Enrollment No._____

NAVRACHANA UNIVERSITY
a UGC recognized University

School: School of Engineering and Technology
Program/s: B.Tech Civil Engineering
Year: 4th **Semester:** 8th
Examination: End Semester Examination
Examination year: May 2023

Course Code: CE416 **Course Name:** **Transportation planning and Pavement Design - II**
Date: 17/05/2023 **Total Marks:** 40
Time: 10:00 am to 12:00pm **Total Pages:**

Instructions:

- *Write each answer on a new page.*
- *Use of a calculator is permitted.*
- ** COs=Course Outcome mapping. # BTL=Bloom's Taxonomy Level mapping*

Q. No.	Details	Marks	COs*	BTL#
Q.1	Answer the following: (Attempt any four)	**20**	CO1, CO2, CO3	BT1, BT2, BT4
	1. Why is bitumen used as binder material? How the binding property can be determined? 2. State the significance of resilient modulus. 3. Define strengthening of pavement. Why it is important to do strengthening? 4. What do you understand by deflection survey of pavement? Explain the procedure for the same. 5. Explain the importance of Checking Rigid pavement for Warping and Corner Stress.			
Q.2	A cement concrete pavement is to be designed for two lanes two-way national highway in Kanpur. The local two-way traffic is 4000 CV/day at the end of the construction period. Calculate the design thickness of pavement and the stresses induced at all places of slab. The design parameters are: **1.** Flexural strength = 45kg/cm^2 **2.** Effective modulus of subgrade reaction of the DLC sub base = 8 kg/cm^3 **3.** Tyre pressure = 7 kg/cm^2 **4.** Rate of traffic increase = 0.070 **5.** Spacing of joints = 4.5m **6.** Width of slab = 3.5m	**10**	CO3, CO4	BT1, BT3, BT6
Q.3	It is proposed to construct a new 4-lane single carriageway section in plain region. Design the pavement for new carriageway with following data: a) 4-lane single carriageway	**10**	CO3	BT3, BT5

b) Initial traffic in each direction in the year of completion of construction = 2000 CV/day
c) Design life = 15 years
d) CBR of soil below 500mm of sub grade = 2.5%
e) CBR of 500mm of sub grade from borrow pits = 22%
f) Traffic growth rate = 4%

Combinations for base and sub base layers:

1) Foamed bitumen emulsion treated RAP over cemented subbase
2) Cementitious base and cementitious sub base with SAMI at the interface of base and the bituminous layer.

Single Axles		Tandem Axles	
Load in tonnes	Expected repetitions	Load in tonnes	Expected repetitions
20	71127	36	35564
18	177820	32	35564
16	569023	28	71128
14	1280303	24	213384
12	2608024	20	177820
10	27622135	16	59273
Less than 10	3556397	Less than 16	237093

Single Axle Loads		Tandem Axle Loads	
Axle Load class, tons	Percentage of axle loads	Axle Load class, tons	Percentage of axle loads
19-21	0.6	34-38	0.3
17-19	1.5	30-34	0.3
15-17	4.8	26-30	0.6
13-15	10.8	22-26	1.8
11-13	22.0	18-22	1.5
9-11	23.3	14-18	0.5
Less than 9	30.0	Less than 14	2.0
Total	93.0	Total	7.0

$$a = \left[0.8521 \times \frac{P}{q \times \pi} + \frac{S}{\pi}\left(\frac{P}{0.5227 \times q}\right)^{0.5}\right]^{0.5}$$

**********End of Question Paper**********