

## MCH-101 Traffic Engineering

L	T	P/D	Total
3	1		4

Max. Marks	:100
Theory	:60Marks
Sessional	:40Marks
Duration	:3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Traffic Characteristics: Importance of traffic characteristics , road user characteristics, vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

Traffic Studies: Traffic volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys.

### UNIT-II

Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures . Capacity and level of Service, fundamental diagram of traffic flow. Relationship between speed, volume and density. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.

### UNIT- III

Traffic Regulation and Control Devices: Traffic control devices: signs, signals, markings and islands. Types of signs. Types of signals. Design of signal by IRC method. Intersections at grade and grade separated intersections. Design of a rotary. Types of grade separated intersections.

Design of Parking Lighting and Terminal Facilities: Parking surveys. On street parking. Off street parking.

### UNIT-IV

Traffic Regulation: Need and scope of traffic regulations. Regulation of speed, vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management.

#### Recommended Books

- (i) Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
- (ii) Highway Engg by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
- (iii) Principles and Practice of Highway Engg. By L.R.Kadiyali, Khanna Publishers, Delhi.
- (iv) Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
- (v) MORTH Specifications for Road and Bridge Works, IRC Publication.

## MCH-102 Geometric Design of Highways

L	T	PID	Total
3	1		4

Max. Marks	: 100
Theory	: 60 Marks
Sessional	: 40 Marks
Duration	: 3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT -I

Highway Alignment: Requirements. Factors controlling alignment. Obligatory points. Engineering surveys for highway location. Route selection. Steps in new project. Highway classifications.

Cross Sectional Element: Pavement surface characteristics. Factors affecting skid resistance. Pavement unevenness. Camber. Providing camber in the field. Width of carriageway. Design Vehicle, medians, kerbs, road margins, right of way and typical cross sections of roads.

### UNIT -II

Sight Distances: Introduction. Stopping sight distance. Reaction time. Analysis of stopping distance. Overtaking sight distance. Analysis of overtaking sight distance. Effect of grade on sight distances. Overtaking zone. Intermediate sight distance. Sight distance at intersections.  
Superelevation: Requirement of superelevation. Limits and attainment of superelevation in the field.

### UNIT-III

Highway Alignment: General. Design speed. Horizontal curves. Superelevation. Analysis of superelevation. Superelevation design. Attainment of superelevation. Widening of pavement on horizontal curves. Methods of introducing extra widening. Horizontal Transition curves. Different types of transition curves. Length of transition curve. Setting out of transition curve. Set-back distance on horizontal curves. Curve resistance.

### UNIT-IV

Vertical Alignment: General. Gradients. Compensation in gradient on horizontal curves. Vertical curves. Summit curve. Length of summit curve. Valley Curve. Length of valley curve and profile. Relevant IRC standards for urban and rural roads.

#### Recommended Books

- (i) Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
- (ii) Highway Engg. by S.K. Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
- (iii) Principles and Practice of Highway Engg. by L.R. Kadiyali, Khanna Publishers, Delhi.
- (iv) Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
- (v) MORTH Specifications for Road and Bridge Works, IRC Publication.
- (vi) Principles of Highway Engineering and Traffic Analysis, by Mannering, F., W. Kilareski, and S. Washburn 3rd Edition, John Wiley and Sons, 2005.

## MCH-103 Pavement Materials

L	T	P/D	Total
3	1		4

Max. Marks	: 100
Theory	: 60 Marks
Sessional	: 40 Marks
Duration	: 3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Subgrade: Significance of subgrade soil. Characteristics of soil. Desirable properties. Index properties of Soil. Soil classification based on grain size. Soil classification system. Evaluation of soil strength. Aggregates: Introduction. Desirable properties of road aggregates. Tests for road aggregates.

### UNIT-II

Bituminous Materials: Introduction. Types of bituminous materials. Tests on bitumen. Cutback and emulsions. Bituminous Paving Mixes: Design of bituminous mix. Marshal method of bituminous mix design.

