**19CE32E4 - RAILWAY, AIRPORT & HARBOUR ENGINEERING**

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| **Course Category**  | Professional Elective | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 3 - 0 - 0 |
| **Prerequisite** | Transportation Engineering | **Sessional Evaluation**  | 40 |
|  **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To illustrate permanent way and its components.
2. To demonstrate different types of stations, yards, points, crossings and turnouts.
3. To outline the basic concepts of airport transportation, aircraft characteristics and airport.
4. To analyze runway orientation by wind rose method.
5. To relate water and water transportation for providing various facilities required in harbour.
6. To elaborate facilities required in harbour with break waters and dredging.
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| **Course Outcomes** | CO1 | Illustrate permanent way, its components and functions in railways. |
| CO2 | Identify functions, requirements and types of stations, yards, points and crossing, turnouts. |
| CO3 | Outline air transport features along with airport components. |
| CO4 | Design components of airport landing area and terminal area. |
| CO5 | Summarize facilities required in harbour and port. |
| CO6 | Relate importance of break waters, docks and dredging in harbour and port. |
| **Course Content** | **UNIT - I****INTRODUCTION TO RAILWAY ENGINEERING:** comparison of railways and highways, milestones in Indian railways, classification of Indian railways **–** rail route classification, railway zones, types of railways.**PERMANENT WAY**: Requirements of ideal permanent way, gauges – selection of gauge- uniformity of gauges, Rails **-** functions , composition of rail steel, requirements of rails, types of rail sections, length of rails, coning of wheels, Sleepers **–** types of sleepers,functions and requirements, adzing of sleepers, spacing of sleepers and sleeper density- problems, Ballast- functions and requirements, types of ballast - renewal of ballast (Theory only).  **UNIT – II****STATIONS AND YARDS:** Railway stations **-** Site selection for railway stations, requirements of railway station, classification of stations**-** operational classification and functional classification, platforms **-** types, loops, sidings, Station yards – types, layouts, Points and crossings **–** turnouts **-** left hand turnout, right hand turnout, types of switches, types of crossings, sleepers at points and crossings (Theory only).**UNIT – III****AIR TRANSPORT:** Introduction to air transportation, characteristics of air transport, development of national organizations for civil aviation, airport zoning and zoning laws, classification of airports, different kinds of flights, Air traffic control **-** forecasting air traffic potential (Basic concepts only).**AIR PORT:** Air craft– types, components, basic structure of air craft, aircraft characteristics, Components of airports and functions **-** terminal area and landing area, planning concepts for terminal building, Parking area **-** patterns of parking, systems of aircraft parking, Aprons **-** loading aprons and holding aprons, hangers **-** T hangers, nose hangers and grouped hangers.**UNIT - IV****AIRPORT PLANNING:** Airport planning – Master plan, regional plan, factors affecting site selection for an airport, characteristics of well-planned airport layout, typical airport layout patterns, blast considerations, blast fences,  **RUNWAY ORIENTATION**: Runway patterns, wind rose analysis in runway orientation **–** problems on runway orientation**,** Construction **-** LCN method of airport runway pavement design, (Theory only).**UNIT - V****WATER TRANSPORTATION**: Salient features of water transportation in India **-** types of water transportation - inland and ocean transportation**,** Tides, Wind and waves – factors governing the characteristics of water waves, Currents, uses and effects of tides at harbour. **HARBOUR AND PORT**: Classification of harbors and ports, site selection, requirements of good port, components of a harbour and port **-** loading and unloading facilities of harbor, quays & wharves, piers, dolphins, jetties, fenders, aprons, transit sheds, Docks – classification, shapes of docks , dry docks & wet docks, Different layouts of harbour.**UNIT - VI****BREAK WATERS:** Breakwaters – types of break waters, details of energy dissipation in mound break water, characteristics of mound break water, rubble mound breakwater – rubble mound breakwater strengthened by concrete blocks, rubble mound breakwater strengthened by patented blocks. **DREDGING:** Classification of dredging, Equipment **-** mechanical type, hydraulic or suction type dredgers, choice of dredger, navigation facilities – need- types- general lights and local lights – fixed light station types only- floating navigation aids types only. |
| **Textbooks****and References** | **TEXTBOOKS:**1. S.C.Saxena & S.P.Arora, “*A text book of Railway Engineering”*, Dhanpat Rai publications, 7th edition, 2015.
2. R. Srinivasan, “*Docks and Harbour engineering”*, Charotar publishing hose Pvt. Ltd, 29th edition, 2018.
3. C.Venkatramaiah, “*Transportation Engineering II”,* Universities press (India) Private Limited, 2ndedition, 2016.

**REFERENCE BOOKS:**1. SP Bindra, “*A Course in Docks and Harbour Engineering”,* Dhanpat Rai Publication, 8th edition, 2016.
2. S.C. Rangwala , “*A text book of Railway Engineering”*, Charotar publishing house, 26th edition, 2016.
3. K.P. Subramanian, “*Highway, railway, airport and harbour engineering”,*  SCITECH publishers, 2nd edition, 2015.
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| **CO3** | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 1 | 2 | 2 | 1 | 1 | - | 1 | - | - | 2 | 1 |
| **CO5** | 1 | - | - | - | - | 1 | - | - | - | - | - | - |
| **CO6** | 1 | - | - | - | - | 1 | - | - | - | - | - | 1 |