessment of Energy and Industry Projects. World Bank Technical Paper 154. Kulkarni V. S., Kaul, S. N., Trivedi R. K., (2001) Handbook of EIA, Scientific Publishers, India.
5. Kulkarni V and Ramachandra T V, 2009. Environmental Management, TERI Press, New Delhi
6. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L., Tu. 1997. Environmental Impact Assessment for Developing Countries in Asia. Volume 1 - Overview. ADB. Ministry of Environment and Forests (2000) EIA Manual.

Course Outcome: At the end of the course students will have the ability to:

- Distinguish Financial System and Services(CO1).
- Exemplify the concept of fund raising for a project through various Financial Services (CO2).
- Explain Venture Capital, leasing and mutual funds(CO3).
- Distinguish various types of Funds, Legal and Institutional Arrangements (CO4).

INFRASTRUCTURE MANAGEMENT LABORATORY

Sub Code: CTI 26L

Contact Hrs: 3 /week

Credits: 0: 0: 1.5

Course Objectives:

- To practice project planning, controlling and generating various reports of small construction project using Spreadsheet, MSP and Primavera tool.
-

1. **Spread sheet programming:** Programming management problems -price forecasting, inventory models, Operation Research and project management problems.
2. **Primavera P6:**Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.
3. **MS project:** Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.
4. **Sample Projects:** Working on Practical Projects.

References:

1. Raina V.K., (1988), "Construction Management practice", Tata – McGraw Hill publishing co.Ltd.
2. K KChitkara, (1999), "Construction Project Management", Tata- McGraw Hill publishing co.Ltd. Publication.
3. User Manual- MS Project & Primavera P6
4. Planning and Control Using MS Project 2013, by Paul Harris.

Course Outcome: At the end of the course students will have the ability to:

- Do the planning, controlling and tracking
- Generate reports of construction project

SEMINAR

Sub Code: CTI 17S & CTI 27S

Contact Hrs: ---

Credits: 0:0:(1.5+1.5)

Course Objectives:

- To work on a specific technical topic in Construction Engineering and Management in order to acquire the skills of oral presentation.
 - To acquire technical writing abilities for seminars and conferences.
-

There will be a seminar in I and II Semester. The students will work for three hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to construction engineering and management and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

PRACTICAL TRAINING IN INDUSTRY / RESEARCH

Sub Code: CTI 31T

Contact Hrs: ---

Credits: 0:0:4

Course Objectives:

- To train the students in the field work so as to have a first hand knowledge of practical problems related to Construction Management in carrying out engineering tasks.
 - To develop skills in facing and solving the problems experiencing in the field.
-

The students individually undertake training in reputed engineering companies doing construction for a specified duration of Eight weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

PROJECT WORK (PHASE-I & PHASE II)

Sub Code: CTI 32P &CTI 41P

Contact Hrs: ---

Credits: 0:0:(14+26)

PHASE I

Course Objectives:

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of construction engineering and management. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

PHASE II

Course Objectives:

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.