### UNIT-III

Polymer and Rubber Modified Binders: Physical and chemical properties. Fly ash and its characterization. Performance based mix design Approaches. Visco elastic properties of bitumen and bituminous mixture.

### UNIT-IV

Construction Methods: Bituminous and concrete pavements. Relevant IS and IRC codes.

#### Recommended Books

- (i) Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
- (ii) Highway Engg by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
- (iii) Principles and Practice of Highway Engg. By L.R.Kadiyali, Khanna Publishers, Delhi.
- (iv) Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.
- (v) MORTH Specifications for Road and Bridge Works, IRC Publication.

## MCH-104 Traffic lab

L	T	P/D	Total
		4	4

Max. Marks : 100

Practical : 60 Marks

Sessional : 40 Marks

Duration : 3 Hours

1. Traffic volume study using videography technique.
2. Traffic speed study using videography technique.
3. Speed study by radar gun
4. Speed study by endoscope
5. Determination of reaction time of driver
6. Parking study
7. Accident investigation study
8. Study for improvement of an accident prone location
9. Bitumen content determination through centrifuge extrude
10. Proportioning of aggregate

## MCH-201 Pavement Analysis & Design

L	T	P/D	Total
3	1		4

Max. Marks	:100
Theory	60 Marks
Sessional	40 Marks
Duration	:3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Pavement Types: Definition, highway and airport pavement comparison, wheel loads, tyre pressure, contact pressure, design factors. Type of distresses structural and functional, serviceability.

### UNIT-II

Stresses in Flexible: Layered system concept, multilayered solutions. Burmister's method, fundamental design concepts.

Stresses in Rigid Pavements: Relative stiffness of slabs. Modulus of subgrade reaction. Stresses due to warping, stresses due to friction, effect of warping, contraction and expansion. Plain versus reinforced pavements, stresses in dowel bar, tie bar, combined stresses.

### UNIT-III

Design of Flexible Pavements: Design factors. Design wheel load. Equivalent single wheel load. Difference between airport and highway design concept. Different design methods. Examples of comprehensive design process. AASHTO method. McLeod method. New IRC Code method.

### UNIT-IV

Design of Rigid Pavement: General design considerations. Design of joints in cement concrete pavements, spacing of expansion joint, spacing of contraction joints. Design of dowel bar. Design of tie bar. IRC recommendations for design of concrete pavements.

Pavement Evaluation and Rehabilitation: Pavement distresses in flexible and rigid pavements, condition and evaluation survey. Present serviceability index. Methods of measuring condition, skid resistance. Principles of maintenance. Methods of structural evaluation.

Recommended Books:

- (i) Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
- (ii) Principles of Pavement Design, by Yoder E.J. and Witczak M.W. 2nd, John Wiley & Sons, INC.
- (iii) Principles and Practice of Highway Engg. By L.R.Kadiyali, Khanna Publishers, Delhi.
- (iv) Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
- (v) MORTH Specifications for Road and Bridge Works, IRC Publication.

## MCH-202 Pavement Construction, Maintenance & Management

L	T	P/D	Total
3	1		4

Max. Marks:	100
Theory	: 60 Marks
Sessional	: 40 Marks
Duration	: 3 Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Introduction: History of road construction, stages of construction, seasonal limitations of pavement construction.

Stabilization of Soil: Mechanical stabilization, cementing additives and chemicals, thermal stabilization.

### UNIT-II

Construction of Non-bituminous Pavements: Brief introduction to earthwork machinery: shovel, hoe, clamshell, dragline, bulldozers, cleaning and grubbing, excavation for road and drain, principles of field compaction of embankment I subgrade. Compacting equipments. Granular roads. Construction steps of GSB, WBM and WMM.

Construction of Bituminous Pavements: Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of busg, premix carpet, BM, DBM and AC. Brief coverage of machinery for construction of bituminous roads: bitumen boiler, sprayer, pressure distributor, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MORTH specifications.

### UNIT -III

Construction of Cement Concrete Roads: Construction of cement concrete pavements, machinery involved in construction, slip-form pavers, joints in cement concrete pavements, IRC and MORTH specifications. Construction of other types of pavements: basic concepts of the following: soil stabilized roads, use of ge-synthetics, reinforced cement concrete pavements, prestress concrete pavements, roller compacted concrete pavements and fibre reinforced concrete pavements. Use of fly ash in cement concrete road construction.

