Roll No: --------------------------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B Tech Civil Engineering	**Semester – V**
Subject (Course): Transportation Engineering-1	**Max. Marks : 100**
Course Code : CEEG 331	**Duration : 3 Hrs**
No. of page/s: 4	

Set A

Assume the suitable values wherever required

Attempt all the questions

Section A (4 x 5 = 20)

Q1. Discuss the classification of urban roads **[CO1] (4)**

Q2. Find the design rate of super elevation for horizontal highway curve of radius 450 m for a mixed traffic condition, having a speed of 125 km/hour. **[CO2] (4)**

Q3. The speed-density (v-k) relationship on a single lane road with unidirectional flow is v=70-0.7k, where v is in km/hr and k is in veh/km. Calculate the capacity of the road.

[CO3] (4)

Q4. Column I	**Column II**
P. Hardness	1. Water adsorption
Q. Porosity	2. Impact test
R. Toughness	3. Soundness test
S. Durability	4. Abrasion test

[CO4] (4)

Match the correct pair of test and property.

Q5. The average daily traffic on a stretch of road is 300 commercial vehicles per lane per day. Design the traffic repetitions for 10 years when vehicle damage factor is 2.5 and traffic growth rate is 7%. **[CO5] (4)**

Section B (10 x 4 = 40)

Q6. Four new road links A, B, C and D are to be constructed during a five year plan period. Suggest the order of priority for phasing the road construction programme based on maximum utility approach. Assume utility units of 0.5, 1, 2 and 4 for the four population ranges and 2, 2and 5 units per 1000t of agricultural, raw material and industrial products from the following data: [CO1] (10)

Proposal	Road length, km	No. of towns/villages serving population range					Productivity in 1000t		
		<500	501-1000	1001-2000	>2000		Agricultural	Raw material	Industrial
A	75	30	15	10	3		8	3	1
B	35	20	8	6	3		5	1	1.6
C	40	15	6	5	5		6	2	3.2
D	50	40	4	3	2		3	7	0.5

Q7. The design speed for a two-lane road is 80 kmph. When a design vehicle with a wheel base of 6.6 m is negotiating a horizontal curve on that road, the off tracking is measured as 0.096 m. Estimate the required widening or carriageway of the two-lane road on the curve. [CO2] (10)

Q8. For designing a 2-phase fixed type signal at an intersection having North-South and East-West road where only straight ahead traffic permitted, the following data is available.

Parameter Design hour	NORTH	SOUTH	EAST	WEST
Flow(PCU/hr)	1000	700	900	550
Saturation Flow	2500	2500	3000	3000

Total time lost per cycle is 12 seconds. Calculate the cycle length (seconds) as per Webster's approach. [CO3] (10)

Q9. Explain the CBR test in detail as per the BIS specifications. [CO4] (10)

Section C (20 x 2 = 40)

Q10. A) Design a new flexible pavement for a two lane undivided carriageway using the following data:

Design CBR value of subgrade = 5%

Initial traffic on completion of construction =300 cvpd

Average growth rate =6% p.a.

Design life =10 years

VDF value =2.5

B) A cement concrete pavement has a thickness of 26cm and lane width of 3.5m. Design the tie bars along the longitudinal joints using the data given below:

Allowable working stress in steel tie bars = 1250 kg/cm^2

Unit weight of CC = 2400 kg/m^3

Max. Value of coefficient friction = 1.2

Allowable tensile stress in deformed tie bars = 2000 kg/cm^2

Allowable bond stress in deformed bars = 24.6 kg/cm^2 [CO5] (10+10)

OR

Q10. A) The design thickness of CC pavement is 26 cm considering a design axle load (98th %tile) of 24000 kg on single axle and M 40 concrete. The radius of relative stiffness is 31.1 cm. Joint width is 1.8 cm. Design the dowel bars for 40% load transfer considering edge loading.

B) Calculate the wheel load stresses at interior, edge and corner for the given data. Also determine the probable location where the crack is likely to develop due to corner loading.

