SWAMI VIVEKANAND UNIVERSITY, SIRONJA, SAGAR (M.P.)

SYLLABUS

For

MASTERS IN TECHNOLOGY

(HIGHWAY ENGINEERING)

Course Code: MTHE

Department of Civil Engineering Faculty of Engineering

Duration of Course: 2 Year
Examination Mode: Semester
Examination System: Grading

Swami Vivekanand University, Sironja, Sagar (M.P.)

2016-2017

MTCEH -0101 - Highway Material and Testing

MARKS 14

Paper Code	Title of the paper	Period Per Week				Distribution of Marks										Grand Total	Duration of Exam
						Theory			TW	Total	Practical		LW	Total			
		L	T	P	C	Max (a)	Min (b)	MST (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)		(i) = (d+h)	
MTCEH - 0101	Highway Material and Testing	3	1	-	4	70	28	20	10	100	-	-	-	-		100	03 Hrs

Unit 1

MARKS 14

Highway Materials

Aggregates, Blending of aggregates by Rothfutch, Triangular Chart, Trial and error and mathematical
proportioning methods. Classification, nomenclature, quality and manufacture of aggregates with respect to
W.B.M., bituminous and concrete roads.
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Unit 2

Bituminous Materials

Classification and various terms used related to tar and bitumen, uses and application of different bituminous materials in highway construction. Origin and preparation of different grades of bitumen and tar used for road construction. The Rheology of bituminous binders, Adhesion of binders to road aggregates and mechanism of stripping and adhesion failures, Weathering of bituminous road materials, Admixtures, rubber, tarbitumen and foam asphalt.

Unit 3

MARKS 14

Bituminous Mixes

Requirements of bituminous mixes. Methods of bituminous mix design and their suitability, advantages and disadvantages. Design of bituminous mixes by Marshall, Hubbard Field, Hveem and Triaxial test methods.

Unit 4

MARKS 14

Materials for Low Cost Roads

Stabilized soils, Lime Fly Ash, Soil-cement and soil-bitumen stabilization. Soft aggregates, low Cement Concrete.

Unit-5

MARKS 14

Cement Concrete Mixes

Proportioning of concrete mixes by absolute volume method, Road Note No. 4 method, Kennedy's method, Talbot Richart method and design method for vibrated concrete.

TEXT BOOKS:

1. P.K.Sinha; Computer Fundamentals -, BPB Publications

2. P.K.Sinha ; Let Us C - P.K.Sinha, BPB Publications

Reference Books:

1. Byron S.Gottfried ; Programming with C - Schaum's Outline Series, Tata McGraw Hill

2. Geoffrey Gordon; System Simulation –

MTCEH -0102 - Transportation Planning

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			TW	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	MST (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH - 0102	Transportation Planning	3	1	-	4	70	28	20	10	100	-	-	-	-	100	03 Hrs

Unit 1 MARKS 14

Transportation planning methodology, hierarchical levels of planning-statewide, regional, urban, passenger and goods transportation. General concept and process of transport planning.

Unit 2 MARKS 14

Urban transportation planning, urban travel characteristics

Private and public, travel behavior analysis, Travel demand estimation and forecasting. Trip classification and socio-economic variables in trip making, trip generation: multiple regression analysis, category analysis, comparative study.

Unit 3 MARKS 14

Modal split analysis

traditional analysis, behavioural approach to mode choice, two-stage modal split models. Trip distribution: Growth factor method, gravity model, intervening opportunity and competing opportunity models, comparative study. Entropy maximizing method and linear programming method in trip distribution.

Unit 4 MARKS 14

Traffic assignment

network assignment, capacity restrained and simultaneous, distribution-assignment methods. Direct demand models of transport planning.

Unit 5 MARKS 14

Land-use transport planning

land-use transport interactions, transport related land-use models, their use in transportation planning. Corridor type travel planning, statewide and regional transportation planning.

TEXT BOOKS:

1. Ammer, D.A. Material Management Irwin Publishers Illionis, 1972.
2. White A.H. Engineering materials, MC Graw - Hill.
3. Deb. A., Engineerig materials, world press.

References :

1. Billmeyer Jr. F.W. Text Book of Polymer Science, Interscience Publishers Inc.
2. Golding Brage Polymers and Resins Nortrand..
3. Schmidt A.X. & Marties CA "Principle of High Polymer Theory & Practice" MC Graw – Hill.
4. Stille, J.K. "Introduction to Polymer Chemistry" Johwiley.
5. Winding C.C. & Hiatt G.D. "Polymetric".

MTCEH-0103- Highway Geometric Design

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			TW	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	MST (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH - 0103	Highway Geometric Design	3	1	-	4	70	28	20	10	100	-	-	-	-	100	03 Hrs

Unit 1 MARKS 14

Design controls and Criteria

Topography and physical features, traffic, impact of vehicular characteristics on road geometrics, speed and safety.

