Construction Engineering

Course Code	Credit Hours
CE-113	2-0

Course Description

This course is designed to equip students with a comprehensive understanding of building construction activities and their sequences, preparing them to effectively manage the practical tasks of a Site Engineer in their professional careers. Civil engineers play a crucial role in overseeing and directing the physical construction of projects from inception to completion, ensuring that design plans are transformed into fully functional facilities. They are also responsible for maintaining rigorous quality control throughout the project lifecycle.

Students will be introduced to both traditional and modern building construction techniques, with a strong emphasis on construction methodologies, quality control, and site supervision. The course aims to develop the skills necessary for students to excel in managing construction projects, ensuring adherence to sustainable practices and compliance with regulatory environments, contractual agreements, design drawings, and specifications.

Textbook:

1. MES Schedule of Rates 2014.

Reference Book:

1. Building Construction by Arora & Gupta,6th Edition, Satya Prakashan, 1988.
2. Professional Practice (Estimation/& Valuation) by Roshan Namavati, Union Book Stall, M, A Jinnah Road Karachi.
3. Stephens W. Nunnally, Construction Methods and Management, 8th Edition, 2013.
4. Metha M., Scarborough W., Armpriest D. 2013 Building Construction: Principles, Materials, and Systems, Pearson.
5. Fundamentals of Building Construction: Materials and Methods, 5th Edition. Edward Allen.
6. Huntington, W. C. Building Construction, John Wiley & Sons. John Wiley & Sons Inc; Subsequent Edition (February 1, 1987).
7. Thompson J. F., Building Construction, Butter world London.

8. R. L. Peurifoy, W. B. Ledbetter, C. J. Schexnayder, Cliff J. Schexnayder. Construction Planning Equipment and Method. 5th Edition, McGraw-Hill Companies

Prerequisites:

Nil

ASSESSMENT SYSTEM FOR THEORY

	Without Project (%)	With Project/Complex Engineering Problems (%)
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25
Project	-	5-10
End Semester Exam	50	45-50

ASSESSMENT SYSTEM FOR LAB

Lab Work/ Psychomotor Assessment/ Lab Reports	70%
Lab Project/ Open Ended Lab Report/ Assignment/ Quiz	10%
Final Assesment/ Viva	20%

Teaching Plan

Week No	Topics/Learning Outcomes
1	**Construction Industry:** Introduction to Construction Projects and Categories.
2	Types of Civil Engineering Structures, Building Permits, Codes and Construction Standards. Misc. topics, Documents required at site, Test requirements for materials
3	**Site Preparations:** Stages of Construction, Site Selection and Orientation of Buildings, Stages of construction, Site layout and setting procedure
4	Preliminary Site Investigations and Clearance, Setting & Layout of Works, Role of Site Engineers, Initial Checks on Drawings.

	Duties of Site Engineer, Initial checks on drawings, Site Measurements, Check Requests, Study of drawings and material take-off.
5	**Excavations:** Excavation and Related Aspects:(a) Methodologies in different types of soils, (b) Stability of Excavations. Safety Precautions and Solution of Particular Problems arising out of condition of Sub-Soil at Site. Protection of adjacent Structures and Water Proofing. Termite Proofing Techniques. Earth Moving Equipment Shovels/Excavators, Major components and their function, size, capacity and output of excavator. Types of excavations and safety precautions Termite Proofing-methods and payments
6	**Sub-Structures:** Understanding the Geotech Report, Compaction Criteria of Soils for Buildings and Roads, Backfill Specs. Foundations: Method of Construction for different types of footings, Piling Works, Use of Sulphate Cement. Foundations, Classification and types of foundations, Understanding the geotechnical report, Preparation of foundation trenches, Timbering in trenches, Compaction of foundation soils, Granular fill specifications, Pile foundations; their suitability, classification of piles according to function, material and installation of concrete piles, Requirements of different types of cement, use of SR cement
7	**Masonry Construction:** Brick, Stone & Block Masonry, Type of Bonds, Types of Mortars, Masonry in Seismic Zones, Construction Methodology, Quality Control Measures, Damp Proof Courses, Plinth Protection and Pointing and Plaster. Crew Size Masonry and walls Selection of suitable type of masonry, quality of good bricks, rules for quality brickwork, testing requirements, types of bonds, mortar requirements, curing, Construction sequence. Purpose and Classification of walls - load bearing, non-load bearing, dwarf, retaining, breast walls and partition walls. Stone masonry- Types of stone Masonry, Rubble Masonry, random and coarsed, principles to be observed in construction of stone masonry walls

