SARDAR RAJA COLLEGE OF ENGINEERING

ALANGULAM

DEPARTMENT OF CIVIL ENGINEERING

MICRO LESSON PLAN

SUBJECT NAME : HIGHWAY ENGINEERING

SUBJECT CODE : CE 2255

YEAR/SEM : II / IV

BRANCH : CIVIL ENGINEERING

STAFF NAME: Prof.R.MURUGESHWARI,

A.P, DEPT. OF CIVIL ENGG.

CE2255 HIGHWAY ENGINEERING L T P C
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OBJECTIVE

The objective of the course is to educate the students on the various components of Highway Engineering. It exposes the students to highway planning, engineering surveys for highway alignment, Design of Geometric Elements of Highways and Urban roads, Rigid and Flexible pavements design. The students further learn the desirable properties of highway materials and various practices adopted for construction. This course enables the students to develop skill on evaluation of the pavements and to decide appropriate types of maintenance.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of Road Construction, Highway Development in India - Jayakar Committee Recommendations and Realisations, Twenty-year Road Development Plans, Concepts of Ongoing Highway Development Programmes at National Level, Institutions for Highway Development at National level - Indian Roads Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute. Requirements of Ideal Alignment, Factors Controlling Highway Alignment Engineering Surveys for Alignment - Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques) Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards], Cross sections of different Class of Roads - Principles of Highway Financing

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Design of Horizontal Alignment – Horizontal Curves Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves- Sight Distances – Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD] -Geometric Design of Hill Roads [IRC Standards Only]

UNIT III FLEXIBLE AND RIGID PAVEMENTS 9

Rigid and Flexible Pavements- Components and their Functions -Design Principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements - ESWL, Climate, Sub-grade Soil and Traffic - Design Practice for Flexible Pavements [IRC

Method and Recommendations- Problems] - Design Practice for Rigid Pavements – IRC Recommendations - concepts only.

UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE 9

Desirable Properties and Testing of Highway Materials: Soil – California Bearing Ratio Test, Field Density Test - Aggregate - Crushing, Abrasion, Impact Tests, Water absorption, Flakiness and Elongation indices and Stone polishing value test - Bitumen - Penetration, Ductility, Viscosity, Binder content and Softening point Tests. - Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications] - Highway Drainage [IRC Recommendations]

UNIT V HIGHWAY MAINTENANCE 9

Types of defects in Flexible pavements – Surface defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments. - Types of Pavement, Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs. - Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only],

TOTAL: 45 PERIODS

TEXT BOOKS

1. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.
2. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2000.

REFERENCES

1. Transportation Engineering & Planning, C.S. Papacostas, P.D. Prevedouros, Prentice Hall of India Pvt ltd, 2006.
2. IRC Standards (IRC 37 - 2001 & IRC 58 -1998)
3. Bureau of Indian Standards (BIS) Publications on Highway Materials
4. Specifications for Road and Bridges, MORTH (India)

SUBJECT DESCRIPTION AND OBJECTIVES

OBJECTIVE

The objective of the course is to educate the students on the various components of Highway Engineering. It exposes the students to highway planning, engineering surveys for highway alignment, Design of Geometric Elements of Highways and Urban roads, Rigid and Flexible pavements design. The students further learn the desirable properties of highway materials and various practices adopted for construction. This course enables the students to develop skill on evaluation of the pavements and to decide appropriate types of maintenance.

SUBJECT DESCRIPTION

Highway inspections are necessary to identify defects, the need for routine/planned maintenance work and unlawful obstruction/interference with the highway. To ensure a consistent countywide approach a system of inspections, assessment methodology, recording and actioning of highway defects has been adopted.There are four ypes of highway inspections carried out on Devon's highways. These are:

- **Scheduled Inspections** carried out to identify highway defects, obstruction or interference that are deemed to be a danger to highway users and so require immediate attention to protect the highway user and keep the highway safe.
- **Condition Inspections** carried out to assess the condition of the network and the need for planned structural maintenance.
- **Specific Inspections** undertaken following a particular request, need or demand, where there are exceptional circumstances or in response to claims being made against the Highway Authority.
- **Random Inspections** undertaken on an ad hoc basis.

MICRO LESSON PLAN

No.of Hours	LECTURE TOPICS	READINGS
UNIT I - HIGHWAY PLANNING AND ALIGNMENT		
1	History of Road Construction, Highway Development in India - Jayakar Committee Recommendations and Realisations, Twenty-year Road Development Plans	T1
2	Concepts of Ongoing Highway Development Programmes at National Level, Institutions for Highway Development at National level	T1
3	Indian Roads Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute	T1
4	Requirements of Ideal Alignment, Factors Controlling Highway Alignment Engineering Surveys for Alignment	T1
5	Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques)	T1
6	Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements	T1
7	Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards]	T1
8	Cross sections of different Class of Roads	T1
9	Principles of Highway Financing	T1
UNIT II - GEOMETRIC DESIGN OF HIGHWAYS		
10	Design of Horizontal Alignment	T1
11	Horizontal Curves Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves Design of Vertical Alignments	T1
12	Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves	T1
13	Sight Distances	T1
14	Factors affecting Sight Distances	T1
15	PIEV theory	T1
16	Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections,	T1
17	Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD andOSD]	T1

18	Geometric Design of Hill Roads [IRC Standards Only]	T1
UNIT III - FLEXIBLE AND RIGID PAVEMENTS		
19	Rigid and Flexible Pavements	T1
20	Components and their Functions	T1
21	Design Principles of Flexible Pavements	T1
22	Design Principles of Rigid Pavements	T1
23	Factors affecting the Design of Pavements	T1
24	ESWL, Climate, Sub-grade Soil and Traffic	T1
25	Design Practice for Flexible Pavements [IRC Method and Recommendations- Problems]	T1
26	Design Practice for Rigid Pavements	T1
27	IRC Recommendations - concepts only.	T1
UNIT IV - HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE		
28	Desirable Properties and Testing of Highway Materials	T1
29	Soil – California Bearing Ratio Test, Field Density Test	T1
30	Aggregate - Crushing, Abrasion, Impact Tests,	T1
31	Water absorption, Flakiness and Elongation indices and Stone polishing value test	T1
32	Bitumen	T1
33	Penetration, Ductility, Viscosity, Binder content and Softening point Tests	T1
34	Construction Practice - Water Bound Macadam Road	T1
35	Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications]	T1
36	Highway Drainage [IRC Recommendations]	T1

UNIT V - **HIGHWAY MAINTENANCE**		
37	Types of defects in Flexible pavements	R1
38	Surface defects, Cracks, Deformation, Disintegration	R1
39	Symptoms, Causes and Treatments	R1
40	Types of Pavement, Failures in Rigid Pavements	R1
41	Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping	R1
42	Pavement Evaluation	R1
43	Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening	R1
44	Special Repairs	R1
45	Overlay design by Benkelman Beam Method [Procedure only],	R1