Contents

Course Details

Course Code	L	T	P	C
SB8002	1	0	2	2

PRE-REQUISITE

- Fundamentals of Highway and Railway engineering, Soil Mechanics, Structural analysis is preferable

COURSE OBJECTIVES

- This course will present the concepts on the design aspects and knowledge on the construction methods of transportation infrastructure. It will provide exposure to the field and serve as base for future practitioners in the field of transportation engineering. The course facilitates the learners to involve in engineering works related to Airports, Metro & seaports planning, design, and construction.

KEY JOB ROLES

?Design engineer
?Site planning engineer
?Construction engineer

OVERVIEW

This course will provide the learner with an overview of major functions involved in the transportation

infrastructure such as Metros, Airports & seaports. It will provide a roadmap for learners to understand the concepts involved in Civil, Structural, Architectural & MEP functions for Planning and Design Transportation infrastructure. These concepts are reinforced with demonstrations and real case studies/projects that have been successfully carried out in major cities in India and Abroad. It provides brief knowledge to the learner to steer through their career in the field of transportation engineering. The course also provides insights on the future modes of transportation, to supplement the learner to stay adept amidst the rapid advancement of technology in this field. Learners are expected to gain knowledge on the design concepts of different structures and their constructability aspect related to transportation infrastructure.

SYLLABUS

UNIT I - INTRODUCTION AND PLANNING OF MASS RAPID TRANSIT SYSTEM (MRTS) (3T+6P)

- Introduction - Overview of Metro, Transit Oriented Development, Necessity and Feasibility Study for MRTS Project, Sustainable and Smart Technologies, Recent Advancements & Future Technologies - Automated Guideway Transit Systems, Suspended Railway / Monorail, High Speed Rail, Semi High- speed Rail, Maglev Trains, Vactrain History, Development and Technology
- Planning ? Alignment Basic Interfacing Principles, Urban level planning constraints and restrictions, Planning of the Station, Integration of systems, HVAC Systems, Tunnel Ventilation System, Fire Protection System, Public Health Engineering, Electrical System, Fire Alarm System, Building Information Modelling (BIM) Walkthrough Contracts and Quality system - Introduction to Contracts, Overview of FIDIC standards, Introduction to Quality Systems.
- Overview of Elevated metros ? Alignment/ Span configuration of elevated structures, Superstructure, Substructure and foundation of elevated metro, Bridge articulation based on profile alignment
- Overview of Station ? Station overall layout, Station foundation, substructure and Pier arm Construction Methods - Challenges in Metro Construction, Precast and cast in-situ construction, Precast yard and Mould development, Precast Erection and Launching methods, Overview of Obligatory Span overview, foundation construction methods

UNIT II - ANALYSIS AND DESIGN OF ELEVATED AND UNDERGROUND STATIONS (3T+6P)

- Elevated station and Viaducts ? Overview and components, Loads and load combination according to IRC/IRS Codes, Modelling, Analysis and Design of superstructure, Substructure and foundation of Viaduct, Idealization of Framed Station and Cantilever station, Design and analysis of platform slab, track slab and above ground structures, Spine beam method, Ductile detailing of structures, Introduction to Modelling Software - STAAD Pro and Midas Civil
- Earth retaining structures ? Types of Earth retaining structures, Diaphragm wall Analysis and design, Shoring Systems, Secant pile wall design, Guide walls, capping beams, supporting systems, Tunnels - Mined/Bored/NATM
- Underground Stations ? Configurations of underground station, Loads and load combination according to IRC/IRS Codes, SIDL for UG stations, Construction Methodology (Bottom-Up method/ Top Down method), Fire resistant criteria and Floatation check, 2D & 3D model generation, SOD restrictions & Element sizing for UG Stations, Design of all the components of UG station.

UNIT III - INTRODUCTION AND TYPICAL MASTER PLANNING OF AN AIRPORT (3T+6P)

- Introduction - key features of a modern airport, Codes and aviation regulation organizations, Growth Requirements and Passenger Demand Capacity, Overview of existing and future Indian Airports

Outline of Master Planning process according to ICAO and FAA Planning and Design of Airside works

? Topography and geotechnical investigation for green field airport and upgradation of existing airport, Survey of various elements/facilities, Layout plans, Configuration and orientation of runways, Design of Runway, Taxiway, Apron, Drainage System and Ducts