Roadway Capacity Analysis and Design of Lane Requirements

2 lane, 4 lane divided and undivided, multilane, freeway, expressways dams

Unit 2 MARKS 14

Cross-section Elements

Pavement surface characteristics, cross slope, lane width, Curbs, shoulders, drainage channels and side slopes, medians, frontage roads and outer separations. Single lane, 2-lane, 3-lane and multilane highways, freeway and expressways

Sight Distance

Analysis of stopping and passing sight distance, discussions of factors involved, discussion on I.R.C. specifications for measurements of sight distances

Unit 3 MARKS 14

Horizontal Alignment

Principles of horizontal curve design, maximum curvature, superelevation rates, transition curves, super-elevation runoff, attainment of superelevation for undivided and divided highways, distribution of e and f, IRC specifications.Pavement widening on curves, sight distance on horizontal curves

Unit 4 MARKS 14

Vertical Alignment Gradients, compensation of grade at curves, design of climbing lanes, shape of vertical curves, procedure for design of summit and valley curves, design of humps. Combination of horizontal and vertical alignment

Unit 5 MARKS 14

Geometrics of At-grade intersection : Geometric elements, alignment and profile at intersections, median openings, median lanes. Rotary intersection. Geometrics of grade separation and interchanges. Geometric Design for Parking-Parking space design for on street and off-street parking

TEXT BOOKS: .

1. P.K.Sinha ; Let Us C - P.K.Sinha, BPB Publications

2. Byron S.Gottfried ; Programming with C - Schaum's Outline Series, Tata McGraw Hill.

3. Geoffrey Gordon; System Simulation

REFRNCE BOOKS: .

1 P.K.Sinha; Computer Fundamentals -, BPB Publications

2. P.K.Sinha ; Let Us C - P.K.Sinha, BPB Publications

3. Byron S.Gottfried ; Programming with C - Schaum's Outline Series, Tata McGraw Hill

4 Mikell T.Groover; CAD/CAM

MTCEH -0104 - Highway Equipments & Machinery

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH - 0104	Highway Equipments & Machinery	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit 1 **MARKS 14**

Selection of highway equipments; Operating cost; depreciation cost, calculation by different methods; economic life of Highway equipment; manual and mechanical method of Highway construction; Tractors, uses and types, gradability; bulldozers, types, operation; Ripping of rock, types of rippers, economy of ripping rock.

Unit 2 **MARKS 14**

Soil compaction, types of compacting equipments & their output; scrapers, types, operation, cycle time, output, load growth curve; Power shovels, size of power shovel, basic parts and operation, factors affecting output of power shovel; draglines basic parts and operation, factors affecting its output.

Unit 3 **MARKS 14**

Trucks and Wagons, general features, types, matching of size of truck and power shovel; Belt Conveyor, its economy, idlers, power required to drive, driving equipment, hold backs, feeders, trippers; Crushers, Jaw crusher, Roll crusher Road and Ball Mill, selection of crushing equipment, screening aggregate, handling crushed stone aggregate.

Unit 4 **MARKS 14**

Cement concrete mixers, proportioning of concrete mixtures, fresh concrete, batching of concrete materials. Tilting concrete mixer, concrete batching plant, Transit mixer, ready mixed concrete, placing of concrete; vibrators, types, cold water & hot water curing of concrete, slip form pavers.

Unit 5 **MARKS 14**

Construction Techniques of Heavy and Special Structures : Dams, Bridges, large spanroofs, high rise Buildings, off shore Platforms, Pipelines, Tunnels and other undergroundS structures, Safety measures in Construction.

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MTCEH -0105 - ELECTIVE-I ELECTIVE- I
(A) Low Cost Road

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH - 0105(A)	ELECTIVE- I	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit – I MARKS 14

Introduction

Concept, objective, scope and coverage of low cost and rural roads. Significance of low cost roads for developing countries, with special reference to India.

Rural Road Planning and Investment

State of art, review of existing practices and their deficiencies in rural road planning. Socio-economic aspects in planning. Preparation of rural road master plans and their evaluation. Stage constructions and planning, and utilization of successive investments.

Unit – II MARKS 14

Geometrics for Low Cost Rural Roads

Traffic and design speed, horizontal alignment, vertical alignment, and cross section elements.

Unit – III MARKS 14

Pavement Design Aspects for Low Cost Rural Roads

Existing pavement design practices for rural roads. Minimum level of serviceability concept for rural roads. Use of strength index as a substitute to CBR (IRC). Thickness design charts (I.R.C.)

Unit – IV MARKS 14

Materials for Low Cost roads

Stabilized soils. Design of soil-lime, soil-cement, soil-bitumen and soil-lime-fly ash mixes. Use of soft aggregates in low cost roads.

Construction, Operation and Plants

Surveying and setting, Excavation, hauling, shaping and compaction,stabilized soils- spreading, mixing, and compaction. Appropriate technologies, tools, plants and equipments for construction of low cost rural roads I.R.C. practices.

Unit – V MARKS 14

Road Drainage :

Drainage of road surface, pavement layers and cross drainage works. Various low cost drainage alternatives.

Maintenance :

Short term routine maintenance, long term maintenance. Organization and finance for maintenance works.

MTCEH -0105 - ELECTIVE- I
(B) Bituminous Concrete Road Construction

Unit – I **MARKS 14**

Detailed study of Bitumen

Properties, lake asphalt, natural rock asphalt, refinery bitumen, cut back bitumen, emulsion bitumen, tar.

Unit – II **MARKS 14**

Tests on bitumen

different tests procedure, significance in detail,

Unit – III **MARKS 14**

Fatigue test, importance, S-N curve procedure.

Unit – IV **MARKS 14**

Construction

Detailed construction procedure of each type quality control specifications specification of materials, IRC, British specifications.

