

# **NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY**

(An Autonomous College under VTU)  
(NAAC Accredited with 'A' Grade, NBA Accredited)



***Outcome Based Education (OBE) /  
Choice Based Credit System (CBCS) Curricula***

**Scheme - M. Tech  
Construction Technology**

**2016 -2017**

  
**PRINCIPAL**  
Nagarjuna College of Engineering & Technology  
Devanahalli (Tq) Bengaluru (Dt.)-Pin: 562164

Department of Civil Engineering  
**NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY**  
Mudugurki Village, Venkatagiri Kote Post,  
Devanahalli taluk,  
Bangalore district - 562 164



**An Autonomous College under VTU**

## **DEPARTMENT OF CIVIL ENGINEERING**

### **VISION**

To transform the students as leaders in Civil Engineering to achieve professional excellence in the challenging future.

### **MISSION**

**M1:** To provide the Civil Engineering knowledge and skills for students through an excellent academic environment.

**M2:** Adopting innovative teaching techniques using modern engineering tools for designing, modeling and analyzing the societal and environmental problems.

**M3:** Developing Communication skill, leadership qualities through teamwork and skills for continuing education among the students.

**M4:** To inculcate moral, ethical and professional values among students to serve the society.

**M5:** Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

## **Program Educational Objectives (PEOs)**

- **PEO1:** Graduates in Civil Engineering will apply the technical knowledge for sustainable societal growth.
- **PEO2:** Graduates of civil Engineering will demonstrate designing, modeling and analyzing skills.
- **PEO3:** Graduates in Civil Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.
- **PEO4:** Civil Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.
- **PEO5:** Civil engineering graduates will have the ability to become entrepreneurs thereby switching over from responsive engineering to creative engineering.

## **Program Outcomes (POs)**

- **PO-1:** Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering.
- **PO-2:** Problem Analysis: Identify, formulate, research literature and analyze complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.
- **PO-3:** Design/Development of Solutions: Design solutions for complex Civil Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.
- **PO-4:** Conduct Investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions related to Civil Engineering problems.
- **PO-5:** Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, FEM, GIS, etc. including prediction and modeling to complex Civil Engineering activities with an understanding of the limitations.
- **PO-6:** The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Civil Engineering practice.
- **PO-7:** Environment and Sustainability: Understand the impact of the professional Civil Engineering solutions in societal and environmental contexts and demonstrate the knowledge and the need for sustainable development.
- **PO-8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities while following the Civil Engineering practice.
- **PO-9:** Individual and Team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
- **PO-10:** Communication: Communicate effectively on complex Civil Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO-11:** Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Civil Engineering projects and in multidisciplinary environments.
- **PO-12:** Life Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Outcome (PSO)**

- **PSO1:** To carryout surveying, prepare layout plans, maps for structures and alignments for canals and roads.
- **PSO2:** To specify, analyze, design, estimate and supervise construction activities such as, test and evaluate foundations and superstructures for buildings, industries, irrigation and hydraulic structures, highways, railways, airports, docks and harbors.
- **PSO3:** To understand the impact of water, air and noise pollution; the methods of waste collection, disposal and processing; specify, design and analyze water supply system, sewerage and industrial effluent conveying and treatment systems.

**M.Tech Construction Technology**

First Semester -Scheme

| Sl. No | Subject Code | Subject                              | Teaching Dept | L-T-P-S (Hrs/week) | Total Credits | Marks      |
|--------|--------------|--------------------------------------|---------------|--------------------|---------------|------------|
| 1.     | 15CCT11      | Mechanization in construction        | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 2.     | 15CCT12      | Advances in construction material    | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 3.     | 15CCT13      | Construction project management      | Civil Engg.   | 4-2-0-0            | 5             | 100        |
| 4.     | 15CCT14      | Structural Masonary                  | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 5.     | 15CCT15<br>X | <b>Elective- I</b>                   | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 6.     | 15CCT16      | Material Characterization Laboratory | Civil Engg.   | 1-0-2-0            | 2             | 50         |
| 7.     | 15CCT17      | Seminar-1                            | Civil Engg.   | 0-0-2-4            | 2             | 50         |
|        |              | <b>Total</b>                         |               | 21-2-4-4           | <b>25</b>     | <b>600</b> |

**Elective- I**

|    |          |   |
|----|----------|---|
| 1. | 15CCT151 | Advanced Design of RC structures        |
| 2. | 15CCT152 | RS and GIS applications in Construction |
| 3. | 15CCT153 | Building Science                        |

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Second Semester - Scheme

| Sl. No | Subject Code | Subject                                | Teaching Dept | L-T-P-S (Hrs/week) | Total Credits | Marks      |
|--------|--------------|--|---------------|--------------------|---------------|------------|
| 1.     | 15CCT21      | Pre Engineered Construction Technology | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 2.     | 15CCT22      | Construction Economics and Finance     | Civil Engg.   | 4-2-0-0            | 5             | 100        |
| 3.     | 15CCT23      | Construction and Contract Management   | Civil Engg.   | 4-2-0-0            | 5             | 100        |
| 4.     | 15CCT24x     | <b>Elective – 2</b>                    | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 5.     | 15CCT25X     | <b>Elective – 3</b>                    | Civil Engg.   | 4-0-0-0            | 4             | 100        |
| 6.     | 15CCT26      | Software application lab               | Civil Engg.   | 1-0-2-0            | 2             | 50         |
| 7.     | 15CCT27      | Seminar-2                              | Civil Engg.   | 0-0-2-4            | 2             | 50         |
|        |              | <b>Total</b>                           |               | 21-4-4-4           | <b>26</b>     | <b>600</b> |

**Elective – 2**

|     |          |                                   |
|-----|----------|-----------------------------------|
| 8.  | 15CCT241 | Construction quality and safety   |
| 9.  | 15CCT242 | Advanced design of sub structures |
| 10. | 15CCT243 | Remedial Engineering              |

**Elective – 3**

|     |          |   |
|-----|----------|---|
| 11. | 15CCT251 | Pavement design and construction                    |
| 12. | 15CCT252 | Design of earthquake resistance structures          |
| 13. | 15CCT253 | Soil expolaration and ground Improvement techniques |

Outcome Based Education(OBE)/  
Choice Based Credit System (CBCS) Curricula

**Third Semester**

| Sl<br>No | Course<br>Code | Course Name                           | Teaching<br>Dept | L-T-P-S<br>(Hrs/week) | Total<br>Credits | Marks      |
|----------|----------------|---------------------------------------|------------------|-----------------------|------------------|------------|
| 14.      | 15CCT31        | Energy and Buildings                  | Civil Engg.      | 4-2-0-0               | 5                | 100        |
| 15.      | 15CCT32x       | <b>Elective – 4</b>                   | Civil Engg.      | 4-0-0-0               | 4                | 100        |
| 16.      | 15CCT33x       | <b>Elective – 5</b>                   | Civil Engg.      | 4-2-0-0               | 5                | 100        |
| 17.      | 15CCT34        | Project Phase– 1                      | Civil Engg.      | -                     | 5                | 50         |
| 18.      | 15CCT35        | Seminar - 3                           | Civil Engg.      | 0-0-0-2               | 1                | 50         |
| 19.      | 15CCT36        | Internship/Term<br>paper/Mini project | Civil Engg.      | -                     | 4                | 50         |
|          |                |                                       | <b>Total</b>     | 12-4-0-2              | <b>24</b>        | <b>450</b> |

**Elective – 3**

|    |          |                                   |
|----|----------|-----------------------------------|
| 1. | 15CCT321 | Project Safety Management         |
| 2. | 15CCT322 | Building Services and Maintenance |
| 3. | 15CCT323 | Disaster Management               |

**Elective – 4**

|    |          |  |
|----|----------|--|
| 1. | 15CCT331 | Construction and Demolition Waste Management |
| 2. | 15CCT332 | Formwork Design Of Structures                |
| 3. | 15CCT333 | Quantitative methods in construction         |

## Fourth Semester

## Outcome Based Education(OBE)/ Choice Based Credit System (CBCS) Curricula

| Sl . No | Course Code | Course Name             | Teaching Dept | L-T-P-S (Hrs/week) | Total Credits | Marks      |
|---------|-------------|-------------------------|---------------|--------------------|---------------|------------|
| 1       | 15CCT41     | Project Phase– II       | Civil Engg.   | -                  | 5             | 50         |
| 2       | 15CCT42     | Project Phase– III      | Civil Engg.   | -                  | 5             | 50         |
| 3       | 15CCT43     | Dissertation Evaluation | Civil Engg.   | -                  | 5             | 100        |
| 4       | 15CCT44     | Project Viva voce       | Civil Engg.   | -                  | 5             | 100        |
|         |             |                         | <b>Total</b>  | -                  | <b>20</b>     | <b>300</b> |

### Note:

- The Laboratory phases are CIE with report submission and seminar presentation of 50 marks each.
- The Seminar (I & II semester) on current topics shall be presented along with a report for evaluation.
- Project work Phase -1, 2& 3 to be awarded by the department committee constituted for the purpose.
- The project thesis evaluation has to be done separately by internal and external examiners.
- The project Viva-voce has to be done jointly by the internal and external examiner.

## MECHANIZATION IN CONSTRUCTION

Course Code: 15CCT11  
Total No. of credits:04  
50:50

L-T-P-S  
4-0-0-0

Exam Hrs: 03  
CIE:SEE Marks:

### Course Objectives:

- To learn the importance of the mechanization in construction
- To understand the characterization and operations of construction equipments
- To go through the procedures involved in production of materials/products used in construction
- To be aware of the different construction methods and techniques involved construction equipments

### SYLLABUS

#### MODULE 1

**Introduction to mechanization:** Definition, advantages and limitations of mechanization, Indian scenario and Global scenario, Need of mechanization in construction industry, Classification of construction equipments, Factors affecting selection of equipment. 10 hr.

