

METE201: DESIGN & CONSTRUCTION OF RIGID PAVEMENTS

Theory:

Unit-1:

THEORIES AND DESIGN OF RIGID PAVEMENTS: Westergaard's analysis, pickets solution, Westergaard formula for loads on applied area. Finite difference method, linear elastic layer method. Finite element method, Deflection in rigid pavements.

Design of concrete pavements: ESWL, Stress calculations, curling stresses, frictional stresses, infiltration stresses and load stresses, slab thickness design, use of charts and formula for diff. Load positions, Design of airfield pavements.

Unit-2:

PAVEMENT JOINTS: Types of joints, contraction and warping joints, dowel bars and tie bars, Temperature reinforcements filling and sealing of joints.

Unit-3:

CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS: Width and thickness of slab, Reinforcing steel design, Design and construction criteria, Factors affecting, crack width and spacing of CRC pavements, design of CRC pavement for Highway and Airfield.

Unit-4:

DESIGN OF PRESTRESSED CONCRETE PAVEMENTS: Stresses in pavements, Thickness design and pre-stressing techniques.

EVALUATION AND STRENGTHENING: Performance evaluation safety, serviceability and durability concepts, Design of overlays on rigid pavements, fibrous concrete overlays, economics of rigid pavements, construction and maintenance.

Unit-5:

CONSTRUCTION OF RIGID PAVEMENTS: Formwork, mixing, spreading, compaction and finishing, slip form pavers.

CEMENT CONCRETE MIXES: Methods with special reference considering the requirements of pavements, comparison of different methods.

Books & Reference Recommended:

1. H.M.S.O. Concrete Road, Design and Construction.
2. Yodar E.J., Principle of Pavement Design.
3. IRC-18-1981, Standards, Specifications and Code of Practice for Construction of Concrete Roads.
4. IRC-58-1988, Guidelines for the design of Rigid Pavements for Highways.
5. IRC SP-49-1988, Guidelines for the use of Dry Lean Concrete as Sub Base for Rigid Pavements.
6. IRC-15, Standard Specification and Code of Practice for Construction of Concrete Road.
7. IRC-44-1976, Tentative Guidelines for CC Mix Design for Pavements.
8. IRC-SP-46-1977, SFRC for pavement.
9. Sharma S.K., Principle Practice & Design in Highway Engineering.

METE202: DESIGN & CONSTRUCTION OF FLEXIBLE PAVEMENTS

Theory:

Unit-1:

Equivalent single wheel load concepts and application, Relationship between wheel arrangements and loading effects, tyre contact area, Effect of load repetition, Effect of transient loads, Impact of moving loading, Factors to be considered in Design of pavements, Design wheel load, soil, climatic factors, Pavement component materials, Environmental factors, Special factors such as frost, Freezing and thawing.

Unit-2:

Design of Flexible Pavements: Methods of design, empirical, semi empirical and analytical, Group Index, CBR, California Resistance value, Triaxial, McLeod, Burmister and F.A.A. method, Pavements models and stress analysis of pavement system, Design of flexible pavement for airfields.

Unit-3:

Construction of flexible pavements: Type of Highway construction, Earth road and Gravel roads, soil stabilized roads, W.B.M. roads, black top roads, seal coat, prime coat and tack coat, premix, Bituminous construction procedures: Surface dressing, Grouted macadam, Bitumen bound macadam, Bituminous carpet, Benkelman Beam method, Pavement roughness and pavement strength, fracture patterns and disintegration, present serviceability of pavement system and cost analysis, optional selection of flexible pavement component.

Unit-4:

Design of bituminous concrete mix: Principles of mix Design, Factors, Method: Marshall, Hveem and field, Hveem, Triaxial, Comparison of different methods.

Unit-5:

Strengthening of pavement: Types of failure, remedial measurement, Pavement Evaluation Methods.

Books & Reference Recommended:

1. Yoder E.J., Principle of Pavement Design.
2. IRC-37-1980, Guidelines for the Design of Flexible Pavements.
3. IRC-16-1981, Specification For Road and Bridge Work, (MORT & H).
4. Khanna & Justo, Highway Engineering.
5. Kadiyali L.R., Principle and Practice of Highway Engineering.
6. Sharma S.K., Principles, Practice & Design in Highway Engineering.
7. IRC-81-1997, Tentative Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique.

METE203: SYSTEM ANALYSIS & URBAN TRANSPORTATION

Theory:

Unit-1:

Probability, statistics for traffic Engineering design: Random variable and statistical measures, Basic concept of probability, probability- laws, Binomial, Poisson, Normal and Exponential distributions.

Sampling theory and regression analysis, General consideration of the accuracy, cost and time requirements of data collection, sampling theory and principles for determining sample size and accuracy relationship, principles of the population mean and standard deviation, regression analysis examples.

Unit-2:

Traffic forecasting: Principles and techniques, Demand, price and capacity relationships, price elasticity, forecasting for long term demand, variables, determination of the design hourly volume.

Planning methods of transport system planning, stages of planning, Transportation study area, collection of travel data, external cordon and screen-line, survey, zoning types of surveys.

Unit-3:

Trip Generation Models: Introduction and definition, Factors governing trip generation, multiple linear regression analysis, aggregated and disaggregated analysis, Category analysis.

