

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE**PERAMBALUR-621212****COURSE PLAN**

Course Code/Name	U23CET45 /HIGHWAY ENGINEERING			
Year/Section/Department	II/CIVIL ENGINEERING			
Credits Details	L:3	T:0	P:0	C:3
Total Contact Hours Required	45 HOURS			

Syllabus:

UNIT I/ HIGHWAY PLANNING AND ALIGNMENT	No. of Periods:9
History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Road ecology -Engineering surveys for alignment, objectives, conventional and modern methods..	
UNIT II/ GEOMETRIC DESIGN OF HIGHWAYS	No. of Periods:9
Dynamic equations of gradually varied flows –Types of flow profiles- classifications: computation by direct step method and Standard step method, - Control section –Break in Grade – Computation.	
UNIT III/ DESIGN OF FLEXIBLE AND RIGID PAVEMENTS	No. of Periods:9
Design principles – pavement components and their role - Design practice for flexible and rigid pavements	
UNIT IV/ HIGHWAY CONSTRUCTION AND MAINTENANCE	No. of Periods:9
Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavements including modern materials and methods, Highway drainage – Special Considerations for hilly roads; Evaluation and Maintenance of pavements.	
UNIT V/ HIGHWAY ECONOMICS AND FINANCE	No. of Periods:9
Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis,	

Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.

Objective:

1. To know the History of road development in India and factors alignment.
2. To understand concept of Geometric design of roads and various aspects of traffic engineering.
3. To design the flexible and rigid pavements
4. To study the highway design, construction and maintenance of highways.
5. Highway Costs, Vehicle Operation Costs, Economic analysis

Text Book:

T1:Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.

T2: Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers, 2017.

Reference Book:

- R1.** C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press` (India) Private Limited, Hyderabad, 2015.
- R2.** Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision),IRC: 37-2012
- R3.** Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC: 58-2012
- R4.** Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.
- R5.** Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010

Website:

W1. <https://www.youtube.com/watch?v=IY4fFH9ZEoU>

W2 . <https://www.youtube.com/watch?v=cuAAo14FkRQ&list=PLSNhedsleX13gMbiKG5L2VIOpQi4vxrbC>

Offline Mode of Study (if Any):

- ❖ <http://nptel.ac.in/courses/105107059/7>
- ❖ <http://nptel.ac.in/courses/105107059/2>

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I-HIGHWAY PLANNING AND ALIGNMENT						
1	Significance of highway planning	T2, R3	634-635, 737-738	Offline	1	1
2	Modal limitations towards sustainability	T2,W1	636	Offline	1	2
3	History of road development in India	T3	19-26	Offline	1	3
4	Factors influencing highway alignment	T2, T3	637 5-6	Offline	1	4
5	Soil suitability analysis - Road ecology	T3	85,89-90	Offline	1	5
6	Engineering surveys for alignment, objectives, conventional and modern methods.	T2,W1	644-648	Offline	1	6
7	Classification of highways	T2	652	Offline	1	7
8	Locations and functions	T2	653-655	Offline	1	8
9	Typical cross sections of Urban and Rural roads.	T2, R3	653-655, 777-779	Offline	1	9

Outcome of Unit I:

At the end of the unit,

❖ Students will be able to Get knowledge on planning and aligning of highway.

UNIT II-GEOMETRIC DESIGN OF HIGHWAYS

10	Cross sectional elements	T2 R3	704-709, 790	Offline	1	10
11	Sight distances	T3	366-388	Offline	1	11
12	Horizontal curves, Super elevation,	T2, T3	709-711, 160-166	Offline	1	12
13	transition curves, widening at curves	T2, T3	709-711, 160-166	Offline	1	13
14	Vertical curves Gradients,	T2	719-720	Offline	1	14
15	Special consideration for hill roads	T2	717-718	Offline	1	15
16	Hairpin bends	T2	718-719	Offline	1	16
17	Lateral and vertical clearance at underpasses.	T2,W2	221	Offline	1	17
18	IRC standards-Road signs	T2, R3	704-709, 790	Offline	1	18

Outcome of Unit II:

At the end of the unit,

❖ Geometric design of highways

UNIT III-DESIGN OF FLEXIBLE AND RIGID PAVEMENTS

19	Design principles	T3	22	Offline	1	19
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20	Pavement components and their role	R3	332-334	Offline	1	20
21	Design practice for flexible and rigid Pavements (IRC methods only)	R3	780-782	Offline	1	21
22	ESWL	T3	249-250	Offline	1	22
23	Pavement Components Materials	T2	720-725	Offline	1	23
24	CBR	T3,W3	279-281	Offline	1	24
25	Tri axial method	T2	728-733	Offline	1	25
26	Design practice for flexible and rigid Pavements (IRC methods only)	R3	780-782	Offline	1	26
27	Embankments.	T2	720-725	Offline	1	27

Outcome of Unit III:

At the end of unit,

- Design flexible and rigid pavements

UNIT IV -HIGHWAY CONSTRUCTION AND MAINTENANCE

28	Highway construction materials	R3	803-850	Offline	1	28
29	properties, testing methods	T2, R3,W4	915-919, 853-856	Offline	1	29
30	Construction practice of flexible	T2, R3	927-928, 877-893	Offline	1	30