#### MODULE 2

Planning for Earthwork Construction, Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers, scrapers, Excavators, Finishing equipment, Draglines and Clamshells, Trucks and Hauling equipment, Hoisting equipment. 10 hr.

#### MODULE 3

Mechanization in aggregate manufacturing: Natural aggregates and recycled aggregates, Mechanization in rebar fabrication, Mechanization in prefabrication 10 hr.

#### MODULE 4

Mechanization in concrete production and placement, Mechanization through construction: formwork and scaffolding-types, materials and design principles. 10 hr.

#### MODULE 5

Mechanization through construction methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology, Safety and Environmental issues in mechanization 10 hr.

**Course Outcomes:** On completion of this course, students are able to get

- Exposure to mechanized construction in Indian scenario and Global scenario
- Can select construction equipment appropriate to tasks.
- Estimate productivity and cost data for construction equipments.
- Knowledge of contemporary issues pertaining to construction methods, equipment usage and management.

### Reference Books:

1. Peurifoy R L, "Construction Planning, Equipment and Methods", 6<sup>th</sup> Edition, Mc Graw Hill, 2001.
2. James F Russell, "Construction Equipment", Prentice Hall, 1985.
3. Sharma S.C. Construction Equipment and Management, Khanna Publishers, Delhi, 1988
4. Dr. Mahesh Varma, Construction Equipment and its planning and application, 3<sup>rd</sup> Edition, Metropolitan Book Company, New Delhi 1983
5. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers Delhi, 1988

### E-Resources:

<http://cmac.co.in/wp-content/uploads/2013/02/Mechanisation-in-Construction-Scope-Applicability-Value.pdf?ckattempt=1>

## ADVANCES IN CONSTRUCTION MATERIALS

Course Code: 15CCT12  
Total No. of credits: 04

L-T-P-S  
4-0-0-0

Exam Hrs: 03  
CIE:SEE Marks: 50:50

### Course Objectives:

- To provide the basic knowledge of science and engineering of concrete properties..
- To study the Codal provisions for concrete mix design.
- To learn effectively the advances in construction materials.

### SYLLABUS

#### MODULE 1

Concrete making materials- Cement: Chemical composition, hydration of cement, Types of cement. Aggregates: Types, properties and tests on aggregates. Admixtures: Types, Mechanism and their effect on concrete property in fresh and hardened state.

10 hr.

#### MODULE 2

Microstructure of concrete, Fresh concrete and its rheology, Mechanical, deformational behaviour of hardened concrete. Creep and Shrinkage of Concrete, Durability of Plain and Reinforced Concrete.

10 hr

#### MODULE 3

Special Concrete: High Strength/Performance Concrete, Fibre Reinforced Concrete, Reactive Powder Concrete, Roller Compacted Concrete, Self-Compacting Concrete, Geo-polymer Concrete and Decorative Concrete, Proportioning of Mixes.

10 hr.

#### MODULE 4

Types of Reinforcements. Corrosion in concrete and its protection, Corrosion of rebars in concrete, Influence of fly ash on the corrosion steel bar in concrete. Electro-chemical process, measures of protection.

10 hr.

#### MODULE 5

Advanced Materials: Polymers, fibres, adhesives and sealants- types and their uses. Adhesives in construction industry, Bridge bearings, Moisture Barriers, Structural glazing.

**Course Outcomes:** On completion of this course, students are able

- To know the properties of fresh concrete and hardened concrete.
- Understand the structural, physical and long-term performance of special concretes.
- To know the uses of advanced materials in construction projects.

### Reference Books:

1. Metha P.K and Monteiro.P.J.M, " **CONCRETE - Microstructure, Properties and Materials**", Fourth Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006
2. Shetty .M.S., "**Concrete Technology, Theory and Practice**", 7<sup>th</sup> Edition, S. Chand & company Ltd., New Delhi 2006
3. Neville. A.M. , "**Properties of Concrete**", 5th Edition, Prentice Hall, 2011.

### E-Resources:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/283886/ep10-new-and-advanced-materials.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283886/ep10-new-and-advanced-materials.pdf)

Course Code: 15CCT13  
Total No. of credits: 05

L-T-P-S  
4-2-0-0

Exam Hrs: 03  
CIE:SEE Marks: 50:50

### Course Objectives:

- To understand the principles of construction project management
- To learn the principles through different methods and to apply the same for preparing project plan and scheduling techniques.
- To understand the evaluation of the project strategies and optimizing the characteristics of project.

### SYLLABUS

#### MODULE 1

**Introduction:** Project Organization, Types, structure and practices. Stages of construction project, Delays. Construction schedule - Preparation, uses and types of construction schedule. Job layout, Work Breakdown Structure, Project planning, Scheduling, Monitoring and Updating. 10 hr

#### MODULE 2

**CPM & PERT:** Introduction to CPM and its applications, Network fundamentals, Numerical on Fulkerson's rule. Introduction to PERT and its uses and importance, Numerical on Time estimates. 10 hr

#### MODULE 3

**Cost & Network:** Time-Cost Trade-off, Direct cost, Indirect cost, Total project cost, Cost optimization, Cost Control in Construction, Numerical on crashing of network. 10 hr.

#### MODULE 4

**LOB:** Introduction to Line of Balance Scheduling, construction and prepare of LOB, Need and methods, Numerical on LOB. 10hr.

#### MODULE 5

**Resource Allocation:** Introduction, Resource usage profiles, Project updating, Planning-leveling and Allocation, Numerical on Resource allocation, Introduction to Building Information Model (BIM). 10 hr

**Course Outcomes:** On completion of this course, students are able to

- Apply knowledge on preparing project plans, schedule of construction, and project organization.
- Identify, formulate and solve problems on construction network and time estimates.
- Identify and apply time cost tradeoff principles and cost control in construction.
- Interpret construction data and presenting in graphical form, perform variance analysis on balancing resources and scheduling activities for repetitive work.
- Design information system on men, material, machine and money for managing various activities of projects.

#### Reference Books:

1. Peurifoy. R L, "Construction Planning, Equipment and Methods"- 6<sup>th</sup> Edition, McGraw Hill. 2001.
2. Chitkara K K, Construction Project Management, 10<sup>th</sup> Reprint, Tata McGraw Hill, 2006.
3. Srinath L.S, "PERT and CPM", 3<sup>rd</sup> Edition, East West Press Pvt. Ltd. New Delhi. 2001.
4. Antill J M & Woodhead R W, Critical Path Methods in Construction Practice, 4<sup>th</sup> Edition John Wiley and Sons, 1990.
5. Harris R B, Precedence & arrow networking techniques for construction, John Wiley, 1978.

#### E-Resources

<http://www2.aku.edu.tr/~icaga/kitaplar/fundamentals-of-construction-management.pdf>

### STRUCTURAL MASONRY

Course Code: 15CCT14  
Total No. of credits: 4

L-T-P-S  
4-0-0-0

Exam Hrs: 03  
CIE:SEE Marks: 50:50

### Course Objectives:

- Students will be expected to understand the strength and elastic properties of masonry and its constituent Materials.
- Make students to learn the behavior and performance of masonry structures
- Students will be to evaluate the strength and stability of masonry structures
- Students shall be introduced to design of load bearing masonry buildings
- Students will understand the design concepts of masonry structures for earthquake resistance
- Students will learn the concepts in designing masonry arches, domes and vaults

### SYLLABUS

#### MODULE 1

**Introduction:** Masonry Units, Materials and Types: History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars.

10hr

#### MODULE 2

**Strength of Masonry in Compression:** Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

10hr

#### MODULE 3

**Flexural and shear bond:** flexural strength and shear strength: Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength.

10hr

#### MODULE 4

**Design of load bearing masonry buildings:** Permissible stresses, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels. Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall. Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions.

10hr

#### MODULE 5

**Introduction to reinforced masonry:** Concepts for vertical and horizontal reinforcement schemes for masonry, construction process, BIS codal provisions. **Masonry arches, domes and vaults:** Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.

10hr

**Course Outcomes:** On completion of this course, students are able to

- Summarize the masonry materials and their characteristics

- Know the concept of the strength and elastic properties of masonry and its constituent materials
- Have clarity on the behavior of bond between the constituent masonry materials and its influence on strength
- Design masonry structures for gravity, wind and seismic loads
- Gain the knowledge of the components, classification and the construction procedure of masonry arches, domes and vaults

**Reference Books:**

- 1) Brick and Reinforced Brick Structures, Dayaratnam P., Oxford & IBH, 1987.
- 2) Structural masonry: Hendry A.W. -Macmillan Education Ltd., 1990.
- 3) Design of Masonry structures - Sinha B.P & Davis -S. 1<sup>st</sup> Edition, E & FN Spon, London UK, 1997.
- 4) Design of Reinforced and Prestressed Masonry- Curtin- Thomas Telford , 1988.
- 5) Structural Masonry- Sven Sahlin- Prentice Hall, New Delhi, 1971.
- 6) Alternative Building Materials & Technologies- Jagadish.K.S, Venkatarama Reddy B V & Nanjunda Rao K S- New Age International, New Delhi & Bangalore, 2007.

**E-Resources:**

<http://engineeringfreedownload.blogspot.com/2014/06/concrete-and-masonry-manual-free.html>

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## ADVANCED DESIGN OF RC STRUCTURES

Course Code: 15CCT151  
Total No. of credits:04

L-T-P-S  
4-0-0-0

Exam Hrs: 03  
CIE:SEE Marks: 50:50

### Course Objectives:

- To have the knowledge of principles of structural design
- To understand different types of structures and detailing of structures.

### SYLLABUS

#### MODULE-1

**Yield line method of design of slabs:** Introduction to yield line analysis of slabs, assumptions, characteristic features, yield line patterns, moment capacity across a yield line, analysis by virtual work method, analysis by equilibrium method, design of slabs using yield line theory.