### UNIT-IV

Highway Maintenance: Pavement distresses, Maintenance operations, Maintenance of WBM, bituminous surfaces and cement concrete pavements. Functional and structural evaluation of pavements, pavement maintenance, maintenance management

Related Topics: Emulsified bituminous mix, precoating of aggregates, recycling of bituminous pavements, shoulder construction.

#### Recommended Books

- (i) Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
- (ii) Highway Engg. By S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.

(Elective Subject)

L	T	P/D	Total
3	1		4

MCH-407 Highway Planning

Max. Marks : 100

Theory : 60 Marks

Sessional : 40 Marks

Duration : 3 Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Transport Planning Process : Status of transportation in India. Objectives and scope of transport planning. Urban, regional and national transport planning. Transport planning process, various stages. Land use and traffic.

### UNIT-II

Transportation Survey: Definition of study area. Zoning. Types of surveys. O-D surveys. Inventories of existing transport facilities, land use and economic activities. TRIP.

Generation: Trip purpose. Factors affecting trip generation. Trip generation estimation by multiple linear regression analysis, brief review of category analysis, advantages and limitations of these methods.

### UNIT-III

Trip Distribution: Methods of trip distribution. Basic concepts of uniform factor method, average factor method and opportunity model. Trip distribution by gravity model.

Traffic Assignment: Principles of assignment. Assignment techniques. All or nothing assignment. Brief review of multipath assignment, capacity restraint assignment and diversion curves.

### UNIT-IV

Modal Split: General considerations for modal split. Factors affecting modal split. Brief introduction to various methods of modal split.

Evaluation: Need for evaluation. Several plans to be formulated. Testing. Considerations in evaluation. Economic evaluation, basic principles, brief introduction to various methods of economic evaluation, comparison.

Mass Rapid Transit Systems: Problems of Urban Transport. Introduction to MRTS. Requirements of MRTS. Types of MRTS. MRTS in India

#### Recommended Books

- (i) Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- (ii) Highway Engg by S.K. Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
- (iii) Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.
- (iv) Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall

## MCH-301 Highway Economics & Finance

L	T	PID	Total
3	1		4

Max. Marks	:100
Theory	:60Marks
Sessional	:40Marks
Duration	:3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Economic Evaluation of Transport Plans: Need for economic evaluation. Cost and benefits of transport projects. Time horizon in economic assessment. Basic principles of economic evaluation, interest rate, method of economic evaluation, benefit cost ratio method, first year rate of return, net present value method, internal rate of return method. Comparison of various methods of economic evaluation.

### UNIT-II

Vehicle Operating Costs: Introduction. Road used cost study in India. Components of VOC, factors affecting VOC. Fuel consumption relationship. Spare parts consumption. Maintenance and repairs labour cost, tyre life, lubricants, utilisation and fixed costs.

### UNIT-III

Value of Travel Time Savings: Introduction. Classes of transport users enjoying travel time savings. Methodology for monetary evaluation of passengers, travel time. Review of work in India on passengers travel time.

Accidents Costs: Introduction. Relevance of accident costing for a developing country. Review of alternative methodologies for accident costing, Indian studies.

### UNIT-IV

Traffic Congestion, Traffic Restraints and Road Pricing: Congestion as a factor in road traffic, Traffic restraint. Road pricing.

Highway Finance: Basic principles. Distribution of highway cost. Sources of revenue, Highway financing in India.

#### Recommended Books

- (i) Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
- (ii) Highway Engg by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
- (iii) Principles and Practice of Highway Engg. By L.R.Kadiyali, Khanna Publishers, Delhi.
- (iv) Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.
- (v) MORTH Specifications for Road and Bridge Works, IRC Publication.



## MCH-203 Public Transportation

L	T	P/D	Total
3	1		4

Max. Marks :100

Theory :60Marks

Sessional :40Marks

Duration :3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Modes of public transportation and application of each to urban travel needs.