Unit – V **MARKS 14**

Special verities of bitumen and bituminous Concrete:

Sheet asphalt, mastic asphalt, dense tar surfacing, polymer modified bitumen, rubber modified bitumen.

MTCEH -0105 - ELECTIVE- I
(B)Cement concrete Road Construction

Unit – I **MARKS 14**

Cement Concrete Pavements : Construction methods, quality control, equipments.

Unit – II **MARKS 14**

Joint details : type, dowel bar tie, bar, joint filler and sealer, IRC specifications.

Unit – III **MARKS 14**

Reinforced Cement Concrete pavements : Continuously reinforced concrete pavement, prestressed concrete pavements, necessity of reinforcement in pavements.

Unit – IV **MARKS 14**

Fibre reinforced concrete pavements : Advantages, applications, mix construction procedure.

Unit – V **MARKS 14**

Construction planning & Management : CPM/PERT in cement concrete road construction

MTCEH -0105 - ELECTIVE- I
(D) Advanced Mathematics

Unit – I **MARKS 14**

Numerical solution of Partial Differential Equation (PDE): Numerical solution of PDE of hyperbolic, parabolic and elliptic types by finite difference method.

Unit – II **MARKS 14**

Integral transforms: general definition, introduction to Mellin, Hankel and Fourier transforms and fast Fourier transforms, application of transforms to boundary value problems in engineering.

Unit – III **MARKS 14**

Integral equations: Conversion of Linear Differential equation (LDE) to an integral equation (IE), conversion of boundary value problems to integral equations using Green's function, solution of Integral equation, IE of convolution type, Abel's IE, Integro differential equations, IE with separable variable, solution of Fredholm Equation with separable kernels, solution of Fredholm and Volterra equations by method of successive approximations.

Unit – IV **MARKS 14**

Calculus of Variation: Functionals and their Variational, Euler's equation for function of one and two independent variables, application to enggneerin problems.

Unit – V **MARKS 14**

FEM: Variational functionals, Euler Lagrange's equation, Variational forms, Ritz methods, Galerkin's method, descretization, finite elements method for one dimensional problems.

MTCEH – 0106 LAB-I Highway Lab

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW (g)	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)		(h) = (e+f)	(i) = (d+h)	
MTCEH - 0106	Lab-I Highway	-	-	6	6	-	-	-	-	-	90	36	60	150	150	-

Unit 1

Cpp programming language: Basics of programming, loops, decisions, structures, functions, objects/ classes, arrays.

Unit 2

Overloading, inheritance, virtual functions and pointers, object oriented programming, Turbo Cpp features and programming, structure engineering problems programming.

Unit 3

Computer Aided drafting, 2-D and 3-D drawings, Introduction to CAD software, drawing of buildings.

Unit 4

Introduction to computer graphics, 3-D modeling software and analysis software

Reference Books:

1. Robert Lafore, Object oriented programming in CPP
2. E. Balaguruswamy, Programming in C
3. Syal and Gupta, Computer programming and engineering analysis.
4. AutoCAD, SolidEdge, Cadlab software and Manuals.

IBTMTCEH- 0107- LAB-II CAD

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		TW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH -0107	Lab-II CAD	-	-	6	6	-	-	-	-	-	90	36	60	150	150	-

(A) Construction

Materials: Unit-I

Stones : Occurrence, varieties, Characteristics and their testing, uses, quarring and dressing of stones. Timber : Important timbers, their engineering properties and uses, defects in timber, seasoning and treatment, need for wood substitutes, Alternate materials for shuttering doors/windows, Partitions and structural members etc. Brick and Tiles: Manufacturing , characteristics, Classification and uses, Improved brick from inferior soils, Hand molding brick table, Clay-fly ash brick table, Flooring tiles and other tiles and their characteristics.

Unit-II

Advance Construction Materials : Use of fly ash in mortars, concrete, Fly ash bricks, stabilized mud blocks, non -erodible mud plinth, D.P.C. materials, Building materials made by Industrial & agricultural waste, clay products P.V.C. materials, advance materials for flooring, doors & windows, facia material, interiors materials for plumbing, sanitation & electrification.

(B) Construction Techniques:

Unit-III

Foundation: Type of soils, bearing capacity, soil slablisation and improvement of bearing capacity, settlement and safe limits. Spread foundations, wall footings, grillage, foundations well foundation, causes of failure and remedial measures; under reamed piles, foundation on shrinkable soils, black cotton soil, timbering for trenches, dewatering of foundations. Hyperbolic parabolied footing, Brick arch foundation. Simple methods of foundation design, Damp proof courses, Repairs Techniques for foundations.

Unit-IV

Masonry and Walls : Brick masonry, Bonds, Jointing, Stone masonry, casting and laying, masonry construction, Brick cavity walls, code provisions regarding load bearing and non load bearing walls. Common defects in construction and their effect on strength and performance of walls, designed Brick masonry, precast stone masonry block, Hollow concrete block, plastering and pointing, white and color washing, distempering, dampness and its protection, Design of hollow block masonry walls. Doors, Windows and Ventilators: Types based on material etc., size location, fittings, construction sunshades, sills and jambs, RCC doors/windows frames. Stairs types, rule of proportionality etc., Repairs techniques for masonry, walls, doors & windows.