**Design of flat slabs:** Introduction, proportioning of flat slabs, advantages and limitations of flat slabs, determination of bending moment and shear force, the direct design method, equivalent frame method, slab reinforcement, design of flat slabs.

10hr.

#### MODULE-2

**Design of grid floors:** Introduction, size beams and topping, Design of grid floor by Rankine's grashoff method, IS-456:2000 method.

10hr.

#### MODULE-3

**Design of continuous beams with redistribution of moments:** Introduction, effective span, stiffness, loading pattern, moment redistribution, bending moment and shear force coefficients, Design of continuous beams.

10hr.

#### MODULE-4

**Design of chimneys:** Introduction, Design factors, stresses due to self weight and wind load. stress in horizontal reinforcement, temperature stresses, combined effect of self weight, wind load and temperature stress in hoop reinforcement, Design of chimneys

**Design of silos and bunkers:** Introduction, Difference between bunkers and silos, Design of rectangular bunker, Design of tension member, Design of circular bunker, Design of silos.

10hr.

#### MODULE-5

Art of detailing earthquake resistant structures, types of bands in earthquake resistant structures, Ductile detailing of RC structures, factors affecting ductile detailing, Expansion and contraction joints.

10hr.

**Course Outcomes:** On completion of this course, students are able to,

- Achieve knowledge of design and development of problem solving skills.
- Apply the principles of structural design.
- Design and develop analytical skills.
- Summarize the principle of structural design and detailing.

### Reference Books:

1. P.C.Varghese, "Advanced Reinforced Concrete Design", 2<sup>nd</sup> Edition, Prentice-Hall of India, New Delhi, 2005.
2. Dr.B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive RCC Design". 8th Edition Laxmi Publication 2005.
3. S S Bhavikatti "Advanced R.C.C Design". 4<sup>th</sup> Edition, New age international publishers, 2008.

4. N. Krishna Raju “Advanced Reinforced Concrete Design”, 2<sup>nd</sup> Edition, CBS Publishers and distributors, New Delhi, 2013.
5. A Park and Paulay, “Reinforced Reinforced and Prestressed Concrete” John wiley & Sons, 1975

**E-Resources:**

<http://www.nptel.ac.in/courses/105105105/>

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## RS and GIS Applications in Construction

Course Code: 15CCT152  
Total No. of credits:04

L-T-P-S  
4-0-0-0

Exam Hrs: 03  
CIE:SEE Marks: 50:50

### Course Objectives:

- Exposure to geographic information concepts and GIS functionality.
- To provide the computer fundamentals of GIS.
- To analysis the GIS data models and structures.
- Understand the concepts of data quality and sources of error.
- To learn GIS, remote sensing and data base positioning systems

### SYLLABUS

#### MODULE 1

**Geographic information concepts and spatial models** – Introduction, spatial information, temporal information, conceptual models of spatial information, representation of geographic information.

**GIS Functionality** – Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction.

10hrs

#### MODULE 2

**Computer Fundamentals of GIS** and Data storage Fundamentals of computers vector/ raster storage character files and binary files, file organization, linked lists, chains, trees. Coordinate systems and map projection: Rectangular, polar and spherical coordinates, types of map projections, choosing a map projection.

10hrs

#### MODULE 3

**GIS Data models and structures** – Cartographic map model, Geo- relation model, vector/ raster methods, non –spatial data base structure viz.. hierarchal network, relational structures. Digitizing Editing and Structuring map data– Entering the spatial (Digitizing), the non- spatial, associated attributes, linking spatial and non- spatial data, and use of digitizers and scanners of different types.

10hrs

#### MODULE 4

**Data quality and sources of error** – Sources of errors in GIS data, obvious sources, natural variations and the processing errors and accuracy. Principles of Spatial data access and search, regular and object oriented decomposition , introduction to spatial data analysis and overlay analysis, raster analysis, network analysis in GIS.

10hrs

#### MODULE 5

**GIS and remote sensing data-** integration techniques in spatial decision support system land suitability and multicriteria evaluation, rule based systems, network analysis, special interaction modeling, Virtual GIS.

**Data base positioning systems**, desirable characteristics of data base management systems, components of a data base management system, understanding the data conceptual modeling. Global positioning system, hyper spectral remote sensing, DIP techniques, hardware and software requirements for GIS, overview of GIS software.

10hrs

**Course Outcomes:** On completion of this course, students are able to

- Know the geographic information concepts and GIS functionality.
- Have the awareness of the computer fundamentals of GIS.
- Summarise the GIS data models and structures.
- Achieve knowledge of concepts of data quality and sources of errors.
- Know about GIS, Remote sensing and data base positioning systems and its uses in the field.

**Reference Books:**

1. Peter A Burrough Rachael A Mc Donnel, Principles of GIS (Oxford), 2000.
2. Christopher Jones. "GIS and Computer cartography "(Longman), 2000.
3. Lillesand, "Remote Sensing and Image interpretation"- (John Wiley and Sons), 2000.

**E-Resources:**

- <http://linlpringer.com>
  - <http://crcnetbase.com>
-

## BUILDING SCIENCE

Course Code: 15CCT153  
Total No. of credits: 04

L-T-P-S  
4-0-0-0

Exam Hrs: 03  
CIE:SEE Marks: 50:50

### Course Objectives:

- Exposure to climatic factors and requirements for health.
- To provide the fundamentals of airflow patterns and estimation of natural ventilation.
- To provide concepts of thermal comfort factors.
- Understand the concepts of propagation of sound and insulation.
- Understand the Principles of day lighting in buildings

### SYLLABUS

#### MODULE 1

Climatic factors, Classification of tropical climates, site climate, micro climate of human settlements, ventilation requirements for health, mechanisms.

10hr

#### MODULE 2

Estimation of natural ventilation, airflow patterns in building.

10hr

#### MODULE 3

Thermal comfort factors, thermal indices, thermal quantities, heat exchange in buildings, periodic heat flow, mechanical and structural means of thermal control.

10hr

#### MODULE 4

Propagation of sound, sound insulation, absorption, transmission reverberation roofing and walling system for sound absorption and insulation, noise and noise control in buildings.

10hr

#### MODULE 5

Principles of day lighting in buildings

10hr

**Course Outcome:** The students are able to:

- Know about climatic factors and requirements for health and mechanisms.
- Assess the fundamentals of airflow patterns and estimation of natural ventilation.
- Summarise the concepts of thermal comfort factors.
- Apply knowledge about propagation of sound and insulation.
- Use the Principles of day lighting in the design of buildings.

### Reference Books:

1. O H Koenigsberger, "Manual of Tropical Housing and Building- Climatic Design", Orient Longman, Chani 1975
2. Deodhat, S V , "Building Science and Planning", 2<sup>nd</sup> Edition, Khanna Pub., 2005.
3. B C Punmia, "Building Construction", 10<sup>th</sup> Edition, Laxmi Pub., 2008.
4. SP:41- Functional Requirements for Buildings, BIS, New Delhi

### E-Resources:

1. <http://linlpringer.com>
2. <http://crcnetbase.com>

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## MATERIAL CHARACTERIZATION LABORATORY

Course Code: 15CCT16  
No. of credits:02

L-T-P-S  
1-0-2-0

Exam Hrs : 03  
CIE: SEE= 25:25

### Course Objectives:

- To provide an exposure to modern techniques to test concrete properties related to civil engineering problems.
- The students will be capable of testing the dynamic behaviour of the building.
- Exposed to Non-Destructive testing methods.

### SYLLABUS

**In-situ test methods:** In situ testing of concrete structures, test methods available, planning of in situ tests, Surface hardness methods- Rebound Hammer equipment, its operation and procedure for testing, factors influencing rebound no., calibration, and interpretation of results, applications and limitations, Ultrasonic methods- UPV testing equipment, its use, different transducer arrangements, tests calibration and interpretation of results, Exposure to IS and other relevant codes

Stress-Strain relationship of concrete and masonry

Mix design, casting and testing High Performance/Strength concrete cylinders and obtaining the stress-strain behavior (Modulus of Elasticity) under compressive loading, casting and testing of stack-bonded masonry prisms and obtaining the stress-strain behavior (Modulus of Elasticity) under compression.

**Instrumentation for dynamic measurement:** Use of vibration measuring instruments (accelerometers), data acquisition systems, Experiments on SDOF systems free vibration tests to obtain natural frequency and damping

**Course Outcomes:** On completion of this course, students are able

- To appreciate how modern instruments are helpful for the experimentation on concrete parameters.
- Gain the importance of experiments on Non Destructive Testing of concrete.
- The students will be able to find the effect of seismic forces on different structural models.

### Reference Books:

1. IS code 10262: 2009
2. Harry G Harris and Gajanan M Sabnis, "Structural Modeling and Experimental Techniques", 2<sup>nd</sup> Edition, CRC Press, Boca Raton, 1999.
3. Dally and Riley, "Experimental stress analysis", 3<sup>rd</sup> Edition, Mc Graw Hill, 1991.

### E-Resources:

1. <http://lin.springer.com>
2. <http://crcnetbase.com>

## **SEMINAR- 1**

Course Code: 15CCT17

L-T-P-S

No. of credits: 02

0-0-2-4

Marks: 50

### **Course objectives:**

- To develop students written and oral communication competencies to enhance technical effectiveness.
- To provide students an opportunity to learn new concepts and to express their presentation skills
- Instill students with initiative, independence, reflection and knowledge transfer
- To develop students ability to think strategically and express their views without hesitation.

The student will have to give a presentation for 20minutes on any current civil engineering topic chosen by him or her after discussion with guide.