### UNIT-II

Transit system operations, para-transit systems, street transit systems, rapid transit systems, estimation of transit demand. Route development, properties of a good route set, determination of a good route set, stop location and stopping policy, schedule development, properties of a good schedule, determination of a good schedule.

### UNIT-III

Capacity of rapid transit systems, line capacity of RTS, capacity of street transit systems. Transit corridor, identification and planning, mass transport management measures, integration of public transportation modes. Public transport infrastructure, case studies, multi mode transportation system.

### UNIT-IV

Planning for public transport, fares and subsidies. Intermediate public transport in Indian cities, types of IPT vehicles. Characteristics of IPT modes.

Recommended Books:

- (i) Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- (ii) Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.
- (iii) Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.

(Elective Subject)  
MCH-408 Transportation Safety & Environment

L	T	P/D	Total
3	1		4

Max. Marks: 100  
Theory : 60 Marks  
Sessional : 40 Marks  
Duration : 3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Trends in roads and highways development. Problem of road accidents in India. Characteristics of road accidents. Causes of accidents. Global and Indian road safety scenario. Factors responsible for success stories in road safety. Role of highway professionals in highway safety.

### UNIT-II

Planning of roads for safety. Land use planning and zoning. Development control and encroachment. Network hierarchy. Route planning through communities. Access control. Traffic segregation. Traffic calming designing for safety: road link design, alignment design. Cross-sectional elements. Traffic control devices. Road side safety. Road side facilities. Some critical elements. Junction design Basic principles. Selection of junction type. Factors affecting safety at various junction types. Elements to improve road safety. Provisions for vulnerable road users.

### UNIT-III

Road safety audit. Concepts of road safety audit, Road safety auditors & key personnel in RSA. Organizing and conducting a road safety audit. Example and commonly identified. Issues during RSA, Road safety audit report. Development of cost-effective of road safety audit accident investigation and prevention. Basic strategies for accident reduction. Significance of accident data. Accident investigation and identification of potential sites for treatment. Problem diagnosis. Selection of countermeasures. Example of selection of counter measures. Detailed design and implementation of countermeasures.

### UNIT-IV

Monitoring and evaluation non-engineering measures for road safety, behavioral counter measures , education. Training and publicity. The goal of police traffic control activities. Strategy for road safety management by police. Role of NGOs in road safety. Legal framework for road safety transport related pollution, noise pollution, air pollution, effects of weather conditions, vehicular emission parameters, pollution standards. EIA requirements of highway projects, world bank guidelines, EIA practices in India. Fuel crisis and transportation, factors affecting fuel consumption, fuel economy in various modes of transportation, various types of alternative fuels.

Recommended Books:

- (i) Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- (ii) Highway Engg. By S.K.Khanna& C.E.G. Justo, New Chand Bros., Roorkee.

## MCH-204 Computational Lab

L	T	P/D	Total
		4	4

Max. Marks	: 100
Practical	: 60 Marks
Sessional	: 40 Marks
Duration	: 3 Hours

Exposure to various transportation related software's like:

- (i) Rate analysis by MORTH software.
- (ii) IRC software's for pavement design.
- (iii) IRC software's for decision modeling.
- (iv) Software for geometric design.

(Elective Subject)

MCH-401 Statistics and Operation Research

L	T	P	Total
3	1		4

Max. Marks	:100
Theory	:60 Marks
Sessional	:40 Marks
Duration	:3 Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

UNIT-I

Fundamental of Operation Research: Deterministic operations research models. Dynamic programming. Linear programming. Integer programming. Branch and bound technique. Deterministic inventory models. Sequencing problems.

UNIT-II

Classification and Presentation of Data: Basic concepts of probability. Probability axioms. Analysis and treatment of data. Population and samples. Measures of central tendency. Measures of dispersion . Measures of symmetry. Measure of Peakedness .

UNIT -III

Probability Distribution: Discrete and continuous probability distribution functions, binomial, poisson, normal, lognormal , exponential, gamma distribution, extreme value distribution. Transformations of normal distributions. Selecting a probability distribution , Parameter Estimation. Method of moments. Method of maximum likelihood. Probability weighted moment s and least square method. Joint probability distributions .

