

METE101-SYSTEM MATHEMATICS & MATHEMATICAL MODELLING

Theory:

Unit-1

Introduction of operation-research, Mathematical Programming Techniques Linear programming (formulation, Graphical solution). Simplex method, BIG-M method. Duality theory in linear programming, Transportation & Assignment Problem.

Unit-2

Network Methods: CPM, PERT, Dynamic Programming, Bellmon's Principle of optimality, Non linear Programming. Fibonacci method.

Unit-3

Game theory, Queuing system, Genetic algorithm, ANN methods, Evolutionary algorithms.

Unit-4

Probability concepts , Additive and Multiplicative laws of Probability , Boye's theorem, statistical frequency distribution, Binomial, Poisson, Normal Distribution, confidence intervals, Tests of Significance for small & large samples. Testing of Hypothesis, Linear and Non linear regression.

Unit-5

Reliability Engineering: Basic concepts of Reliability, Design for Reliability constraints and consideration Reliability and Mathematics, Components Reliability and Hazard models, System Reliability models.

Books & References Recommended:

1. Operation Research by Phillips & Ravindran
2. Operation Research by TAHA
3. Probability, Statistics & Decision in Civil Engineering by Benjamin & Cornell
4. optimization by S.S. Rao

METE102: MATERIAL SCIENCE & CONCRETE TECHNOLOGY

Theory:

Unit-1:

Structure of solid materials, Atoms and bonds, inter-atomic and intermolecular bond, Crystals, Classification of solids. Mechanism of elastic and plastic action in Tension, Compression, Pure bending and torsion, Elastic and inelastic Properties of solids, dislocations, Strain hardening, Triaxial stress.

Unit-2:

CREEP: Components of creep fracture, analysis of creep curves, method of predicting creep strength, designing of creep.

FATIGUE: Fatigue loading, mechanism, factor affecting creep fatigue properties, S.N. Diagrams. **HARDNESS:** relation between hardness of different atomic structure measurement of hardness with other mechanical properties.

Unit-3:

CONCRETE MATERIALS: Cement Manufacture, Composition, Structure, Hydrated Cement paste, heat of hydration, Test for physical properties, different types of cements, properties of aggregates.

FRESH CONCRETE: Workability, Factor affecting, testing, vibration analysis of fresh concrete.

STRENGTH OF CONCRETE: nature of strength, factor affecting, Autogenous heating, Maturity of concrete, fatigue strength, Impact strength. Admixtures & Plasticizers.

Unit-4:

ELASTICITY SHRINKAGE AND CREEP: Modulus of elasticity, Dynamic Modulus, Poisson's ratio, early volume changes, swelling, shrinkage, creep factors influencing creep nature. Rheological models, effects and design of creep.

DURABILITY OF CONCRETE: Permeability of concrete, Thermal properties of concrete, resistance of concrete to fire, resistance to abrasion, Electrical properties, Acoustic properties, Chemical attack.

Unit-5:

TESTING OF HARDENED CONCRETE: Destructive and non destructive testing of concrete, Tests of composition of hardened concrete, variation of test results, Accelerated testing of concrete.

MIX DESIGN: Basic consideration, factor in choice of mix. Proportion, Method of mix design, I.S. Code method, I.B.C. Murdock, A.C.I. Method based on road note No.4, Design of different types of concrete: Light weight and high density.

Books & References Recommended:

1. Concrete Technology by Neville
2. Concrete Technology by Shetty

METE103: ALIGNMENT & GEOMETRIC DESIGN OF HIGHWAYS

Theory:

Unit -1:

PRINCIPLE OF ROUTE SELECTION AND HIGHWAYS LOCATION:

Reconnaissance, Preliminary and final location surveys. Different Studies for Route Locations: Traffic, Soil and Materials, Drainage etc. Use of Aerial Photographs and Remote Sensing in route location, preparation and presentation of project documents.

Unit-2:

HIGHWAY FINANCING, ECONOMICS AND ADMINISTRATION: Financing of Highways, revenues and expenditures, Highway financing in India. Economics of Highway improvements, Highway administration and planning in India, Saturation System.

Unit-3:

CLASSIFICATION OF HIGHWAY: Terrain classification, design speed and other factor for Geometric design, uniform and non-uniform acceleration theory.

CROSS SECTIONAL ELEMENTS: Road lines, building and control lines, roadways, width, shoulders. Median, Camber.

SIGHT DISTANCES: Analysis of stopping sight distance, Intermediate and passing sight distance.

Unit-4:

HORIZONTAL ALIGNMENT: Design Radius, dynamics and motion of vehicle on a curve, Friction between tyre and road surface, Different curves, Superlevation, widening and transition curves, setting of transition spiral, use of tables.

Unit-5:

VERTICAL ALIGNMENT: Gradients, Grade Compensation, Relation between gradient and camber, Design of Summit and Valley curves, Design criteria for hair pin bend, Design of curves in tight location, lateral and vertical clearances, under passes, coordination of horizontal and vertical, set back distance.