### **Course Outcomes:**

1. Students get the awareness about the recent technology trends based on their field of interest
2. Able to prepare an effective written technical report
3. Able to plan and produce presentation materials which most effectively communicate the intended message for their technical oral presentation

## PRE ENGINEERED CONSTRUCTION TECHNOLOGY

Course Code: 15CCT21

L-T-P-S

Exam Hrs: 03

Total No. of credits: 4

4-0-0-0

CIE:SEE Marks:

50:50

### **COURSE OBJECTIVES:**

- To know the importance of pre engineering construction technology in construction industry.
- To learn the modular coordination in pre engineering construction technology.
- To understand the production process in pre engineering elements/products.
- To study the concepts and design criteria of pre engineering buildings.

### **SYLLABUS**

#### **MODULE 1**

General Principles of Fabrication: Introduction - Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication - Economy of prefabrication – Design of simple rectangular beams and I beams – Handling and erection stresses – Elimination of erection stresses – Beams, columns – Symmetrical frames. 10 hr.

#### **MODULE 2**

**Modular Construction Practices:** Introduction to Modular Construction, Modular coordination, Modular Standardization, Modular System Building, Limitation and Advantages of Modular Construction - Standardization – Planning for Components of prefabricated structures – Disuniting of structures. 10 hr.

#### **MODULE 3**

Prefabricated Elements: Roof and floor panels, ribbed floor panels – wall panels – footings – Joints for different structural Connections – Effective sealing of joints for water proofing – Provisions for non-structural fastenings – Expansion joints in pre-cast construction. Designing and detailing of precast unit for factory structures –Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Single span single storeyed frames –Single storeyed buildings – slabs, beams and columns. 10hr

#### **MODULE 4**

**Production and Hoisting Technology:** Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening. Equipments for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads. 10 hr.

## MODULE 5

**Pre-Engineered Buildings:** Introduction – Advantages - Pre Engineered Buildings Vs Conventional Steel Buildings –  
Concept of Pre Engineered Buildings (PEB) – Design criteria of PEB – Applications 10  
hr.

### COURSE OUTCOME:

On completion of this course, students are able to

- Apply the concept and limitations of pre engineering construction techniques.
- Implement modular construction practices.
- Gain the knowledge about production of the pre engineering elements.
- Have the awareness of reliable proportioning concepts in construction techniques.

### REFERENCE BOOKS:

1. L. Mokka, 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.

### E-Resources

<http://www.slideshare.net/hlksd/96382022-preengineeredbuildings-46415441>

<http://nptel.ac.in>

<http://crecnetbase.com>

## CONSTRUCTION ECONOMICS & FINANCE

Course Code: 15CCT22

L-T-P-S

Exam Hrs: 03

Total No. of credits: 5

4-2-0-0

CIE:SEE Marks:

50:50

### **COURSE OBJECTIVES:**

- To understand study the role of economics and financial concepts applied to construction business
- To know the Time – value of money
- To study the concepts of Construction Economics and Finance such as comparing alternatives, proposals, evaluating alternative investments, management of funds and management of accounts
- To learn about financial management like construction accounting, financial statements, ratios and working capital management

### **SYLLABUS**

#### **MODULE 1**

Engineering economics, Basic principles, Time value of money, Nominal and Effective Interest, Discounted cash flow, Cash flow diagrams Equivalence – Single payment Compound amount factor, Uniform annual series payments – Derivations and problems. 10 hr.

#### **MODULE 2**

Comparison of Alternatives - Basis of comparison and methods of comparison - Presentworth, Future worth and Annual worth methods, ROR and Incremental analysis. 10 hr.

#### **MODULE 3**

Public project evaluation - Benefit-Cost analysis and Equipment economics - Replacement analysis Breakeven analysis – project economics. 10 hr.

#### **MODULE 4**

Capital budgeting, Taxation and Inflation Depreciation – methods of depreciation, purpose of depreciation 10 hr.

#### **MODULE 5**

Financial management–Workingcapital management, Sources of finance, Long term and short term Finance Construction accounting – Basic concepts and principles, Income statement, Financial statements – Profit and Loss, balance sheets and financial ratios 10 hr.

**COURSE OUTCOMES:**

On completion of this course, students are able to

- 1) Apply the concepts in economics and finance in constructions
- 2) Calculate the different values of money at different periods of time.
- 3) Select the best alternative from the available options while purchasing equipments using different methods of comparison considering time – value of money
- 4) Evaluate construction project economics, cost-benefit analysis and break-even analysis
- 5) Understand the importance of working capital management, sources of funds, budgeting and control.
- 6) Prepare and manage by keeping accounts, balance sheets and financial statements.

**REFERENCE BOOKS:**

1. Courtland A. Collier and William B. Ledbetter,” Engineering Economics and Cost Analysis”, Harper & Row. 2005.
2. Kuchal S.C, “Financial Management” 16<sup>th</sup> Edition, Chethanya Publication House, Allahabad 2005
3. Van Horne J.C, “Fundamentals of Financial Management”, 12<sup>th</sup> Edition, Prentice Hall. 2001.
4. Harris F and Mc Caffer R. “Modern Construction Management”, 7<sup>th</sup> Edition, BSP Professional Books, 2013.
5. Chitkara. K. K. “Construction Project Management”, 3<sup>rd</sup> Edition, Tata McGraw Hills, 2014

**E-Resources**

[https://iimtstudies.files.wordpress.com/2014/03/finance\\_and\\_eco.pdf](https://iimtstudies.files.wordpress.com/2014/03/finance_and_eco.pdf)

[https://www.openstaxcollege.org/files/textbook\\_version/low\\_res\\_pdf/21/principles-of-economics-LR.pdf](https://www.openstaxcollege.org/files/textbook_version/low_res_pdf/21/principles-of-economics-LR.pdf)

## CONSTRUCTION AND CONTRACT MANAGEMENT

Course Code: 15CCT23

L-T-P-S

Exam Hrs: 03

Total No. of credits: 5

4-2-0-0

CIE:SEE Marks: 50:50

### **COURSE OBJECTIVES:**

- To learn the role and concepts of construction and contract management
- To learn the process of tendering in construction industry
- To know the concepts of alternate dispute resolution techniques
- To know the concepts of arbitration and conciliation as per Indian act 1872 and Arbitration and Conciliation Act 1996
- To learn the value engineering in contract management

### **SYLLABUS**

#### **MODULE 1**

Construction contracting, Definition of contract, Types of contracts, contract documents, Pre-contract requirements, International contracts, Conditions and specifications of contract. Definition of tender, types of tenders, tendering procedure, tendering documents. 10 hr.

#### **MODULE 2**

Standard forms of contracts, methods of inviting tenders, pre-bid meetings, pre-qualification system, scrutiny of tenders and comparative statement. Law of contracts, essential elements of valid contracts, The Indian Contract Act 1872 - Definition of the contract as per the ACT. Valid, Voidable, Void contracts, Objectives of the act, Contingent of contracts, Breach of contracts and its consequences. 10 hr.

#### **MODULE 3**

Contract administration, Construction Claims - Extra items and causes of claims, Types of construction claims, documentation, settlement of claims, extension of time, compensation and disputes. Alternate Dispute resolution techniques – negotiation, mediation, litigation, conciliation and arbitration, Dispute review board (DRB), FIDIC. 10 hr.

#### **MODULE 4**

Modern Trends in dispute resolution, Provision of Arbitration act 1940, Arbitration and Conciliation Act 1996 – case studies, Difference between 1940 Act and 1996 Act Extent of application of 1996 Act, Objectives. Composition of the arbitral tribunal, jurisdiction of arbitral tribunal, duties, power of arbitrators. 10 hr.

### **MODULE 5**

Project cost estimation, rate analysis-labour, materials and equipment production, Overhead charges, Bidding models and strategies. Professional ethics, Duties and responsibilities of parties, Management Information systems, Risk analysis, Value engineering. 10 hr.

#### **COURSE OUTCOME:**

On completion of this course, students are able to

- Prepare Contract Schedules, Notice Inviting Tender And Contract Documents.
- Understand The Indian Contract act 1872 as applied to construction.
- Understand Laws Of Construction Contract.
- Implement Dispute Resolution.
- Prepare Contract Management Plan As Per Standards.

#### **REFERENCE BOOKS:**

1. Roshan Namavathi, “Professional Practice”
2. Gajaria GT, “Law Relating to Building & Civil Engg. Contracts in India” Lexis Nexis Butterworths india, 2000
3. Collier, Kieth, “Managing Construction Contracts” 2<sup>nd</sup> Edition, Reston Publishing Co., 1982.
4. Civil Engineering Contracts and Estimates - B. S. Patil – Universities Press- 2006 Edition reprinted in 2009.
5. The Indian Contract Act (9 of 1872), 1872- Bare Act- 2006 edition, Professional Book Publishers.
6. The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.
7. FIDIC Document (1999) and current literature

#### **E-Resources**

- <http://www2.aku.edu.tr/~icaga/kitaplar/fundamentals-of-construction-management.pdf>

<http://osp.mans.edu.eg/elbeltagi/CM%20CH1%20Introduction.pdf>

## CONSTRUCTION QUALITY AND SAFETY

Course Code: 15CCT241

L-T-P-S

Exam Hrs: 03

Total No. of credits: 4

4-0-0-0

CIE:SEE Marks:

50:50

### **COURSE OBJECTIVES:**

- To learn the importance of quality and safety in construction industry.
- To know the tools and techniques of quality and safety.
- To learn the concept of TQM
- To study the process of certification of ISO 9000 in construction.

### **SYLLABUS**

#### **MODULE 1**

Construction Quality, Definition of quality as given by Deming, Juran, Crosby, Inspection and Testing, Quality control, Quality Assurance, difference between Quality control, Quality Assurance (QA/QC). Quality certification for companies and laboratories (ISO Certification, NABL certification).

10 hr.

#### **MODULE 2**

Total Quality Management - Total quality control (TQC) and Total Quality Management (TQM), Need for TQM in construction industry. Critical factors of TQM, TQM in Projects, Benchmarking, concepts of quality policy, standards, manual, Third Party Certification.

10 hr.