- Planning of Terminal Building ? Functions of Terminal building, Building Information Modelling (BIM) walkthrough, Facilities and services of terminal building: Passenger conveniences, Travellators, Departure and Arrival gates, MEP and HVAC Services etc.,
- Planning of Landside works ? Planning of Approach roads to Terminal building, Landside access for Arrival/Departure Planning, Multi- Level/Surface car parking/Waiting areas, Air Traffic Control Tower, Drainage Planning, arboriculture, Water harvesting cum storage/distribution, Fuel storage and supply, Power supply and Renewable Energy, Airport fire & Rescue station

UNIT IV - CONSTRUCTION AND MAINTENANCE OF AIRPORT AIRSIDE WORKS (3T+6P)

- Pre-construction activities - Statutory Approvals, mobilization of key resources and Estimation of requirement of Plant and equipment - Earthmoving Plants, Dumpers and Compaction Equipment, Hoists and Tower Cranes
- Construction of Runways and Taxiways - Airport Layout and Grading Plan, Execution and Estimation of various Layers of Flexible Pavements and Rigid Pavements, precast and cast in-situ drainage and duct, Navigational and Meteorological aids - Marking, Lighting, Instrument landing system and stations, etc., Maintenance, Evaluation and Rehabilitation of Runways and Taxiways - Evaluation of runways and taxiways, Causes & Typical Failures of Flexible and Rigid Pavements, Maintenance, Strengthening and Rehabilitation of Pavements, Discussion on pavement repairs

UNIT V - OVERVIEW OF PORTS AND HARBOURS (3T+6P)

- Introduction and Evolution of Ports and Harbours, Classification of Ports, Overview of Indian Seaports General Terms and Conventions ? Waves and Tides, Tidal Variations, Return Period, Tranquility, Littoral Drift, Wave Transmission, Wave Reflection, Wave Overtopping, Wave Diffraction, Types of Ships, *Parts of Ship, Ship Size Parameters, Ship Motions
- Overview of Marine structures - Container and bulk terminal, Liquid terminals, Breakwaters, Shipyard facilities, port infrastructures and Bulk Terminals, Walkthrough of Typical Shipyard Cum Port
- Operation and components of Ports ? Vessel and cargo related Operations of Ports, Berthing Structures ? Wharf, Quay, Pier, jetty, Storages - Container yards, Stack yards, Warehouse, Tankage
- Site Investigation and Survey ? Hydrographic, topographic, Meteorological, Oceanographic, Geological, Seismic, Resources data

Approach Facilities, Navigation Aids ? Audible, Radio, Visual, Others, Design considerations and Functional requirements of typical structures, Breakwater Structures, Fenders, Dolphin, Shipyard structures - Slipways, Dry Docks, Floating Docks, and Ship Lifts, Shore protection and Reclamation works

TOTAL: 45 PERIODS

CASE STUDIES

?Case studies of top-down construction with permanent retaining system.
?Case study of an underground station

?Design and orientation of runways
?Design of Drainage and Rainwater harvesting
?Design of parking space

ATTAINMENT OF LEARNING OUTCOMES STUDENT ASSESSMENT PLAN

1. The conceptualisation and comprehension level of learning outcomes intended through the course

is measured through assessments conducted in multiple stages.

1. The understanding of concepts & principles, evolution of practices, codes & guidelines, emerging trends etc. are tested through assessment questions.
2. The skill outcome related to design, computation, workflow, report & work plan preparation, implementation etc. are assessed through assignments. Such assignment questions & answer keys will be shared to the college SPOC for enabling evaluation by respective faculties.

STUDENT ASSESSMENT 1:

Students will have to prepare a basic layout for metro station, considering the various structural elements of metro station and diaphragm wall for the given site specifications.

STUDENT ASSESSMENT 2:

Prepare a basic layout of runway including orientation using Wind Rose diagram and designing runway length.

SOFTWARE EXPOSURE

- Learners are exposed to WALLAP (Diaphragm wall analysis software) for 5 % of course duration & STAAD Pro (Analysis software for Metro stations) for 10 % of the course duration.
- The students can use free student version of STAAD Pro even post the completion of this course. Diaphragm wall analysis can also be done using the STAAD pro student version.

LEARNING OUTCOMES

Upon completion of this course the learner will be able to:
?**LO.1:** Create a Conceptual layout of both elevated and underground metro station
?**LO.2:** Design Diaphragm wall for the construction of Underground Metro station.
?**LO.3:** Assess the suitability of a given site for the construction of airport, metro and seaport
?**LO.4:** Comprehend the requirements of airport and the associated service requirements.