UNIT-IV

Regression Analysis: Simple linear regression .Evaluation of regression . Confidence intervals and tests of hypotheses. Multiple linear regressions. Correlation and regression analysis.

Recommended Books:

(i) Applied Numerical Methods for Engineers by Akai

(ii) Numerical Recipes -The Art of Scientific Computing by Press, Flannery, Tenksky, Vetterling.

(Elective subject)  
MCH-402 Concrete Technology

L	T	P/D	Total
3	1		4

Max. Marks:	100
Theory	: 60 Marks
Sessional	: 40 Marks
Duration	: 3 Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Concrete as Pavement Material: Introduction. Preparation and grade of concrete.  
Concrete Ingredients: Types of cement. Aggregates. Classification of aggregate. Properties of aggregate. Quality of mixing water. Admixtures.

### UNIT-II

Properties of Concrete: Introduction, workability, stress strain characteristics of concrete, young's modulus of concrete, creep and shrinkage of concrete, permeability, durability of concrete, joints.

### UNIT-III

Production of Concrete: Batching, mixing, transportation, compaction, vibration, curing, formwork removing. Ready mixed concrete.  
Non-Destructive Testing of Concrete: Significance. Rebound hammer. Ultrasonic pulse velocity technique. Penetration technique. Pullout test. Cover meter. Core tests.

### UNIT-IV

Deteriorations: Causes, deteriorations by water, surface wear, frost action, chemical Reaction, corrosion of reinforcement etc, preventive measures.  
Advances in Concrete: Introduction to light weight concrete. High strength concrete. Prestressed concrete. Fibre reinforced concrete. Polymer concrete composites.

Recommended Books:

- (i) M.L.Gambhir, "Concrete Technology" TMH Pub.N Delhi.
- (ii) Shetty M.S. "Concrete Technology" S.Chand & Co.N Delhi.

**(Elective Subject)**

**MCH-403 Project Management**

L	T	P/D	Total
3	1		4

**Max. Marks: 100**

**Theory : 60 Marks**

**Sessional : 40 Marks**

**Duration : 3Hours**

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

**UNIT-I**

Time Estimates: Earliest expected time, latest allowable occurrence time, slack time, earliest start time, earliest finish time, latest start time and latest finish time.

**UNIT-II**

Network Scheduling: Critical path method (CPM). Program evaluation and review technique (PERT). Precedence diagram technique (PDM)

Cost Optimization: Cost slope, crashing critical path, optimum duration.

**UNIT-III**

Updating: Introduction, examples, when to update.

Resource Allocation: Introduction, resource smoothing, resource leveling, Line of balancing technique (LOB). Recourse based network.

**UNIT-IV**

Linear Programming and Critical Path Scheduling: Introduction, standard form, formulation by linear programming, transportation model, method of solution, fictitious cost method, Linear programming and critical path.

**Recommended Books**

- (i) Project Planning & Control with PERT & CPM by B.C.Punmia & K.K.Khandelwal, Lakshmi Pub. Delhi.
- (ii) Construction Management & Planning by B. Sengupta & H. Guha, Tata McGraw -Hills.
- (iii) PERT & CPM -Principles & Applications by L.S Srinath. Affiliated East-West Press (P) Ltd.
- (iv) Construction Planning & Management by P.S. Gellatly & B.M. Dhir, Wiley Eastern Ltd.

(Elective)  
MCH-404 Bridge Engineering

L	T	P/D	Total
3	1		4

Max.Marks: 100	
Theory	: 60 Marks
Sessional	: 40 Marks
Duration	: 3Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

### UNIT-I

Types of Bridges: Consideration of loads and stresses in bridges, bridge loading as per IRC and IRS specifications, traffic lanes, footway, kerbs, railing and parapet loading, impact, wind load, longitudinal forces, temp effects, secondary stresses, erection stresses, earth pressure, effect of live load on back fill and on the abutment.