#### **MODULE 3**

PDCA Cycle. Quality aspects in every phase in the life cycle of Construction project, Study of ISO 9000 - Quality System Standards, Purpose of ISO Standards, Certification process for ISO 9001, Certification bodies involved, Eight Principles of ISO-Basic meaning, applying these principles for an effective quality process in the organization, Management support and commitment necessary for achieving implementation for quality system standards.

10 hr.

#### **MODULE 4**

Construction Safety-meaning and scope, Safety in construction-Technological aspects, organizational aspects and behavioural aspects, Safety legislation and Standards, Contract conditions on safety in civil Engineering projects.

10 hr

#### **MODULE 5**

Safety rules in construction, Safety in construction operations, Safety in the use of construction equipment, Ergonomics, Accident Prevention and safety, Construction Safety Management.

10 hr.

#### **COURSE OUTCOME:**

On completion of this course, students are able to

- Gain the knowledge of different aspects of quality and related tools.
- Apply techniques of total quality assurance and quality control programme
- Know the importance of various aspects of safety during construction activity.
- Apply principles of environmental safety to construction projects.
- Implement of ISO 9000 in construction.

#### **REFERENCE BOOKS:**

1. N. Logothetis, "Management for Total Quality", 8<sup>th</sup> Edition, Prentice Hall New Delhi, 2003.
2. David Gold Smith, "Safety Management in construction and Industry", Mc Graw Hill, 1987.
3. K N Vaid, "Construction Safety Management", 3<sup>rd</sup> Edition, Aspen Publishers New York, 2006
4. D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book House, Bangalore. 2000
5. "The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, Universal Law Publishing Co. Pvt. Ltd.

#### **E- Resources**

[http://www.docs.csg.ed.ac.uk/EstatesBuildings/HealthandSafety/Managing\\_health\\_and\\_safety\\_in\\_construction.pdf](http://www.docs.csg.ed.ac.uk/EstatesBuildings/HealthandSafety/Managing_health_and_safety_in_construction.pdf)

## ADVANCED DESIGN OF SUB STRUCTURES

Course Code: 15CCT242

L-T-P-S

Exam Hrs: 03

Total No. of credits: 4

4-0-0-0

CIE:SEE Marks:

50:50

### **Course objective:**

- Exposure to substructure and shallow foundations.
- To learn the fundamentals of pile foundation.
- To learn concepts of drilled pier, caissons and well foundations.
- To understand the concepts of data quality and sources of error.
- To know the concepts of foundations in marine structures.

### **SYLLABUS**

#### **MODULE 1**

**Introduction:** Introduction to sub structure, definition, purpose, requirements, types. Foundation: Types, selection criteria, requirements, load computation, design steps.

**Shallow foundation:** Types, depth of footings, loads, principles of design, proportioning of strip, spread, rectangular, trapezoidal, combined footings (no structural design), numerical problems on proportioning, raft foundation-design method, modulus of subgrade reaction.

10hrs

#### **MODULE 2**

**Pile foundation:** Introduction, necessity, various classifications, load carrying capacity, static method for driven piles in sand and clay, negative skin friction, dynamic formulae, pile group, group efficiency, numerical problems on above, under reamed piles, pile load test, concept of batter piles.

10hrs

#### **MODULE 3**

##### **Drilled pier, Caissons, well foundation**

Introduction, construction of drilled pier, merits & demerits of drilled piers, caissons-open type, pneumatic and

floating caissons concept, advantages, disadvantages, stability of floating caissons. Well foundation types, shapes,

forces acting, components, sinking of wells, tilts and shifts.

10hrs

#### **MODULE 4**

**Marine substructures:** Introduction, types, concepts of breakwater, wharves, pier, seawall, docks, quay walls, design loads, combined loads, and design method of break waters.

10hrs

## MODULE 5

**Foundation of transmission line towers:** Introduction, necessary, forces, design criteria, choice of foundation, design procedure.

10hrs

### COURSE OUTCOME:

#### Students will be able to

- Know the different types of foundations.
- Understand the fundamentals of pile foundation and its applications.
- Summarise the concepts of drilled pier, caissons and well foundations.
- Achieve knowledge of data quality and sources of errors.
- Know about foundations in marine structures and its uses in the field.

### REFERENCE BOOKS:

1. Gopal Ranjan and ASR Rao, “Basic and Applied Soil Mechanics”, 2<sup>nd</sup> Edition, New Age Int. (P) Ltd. 2004.
2. Swamisaran, “Analysis and Design of Sub-Structures”, 2<sup>nd</sup> Edition, IBH & Oxford, 2006, reprint on 2010.
3. B.M.Das, “Principles of Foundation Engineering”, 4<sup>th</sup> Edition, PWS Kent, Boston. 1999.
4. J.E. Bowles, “Foundation Analysis and Design”, 5<sup>th</sup> Edition, McGraw-Hills, 1996.
5. Teng, “Foundation Design”, 4<sup>th</sup> Edition, Prentice Hall, India, 1962.
6. K.R. Arora, “Soil mechanics and foundation engineering”, Standard publishers distributors, 2000

### E-Resources

[https://www.mainroads.wa.gov.au/Documents/SE%20Design%20Manual%203\\_8\\_11.PDF](https://www.mainroads.wa.gov.au/Documents/SE%20Design%20Manual%203_8_11.PDF)

## REMEDIAL ENGINEERING

Course Code: 15CCT243

L-T-P-S

Exam Hrs: 03

Total No. of credits: 4

4-0-0-0

CIE:SEE Marks: 50:50

### **COURSE OBJECTIVES:**

- To study the cause for deterioration of concrete structures, and experimental investigations using NDT.
- To understand the influence of climate, temperature and chemicals on concrete structures.
- To have the knowledge of materials used for the repair of deteriorated concrete structures.
- To study the different techniques for repairing the concrete structures.
- To have the knowledge of the examples of repair and techniques.

### **SYLLABUS**

#### **MODULE 1**

General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT.

10hrs

#### **MODULE 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.

10hrs

#### **MODULE 3**

Materials for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete.

10hrs

#### **MODULE 4**

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.

10hrs

#### **MODULE 5**

Examples of Repair: To Structures Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies

10hrs

### **COURSE OUTCOMES:**

**Students will be able to**

- Recognize causes for deterioration of concrete structures, preliminary investigations and experimental investigations using NDT.
- Understand the different influences on serviceability and durability characteristics.
- Use the materials for repair of deteriorated concrete structures.
- Understand the different techniques for repairing the concrete structures.
- Evaluate the different examples of repairs and techniques.

**REFERENCE BOOKS:**

1. Sidney., M. Johnson “Deterioration Maintenance and Repair of Structures” 2<sup>nd</sup> Edition, 2006.
2. R.N. Raikar “Rehabilitation of Structures”- Edited by, Vol. 1, 2 and 3, Proc., Int. Symposium, Maharashtra Indian Chapter of ACI, Bombay Denison Campbell, Allen & Harold Roper, “ Concrete Structures– Materials, Maintenance and Repair”- Longman Scientific and Technical
3. CPWD Hand book on Repair and Rehabilitation of RCC Buildings, DG(W), Central Public Works Department, New Delhi, 2002.

**E-Resources**

[www.majcon.com.au/Remedial-Engineering.htm](http://www.majcon.com.au/Remedial-Engineering.htm)

<https://au.jora.com/Remedial-Engineer-jobs-in-Sydney-South-NSW>

## PAVEMENT DESIGN AND CONSTRUCTION

Course Code: 15CCT251

L-T-P-S

Exam Hrs: 03

Total No. of credits: 4

4-0-0-0

CIE:SEE Marks:

50:50

### **COURSE OBJECTIVES:**

The objective of this course is to select appropriate pavement and surfacing materials, types, layer thicknesses and configurations to ensure that the pavement performs adequately and requires minimal maintenance under the anticipated traffic loading for the design life adopted.

### **SYLLABUS**

#### **MODULE-1**

**Introduction:** Highway and airport pavements, Types and component parts of pavements, their differences – Factors affecting design and performance of pavements. Stresses and deflections in homogeneous masses, wheel load stresses, various factors in traffic wheel loads, ESWL and EWL factors.

10 hr.

#### **MODULE-2**

**Design of Flexible Pavements:** Empirical methods of Group index method, Plate load test, CBR method – Testing as per IRC, AASHTO, CRV method –Design of pavement by Equivalent C-Value and R-Value method, Triaxial test– Kansas method, McLeod's method, Burmisters layered system concepts and Numerical on above.

10 hr.

#### **MODULE-3**

**Design of Rigid Pavements:** General design considerations, Westergaards design and stress equations for wheel loads, Types of stresses - Wheel load stresses, Temperature stresses ,warping stresses, frictional stresses and combination of stresses, Numerical on above. Design of joints in cement concrete pavements and their functions, joint spacing. Design of Dowel bars and Design of Tie bars.

10 hr.

#### **MODULE-4**

**Equipment in Highway Construction:** Various types of equipment for excavation, grading and compaction – their working principle, Advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction. **Subgrade:** Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

10 hr    **MODULE-5**

**Flexible Pavements:** Specifications of materials, construction method and field control checks for various types of flexible pavement layers – WBM-BM- SDBCBC

**Cement Concrete Pavements:** Specifications and method of cement concrete pavement construction and Quality control tests.

10 hr.

**COURSE OUTCOMES:**

Students will be able to

- Focus on the design of Highway pavement.
- Understand the Concepts of pavement components in flexible and rigid pavement.
- Concepts of stress strain in flexible pavements based on the layered elastic and viscoelastic solutions.
- Identify, formulate and design the stresses and deflections in rigid pavements.
- Evaluate pavement performance, failure criteria, and pavement condition rating

**REFERENCE BOOKS:**

1. Khanna and Justo, “Test Book of Highway Engineering”- 3<sup>rd</sup> Edition, Nemchand brothers, Roorke-2006
2. Yoder, E.J., and Witzak, “Principles of Pavement Design”- 2nd ed. John Wiley and Sons, 1975.
3. Yang, “Design of Functional Pavements”- 3<sup>rd</sup> Edition, McGraw Hill Book Co. 2006
4. Huang, “Pavement Analysis”- 3<sup>rd</sup> Edition, Elsevier Publication, 2006.