	Concrete Block masonry- Hollow and Solid construction methods and bonds Reinforced brick masonry, confined masonry and masonry in seismic zones Damp proof course (DPC)
8	**Wood Works:** Types of Wood, Seasoning Procedures, Types of Doors, Windows & Floors, Fitting/Fixtures and Hardware, Quality Control Measures. Doors and windows Types of doors - Paneled, flush, glazed, collapsible doors, rolling steel shutters, side sliding doors, door frames, PVC shutters, metal doors and different door elements Types of windows - Steel, glazed, wooden paneled, aluminum glazed, sliding Ventilators and fixed glass windows Fitting, fixtures and hardware Installation sequence and quality checks Flooring, Types of floors, Flooring materials-tiles, marble, terrazzo, dado, wooden and their under layers, Fixing procedures and specifications
9	**MID SEMESTER EXAMS**
10	**Finishing Works:** Paint, Distemper, Weather Shield, Tiling, Marble, Metal Finishing Works etc. Distempering, painting, varnishing, whitewashing, weather shields, Different types & application methods.
11	**Roof Insulation:** Types, Techniques and Quality Issues. **Services:** Construction Requirements and Methods of laying sewers, sui gas plumbing, water supply and drainage systems. Roofing, Type of roofs, Roof insulation types and techniques, Roof water treatments Water supply, Typical water supply and plumbing layout, Types of pipes, UPVC, GI, PPR, PE, HDPE, AC, Soil pipes and vent pipes, Testing requirements and procedures, Fitting and fixtures Sewerage, Components of sewerage - manholes, septic tanks, soakage pits, soakage wells, Sewers pipes and specifications, Testing requirements, Misc Engg Services, Suigas layout

12	**Temporary Works:** Overview of Temporary Structures, Types and Uses of Formwork for various Building Units/ members, Stripping Times, Safety Precautions. Scaffoldings & Formwork, Components of formwork purpose & types of scaffolding and centering, Characteristics of a good formwork, safety and precautions, Minimum formwork removal time guidelines
11	**Structural Construction:** Reinforced Concrete Frame Construction such as columns, beams, slab, roof, pre-stressed concreting. Methods of concreting vertical and horizontal members, including mechanized placement, ready mix concrete, under water concreting, short concreting. CMD and Timelines, Curing, Concrete pouring machinery and Quality Control Measures. Concrete practices (An overview), Material requirements for CMD and timelines, Material demand and Testing requirements, Concrete ingredients, batching, mixing, transportation, placing, compaction, curing of concrete, hot weather & cold weather concreting, Quality control in concreting
13	**Reinforcement:** Steel fixing practice, understanding test results and requirements, Standard reinforcement detailing techniques, Overview of Steel Construction. Steel fixing practice, Standard reinforcement detailing techniques
14	**Overview of Construction Aspects of Infrastructure Engineering Projects:** Pavements - Introduction to Types, Typical Sections and Materials, Methodology for Construction and Repair, Quality Control Measures and Tests requirements, Understanding JMF, Construction Joints. Type of joints- Contraction, expansion and construction
15	Different types of equipment and machinery used in concrete pouring and infrastructure works. Tools and plant for building works Dozers, major components, types, sizes of dozers and their uses. Auxiliary equipment like, drag line, clamshell, Rippers, ditcher etc.

	Formation/Finishing Equipment Graders - Major components type and size of graders. Scrapper - Major components types and size of scraper. Compaction Equipment - Type and size of rollers, compactors and vibrating rollers etc. Handling and Transporting Equipment Front End loaders, type and size of loaders. Dump Truck - Truck types, sizes. Cranes - Types of cranes, boom size. Crushers - Types of crushers, Aggregate production, screening of crush aggregate. Transit Mixers - Types and size of Transit mixer. Batching Plants Type of batching plants, their installation and functions. Asphalt Batching Plant, Size.
16-17	**Construction Equipment Selection** Evaluating various options based on economic principles, Determine the most cost-effective and efficient machinery for project requirements. Haulage and output of dozers. Operation and output of graders grading and scarification operations. Haulage dumping and scrapping operation and output of scrappers. Operation and output of FE loaders. Dump truck, highway and off the road operation and output Lifting capacities of cranes Output of crusher Operation of transit mixers. Concrete Batching Plant, operation, control and maintenance, and output. Operation, control and maintenance, Output.
18	**End Semester Exam**

Practical: Nil.