Books & Reference Recommended:

1. IRC Special Publication 19-1977, Manual for Survey Investigation and Preparation of Road Project.
2. IRC Special Publication 20-1979, Manual for Route Location, Design Construction and Maintenance of Rural Highways.
3. IRC-73-1980, Geometric Design Standards for Rural Highways.
4. IRC-52-1970, Design Tables for Horizontal Curves for Highways.
5. IRC-52-1973, Recommendation about the Alignment Survey Geometric Design of Hill Roads.
6. Drew, Traffic Flow Theory.
7. Sharma S.K., Principle Practice and Design of Highway Engg.
8. Kadiyali L.R., Highway Engg.
9. Kadiyali L.R., Principles of Highway Engg.

W.e.f. Academic Session 2014-15

METE104: SOIL MECHANICS IN HIGHWAY ENGINEERING

Theory:

Unit-1:

CLASSIFICATION OF SOILS: IS Classification, AASHTO Classifications, CAA Classifications. Introduction to Geotechnical Investigations, different methods of investigation, trial pits, rotary drilling, percussion drilling, geophysical methods. Introduction to rock engineering, core recovery, Rock quality designation, joint condition, joint orientation Rock Mass Rating, crushing strength, point load index, rock durability test, pressure meter test, percolation tests.

Unit-2:

COMPACTION: Theory of compaction, factors affecting compaction, effect of compaction on soil, properties, measurement of field compaction and field methods of compaction and control.

CBR and group index: Laboratory and field determination of CBR value, effect of soaking, modules of sub-grade reaction.

Unit-3:

BEARING CAPACITY: Skempton's analysis, Plate Load Test, penetration tests, General bearing capacity equation, effect of water table on bearing capacity.

Stability of slopes: Types of slope failure, Bishop's slope stability analysis, Stability number.

Unit-4:

EARTH PRESSURES: Classical theories, effect of submergence and seepage.

Unit-5:

SOIL STABILIZATION: Mechanics of stabilization, Mechanical, Electrical, cement, lime, Bitumen and Chemical Stabilization.

DRAINAGE: Vertical and sand drains, Surface and sub-surface drainage for highways, Drainage for Hill roads.

Books & Reference Recommended:

1. Singh Alam, Soil Engineering in Theory and Practice, Asia Publication House.
2. HMSO, Soil Mechanics for Road Engineers.
3. Khanna S.K., and Justo, C.G., Highway Engineering.
4. Punmia B.C., Soil Mechanics and Foundation Engineering.
5. Prora, Soil Mechanics.
6. Venkat Ramaiha, Soil Mechanics.
7. IRC-49-1973, Recommended Practice for the Pulverization of B.C. for lime Stabilization.
8. IRC-50-1973, Recommended Design for the use of Cement-Modified Soil in Road Constructions.
9. IRC-51-1992, Guideline for the use of Soil Lime Mixing Road Construction.

METE105: TRAFFIC ENGINEERING

Theory:

Unit-1:

TRAFFIC CHARACTERISTICS: Road user, Vehicle, Speed Studies, Different Traffic Surveys and Studies.

Non-signalised Intersections: At grade and grade separated intersection, channelization warrants, weaving action at intersection, delay models, Theoretical models for determining weaving capacity, design of intersection.

Signalized Intersections: Warrants for the use of traffic signals, phasing, signal aspects and the intergreen period, determination of effective green time, optimum cycle time and timing diagram, effect of left and right turning and heterogeneity, P.C.U. concepts, ultimate capacity of whole intersection, delay calculation and optimum cycle length, queue lengths at the commencement of green period, coordination of traffic signals.

Unit-2:

TRAFFIC FLOW MODELS: Elements of traffic flow, fundamental diagram of road traffic, relationships between the variables, macroscopic and microscopic flow models based on response-Stimulus approach, Hydrodynamic analogy, Queuing model.

Unit-3:

PARKING: Parking survey, types of parking, parking meters, design of parking places.

LIGHTING: Lantern arrangements, types of signs and marking and their design.

ACCIDENTS: Causes, data collection, analysis of accident data, Collision and condition diagram, remedial measures for accidents.

Unit-4:

HIGHWAY CAPACITY: Basic, Possible and Practical capacities, level of service concept, factors affecting capacity and level of service, capacity of freeway, expressway, Urban Streets.

Unit-5:

TRAFFIC MANAGEMENT: One way street, two-way, flow operation, closing side streets, exclusive bus lanes.

Instruments for volume measurement spot speed measurement, electronic timers cameras, Radar Photography, Vehicle Mounted Instruments, measurement of concentration.

Books & Reference Recommended:

1. Louis J, Pignataro, Theory and Practice, Prentice-Hall.
2. Kadiyali L.R., Traffic Engg. And Transport Planning.
3. IRC-65-1976, Recommended Practice for Traffic Rotaries.

W.e.f. Academic Session 2014-15

4. IRC-SP-12-1973, Tentative Recommendation on the Provision of Parking space for urban area.