**E-Resources**

<http://civildigital.com/pavement-design-road-construction-design-parameters/>

<http://civildigital.com/pavement-design-examples/>

# DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Course Code: 15CCT252

L-T-P-S

Exam Hrs : 03

No. of credits: 04

4-0-0-0

CIE:SEE marks:50:50

## Objectives

- Introduce to students the principles of engineering seismology.
- To study the causes of occurrences of earthquakes
- To study the damages caused by previous earthquakes and understand the importance of earthquake resistant design
- Apply the philosophy of earthquake resistant design and the methodology to design as per IS code
- To know the importance of ductility in earthquake resistant design of RC structures

## SYLLABUS

### MODULE 1

**Introduction to engineering seismology**, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devices, base isolation systems.

10hr

### MODULE 2

**The Response history and strong motion characteristics.** Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multistoreyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.

10hr

### MODULE 3

**Structural Configuration for earthquake resistant design**, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.

10hr

### MODULE 4

**Design of Reinforced concrete buildings for earthquake resistance**-Load combinations, Ductility and energy absorption in buildings. confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS-1893. Structural behavior, design and ductile detailing of shear walls.

10hr

### MODULE 5

**Seismic response control concepts** – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.

10hr

## Course Outcomes:

- Students will be able to categorize the seismic activity effect they may have on engineering structures
- Apply the basic codal provisions for earthquake resistant design of masonry structures as per Indian standards.
- Design and detailing to achieve ductility in RC structures as per Indian standards.
- Understand seismic response, evaluation and retrofitting of structures.

### Reference Books:

1. Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed. – Anil K. Chopra, Pearson Education.
2. Earthquake Resistant Design of Building Structures, 1<sup>st</sup> Edition, Vinod Hosur, WILEY (india)
3. Earthquake Resistant Design of Structures, Duggal, 2<sup>nd</sup> Edition, Oxford University Press
4. Earthquake resistant design of structures - Pankaj Agarwal, Manish Shrikande – 5<sup>th</sup> Edition PHI India
5. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
6. Design of Earthquake Resistant Buildings, Minoru Wakabayashi, 4<sup>th</sup> Edition, McGraw Hill Pub.
7. Seismic Design of Reinforced Concrete and Masonry Buildings, 2<sup>nd</sup> Edition, T Paulay and M J N Priestley, John Wiley and son

### E-Resources

<https://upodofoxan.files.wordpress.com/2014/01/51ea7jh.pdf>

<http://www.scribd.com/doc/193099014/Earthquake-resistant-design-of-structures-by-pankaj-agarwal#scribd>

<http://elearning.vtu.ac.in/18/enotes/06CV834/EQ-GPCt.pdf>

## SOIL EXPLORATION & GROUND IMPROVEMENT TECHNIQUES

Course Code: 15CCT253

L-T-P-S

Exam Hrs: 03

Total No. of credits: 4

4-0-0-0

CIE:SEE Marks: 50:50

### **COURSE OBJECTIVES:**

- Prepare the students to understand and analyze the field data
- To assess the knowledge of improving the properties locally available soils.
- To introduce the various types of improvement methods of engineering properties soils.
- To introduce the application of engineering methods to ground improvement projects.

### **SYLLABUS**

#### **MODULE 1**

**Principles of exploration:** Geophysical and sounding methods, Modern methods of boring and sampling, Preservation and transportation of samples, Sampling records, Soil profiles, various types of field tests - Methods of Boring, Augering and Drilling. Machinery used for drilling, types of augers and their usage for various projects. 10 hr.

#### **MODULE 2**

Instrumentation - Rollers, Pressure meters, Piezometer, Pressure cells, Sensors, Inclinerometers, Strain gauges etc. Investigation below sea/river bed, offshore investigation, interpretation of exploration data and report preparation, economics of field testing & lab testing, engineering properties of soft & weak and compressible deposits. 10 hr.

#### **MODULE 3**

Need and objectives for ground improvement, principles of ground improvement, classification of improvement techniques, suitability, feasibility & desirability, Mechanical Modification: Principles of densification, Compaction – shallow & deep compaction, properties of compacted soils. Hydraulic Modification: Objectives, techniques, dewatering methods. 10 hr.

#### **MODULE 4**

Methods of soil improvement-lime stabilization and injection; thermal, electrical and chemical methods; Dynamic consolidation; vibroflotation; compaction by blasting; pre-consolidation with vertical drains; Granular piles; soil nailing; Grouting; Electro-osmosis; Soil freezing; Vacuum consolidation; Case histories Soil confinement. 10 hr.

#### **MODULE 5**

**Reinforced Earth Technology:** Concept of soil reinforcement, Reinforcing materials, Backfill criteria, Art of reinforced earth technology, Design and construction of reinforced earth structures. Ground Anchors: Types of ground anchors and their suitability, Uplift capacity of anchors. 10 hr.

## **COURSE OUTCOME:**

Students will be able to

- Identify difficult ground conditions in engineering practice.
- Implement various exploration methods in soil and rock.
- Interpret field and laboratory data and prepare soil investigation report.
- Identify different ground improvement techniques.
- Understand the concept of reinforced earth and ground anchors for soft soil improvement.

## **REFERENCE BOOKS:**

1. Hvorslev MJ, "Subsurface Exploration and Sampling of Soils for Civil Engg. Purposes" 3<sup>rd</sup> Edition, Elsevier Pub. Co., 2010
2. Manfredd RH, "Engineering Principles of Ground Modification", 3<sup>rd</sup> Edition, Mc Graw Hill Publishing Co. 2008
3. J. E. Bowles, "Foundation Analysis and Design", 3<sup>rd</sup> Edition, McGraw Hill Companies, 2001.
4. M. D., Desai, "Ground Property Characterization from In-Situ Testing", 3<sup>rd</sup> edition, Published by IGS-Surat Chapter, 2005.
5. Head KH, "Manual of Soil Laboratory Testing". 3<sup>rd</sup> Edition, 2006.
6. Purushotham Raj, "Ground Improvement Techniques", 3<sup>rd</sup> Edition, University Science Press, 2009.
7. Ingles O.G. and Metcalf J.B., "Soil Stabilization – Principles and practice", 3<sup>rd</sup> Edition, Butterworths, London, 1972
8. "Current Literature"

## **E-Resources**

<http://theconstructor.org/geotechnical/site-investigation-or-soil-exploration/312/>

<http://elearning.vtu.ac.in/10/enotes/06CV64/Unit1-HBN.pdf>

## SOFTWARE APPLICATIONS LABORATORY

Course Code: 15CCT21

L-T-P-S

Exam Hrs: 03

Total No. of credits: 2

1-0-2-0

CIE:SEE Marks:

50:50

### **COURSE OBJECTIVES:**

- Prepare work break down plan and estimate resources required in a construction project.
- Prepare precedence diagram and network diagrams.
- Implement resource allocation and levelling using MSP.
- To prepare the reports using MSP

### **SYLLABUS**

#### **SOFTWARE APPLICATION**

Use of construction management software's (MS-PROJECTS, PRIMAVERA) Analysis of skeletal and continuum structures using standard FEM packages, BIM.

#### **MICROSOFT OFFICE PROJECT**

Planning and Scheduling, creating work break down structure, Prepare the resource sheet, assign and level the resource, Time Estimate for activities and Expected Time calculation for residential building, Road project and bridges. Preparing different reports available in MSP, Plot the variance graphs for the given Project

### **COURSE OUTCOME:**

- Understanding the construction management software
- Understanding the concepts of construction project management.
- Creating the construction project reports

### **REFERENCE BOOKS:**

1. "Software Manuals"
2. Harry G Harris and Gajanan M Sabnis, "Structural Modeling and Experimental Techniques", 2<sup>nd</sup> Edition, CRC Press., 1999.

### **E-Resources**

<https://mitseu.files.wordpress.com/2014/08/microsoft-project-2013-step-by-step.pdf>

## SEMINAR- 2

Course Code: 15CCT27  
No. of credits: 02

L-T-P-S  
0-0-2-4

Marks: 50

### Course objectives:

- To develop students written and oral communication competencies to enhance technical effectiveness.
- To provide students an opportunity to learn new concepts and to express their presentation skills
- Instill students with initiative, independence, reflection and knowledge transfer
- To develop students ability to think strategically and express their views without hesitation.

The student will have to give a presentation for 20 minutes on any current civil engineering topic chosen by him or her after discussion with guide.

### Course Outcomes:

1. Students get the awareness about the recent technology trends based on their field of interest
2. Able to prepare an effective written technical report
3. Able to plan and produce presentation materials which most effectively communicate the intended message for their technical oral presentation

## ENERGY AND BUILDINGS

| Course Code | L:T:P:S | Credits | Exam marks       | Exam Duration | Course Type |
|-------------|---------|---------|------------------|---------------|-------------|
| 15CCT31     | 4:2:0:0 | 5       | CIE:50<br>SEE:50 | 3 hours       | FC          |

### Course Objectives:

- To know development of Zero energy buildings
- To introduce concepts of energy efficient building construction.
- To impart importance of Sustainable development.
- To learn energy buildings concepts and ecological design concepts applicable to modern buildings.
- To provide exposure to various national and international rating systems as compliance requirements for energy.

