| Question Paper Code | 12507 |
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## B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Fourth Semester

### Civil Engineering

### 20CEPC404 - HIGHWAY ENGINEERING

(Regulations 2020)

Duration: 3 Hours                                    Max. Marks: 100

### PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

*Marks, K-Level, CO*

1.  Classify the roads according to Nagpur road plan.  *2,K1,CO1*
2.  Define road ecology.  *2,K1,CO1*
3.  Define super elevation.  *2,K1,CO2*
4.  Compare summit and valley curves.  *2,K2,CO3*
5.  What is prime coat and tack coat?  *2,K1,CO4*
6.  What is a flexible pavement?  *2,K1,CO4*
7.  List out the types of defects in flexible pavements.  *2,K1,CO5*
8.  What is mud pumping in rigid pavements?  *2,K1,CO5*
9.  What are the types of highway user benefits?  *2,K1,CO6*
10. Define MVOC.  *2,K1,CO6*

### PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Compare the two modes of Transportation – Railways and Highways.  *13,K2,CO1*

    **OR**

    b) Explain detail about the engineering surveys conducted for highway alignment.  *13,K2,CO1*

12. a) The speed of overtaking and over taken vehicles, 70 and 40 kmph, respectively on a two-way traffic road. If the acceleration of overtaking vehicle is 0.99m/s$^2$. Calculate SSD, OSD and ISD.  *13,K3,CO2*

    **OR**

    b) Find the safe stopping sight distance for the design speed of 50 kmph. Assume co-efficient of friction as 0.37 and reaction time of driver as 2.5 seconds.
    (i) Two way traffic on a two lane road and
    (ii) Two way traffic on a single lane road.  *13,K3,CO2*

13. a) 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/cm$^2$ , Radius of contact area a=15 cm$^2$ *13,K3,CO4*

**OR**

b) Explain about
(i) Layer system concept. *7,K2,CO4*
(ii) ESWL. *6,K2,CO4*

14. a) Classify the different types of failures in rigid pavement and mention the important causes of each. *13,K2,CO5*

**OR**

b) Explain how the Benkelman Beam is used to design the thickness of the overlay. *13,K2,CO5*

15. a) Explain the various methods of economic analysis in highway projects. *13,K2,CO6*

**OR**

b) Calculate the annual cost of a stretch of highway with the following data. *13,K2,CO6*

| Item | Total Cost Rs. In lakhs | Estimated Life, years | Rate of interest % |
|---|---|---|---|
| Land | 30 | 90 | 7 |
| Earthwork | 45 | 30 | 8 |
| Bridges, culvert and drainage | 50 | 50 | 9 |
| Pavement | 90 | 15 | 10 |
| Traffic signs , road appurtenances | 20 | 5 | 10 |

**PART - C (1 × 15 = 15 Marks)**

16. a) 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. *15,K3,CO3*

**OR**

b) Explain the steps involved in the design of hill roads. *15,K2,CO3*