### UNIT-II

Design of RC Bridges: Slab culvert, box culvert, pipe culvert, T-beam bridge, super structure, design examples, brief introduction to rigid frame, arch and bow string girder bridges. Design of pre-stressed concrete bridges, pre-tensioned and post tensioned concrete bridges, analysis and design of multi-lane prestressed concrete T-beam bridge super structure.

### UNIT- III

Steel Bridges: Types, economical span, loads, permissible stresses, fluctuation of stresses, secondary stresses, plate girder bridges, general arrangement, bridge floors, plate girder railway bridges, deck type plate girder bridges, design example. Truss bridges, types, wind force on lattice girder bridge, bracings, truss bridge for railway- through type truss bridge. Pier, abutment and wing walls, types of piers, forces on piers, stability, abutments, bridge code provisions for abutments, wing walls, design examples.

### UNIT-IV

Bearings: Functions, bearings for steel and concrete bridges, bearings for continuous span bridges, IRC provisions for bearings, fixed bearings, expansion bearings, materials and specifications, permissible stresses, design considerations for rocker and roller cum rocker bearings, sliding bearings. Foundations, types, general design criterion, design of well and pile foundations for piers and abutments.

#### Recommended Books:

- (i) Victor DJ, Essentials of Bridge Engineering, Oxford & IBH Pubb Co.
- (ii) Rowe RE, Concrete ridge Design

MCH-405 Environmental Impact Assessment

L	T	PID	Total
3	1		4

Max. Marks : 100  
Theory : 60 Marks  
Sessional : 40 Marks  
Duration : 3 Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

UNIT-I

Environment and Human Activity: Resources, pollution, reuse and environmental management. Management of Aquatic Environment: Water quality controls. Drainage basin activities and water pollution. The impact of human activity on aquatic resources. The control measures, regional planning.

UNIT-II

Air Quality Management: Atmosphere, effect of human activity on air quality, waste disposal alternative. Optimization, planning of waste disposal.

UNIT-III

Waste Management: Impact of waste disposal of human activity land use management, impact of land use on human life. Control of hazards in land use, management of land use.

UNIT-IV

Environmental Assessment: National environmental policy, implication of environment assessment in design process. Preparation of assessment, quantification. General requirements of environmental standards. Techniques of setting standards. Case studies of EIA of river valley projects and thermal power projects.

Recommended Books

- (i) Environmental Impact Analysis by R.K.Jail and L.V.Urban
- (ii) Environmental Impact Assessment by Canter
- (iii) Environmental Impact Assessment by J.Glasson



(Elective Subject)

### MCH-406 Highway Drainage Systems

L	T	P/D	Total
3	1		4

Max. Marks: 100

Theory : 60 Marks

Sessional : 40 Marks

Duration : 3 Hours

Note for Paper setter: EIGHT questions are to set selecting at least TWO questions from each unit, covering entire syllabus. Students will be required to attempt FIVE questions selecting at least one question from each unit.

#### UNIT-I

Introduction, Importance of drainage, Type of Road Drainage, General Criterion for Road Drainage.

Systems of Drainage: Surface and sub-surface drainage systems.

#### UNIT-II

Internal drainage of pavement structure, components of surface drainage system, surface drains, road side drains, catch water drains, geometric drainage with transverse drains, horizontal drains, sub surface drain in heavy clayey soil, sub surface drain at valley curve I change of grade, capillary cut-off.

#### UNIT-III

Design of surface drainage and subsurface drainage system: Hydrologic analysis, hydraulic analysis, data for drainage design, design steps.

#### UNIT-IV

Cross Drainage, Sub surface drainage, lowering of water table, control of seepage flow, control of capillary rise, design of filter material, drainage of slopes and erosion control, road construction in water logged areas. Drainage in hill road. Drainage systems for Airport and Railways.

Books recommended:

- (i) Highway Engg by S.K. Khanna & C.E.G Justo, Nem Chand Bros., Roorkee.
- (ii) Principles and Practice of Highway Engg by L.R. Kadiyali, Khanna Publishers, Delhi.
- (iii) Rural Road Manual, IRC SP-20