Unit-V

Floors and Roofs : Types, minimum thickness, construction, floor finishes, Flat roofs,RCC jack arch, reinforced brick concrete, solid slab and timber roofs, pitched roofs, false ceiling, roof coverings, Channel unit, cored unit, Waffle unit, Plank and Joist, Brick panel, L-Panel, Ferrocement roofing units, water proofing .Services : Water supply & Drainage, Electrification,

Fire protection, thermal insulation, Air Conditioning, Acoustics & Sound insulation, Repairs to damaged & cracked buildings, techniques and materials for low cost housing., Repairs techniques for floors & roofs.

References:

Grading IVth Semester w.e.f.2011-12

1. Mohan Rai & M.P. Jai Singh; Advance in Building Materials & Construction,.
2. S.C. Rangwala; Engineering Materials
3. Sushil Kumar; Building Construction,
4. B.C. Punmia; Building Construction ,.
5. Building Construction, Metchell
6. Construction Technology, Chudley R.
7. Civil Engineering Materials, N. Jackson.
8. Engineering Materials, Surendra Singh.

List of Experiments:

1. Tests on Bricks
2. Tests on Aggregates
3. Tests on Cement
4. Determination of compressive strength of concrete with different cement grades.
5. Determination of workability of concrete by slump test
6. Determination of workability by compacting factor apparatus.
7. Determination of workability by Vee Bee consistometer.
8. Nondestructive testing of concrete by Rebound hammer test
9. Nondestructive testing of concrete by ultrasonic Method.
10. Test for the effect of admixtures on the concrete compressive strength
11. Testing of microconcrete
12. Design of concrete mix.

MTCEH-0201 - PAVEMENT ANALYSIS & DESIGN

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-O201	Pavement Analysis & Design	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit 1 MARKS 14

Components of pavement structure, importance of subgrade soil properties on pavement performance. Functions of subgrade, sub-base, base course and wearing course.

Stresses in flexible pavements : Stresses in homogenous masses and layered systems, deflections, shear failures, equivalent wheel and axle loads.

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Unit 2 MARKS 14

Elements in design of flexible pavements : Loading characteristicsstatic, impact and repeated loads, effects of dual wheels and tandem axles, area of contact and tyre pressure, modulus or CBR value of different layers, equivalent single wheel load, equivalent stress and equivalent deflection criterion, equivalent wheel load factors, climatic and environmental factors.Types of distress, structural and functional, serviceability, fatigue cracking, pavement deformation and low temperature shrinkage cracking. Factors affecting performance, relation between performance and distress.

Design methods for flexible pavements : Group Index method, California bearing ratio (CBR) adopted in various countries, Wyoming method, North Dakota Cone Method, U.S. Navy method, Triaxial method, stabilometer method, Mcleod method, Benkelman Beam method, Boussiusq's and Burmister's analysis and design method. AASHTO method of flexible pavements design. Design of flexible airport pavements. Design methodology for low cost pavements.

Unit 3 MARKS 14

Rigid Pavements : Wheel load stresses, liquid and elastic Soil subgrade. Westergaard's analysis, Bradbury's approach Arlington test, Pickett's corner load theory and charts for liquid, elastic and solid of finite and infinite depths of subgrade.

Temperature stresses : Thermal properties of aggregates and concrete. Effect of temperature variation on concrete pavements, Westergaard"s and Thomlinson's analysis of warping stresses, Combination of Stresses due to different causes.Reinforced concrete slabs. Prestressed concrete slabs-general details. Design of tie bars, dowel bars.

Unit 4 MARKS 14

Design methods of rigid pavements : IRC method of design based on fatigue, introduction to Relaibility Analysis, PCA method of design, Road Note 29 method of design and AASHTO method of rigid pavement design.

Unit-5 MARKS 14

Pavement overlays : Flexible overlays and determination of overlay thickness. Rigid overlays and determination of overlay thickness

Swami Vivekanand University, Sagar(M.P.)

MTCEH-0202 -TRAFFIC ENGG. & FIELD STUDIES

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-O202	Traffic Engg. & Field Studies	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit 1 MARKS 14

Introduction Definitions and normal scope of study within traffic engineering.

Traffic Characteristics :

(a) **Road User Characteristics :** General Human characteristics, Physical characteristics-Mental and Emotional factors, reactions to traffic situations, factor affecting reaction time, PIEV-theory.

(b) **Vehicular characteristics :** Vehicular characteristics affecting road design width, height, Length, and other dimensions, Weight, Power, Speed and braking capacity. IRC and international standards for maximum vehicular dimensions and weight, Resistances to tracking and power requirements.

Unit 2 MARKS 14

Various Traffic Studies :

i) Sport speed studies-data analysis and interpretations

ii) Speed and delay studies-Purpose, causes of delay, various methods of speed and delay studies.

iii) Traffic volume studies and characteristic

iv) Origin and destination studies : Various methods of O and D studies and sampling

Unit 3 MARKS 14

Traffic Controls and Operations :

a) Traffic regulations and various means of traffic control, traffic islands and rotaries.

b) Traffic Management-Techniques and applications

c) Roadway Lighting-Design and layout

Unit 4 MARKS 14

Traffic capacity studies-Volume and density relationships, critical density, basic, possible and practical capacities. Factors affecting possible and practical capacities.

ii) Parking studies and characteristics-Public interest in parking studies, cordon count, space inventory, parking practices. Evaluation of parking controls.

iii) Accident studies and characteristics-Causes of accidents, accident studies and records, reports application of accident studies, preventive measures.