Wheel load, P = 5100 kg

Pavement thickness = 36 cm

K = 6 kg/cm^2

Radius of contact area = 15 cm [CO5] (10+10)

Q11. A) Discuss the Nagpur road plan and its objectives in detail. Derive the general equation for design of superelevation. **[CO1,2] (6+6)**

B) On a specific highway, the speed-density relationship follows the Greenberg's model $[v = v_f \ln (k_j / k)]$, where v_f and k_f are the free flow speed and jam density respectively. When the highway is operating at capacity, find the density obtained as per this model.

[CO3] (8)

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Set B

Assume the suitable values wherever required

Attempt all the questions

Section A (4 x 5 = 20)

Q1. Discuss the special considerations while aligning roads on hilly areas. [CO1] (4)

Q2. Calculate the SSD on a level road stretch for design speed of 50 km/hr. for 2-way traffic on a single lane road. [CO2] (4)

Q3. A transport company operates a scheduled daily truck service between city P and city Q. One-way journey time between these two cities is 85 hours. A minimum layover time of 5 hours is to be provided at each city. How many trucks are required to provide this service? [CO3] (4)

Q4. In the Marshall method of mix design, the coarse aggregates, fine aggregates, filler and bitumen, having respective specific gravities of 2.62, 2.72, 2.70 and 1.02, are mixed in the ratio of 55, 34.6, 4.8 and 5.6%, find the specific gravity of the mix. [CO4] (4)

Q5. Determine the VDF value of the HCV with rear axle load of 15.5 t in terms of the standard axle load of 8.16 t. [CO5] (4)

Section B (10 x 4 = 40)

Q6. The following data were collected for planning road development programme of a district. **[CO1] (10)**

Total area = 6300 km^2

Agricultural and developed area = 2800 km^2

Railway track length = 75 km

Number of towns or villages in different population ranges is as below:

Population	>5000	2001-5000	1001-2000	501-1000	<500
No. of towns/ Villages	10	40	150	310	490

Calculate the length of road as per Nagpur road plan.

Q7. Calculate:

a) **Length of the transition curve**
b) **Shift of the curve** **[CO2] (10)**

Using the data given below:

Design speed = 65 kmph

Radius of circular curve = 220m

Pavement width including the extra widening = 7.5m

Allowable rate of introduction of superelevation (about center line) is 1 in 150.

Q8. A two-lane urban road with one-way traffic has a maximum capacity of 1800 vehicles/hour. Under the jam condition, the average length occupied by the vehicles is 5.0 m. The speed versus density relationship is linear. For a traffic volume of 1000 vehicles/hour, find the density. **[CO3] (10)**

Q9. Explain the aggregate impact test in detail as per the BIS specifications. [CO4] (10)

Section C (20 x 2 = 40)

Q10. A) Design a new flexible pavement for a four lane divided carriageway using the following data:

Design CBR value of subgrade = 8%

Initial traffic on completion of construction =3500 cvpd

Average growth rate =6.5 % p.a.

Design life =15 years

VDF value = 4

B) A cement concrete pavement has a thickness of 28 cm and lane width of 3.5m. Design the tie bars along the longitudinal joints using the data given below:

Allowable working stress in steel tie bars = 1250 kg/cm^2

Unit weight of CC = 2400 kg/m^3

Max. Value of coefficient friction = 1.4

Allowable tensile stress in deformed tie bars = 2000 kg/cm^2

Allowable bond stress in deformed bars = 24.6 kg/cm^2 [CO5] (10+10)

OR

Q10. A) The design thickness of CC pavement is 28 cm considering a design axle load (98th %tile) of 14000 kg on single axle and M 40 concrete. The radius of relative stiffness is 64.2 cm. Joint width is 2 cm. Design the dowel bars for 40% load transfer considering edge loading.

B) Calculate the wheel load stresses at interior, edge and corner for the given data. Also determine the probable location where the crack is likely to develop due to corner loading.

Wheel load, P = 5100 kg

Pavement thickness = 36 cm

K = 6 kg/cm^2

Radius of contact area = 15 cm [CO5] (10+10)

Q11. A) Discuss the Bombay road plan and its objectives in detail. Find the total width of a pavement on a horizontal curve to be aligned along a rolling terrain with a minimum ruling radius. Assume the necessary data. [CO1, 2] (6+6)

B) The free mean speed on a highway is found to be 80 kmph. Under stopped condition the average spacing between vehicles is 6.9m. Determine the capacity flow. [CO3] (8)