ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

April/may 2024

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, L.
CIVIL ENGINEERING
CE5402 HIGHWAY ENGINEERING (E&T)
SEMESTER- IV
(Regulation 2019)

Time: 3hrs   Max.Marks: 100

CO 1	Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures.
CO 2	Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts.
CO 3	Designing various types of pavements to meet specified needs of safety, efficiency and longtime sustainability by adopting various design standards.
CO 4	Select appropriate methods for construction, evaluation and maintenance of roadways.
CO 5	Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	List the classification of Urban roads	2	1	L1
2	What are the major agencies involved in road construction and planning in India	2	1	L1
3	What is a camber, list the shapes and the function of camber	2	2	L2
4	What are the two effects when the vehicle traverses a horizontal curve	2	2	L4
5	Explain the concept of flexible pavement design	2	3	L3
6	What are the critical location for stresses in Rigid pavement. Give illustration	2	3	L3
7	What are the different tests on road aggregates	2	4	L1
8	What are the different failures of rigid pavements	2	4	L1
9	State the benefits of highway improvement	2	5	L3
10	What are the sources of revenue for the government for road improvement	2	5	L4

PART- B (5 x 13 = 65 Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks	CO	BL
11 (a) (i)	What are the different stages of surveying and explain the steps involved	7	1	L2

			Marks	CO	BL
(ii)	Explain in detail the classification of different types of roads	6	1	L2
	Or				
11 (b) (i)	Enumerate on the effect of construction on road ecosystem interaction	7	1	L2
(ii)	What is highway alignment and explain the factors affecting the Highway alignment	6	1	L2
12 (a) (i)	List the different road margins provided and brief on them with illustration	7	2	L2
(ii)	Explain PIEV theory with illustration and example	6	2	L3
	Or				
12 (b) (i)	The design speed of a highway is 80kmph. The radius of horizontal curve is 200m. The transverse coefficient of friction is 0.15 (i) Calculate the superelevation required to maintain this speed (ii) If the maximum superelevation of 0.07 is not to be exceeded. Calculate the maximum allowable speed on this horizontal curve as it is not possible to increase the radius	7	2	L2
(ii)	What is widening of pavement on horizontal curve. Derive the expression for the extra width of pavement on horizontal curve	6	2	L3
13 (a) (i)	Design a new flexible pavement for a two-lane undivided carriageway using the following data Design CBR value of subgrade=4% Initial traffic on completion of construction =300 cv perday Average growth rate=6.0% per year Design life=10 years VDF=2.5	13	3	L4
	Or				
13 (b) (i)	Explain the temperature effects on the rigid pavement with illustration. Give the notations of the temperature stresses at the critical locations of the pavement	13	3	L4
14 (a) (i)	List the different tests on Bitumen and explain two of them in detail	13	4	L3
	Or				
14 (b) (i)	What are the different distresses in the flexible pavements, illustrate with reference to different layers	13	4	L3
15 (a) (i)	Explain the general benefits, quantifiable and non-quantifiable benefits for the highway users	13	5	L4
15 (b) (i)	What are the factors to be considered in the vehicle operation cost and the state the various factors to be considered in the computing of Annual highway cost	13	5	L4

PART- C (1 x 15 = 15 Marks)
(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	The speeds of overtaking and overtaken vehicles are 70 and 40 kmph respectively on a two-way traffic road. The average acceleration during overtaking may be assumed as 0.99m/sec²	15	2	L5

	(i) Calculate the safe overtaking sight distance		
	(ii) What is the minimum length of overtaking zone		
	Draw a neat sketch of the overtaking zone and show the position of the sign posts		

Pavement design with recommended component layers for cumulative traffic range 1 to 10

CBR, %	CSA, msa	Total pavement thickness, mm	Granular sub-base course, mm	Granular base course, mm	Binder course, mm	Surface course, mm
3	1	550	435	225		20 PC
	2	610	335	225	50 BM	20 PC
	3	645	335	250	60 BM	20 PC
	5	690	335	250	60 DBM	25 SDBC
	10	760	335	250	90DBM	40 BC
4	1	480	255	225		20 PC
	2	540	265	225	50 BM	20 PC
	3	580	280	250	50 BM	20 PC
	5	620	285	250	60 BM	25 SDBC
	10	700	330	250	80 BM	40 BC
6	1	390	165	225		20 PC
	2	450	175	225	50 BM	20 PC
	3	490	190	250	50 BM	20 PC
	5	535	210	250	50 BM	25 SDBC
	10	615	260	250	65 BM	40 BC
8	1	375	150	225		20 PC
	2	425	150	225	50 BM	20 PC
	3	450	150	250	50 BM	20 PC
	5	475	150	250	50 DBM	25 SDBC
	10	550	200	250	60 DBM	40 BC
10	1	375	150	225		20 PC
	2	425	150	225	50 BM	20 PC
	3	450	150	250	50 BM	20 PC
	5	475	150	250	50 DBM	25 SDBC
	10	540	200	250	50 DBM	40 BC

NAME OF THE TABLE CHARTS: ...

1. Pavement Thickness Design Chart for Traffic
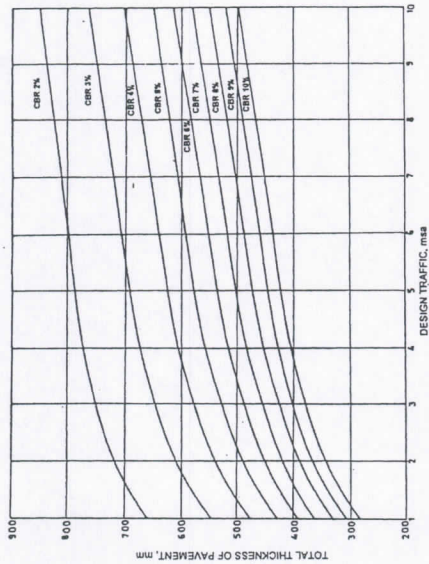2. Pavement design with recommended component layers for cumulative traffic range 1 to 10 msa
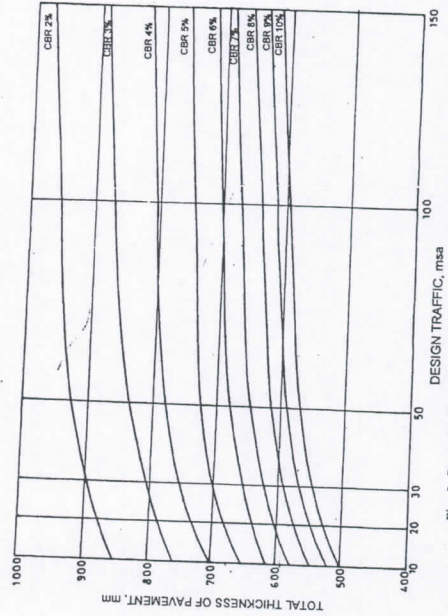
Fig. 1. Pavement Thickness Design Chart for Traffic 1-10 msa

Fig. 2. Pavement Thickness Design Chart for Traffic 10-150 msa