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Unit 5 **MARKS 14**

Planning and administration :

i) Major streets and expressways, ribbon development, mass transportation, Traffic Engineering Functions-overall functional planning.

ii) Suitable organisational setup for India-guidelines and experience from other Countries for implementation of traffic engineering functions.

Field studies : Conducting field studies on all aspects as outlined in fourth para above and preparation of reports.

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TEXT BOOKS:

1. HIGHWAY ENGG BY KHANNA AND JUSTO

2. A TEXT BOOK ON HIGHWAY ENGINEERINGS. B. SEHGAL, K. L. BHANOT

References : .

1. TRANSPORTATION ENGINEERING BY B.L.GUPTA AND M.L. GUPTA
2. TRAFFIC & HIGHWAY ENGINEERING NICHOLAS GARBER, LESTER HOEL

MTCEH -0203- HIGHWAY CONSTRUCTION

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-0203	Highway Construction	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit 1 MARKS 14

Classification of types of highway construction, Suitability of each type under Indian conditions. Selection of base course and surface course.

Earthwork and Soling : Selection of soils, construction of emban-kments, excavation and compaction equipments. Field and laboratory tests for quality control. Stone soling, brick soling, current practices. Construction of earth roads, gravel roads, soil stabilised roads, water bound macadam. Paved roads (i) bricks (ii) stones.

Unit 2 MARKS 14

Bituminous Construction : Properties requirements and specifications of materials, equipments and plants. Detailed construction procedure of each type. Field and laboratory tests for quality control. Choice of binders under different conditions. IRC, British, and MOST Specifications.

Recommendations under Indian Conditions : Bituminous surface treatments, interface treatments-primecoat, and tackcoat, surface dressing and seal coat, grouted or penetration macadam, bituminous bound macadam, Sheet asphalt, bituminous concrete, mastic asphalt, dense tar surfacing

Unit 3 MARKS 14

Cement Concrete Road Construction : Necessity of providing a base course under cement concrete road construction. Selection of materials, Constructions methods, detailed construction procedure. Quality control tests (Lab. and Field). Construction equipments.

Joints in Cement Concrete Pavements : Classification of various types of joints, necessity of providing each type, method of construction of joints, load transfer devices, dowel bars, tie bars. Joint filler and sealer materials, IRC specifications.

Unit 4 MARKS 14

Reinforced Cement Concrete Road Construction : Necessity of providing reinforcement in cement concrete pavements, continuously reinforced concrete pavements, prestressed concrete pavements and fibre reinforced concrete pavements prestressed concrete pavements and fibre reinforced concrete pavements. Selection of the mix, compaction method and construction procedure for each type. Recommendations under Indian conditions.

Unit 5 MARKS 14

Construction Planning and Management : CPM/PERT in Highway Construction

Swami Vivekanand University, Sagar(M.P.)

MTCEH-0204 - ELECTIVE- II
(A)Airport Planning and Design

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH 0204	ELECTIVE- II	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit 1 **MARKS 14**

History and development of aviation. Air traffic trend in India, aviation organisations and their functions. Airport Planning. Aircraft characteristics related to airport planning and design, airport master plan, Site selection, air traffic demand analysis and planning surveys, obstruction clearance requirements, airport zoning, airport configuration, hierarchic planning levels

Unit 2 **MARKS 14**

Geometric design of landing area. Airport classification, runway and taxiway geometric standards, exit taxiways, separation and clearances. Capacity and delays, Runway capacity, factors affecting capacity, capacity related and not related with delay, gate capacity.

Unit 3 **MARKS 14**

Terminal area, Facilities to be provided at terminal, space requirements, number and size of gate positions, aircraft parking systems.Visual aids. Airport day time markings, airport lighting, related visual aids, visibility.

Unit 4 **MARKS 14**

Air traffic control. Definition and its importance, flight rules navigational aids, landing aids, VASI, enroute air traffic controls. Heliports and STOL Ports. Heliport site selection, STOL and VTOL aircrafts, STOL ports, obstruction and clearance requirements.

Unit 5 **MARKS 14**

Airport Drainage. Design run-off, Inlet size and location design, surface and sub-surface drainage.

MTCEH-0204 (B) Highway Bridges

Unit – I **MARKS 14**

Bridge site investigation and survey : Site selection, design data collection, different surveys.

Unit – II **MARKS 14**

Bridge hydrology : Scour, depth of foundation, economic span, afflux.

Unit – III **MARKS 14**

Loading Standards : Design loads and forces, Indian loading standards of highway bridges, design of R.C.C. beam and slab bridges.

Unit – IV **MARKS 14**

Bridge Components : Type of foundations, bridge super structure and sub structure, erection of bridges.

Unit – V **MARKS 14**

Testing and strengthening of bridges : Inspection and data collection, bridge failure, fatigue of bridges, S-N curve, strengthening of bridges.

MTCEH-0204 (C)Harbour and Dock Engg.

Unit – I **MARKS 14**

Harbour, parts and natural phenomena : types of harbor, site selection, harbor planning, types of ports, requirements, littoral drift, tides, types, waves and wind.

Unit – II **MARKS 14**

Breakwater : types, tetra pod, mound construction wall breakwater.

Unit – III **MARKS 14**

Docks : Open births, approaches to basin and docks, design and construction of basin or dock wall, dock entrances, repair docks, graving or dry dock, method, forces, floating dry dock.