Unit-4:

Distribution Models: Methods of trip distribution, Growth factor models, Gravity model, Tanner model, intervening opportunity model, competing opportunity model. Assignment models: General principle, Assignment techniques, All or nothing Assignment, multiple route assignment, capacity restraint assignment, diversion curves.

Unit-5:

Economic analysis: Need, costs and Benefits, Time horizon in Economic assignment, basic principles, methods of Economic evaluation.

Traffic and the Environment, effects of traffic on the environment.

Books & Reference Recommended:

1. Kadiyali L.R., Traffic Engineering and Transport Planning.
2. Martine Wool and Brain V. Martin, Traffic System Analysis.
3. Hutchinson B.G., Principles of UTS Planning, Mc Graw-Hill Publish.
4. Saxena, Traffic Planning and Design.
5. Bruton M.J., Introduction to Transportation Planning.

METE204: TRANSPORTATION PLANNING

Theory:

Unit-1:

Transportation in Society: Role of transportation (Land, Air, water) in civilization, Economic, social, political, environmental roles of transportation today in India.

The fields of Transportation Engineering: Different fields involved, system planning, scientific approach to model development science and professional judgment, organizations. Component of transportation system: Transport technology, professional systems, Transportation network and their analysis, vehicle and containers.

Unit-2:

Vehicle Motion: Equations of motion, Resistances, Path characteristics, Prediction of vehicle performance, Generalized vehicle performance relationships, work, energy and fuel consumptions, Continuous flow system: General characteristics, belt conveyors, pipe lines, concepts of flow and design.

Terminals: Functions, Analysis, Process flow charts, Terminal processing time, waiting times, capacity and level of service concepts simulation probability density functions. Queuing theory, Passenger and Freight terminals, air, bus, railroad.

Unit-3:

Transport costs, Demand and Supply: Concepts, types, future costs and present value, Treatment of inflation, cost estimating methods, choice of technology and cost output relationships, Demand function, Demand models, urban travel for casting model, demand for freight transportation, projection techniques, Theory of transport supply, supply characteristics of transport facilities, pricing, supply characteristics of carriers, supply relationships for an urban transit time.

Transportation Networks Flows: Merging of demand and supply relationships, Economic market equilibrium and extension to include level of service, network equilibrium traffic assignment.

Unit-4:

Environment impacts: Noise impact, air pollution, impact on land and value, vibration, evaluation procedures, situation in India.

Decision making: Characteristics of Transportation problems, problem solving process, multiple objective evaluation and selection methods, selection procedures. Economic evaluation methods, Long range transportation planning, Types of Planning process Data base Alternative, and their generation.

Unit-5:

Operation plans, system operation and management: operation plans, components, single line analysis, Network relationship, TSM Management scheme for reducing congestion in CED and on streets, Reducing travel peaks, traffic Engg. Measures, Road Traffic models for CBD, corridor operation planning, maintenance, Integrated operation planning and design and design of a system, Implementation: Urban transportation legislation, legal powers, financing.

Books & Reference Recommended:

1. Edward K. Morlok, Introduction to Transportation Engineering and Planning Mc Graw Hill Book Co.
2. John W. Dickey, Metropolitan, Transportation Planning, Mc Graw Hill Co.
3. Kadiyali L.R., Traffic Engineering and Transportation Planning, Khanna Publication Delhi.
4. Wohl, Martin and Brien V. Martin, Traffic System Analysis for Engineers and Planners, Mc Graw Hill Book Co.
5. Hutkiinson, Bruce D., Principles of Urban Transport System Planning, Mc Graw Hill.

METE205: RAILWAY ENGINEERING

Theory

Unit-1

Introduction, Permanent Way and Rails: Rail transportation and its importance in India. Permanent way: requirements and components. Gauges in India and abroad. Selection of gauge. Coning of wheels. Adzing of sleepers. Rails: functions, composition of rail steel, types of rail sections, requirements of an ideal rail section, length of rails. Creep of rails. Long welded rails and continuously welded rails.

Unit-2

Sleepers, Fastenings and Ballast: Sleepers: functions, requirements of an ideal sleeper. Types of sleepers: wooden, cast iron, steel and concrete sleepers, advantages, disadvantages and suitability of each type. Sleeper density. Fastenings for various types of sleepers: fish plates, spikes, bolts, bearing plates, keys, chairs, jaws, tie bars. Elastic fastenings. Ballast: functions, requirements, types of ballast and their suitability.

Unit-3

Points and Crossings: Necessity. Turnout: various components, working principle. Switch: components, types. Crossing: components and types. Design elements of a turnout, design of a simple turnout. Layout plan of track junctions: crossovers, diamond crossing, single-double slips, throw switch, turn table, triangle.

Unit-4

Signaling, Interlocking and Train Control: Signals: objects, types and classification. Semaphore signal: components, working principle. Requirements / principles of a good interlocking system. Brief introduction to devices used in inter locking. Methods of control of train movements: absolute block system, automatic block system, centralized train control and automatic train control systems.

Unit-5

Stations, Yards and Track Maintenance: Stations: functions and classification. Junction, non-junction and terminal stations. Yards: functions, types. Marshalling yard: functions, types. Maintenance of railway track: necessity, types of maintenance brief introduction to mechanized maintenance, M.S.P. and D.T.M.