Reg. No.															

Question Paper Code	13647

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Civil Engineering

20CEPC404 - HIGHWAY ENGINEERING

Regulation - 2020

(Use of IRC recommended CBR design charts is permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following is a modern method used in engineering surveys? (a) Chain surveying (b) Leveling (c) LiDAR (Light Detection and Ranging) (d) Compass surveying	1	K1	CO1
2.	Among the engineering surveys which method uses GPS technology for alignment? (a) Theodolite survey (b) Aerial survey (c) Total station survey (d) Satellite survey	1	K1	CO1
3.	What is the purpose of super elevation in road design? (a) To reduce construction costs (b) To facilitate drainage (c) To counteract the lateral acceleration of vehicles on curves (d) To increase road width	1	K1	CO2
4.	The rate of super elevation is typically expressed as: (a) A percentage of the road width (b) A ratio of rise to run (c) A horizontal curve radius (d) A slope percentage	1	K1	CO2
5.	According to IRC standards, the minimum vertical clearance for underpasses should be: (a) 2.5 meters (b) 3.5 meters (c) 4.5 meters (d) 5.5 meters	1	K1	CO3
6.	A hairpin bend is characterized by: (a) A gradual curve (b) A very sharp curve with a small radius (c) An upward slope (d) A transition zone	1	K1	CO3
7.	What is the primary purpose of pavement design? (a) To enhance aesthetic appeal (b) To provide a smooth surface for vehicles (c) To support traffic loads while ensuring durability (d) To reduce construction costs	1	K1	CO4
8.	What type of joint is commonly used in rigid pavements to control cracking? (a) Expansion joint (b) Construction joint (c) Contraction joint (d) Control joint	1	K1	CO4
9.	What is the purpose of using geosynthetics in pavement construction? (a) To reduce costs (b) To improve drainage and reinforce soil (c) To enhance visual appeal (d) To replace traditional materials	1	K1	CO5
10.	Which of the following is considered a vehicle operation cost? (a) Fuel expenses (b) Insurance premiums (c) Maintenance and repair costs (d) All of the above	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Outline about obligatory points and its importance.	2	K2	CO1
12.	Brief short on the requirements of an ideal alignment.	2	K2	CO1
13.	Differentiate lag or reaction distance and braking distance.	2	K2	CO2
14.	Enlist the different types of Sight Distances.	2	K2	CO2
15.	Solve the deviation angle for a descending gradient 1 in 25 meeting an ascending gradient 1 in 30.	2	K2	CO3

16.	Draw a typical Transition curve and show all its zones.		*2*	*K2*	*CO3*
17.	Brief about prime coat and tack coat.		*2*	*K2*	*CO4*
18.	Brief on the components of flexible pavements.		*2*	*K2*	*CO4*
19.	Differentiate between Tar and Bitumen.		*2*	*K2*	*CO5*
20.	Outline the desirable properties of road aggregate.		*2*	*K2*	*CO5*
21.	Compare the types of models in DBFOT.		*2*	*K2*	*CO6*
22.	Explain in short the formula for CRF and its elements.		*2*	*K2*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Write brief notes on: 1. Central Road Fund 2. Indian Roads Congress 3. National Highway Authority of India	*11*	*K2*	*CO1*
		OR			
	b)	Explain the factors influencing the highway alignment.	*11*	*K2*	*CO1*
24.	a)	The radius of the horizontal curve is 120 m, The design speed is 60 kmph and the design coefficient of lateral friction is 0.15. (i) Calculate the super elevation required. (ii) Calculate the Coefficient of friction if no super elevation is provided.	*11*	*K3*	*CO2*
		OR			
	b)	Calculate the minimum sight distance required to avoid a head on collision of two cars approaching from the opposite direction at 90 and 60 kmph. Assume a reaction time of 2.5 seconds coefficient of friction of 0.7 and brake efficiency of 50 % in either case.	*11*	*K3*	*CO2*
25.	a)	A vertical summit curve is formed at the intersection of 2 gradients +3% and -5%.design the length of the summit curve to provide a SSD for a design speed of 80kmph .assume any other data.	*11*	*K3*	*CO3*
		OR			
	b)	A descending gradient of 1/30 meets an ascending gradient of 1/40 to form a valley curve. Calculate the length of the curve. Take SSD as 150 m.	*11*	*K3*	*CO3*
26.	a)	Design a flexible pavement for the following details: No. of commercial vehicle in each direction = 500, Construction period= 2 years, Annual traffic growth rate = 7.5%, CBR Value = 6%, Road type=SH, Pavement width = 7 m, Design period = 20 years.	*11*	*K3*	*CO4*
		OR			
	b)	Calculate the stress at the interior, edge and corner regions of the CC pavement using Westergaard's stress equation where wheel load P=6100kg, Pavement thickness h=18cm, Modulus of subgrade reaction k=6kg/cm2 , Radius of contact area a=15 cm2.	*11*	*K3*	*CO4*
27.	a)	Describe the symptoms, causes and remedial measures for the different types of failure in flexible pavements.	*11*	*K2*	*CO5*
		OR			
	b)	Outline how the Benkelman Beam is used to design the thickness of the overlay.	*11*	*K2*	*CO5*

28. a) Find the annual cost of a stretch of highway with the following data *11 K2 CO6*

Item	Total Cost Rs. In lakhs	Estimated Life , years	Rate of interest %
Land	35	100	6
Earthwork	40	40	8
Bridges, culvert and drainage	50	60	8
Pavement	100	15	10
Traffic signs , road appurtenances	15	5	10

OR

b) Explain the highway projects under PPP and its types. *11 K2 CO6*