Unit – IV **MARKS 14**

Entrance locks, Aprons and Transit sheds : Lock foundation, lock gates, general information of Apron, transit sheds.

Unit – V **MARKS 14**

Dredging and navigational aids : disposal of dredged material, types of dredging devices, necessity of signals, types, lighthouse, moorings.

MTCEH-0204 (D) Tunnel Engg.

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-0204	ELECTIVE-II	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit – I **MARKS 14**

General aspects : Tunnel alignment, surveys, design of shape and size.

Unit – II **MARKS 14**

Tunneling methods : Different methods of tunneling in soft soil, Forepoling, needle beam, American, English.

Unit – III **MARKS 14**

Compressed air tunneling in different types of soils : Volume of air required, airholding blows, fire hazard.

Unit – IV **MARKS 14**

Tunneling in rock: Faces of operation, methods, drift, heading and bench, full face, cantilever car dump, mucking.

Unit – V **MARKS 14**

Shafts tunnel lining and tunnel ventilation : Advantages of shaft, size and location, necessity of tunnel lining, materials, design of thickness, objects of ventilation, requirements, volume of air, mechanical ventilation.

MTCEH-0205 - ELECTIVE- III
(A)Highway Subgrade and Foundation Analysis

Unit – I **MARKS 14**

Subgrade : Functions of subgrade, importance of subgrade, importance of subgrade soil properties on pavement performance. Soil Survey-Soil survey procedure for highways and ground water investigations. Identification and significance of soil characteristics. Soil classification for highway engineering purposes-Casagrande, U.S.P.R.A., Unified, C.A.A., Burmister, HRB, FAA and compaction classification and their limitations. Chemical tests for soils. Effect of water in soils-Swelling, shrinkage, cohesion and plasticity in soil

Unit – II **MARKS 14**

Soil-Moisture Movement-Ground water, gravitational water, held water, soil suction.

Drainage : General principles, hydrology, rational methods, hydraulics, flow through open channels, flow through culverts. Subsoil drainage-control of high water table and seepage flow, drainage of fine grained soils.

Unit – III **MARKS 14**

Frost Action in Soils : Evaluation and design of subgrades laboratory strength evaluation, settlement analysis. Stress-strain relationship in soils. Compaction of Soils-Field and laboratory methods and equipments. Field control and subgrade and embankment compaction

Unit – IV **MARKS 14**

Stresses in soils-Theories of elastic and plastic behaviour of soils.

Foundation : Evaluation and design of soil embankments and cutslopes, stability of embankments, methods of reducing settlements. Consolidation of compressible soils estimation of rate of settlement due to consolidation in foundations of road embankments.

Unit – V **MARKS 14**

Construction of high embankments over weak foundations. Various methods of excavation and displacement of soft and swampy soil for the construction of embankments. Vertical Sand Drains : Design criteria, construction and uses.

MTCEH-0205(B) Advances of Concrete Technology

Unit – I **MARKS 14**

Introduction to concrete : Concrete materials & its testing, general, compression test, flexural test, fatigue test, S-N curve.

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Unit – II **MARKS 14**

Concrete Mix Design : Concept of mix design, methods of proportioning, various methods of mix design sampling & acceptance criteria,

Unit – III **MARKS 14**

Special concrete & concreting method : Light wt. concrete, Aerated concrete, Higher Density concrete, sulphur infiltrated concrete, Ferro-cement

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Unit – IV **MARK 4**

Fibre reinforced concrete : Fibre used, factor effecting properties, relative fibre matrix stiffness, volume of fibre aspect ratio of fibres, orientation of fibre workability, application, Glass FRC, current development in FRC, High Fibre volume Micro fibre system, compact reinforced composites.

Unit – V **MARKS 14**

Polymer concrete : Types; polymer impregnated concrete, PCC, Polymer concrete, partially impregnated concrete, creep, shrinkage due to polymerization, durability fracture of polymer impregnated concrete application of polymer impregnated concrete.

MTHE 0205 (C)Fiber Reinforced Concrete

Unit – I **MARKS 14**

Introduction, properties of Fiber reinforced Concrete: Types of fibers, factors affecting properties, advantages, disadvantages.

Unit – II **MARKS 14**

Testing of Fiber reinforced Concrete: Compressive Strength, Flexural Strength, Ultrasonic test, fatigue test, S-N Curve.

Unit – III **MARKS 14**

Mix of Fiber reinforced Concrete: Factors affecting mix design, volume of fibers, net air voids, mixing in concrete mixer, problems in mixing, solution.

Unit – IV **MARKS 14**

Applications, glass fiber reinforced cement: Various applications, general information's of glass fiber reinforced cement.

Unit – V **MARKS 14**

Current development in fiber reinforced concrete: High fiber volume micro-fiber system, slurry infiltrated fiber concrete, compact reinforced composites.

MTCEH 0205 (D)Advanced Highway Equipments

Unit – I **MARKS 14**

Selection of equipment, Tractors and related equipment: Equipment selection, operating and owning cost, depreciation cost, calculation, types of tractors, bulldozer, scraper, and ripper.

Unit – II **MARKS 14**

Excavating equipment: power shovel, drag line, output, basic operation

Unit – III **MARKS 14**

Trucks and wagons, Belt conveyor system: types of trucks, capacity, matching of size of truck and power should general information of belt conveyor systems, idlers, power requirement analysis, holdback.

