# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Civil Engineering (Transportation Engineering)**

**Subject Code: ME02069051**

**Subject Name: Seaport Infrastructure Engineering**

| | |
|---|---|
| w. e. f. Academic Year: | 2024-25 |
| Semester: | 2 |
| Category of the Course: | Professional Elective Course |

| | |
|---|---|
| **Prerequisite:** | Transportation Engineering. |
| **Rationale:** | Seaport infrastructure is a vital part of the maritime sector and is important for economic growth and global trade. It's also a crucial transportation node that facilitates the delivery of goods to nearby towns and international markets. It plays a vital role in the global economy, facilitating international trade, economic growth, and development. For the large quantity of cargo movement over the long distances at the national, international and intercontinental levels; waterway transportation is the most economical mode. Planning of new port requires proper knowledge of location, natural phenomena, environmental impacts, hinterland products, connectivity, forecast of passenger and cargo demand, infrastructure and management aspects. Therefore, this subject is aimed to provide the clear understanding of the seaport infrastructure and its development. |

**Program Outcomes**

| No | Program Outcomes |
|---|---|
| 01 | Engage in critical thinking and research to develop solutions to multifold real-world problems. |
| 02 | Communicate effectively with the engineering community at large level on complex design tasks & write and present technical reports. |
| 03 | Demonstrate a high level of professionalism in handling multidisciplinary and complex engineering problems. |
| 04 | Plan, assess, create, integrate, carry out, and oversee complex engineering projects in a sustainable local and global context. |
| 05 | Address societal issues by offering technologically advanced, reasonably priced solutions while upholding high standards of ethics and professionalism. |

**Course Outcome:**

After Completion of the Course, Student will be able to:

| No | Course Outcomes | RBT Level |
|---|---|---|
| 01 | Understand key planning concepts of seaport infrastructure, including capacity, transportation links, cargo handling. | U |
| 02 | Conduct port demand estimation and management. | A |

| | | |
|---|---|---|
| 03 | Plan and design the port and harbour components | N, E |
| 04 | Design the port facilities, and cargo handling facilities required. | N, E |
| 05 | Discriminate harbour works, berthing structures, and transit sheds. | A |

**Revised Bloom's Taxonomy (RBT)*

**Teaching and Examination Scheme:**

| Teaching Scheme (in Hours) | | | Total Credits L+T+ (PR/2) | Assessment Pattern and Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Tutorial / Practical | | |
| L | T | PR | C | ESE (E) | PA / CA (M) | PA/CA (I) | ESE (V) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 20 | 30 | 150 |

**Course Content:**

| Unit No. | Content | No. of Hours | % of Weightage(%) |
|---|---|---|---|
| 1 | Ports and harbours as the interface between the water and land infrastructure- an infrastructure layer between two transport media- History of port growth- factors affecting growth of port- Classification of harbour. Selection of site and planning of harbors, location of harbor, master plan, ship characteristics, Site investigations – hydrographic survey, topographic survey, soil investigations, current observations, tidal observations, Layout of port and Harbour, Port planning. | 5 | 10 |
| 2 | Port Demand Estimation and Management: Forecasting demand for services of a new port, Optimal handling capacity estimation, Evaluation, and management of port projects. Long-term port planning. Modeling port demand and supply. Port traffic forecasting. Strategic Port Planning, Operational port planning, Terminal planning module. | 7 | 20 |
| 3 | Fundamentals of port structures design, design codes, guidelines and functional requirements. Structural, geotechnical, and materials considerations, for a variety of environmental conditions, including extreme wave and current environments and seismic loading- Dry infrastructures-Wet infrastructures –Support vessels, Meteorological, hydrological and oceanographic data required for port design- Determination of location- Economic viability. | 10 | 20 |
| 4 | Different types of Breakwaters, jetties & quay walls and dolphins- | 10 | 25 |

| | | | |
|---|---|---|---|
| | Hydrodynamic loading on such structures and Structural Design aspects. Functional designing of the various components of ports and marine terminals, including steel, concrete, timber, and stone structures. Design procedures for breakwaters, bulkheads, wharves, dolphins, piers, fender and mooring systems and revetments. | | |
| 5 | Size and shape of harbour and turning basin – Type, location and height of Breakwaters – Location and width of entrance to harbour – Depth of harbour and navigational channel – Number, location and type of docks or berths or jetties- Shore facilities for Marine terminals and fishing harbours. | 5 | 10 |
| 6 | Docks and Sea Port Facilities: harbor docks, use of wet docks, design of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking, construction of dry docks, gates for dry docks, pumping plant, floating docks, slipways, locks, size of lock, lock gates, types of gates; port development, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, inland port facilities.<br>Navigational aids, types, requirements of signals, lighthouses, beacon light, buoys. Dredging & coastal protection: Types of dredgers, choices, usage of dredged material, sea wall protection-sea wall revetment, bulkhead. Economic evaluation of port project, impacts of port activities. | 8 | 15 |
| | **Total** | **45** | **100** |

**Suggested Specification Table with Marks (Theory):**

| **Distribution of Theory Marks (in %)** | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| **20** | **20** | **30** | **10** | **20** | **-** |

*Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)*

**References/Suggested Learning Resources:**

**(a) Books:**


1. Seetharaman,S. Dock and HarbourEngineering, Umesh Publications, New Delhi, India, 1999.

2. Srinivasan, R. Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Ltd., Anand, India, 2009.
3. Hasmukh P. Oza and Gautam H. Oza, Dock and Harbour Engineering, Sixth Edition, Charotar Publishing House Pvt. Ltd., 2011.
4. Muir Wood, A.M., and Fleming.C.A., Coastal Hydraulics Sea and Inland Port Structures, 1st Edition, Hallstead Press, 2002
5. R. L. Silvester, "Coastal Engineering Volume I & II, Elsevier Publishers, 2000.
6. Bindra, S.P., A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, 2012, Ninth Edition.
7. Alonzo Def. Quinn, Design and Construction of Ports and Marine Structures, McGraw – Hill Book Company, New York, 1997.

**(b) Open source software and website:**

1. PHRI (Port and Harbour Research Institute) Japan manual.
2. http://dredge-india.nic.in/ops-main-page.html
3. https://nptel.ac.in/courses/114/106/114106025/#
4. https://www.asce.org/continuing-education/port-engineering-certificate-program/

**(c) Suggested Lab work and Tutorial List:**

1. Cargo and passenger demand forecasting for the ports
2. Lay out planning of Seaport
3. Planning and design of harbour infrastructures using IS codes.
4. Planning and design of port area infrastructures using IS codes.
5. Economic evaluation of the Port project

**(d) Suggested Activities for Students:** Field visit of any port is mandatory.

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