31	concrete pavements including modern materials and methods	T2, R3	928-932, 895-902	Offline	1	31
32	Highway drainage	T2, R3,W4	933, 915-920	Offline	1	32
33	Special Considerations for hilly roads;	T2,W4	935-937	Offline	1	33
34	Evaluation and Maintenance of pavements.	T2	927	Offline	1	34
35	Abrasion Test	T2, R3	943, 920-921	Offline	1	35
36	Test on Bituminous Surface	T2,W4	769-771	Offline	1	36

Outcome of Unit IV:

At the end of unit,

- ❖ Gain knowledge on Highway construction materials, properties, testing methods

UNIT V-HIGHWAY ECONOMICS AND FINANCE

37	Highway User Benefits	T2, R3,W4	1059- 1075, 945-965	Offline	1	37
38	Highway Costs	T2, R3	1086- 1088, 980-985	Offline	1	38
39	Vehicle Operation	T2,	1079-	Offline	1	39

	Costs	R3	1080, 968-970			
40	Economic analysis,	T2	1016-102	Offline	1	40
41	Highway projects under Public-	T2, R3	1021, 996	Offline	1	41
42	Bidding process	R5	5.105	Offline	1	42
43	Highway finance.	T2, R3,W4	1032- 1039, 1021- 1030	Offline	1	43
44	Highway Contracts	R3	1066	Offline	1	44
45	Highway Private Sector Participation	R3	945-965	Offline	1	45

Outcome of Unit V:

At the end of unit,

- ❖ Understand the concept of pavement management system, evaluation of distress and maintenance of pavements.

Course Outcome:

At the end of course:

Students should be able to do:

CO1: Students will be able to Get knowledge on planning and aligning of highway

CO2: Geometric design of highways

CO3: Design flexible and rigid pavements.

CO4: Gain knowledge on Highway construction materials, properties, testing methods

CO5: Understand the concept of pavement management system, evaluation of distress and maintenance of pavements.

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓						✓					
CO 2	✓	✓					✓			✓		
CO 3	✓	✓		✓			✓	✓		✓		
CO 4	✓	✓		✓			✓	✓	✓	✓		
CO 5	✓	✓		✓			✓	✓	✓	✓		

Assignment:

Batch Details	Register Number	Total Nos	Mode of Assignment	Topics
I	810421103001- 810421103052, 810421103301- 810421103312	57	Assignment	
			Poster Presentation/PPT	
II	810421103001- 810421103052, 810421103301- 810421103312	57	Assignment- Seminar	
			Case Study Report/Mini Project/Model	
III	810421103001- 810421103052, 810421103301- 810421103312	57	Technical Aptitude- Objective	

SIM Questions:

SIM 1	<ol style="list-style-type: none"> 1. Describe the development of roads in India during British period. 2. Explain in detail about second twenty year road plan. 3. Compare the three twenty year road development plan in India. 4. Explain the different components of the National Highway Development Programme. 5. Briefly explain the role of MORTH and IRC in highway development. 6. Explain the activities of National Highways Authority of India. 7. Write brief about on: <ul style="list-style-type: none"> Central Road congress (CRF) *Indian Road congress(IRC) *Central Road Research Institute(CRRI) *National Highway Authority of India (NHAI) 8. Describe the functions and responsibility of the following institutions. 9. Describe the requirement of ideal highway alignment.(or)Explain the requirement of ideal alignment. 10. Explain with neat sketches, any four factors controlling the alignment of roads. 11. State and explain the economic factors influencing highway alignments. 12. Explain the three stages in conventional ground survey.
SIM 2	<ol style="list-style-type: none"> 1. Calculate the length of transition curve and shift using the following data: <ul style="list-style-type: none"> (i) Design speed=70 KMPH (ii) Radius of circular curve=250m (iii) Pavement width including extra widening=7.5m Allowable rate of introduction of super elevation (pavement rotated about the centre line)=1 in 150. 2. State the factors influencing the overtaking sight distance. 3. Derive an equation for calculating overtaking sight distance in level surface. 4. Distinguish between overtaking sight distance and intermediate sight distance. How will you calculate these? 5. The speeds of overtaking and overtaken vehicles are 80 and 50 KMPH respectively on a two way traffic road. If the acceleration of the overtaking vehicle is 0.9m/sec^2. <ul style="list-style-type: none"> (i) Calculate the safe overtaking sight distance. (ii) Mention the minimum length of overtaking zone. Draw a neat sketch of the overtaking zone and show the position of the sign posts. 7. Calculate the SSD for design speed of 70 kmph for two way traffic and one way traffic road. Take reaction time = 2.5 seconds and coefficient of friction = 0.35. 8. Calculate the stopping sight distance required to avoid head on collision of two cars

	<p>approaching from opposite directions at a speed of 75 kmph and 85 kmph. Assume that the reaction time of drivers be 2.5 secs and coefficient between road surface and tyres be 0.4.</p> <p>9. What are the objectives of widening of road pavement at horizontal curves? Derive an expression for the extra widening.</p> <p>10. Explain the reasons for widening of pavements on horizontal curves.</p> <p>12. The following are the details, pertaining to the road:</p> <p style="padding-left: 20px;">Pavement width = 7m</p> <p style="padding-left: 20px;">Radius of curve = 200m</p> <p style="padding-left: 20px;">Maximum length of wheel base = 6m</p> <p style="padding-left: 20px;">Design speed = 70 km/hr</p> <p>Calculate the extra widening required in the curved portion.</p>
SIM 3	1.

Submission Details:

Phase 1 (Before AT 1)		Phase 2 (Before AT 2)		Phase 3 (Before AT 3)	
Assignment 1	SIM 1	Assignment 2	SIM 2	Assignment 3	SIM 3