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Unit – IV **MARKS 14**

Drilling of rock and earth, blasting of rock : technical terms of drilling, types of drills, selection of drilling machine, technical terms of blasting of rock, types of explosives, handling misfire, spacing of blast holes.

Unit – V **MARKS 14**

Concrete and related equipment : proportioning concrete mixtures, batching, ready mixed concrete, concrete mixer, vibrators, shuttering.

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MTCEH – 0206 LAB-III Advanced Highway Lab. – III

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-0206	Advanced Highway Lab. – III	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit 1

Cpp programming language: Basics of programming, loops, decisions, structures, functions, objects/ classes, arrays.

Unit 2

Overloading, inheritance, virtual functions and pointers, object oriented programming, Turbo Cpp features and programming, structure engineering problems programming.

Unit 3

Computer Aided drafting, 2-D and 3-D drawings, Introduction to CAD software, drawing of buildings.

Unit 4

Introduction to computer graphics, 3-D modeling software and analysis software

Reference Books:

1. Robert Lafore, Object oriented programming in CPP
2. E. Balaguruswamy, Programming in C
3. Syal and Gupta, Computer programming and engineering analysis.
4. AutoCAD, SolidEdge, Cadlab software and Manuals.

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MTCEH- 0207- LAB-IV Advanced Highway Lab. – IV

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-O207	Advanced Highway Lab – IV	3	1	4		70	28	10	20	100	-	-	-	-	100	03 Hrs

Unit-I MARKS 14

Stones : Occurrence, varieties, Characteristics and their testing, uses, quarring and dressing of stones. Timber : Important timbers, their engineering properties and uses, defects in timber, seasoning and treatment, need for wood substitutes, Alternate materials for shuttering doors/windows, Partitions and structural members etc. Brick and Tiles: Manufacturing , characteristics, Classification and uses, Improved brick from inferior soils, Hand molding brick table, Clay-fly ash brick table, Flooring tiles and other tiles and their characteristics.

Unit-II MARKS 14

Advance Construction Materials : Use of fly ash in mortars, concrete, Fly ash bricks, stabilized mud blocks, non-erodible mud plinth, D.P.C. materials, Building materials made by
Industrial & agricultural waste, clay products P.V.C. materials, advance materials for flooring, doors & windows, facia material, interiors materials for plumbing, sanitation & electrification.

Unit-III MARKS 14

Foundation: Type of soils, bearing capacity, soil slablisation and improvement of bearing capacity, settlement and safe limits. Spread foundations, wall footings, grillage, foundations well foundation, causes of failure and remedial measures; under reamed piles, foundation on shrinkable soils, black cotton soil, timbering for trenches, dewatering of foundations. Hyperbolic parabolied footing, Brick arch foundation. Simple methods of foundation design, Damp proof courses, Repairs Techniques for foundations.

Unit-IV MARKS 14

Masonry and Walls : Brick masonry, Bonds, Jointing, Stone masonry, casting and laying, masonry construction, Brick cavity walls, code provisions regarding load bearing and non load bearing walls. Common defects in construction and their effect on strength and performance of walls, designed Brick masonry, precast stone masonry block, Hollow concrete block, plastering and pointing, white and color washing, distempering, dampness and its protection, Design of hollow block masonry walls. Doors, Windows and Ventilators: Types based on material etc., size location, fittings, construction sunshades, sills and jambs, RCC doors/windows frames. Stairs types, rule of proportionality etc., Repairs techniques for masonry, walls, doors & windows.

Unit-V MARKS 14

Floors and Roofs : Types, minimum thickness, construction, floor finishes, Flat roofs,
RCC jack arch, reinforced brick concrete, solid slab and timber roofs, pitched roofs, false ceiling, roof coverings, Channel unit, cored unit, Waffle unit, Plank and Joist, Brick panel, L-Panel, Ferrocement roofing units, water proofing .Services : Water supply & Drainage, Electrification,

Fire protection, thermal insulation, Air Conditioning, Acoustics & Sound insulation, Repairs to damaged & cracked buildings, techniques and materials for low cost housing., Repairs techniques for floors & roofs.

References:

Grading IVth Semester w.e.f.2011-12

1. Mohan Rai & M.P. Jai Singh; Advance in Building Materials & Construction,.
2. S.C. Rangwala; Engineering Materials
3. Sushil Kumar; Building Construction,
4. B.C. Punmia; Building Construction ,.
5. Building Construction, Metchell
6. Construction Technology, Chudley R.
7. Civil Engineering Materials, N. Jackson.
8. Engineering Materials, Surendra Singh.

List of Experiments:

1. Tests on Bricks
2. Tests on Aggregates
3. Tests on Cement
4. Determination of compressive strength of concrete with different cement grades.
5. Determination of workability of concrete by slump test
6. Determination of workability by compacting factor apparatus.
7. Determination of workability by Vee Bee consistometer.
8. Nondestructive testing of concrete by Rebound hammer test
9. Nondestructive testing of concrete by ultrasonic Method.
10. Test for the effect of admixtures on the concrete compressive strength
11. Testing of microconcrete
12. Design of concrete mix.

MTCEH-0301 ELECTIVE IV
(A) Traffic Management and Design

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-O301	ELECTIVE IV	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

UNIT 1. **MARKS 14**

Principles and methodology of Traffic Management. Traffic Systems Management-an overview. Various techniques of management, Regulatory management systems, Cybernetics, applications to traffic management systems. Directional flow management, unbalanced flow, exclusive bus lanes.