### Syllabus

#### Module – I

**Introduction**, Energy and Buildings – Zero carbon buildings and types, Development of Zero carbon buildings, Advantages & Disadvantages. 10hrs

#### Module – II

**Energy efficiency**- definition Energy efficiency ,energy monitoring, energy modeling, carbon reduction in buildings 10hrs

#### Module – III

**Energy scenario** – Basics of Energy and its various forms- Energy Management and audit Need for the Energy Conservation Concept of conventional, non-conventional, renewable, non-renewable energy sources Application of non conventional and renewable energy sources- Solar, wind, bio, hydro and tidal energy sources. 10hrs

#### Module – IV

**Energy and models**-Economic Models, Computation of embodied energy, Life cycle energy assessment - case studies. 10hrs

#### Module – V

**Green building**-Green building concepts, rating standards – case studies. Energy efficient materials and Technologies.

### Course Outcomes:

Students will be able to

- Knowledge on energy and building for construction purpose.
- An understanding on sustainability of buildings with respect to the environment.
- Knowledge on renewable energy and energy conservation through material usage.
- A thorough understanding on designing energy buildings.
- Insight into minimum requirements for the energy-efficient design and construction of buildings.

### Text Books:

- 1) Dejan Mumovic and Mat Santamouris “ A hand book of Sustainable Building Design & Engineering – An Integrated approach to energy, health and operational performance, Earthscan publishing house, 2009 ,ISBN-13: 978-1844075966
- 2) Watson Donald, Climatic Design: Energy Efficient Building- Principles & Practices, McGraw Hill, New York, 1983,ISBN-13: 978-0070684782

**Reference Books:**

- 1) Koenigsberger, Ingersoll, Mayhew and Szokolay, Manual of Tropical Housing and Building- Part 1 Climatic Design, Orient Longman, Madras 1984. ISBN 9788173718458
- 2) "Current Literature"

**e-Resources:**

1. [www.greenresourcecouncil.org/green-resources/reference-links](http://www.greenresourcecouncil.org/green-resources/reference-links)
2. [energy.gov/eere/buildings](http://energy.gov/eere/buildings)
3. [www.michigan.gov/documents/CIS\\_EO\\_Inside\\_ChurchManual..](http://www.michigan.gov/documents/CIS_EO_Inside_ChurchManual..)
4. [energy.gov/energysaver/led-lighting](http://energy.gov/energysaver/led-lighting)

## BUILDING SERVICES AND MAINTENANCE

| Course Code | L:T:P:S | Credits | Exam marks       | Exam Duration | Course Type |
|-------------|---------|---------|------------------|---------------|-------------|
| 15CCT322    | 4:0:0:0 | 4       | CIE:50<br>SEE:50 | 3 hours       | FC          |

### Course Objectives:

- 1) To understand the concept of building services and maintenance.
- 2) To understand the different types of building services.
- 3) To study the fire protection system of building.
- 4) To study the concept of green building in building services and maintenance

### Syllabus

#### Module – I

**Introduction to Building Services** – Definitions, Objective and uses of services, Applications of services for different types building considering, Classification of building services, Types of services and selection of services.

#### Module – II

**Mechanical Services in Buildings** – Introduction, Lift: Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts of Lift. Elevators & Escalators: Different types of elevators and Escalators, Freight elevators, Passenger elevators, Hospital elevators, Uses of different types of elevators Escalators,

#### Module – III

**Air Conditioning:** Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners, (Central type, Window Type, Split Unit), Preventive and protective maintenance, Scheduled and contingency maintenance planning.

#### Module – IV

**Fire Protection, Acoustic and Sound Insulations** – Introduction, Causes of fire and Effects of fire, General Requirements of Fire Resisting building as per IS and NBC 2005, Characteristics of Fire resisting materials, Requirement of good Acoustic, Various sound absorbent, Factors to be followed for noise control in residential building

#### Module – V

**Miscellaneous Services and Green Buildings Provisions** - Rain water Harvesting for buildings, Concept of GREEN buildings, Components of GREEN building, M.I.S. for building maintenance, Maintenance standards, Economic maintenance decisions.

### Course Outcomes:

Students will be able to

- 1) Apply various types of services as per needs of building.
- 2) Plan various types of mechanical services as per requirements of building.
- 3) Apply various types of fire services as per requirements of building.
- 4) Apply Green Building technology aspects .
- 5) Implement the Services and maintenance in residential buildings.

### Text Books:

- 1) S. M. Patil “Building Services” Seema Publication, Mumbai Revised second edition. ISBN no : 8175259805
- 2) R. Udaykumar “Building Services” ‘Eswar Press -Chennai , ISBN NO-9788178740638

**Reference Books:**

- 1) “NBC” Relevant Parts: BIS New Delhi,ISBN NO-81-7061-026-5
- 2) Jain V K,” Services in Building Complex and High Rise Buildings”,Khanna Publishers, ISBN NO-. 978-81-7409-245-8
- 3) “Current literature”

**e-Resources:**

1. <https://facilities.princeton.edu/about.../grounds-and-building-maintenanc..>
2. [https://en.wikipedia.org/wiki/Building\\_services\\_engineering](https://en.wikipedia.org/wiki/Building_services_engineering)
3. [www.yellowpages.com](http://www.yellowpages.com) › Window Cleaning near Chalmette, LA

## Disaster Management

| Course Code | L:T:P:S | Credits | Exam marks       | Exam Duration | Course Type |
|-------------|---------|---------|------------------|---------------|-------------|
| 15CCT323    | 4:0:0:0 | 4       | CIE:50<br>SEE:50 | 3 hours       |             |

### Course Objectives:

- To impart the basic knowledge of Civil engineering.
- To define and describe disaster, hazard, emergency, vulnerability, and risk.
- The importance of disaster management to handle the situation.
- Understand the roles of government agencies in emergency management.
- Describe the basic types of hazards and their potential consequences.

### Syllabus

#### Module – I

**Introduction:** Disaster preparedness, Goals and objectives of ISDR Programme, Risk identification, Risk sharing.

**Disaster and development:** Development plans and disaster management, alternative to dominant approach, Disaster development linkages, Principle of risk partnership 08 hrs

#### Module – II

**Application of Technology in disaster risk reduction:** Application of various technologies, Data bases RDBMS Management information systems, Decision support system and other systems, Geographic information systems, Intranets and extranets, video teleconferencing, Trigger mechanism, Remote sensing an insight contribution of remote sensing and GIS. 08 hrs

#### Module – III

**Awareness of Risk reduction:** Trigger mechanism, constitution of trigger mechanism, risk reduction by disaster information network education, risk reduction by public awareness. 08hrs

#### Module – IV

**Development of Planning on disaster:** Implication of development planning, financial arrangements, areas of improvement, disaster preparedness, community based disaster management, emergency response. 08 hrs

#### Module – V

**Seismicity:** Seismic waves, Earthquakes and faults, measures of earthquake, magnitude and intensity, ground damage, Tsunamis and earthquakes. 08 hrs

### Course Outcomes:

Students will be able to:

- I. Develop an understanding of the key concepts, definitions a key perspectives of All Hazards Emergency Management.
- II. Understand the Emergency/Disaster Management Cycle.
- III. Have a basic understanding for the history of Emergency Management.
- IV. Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery.
- V. Develop a basic understanding for the role of public an private partnerships

**Text Books:**

1. Pardeep Sahni, Madhavi Malalgoda and Ariyabandu, "Disaster risk reduction in south Asia", PHI, Published by PHI Learning 0 (2004-08-30),Edition: First edition, ISBN:978-81-203-2200-4
2. Amita sinvhal, "Understanding earthquake disasters", TMH, 2010, Edition: First edition, Published by Tata McGraw Hill, New Delhi, ISBN 10: 0070144567 ISBN 13: 9780070144569
3. Pardeep sahani, Alka Dhameja and Uma Medury, "Disaster Mitigation: Experiences and reflections", PHI, Published by PHI Learning Pvt. Ltd, 2001, ISBN : 8120319141, 9788120319141.

**Reference Books:**

1. Ayaz,. Disaster Management: Through the New Millennium. , Anmol Publications. (2009).Published by Anmol Publications Pvt. Limited, 2003, Edition: 10th edition ISBN : 8126113669, 9788126113668.
2. Dave, P. K.. Emergency Medical Services and Disaster Management: A Holistic Approach.New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009, Edition: 20th edition, ISBN : 8184484887.
3. Narayan, B. ,Disaster Management, New Delhi: A.P.H. Publishing Corporation,2009, Edition: 1st edition,ISBN 13: 9788176482127
4. Kumar, N.. Disaster Management. New Delhi: Alfa Publications. ,2009. Edition: 20th edition, ISBN: 9781566705240.

**e-Resources:**

4. <http://elearning.vtu.ac.in>
5. <https://research.un.org/en/disaster/e-resources>
6. www.jsu.edu › Houston Cole Library
7. <https://books.google.co.in/books?isbn=3110931443>

**Construction and Demolition Waste Management**

| <b>Course Code</b> | <b>L:T:P:S</b> | <b>Credits</b> | <b>Exam marks</b> | <b>Exam Duration</b> | <b>Course Type</b> |
|--------------------|----------------|----------------|-------------------|----------------------|--------------------|
| 15CCT331           | 4:2:0:0        | 5              | CIE:50<br>SEE:50  | 3 hours              | FC                 |

**Course Objectives:**

- To understand the concept of Zero waste in construction.
- To understand the different types of recycling techniques
- To study the properties of recycling products.
- To know the concept of Demolition and deconstruction for buildings
- To study the concept of national policy.

