

**Name of Specialization: Transportation Engineering**

**No. of Question: 50 (Objective Type)**

**Duration: 1 Hr. 30 Min**

**Maximum Marks: 50**

**Transportation Planning:** Fields of transportation Engineering; System- Environment Ensemble; Transportation planning process; Transportation problems and problem-solving process. Technologies of Transport and System Components, Network Analysis; Minimum Path Algorithms, Path Characteristics, Path-Vehicle Interaction – Discrete Flows and Continuous Flows, Vehicle and its Performance, System Performance, Vehicle and Container, Weight to Volume relation, Terminal Planning, Operational Planning. Urban transportation planning process; trip generation, correlation analysis and regression analysis; trip distribution, Growth factor methods and Synthetic methods; modal split models, first generation, second generation, behavioural models; minimum travel path computations; Trip assignments, route assignment, multiple assignment and network assignment. Urban Forms, mobility and activity hierarchy; accessibility-based early-era models; Lowery's model and its derivatives; Modern era models.

**Transportation Infrastructure:** Highway alignment and engineering surveys, Geometric design of highways. Railways for urban transportation-Engineering surveys for track alignment Obligatory Points-Conventional and modern methods, remote sensing and GIS Application in Transportation Engineering. Water transportation system, harbours docks, port facilities. Airport planning, topographical geographical features, air traffic characteristics, factors affecting airport site selection. Transportation Environment Interaction and Analysis, Urban Mass Transportation System, Intelligent Transportation System, Modelling and Simulation in Transportation.

**Highway Material Characterization:** Classification, physical and strength characteristics, proportioning of aggregates, Aggregate texture and skid resistance, polishing of aggregates. Classification, Structural and Constructional problems in soil subgrade, Soil Identification and strength tests, Soil-moisture movement, Sub-soil drainage, Soil stabilization, Characteristics and use of Fly Ash, Bottom ash and Pond Ash. Bitumen sources and manufacturing, Bitumen constituents, structure and Rheology, Mechanical and engineering properties of bitumen, Tests on bitumen, Emulsions, Tar – Properties, types, modifications, Durability of bitumen, Adhesion of bitumen, Modified bitumen. Desirable properties of mixes, Design of bituminous mixes, Tests on bituminous mixes, Fillers, Theory of fillers and specifications. Marshall, Hubbard Field & Hveam Methods. Asphalt mix Constituents and their requirements, Physical, plastic and structural properties of concrete, Factors influencing mix design, Design of concrete mixes for DLC and PQC with appropriate admixtures like flyash and high range water reducing admixtures etc. IRC and MORTH consideration for asphalt and cement pavement mixes.

**Highway Pavements:** Components of pavement structure, importance of sub-grade soil properties on pavement performance. Functions of sub-grade, sub-base, base course and wearing course. Stresses in Flexible Pavements, Elements in Design of Flexible Pavements, Design Methods for Flexible and Rigid Pavements, Asphalt pavement construction procedures and specifications, Quality control requirements. Concrete Road construction: Construction methods, Quality control requirements, Joints in cement concrete pavements, reinforced cement concrete road construction. IRC & MORTH recommendations for construction of Bituminous and Concrete roads. Present practices being followed for quality assurance and speedy construction in the country like by NHAI.

**Traffic Engineering:** Elements of traffic engineering, issues for traffic engineers; road users, vehicles, highways and control devices, modelling concepts. Traffic Stream Characteristics, Traffic Studies, Traffic design, Statistical application in Traffic Engineering, Traffic Flow Theory, Time Series Analysis, Management Techniques.

**Pavement Maintenance and Management System:** Pavement Evaluation and Performance Analysis, Types of Distress, Pavement Evaluation & Measuring Equipments, Pavement Overlays, Design Alternatives – Analysis, Evaluation and Selection, Pavement Management System.

**Road Safety and Management:** Road accidents, causes, scientific investigations and data collection. Road safety issues and various measures for road safety. Engineering, education and enforcement measures for improving road safety' Short term and long term measures. Traffic management techniques. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works Economic evaluation of roads.

**Rural Roads:** Classification of Roads, Brief introduction to earlier 20 year Plans, System's Approach, NATPAC Model, Gravity Model, CRRM Model, FBRNP Model, Concepts of PMGSY. Geometric Design Standards for Rural Roads with special reference to PMGSY, Hill Road Standards. Various pavement design methods for Rural roads including Flexible and Rigid pavements using IRC:SP-20, IRC-72, IRC-37, IRC:SP-62, CRRM Nomograms. CRRM Method, Triangular Chart Method, Fuller's Method, Rothfuch method, PI based Method. Brief introduction to conventional materials, Marginal and Waste Materials including Fly Ash, GBFS, BFS, SMS, Bagasse, CRMB, etc. Case Studies of Waste Material Utilization in Rural Roads, Low Cost Techniques for Rural Road Construction, Tractor Bound Technology, Special Considerations for Hill Areas. Transverse and Longitudinal Drainage, Design of drains, Minor CD Works, Filter Design etc. Type and Causes of Failures, Remedies.