UNIT 2. **MARKS 14**

Speed Control and Zoning, Parking Control-midblock and intersection area management. Traffic Segregation and channelization. Principles and design of Traffic Signs, their placement, visibility, sign information, letter size design, symbolic sign design, universal signs.Pavement markings, design details, delineation of pavement markings, delineators for road bridges, markings in overall management.

UNIT 3. **MARKS 14**

Signalisation : Design-cycle, phase, turn-control signal, pedestrian signal-various criteria and design considerations. Signal indictions and their appropriateness, coordination of signals. Signal preemption for priority movement-principles and design. Filter signals.

UNIT 4. **MARKS 14**

Traffic system management-route and network management. Area traffic management. City wide traffic control and management, centralised data processing and monitoring system.

UNIT 5. **MARKS 14**

Evaluation of traffic design for management. Before and after study technique, evaluation procedure and methodology, system performance evaluation.

MTCEH-0301 (B) Transportation System Analysis

UNIT 1. **MARKS 14**

Concept of a system, system elements and system attributes.Components of transportation system, transport technology, transportation networks, vehicles and containers

UNIT 2. **MARKS 14**

Transportation system and its environment, cost concepts, cost estimating methods, standardised cost models, transportation demand and projection techniques, theory of transportation supply relationships for an urban transit line, elasticity models.

UNIT 3. **MARKS 14**

Operational plans, components of operation flow, analysis of a single line, network relationships, management of facility use, carrier operations planning, integrated operations.

UNIT 4. **MARKS 14**

Transportation network flows, theory of network equilibrium, traffic assignment, monitoring and control, performance analysis and reporting

UNIT 5 **MARKS 14**

Environmental impacts, A conceptual framework, impacts on the natural environment noise and pollution, impact on land-use and value.

MTCEH-0302 ELECTIVE V
(A) Pavement System Management

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		TW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-O302	ELECTIVE V	3	1	-	4	70	28	10	20	100	-	-	-	-	100	03 Hrs

UNIT 1. **MARKS 14**

Pavement Management Process : Introduction, General nature and appliability of systems methodology. Basic components of pavement management system, planning pavement investments, pavement research management.

UNIT 2. **MARKS 14**

Pavement Evaluation and Performance : General concept of pavement evaluation, evaluation of pavement performance, evaluation of pavement structural capacity, evaluation of pavement distress, evaluation of pavement safety.

UNIT 3. **MARKS 14**

Design Alternatives-Analysis, evaluation and selection : Framework for pavement design, design objectives and constraints, asic structural response models, characterization of physical design inputs, Generating alternative pavement design strategies.

UNIT 4. **MARKS 14**

Economic evaluation of alternative pavement design strategies, analysis of alternative design strategies. Predicting distress, predicting performance, selection of optimal design strategies

UNIT 5. **MARKS 14**

Implementation : Implementation of a pavement management system, construction, maintenance and rehabilitation. Feedback data system. Examples of working design and management systems

MTCEH-0302 (B) Transportation Economics, Project Evaluation and Appraisal

UNIT 1. **MARKS 14**

Principles Z: Purpose and major considerations in Transport Economic analysis. Identification and measurement of transportation costs and benefits.

UNIT 2. **MARKS 14**

Cost and benefits. Capital cost, inflation cost, interest during construction, maintenance cost, road user costs, vehicle operating cost, accident cost, congestion cost and pricing, non-user cost and consequences. Savings and benefits, road-user benefits and consumer surplus. Social costs and benefits from transportation project options. Interest and vestcharge, concept of interest and vestcharge, rate of vestcharge, compound interest equations

UNIT 3. **MARKS 14**

Methods of economic analysis, characteristics and basic understanding of the methods. Comparisons and limitations of various methods, ranking of independent alternative projects

UNIT 4. **MARKS 14**

Techno-economic feasibility studies and evaluation of alternative projects. Welfare economics, evaluation and appraisal of transport investments.

UNIT 5. **MARKS 14**

Special considerations for transportation economics in analysis for developing countries. Appraisal and evaluation of economic consequences of an urban bypass.

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MTCEH-0303 Project/Seminar

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-0303	Project	-	-	4	4	-	-	-	-	-	100	30	-	100	100	-

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MTCEH- 0304 Dissertation Part-I
(Literature Review/Problem Formulation/ Synopsis)

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max	Min	TW		(d) =	Max	Min		(h) =	(i) =	
						(a)	(b)	(c)	(d)	(a+c+d)	(e)	(f)	(g)	(e+f)	(d+h)	
MTCEH-0304	Dissertation Part- I	-	-	8	8	-	-	-	-	-	120	48	80	200	200	

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MTCEH-0401 Dissertation Part- II

Paper Code	Title of the paper	Period Per Week				Distribution of Marks									Grand Total	Duration of Exam
						Theory			MST	Total	Practical		LW	Total		
		L	T	P	C	Max (a)	Min (b)	TW (c)	(d)	(d) = (a+c+d)	Max (e)	Min (f)	(g)	(h) = (e+f)	(i) = (d+h)	
MTCEH-0401	Dissertation Part- II	-	-	20	20	-	-	-	-	-	300	120	200	500	500	03 Hrs