**Syllabus**

**Module – I**

**3R' principle**-Zero waste concept, 3 R' s Principle, (Reuse ,recycle, Reduce) with examples, sustainability, misplaced resource, waste minimization techniques, Governmental role in waste management, citizen role in waste management. 10hrs

**Module – II**

**Recycling products**- Recycling methods and techniques involved ,Recycling products and its application, enhancing the properties of recycled aggregates by various techniques, Reuse of fine aggregate and coarse aggregate and its application. 10hrs

**Module – III**

**Demolition and de- construction**-Demolition, de- construction concept, types of waste, source separation, commingled separation, waste management plan, types of deconstruction, Designing for deconstruction. 10hrs

**Module – IV**

**C and D waste**-Deconstruction activity for 2-storied building, Introduction to C &D waste, waste management plan for C and D waste, Role of citizen and government in C&D waste management. 10hrs

**Module – V**

Present Indian scenario ,national policy, specifications, standards, LEED 10hrs

**Course Outcomes:**

Students will be able to

- Analyse and apply the legal requirements of the construction industry in regard to the management of C&D W. Formulate, design, evaluate and review pre-construction and construction phase resource efficient waste management plans.
- Evaluate, assess and recommend potential reuse/recycling/disposal options considering existing and potential future markets/uses.
- Critically assess different waste management practices on site to recommend resource efficient strategies identifying current knowledge gaps as identified by industry.
- Demonstrate a comprehensive knowledge and understanding of waste prevention strategies including design for reuse and recovery; design for materials optimisation; design for off-site manufacture; design for deconstruction and design for waste efficient procurement.
- Engage in the creative and innovative development of waste prevention and minimisation design/construction principles to proactively troubleshoot and solve original technical problems.

**Text Books:**

- 1) Greg Winkler, "Recycling Construction and Demolition waste": A LEED-Based Toolkit (Green Source) (Google ebook), Mc Graw Hill Professional, *ISBN: 978-0-07-171339-9*
- 2) Greg Winkler, "Green Facilities: Industrial and Commercial LEED Certification" (GreenSource) (McGraw-Hill's Greensource) 1st Edition *ISBN-13: 978-0071744539*

**Reference Books:**

- 1) V M Tam, Chi Ming Tam, "Reuse of Construction and Demolition Waste in Housing Development", Nova Science Publishers, 2008. *ISBN: 9781604563627*.
- 2) "Current Literature"

**e-Resources:**

1. [www.intechopen.com/books/howtoreference/waste-management](http://www.intechopen.com/books/howtoreference/waste-management).
2. [www.gsa.gov/portal/content/102299](http://www.gsa.gov/portal/content/102299)
3. [lcghd.org/.../construction-and-demolition-debris](http://lcghd.org/.../construction-and-demolition-debris)
4. [web.epa.ohio.gov/ocapp/p2/recyc/debris.html](http://web.epa.ohio.gov/ocapp/p2/recyc/debris.html)

**FORMWORK DESIGN OF STRUCTURES**

| <b>Course Code</b> | <b>L:T:P:S</b> | <b>Credits</b> | <b>Exam marks</b> | <b>Exam Duration</b> | <b>Course Type</b> |
|--------------------|----------------|----------------|-------------------|----------------------|--------------------|
| 15CCT332           | 4:2:0:0        | 5              | CIE:50<br>SEE:50  | 3 hours              | FC                 |

**Course Objectives:**

- To study and understand the overall and detailed planning of formwork, plant and site equipment.
- To understand the Design for various elements such as slabs, beams, columns, walls, shells and tunnels.
- To attain the knowledge of design of Decks and False works
- To know different forms of and Erecting the Formwork Building
- To know the latest methods of form construction.

**Syllabus**

**Module – I**

**Introduction:** Formwork and false work, Temporary work systems, Construction planning and site constraints, Materials and construction of the common formwork and false work systems, Special and proprietary forms. 10hrs

**Module – II**

**Formwork – Design:** Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each, Concrete pressure on forms, Design of timber and steel forms, Loading and moment of formwork. 10hrs

**Module – III**

**Design of Decks and False works:** Types of beam, decking and column formwork, Design of decking, False work design, Effects of wind load, Foundation and soil on false work design. 10hrs

**Module – IV**

**Building and Erecting the Formwork:** Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiplex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence-Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI -Design deficiencies - Permitted and gradual irregularities. 10hrs

**Module – V**

**Special Forms and Safety in use of Formwork::** The use and applications of special forms, Safety use of formwork and false work. 10hrs

**Course Outcomes:**

Students will be able to

- Understand the sequence of construction of civil engineering structures.
- Appraise a right material for manufacturing false work and form work suiting specific requirements.
- Design decking, form work and false work.
- Understand the safety steps involved in the design of form work and false work.

**Text Books:**

1. Austin, C.K., Formwork for concrete, Cleaver - Hume Press Ltd., London, 1996
2. Michael P. Hurst, Construction Press, London and New York., 2003

**Reference Books:**

1. Robert L. Peurifoy and Garold D. Oberiender, Formwork for Concrete Structures, McGraw-Hill, 1996.
2. Tudor Dinescu and Constantin Radulescu, Slip Form Techniques, Abacus Press, Turn Bridge Wells, Kent, 2004.

**E-Resource:**

- [www.atkinsglobal.com/.../Concrete...](http://www.atkinsglobal.com/.../Concrete...)
- [www.worldcat.org/...mwork-for-concrete-structures/...](http://www.worldcat.org/...mwork-for-concrete-structures/...)
- <http://www.Webcrawler.com>
- [thacampbell.typepad.com/...lass\\_handouts/Formwork.pdf](http://thacampbell.typepad.com/...lass_handouts/Formwork.pdf)
- [www.okorder.com/Formwork+Design](http://www.okorder.com/Formwork+Design)

**QUANTITATIVE METHODS IN CONSTRUCTION**

| Course Code | L:T:P:S | Credits | Exam marks       | Exam Duration | Course Type |
|-------------|---------|---------|------------------|---------------|-------------|
| 15CCT333    | 4:2:0:0 | 5       | CIE:50<br>SEE:50 | 3 hours       | FC          |

**Course Objectives:**

- To study the various quantitative methods applied to the elements of management.
- To study the effect of probability distribution and linear programming,
- To study and understand the concepts of Statistical methods and its applications in Engineering.
- To study the effect of dynamic programming, travelling salesman problem.

**Syllabus**

**Module – I**

**Averages and Dispersion:** Data collection, presentation of data, measures of central tendencies, measures of dispersion and coefficient of variation. 10hrs

**Module – II**

**Probability Distributions and Sampling:** Definition of probability, axioms of probability, conditional probability, Baye’s theorem, one dimensional random variable, expectation and variance, curve fitting-linear, non-linear and exponential, correlation and regression. 8hrs

**Module – III**

**Probability Distributions:** Normal and exponential distributions, two dimensional random variables, marginal distributions, conditional distributions, expectation, covariance and correlation, moments, relation between raw and central moments, skewness, kurtosis and central limit theorem 10hrs

**Module – IV**

**Linear Programming:** Introduction to linear programming, formulation of LPP, solution of LPP-Graphical method, Simplex method, big-M method, two-phase method, transportation problem and assignment problem. 12hrs

**Module – V**

**Markov Chains:** Probability vectors, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probabilities, stationery distribution of regular Markov chains and absorbing states.

**Dynamic Programming:** Introduction to dynamic programming, traveling salesman problem and simulation applied to construction. 12hrs

**Course Outcomes:**

Students will be able to

- Formulate and solve deterministic optimization problems.
- Model risk and uncertainty in construction industry.
- Apply stochastic optimization techniques for decision making under uncertainty.
- Formulate and solve linear programming.
- Plan and manage activities using simulation, queuing and game theory.

**Text Books:**

1. Dr.B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36<sup>th</sup> Edition,ISBN NO- 8174091955, 9788174091956
2. Hamdy A. Taha, *Operations Research*, 5<sup>th</sup> Edition, PHI. Prentice Hall of India Private limited, 2004 Publisher, ISBN- 8120322355
3. William Feller, *An Introduction to Probability Theory and its Applications*, Vol.1, 3<sup>rd</sup>

Edition. ISBN-978-81-265-1805-0

**Reference Books:**

1. James J. Adrian, P.E. "Quantitative methods in construction management", American Elsevier. ISBN NO- 0444001344, 9780444001344
2. Alfredo, H.S. and Wilson, H. Tang, "Probability concepts in Engineering, Planning and Design", Vol. 1, John Wiley & sons. 0471032018, 9780471032014
7. Rao S.S., *Engineering Optimization*, New Age International. 81-7061-026-5
8. R.E. Walpole and R.H. Myers, *Probability and Statistics for Engineers and Scientists*, 8<sup>th</sup> Edition, Pearson Education. 0073529575, 9780073529578

**e-Resources:**

1. [evlab.mit.edu/sites/default/files/documents..](http://evlab.mit.edu/sites/default/files/documents..)
2. [www.worldcat.org/title/quantitative-methods-in...](http://www.worldcat.org/title/quantitative-methods-in...)
3. [mef.med.ufl.edu/files/2009/03/qualitative-research.pdf](http://mef.med.ufl.edu/files/2009/03/qualitative-research.pdf)
4. <https://books.google.co.in/books?isbn=0471032018>
5. <https://books.google.co.in/books?isbn=8122411495>

**Reference Books:**

1. James J. Adrian, P.E. "Quantitative methods in construction management", American Elsevier. ISBN NO- 0444001344, 9780444001344
2. Alfredo, H.S. and Wilson, H. Tang, "Probability concepts in Engineering, Planning and Design", Vol. I, John Wiley & sons. 0471032018, 9780471032014
7. Rao S.S., *Engineering Optimization*, New Age International. 81-7061-026-5
8. R.E. Walpole and R.H. Myers, *Probability and Statistics for Engineers and Scientists*, 8<sup>th</sup> Edition, Pearson Education. 0073529575, 9780073529578

**e-Resources:**

1. [evlab.mit.edu/sites/default/files/documents..](http://evlab.mit.edu/sites/default/files/documents..)
2. [www.worldcat.org/title/quantitative-methods-in...](http://www.worldcat.org/title/quantitative-methods-in...)
3. [mef.med.ufl.edu/files/2009/03/qualitative-research.pdf](http://mef.med.ufl.edu/files/2009/03/qualitative-research.pdf)
4. <https://books.google.co.in/books?isbn=0471032018>
5. <https://books.google.co.in/books?isbn=8122411495>

