Q.P. Code : 577602

(3 Hours)   [Total Marks : 80

N.B. : (1) Question **No 1** is **compulsory**.
      (2) Attempt **Any 3** out of remaining
      (3) Assume any suitable data wherever required.

1.   (a) Trace the history of road development in India in a chronological order.   5
    (b) What is breaking distance? Calculate the breaking distance for a moving   5
      vehicle design speed of 100KMPH?
    (c) State and briefly explain the reasons for strengthening the edge and corners   5
      of cement concrete slab.
    (d) What is fatigue behavior of cement concrete road? State the relationship   5
      between fatigue life and stress ratio.

2.   (a) Mention the essential requirements of bitumen suitable for road making.   10
      Describe briefly the prescribed laboratory tests in order to determine its
      suitability for road work.
    (b) The speed density relationship for a particular road was found to be   10
      $U=42.76-.22K$, where K is the density in vehicles per Km. Find the capacity
      of the toad.

3.   (a) A two lane road with a design speed of 80KMPH has a horizontal curve   10
      with a radius of 480m. Design the rate of superelevation for a mixed traffic
      and calculate by how much the outer edge of the pavement should be raised
      with respect to the center line, if the pavement is rotated with respect to
      the centre line.
    (b) Explain the method for estimation of design traffic for flexible pavement   5
      design as per IRC recommendation.
    (c) How much camber is to be provided on a road having with of 7m with   5
      bituminous concrete surface located in heavy rainfall area?

TURN OVER

4. (a) Design a regid pavement making use of westergaard's wheel load and warping stress equations at edge region of the slab. The design data are given below   **10**

Design wheel load = 7500kg, Contact pressure = 7.5kg/cm², Spacing between longitudinal joints = 3.75m and contractions joints is 4.2m, Elastic modulus of the pavement material/CC is 3×105kg/cm², poisson's ratio=0.15, Modulus of Sub grade reaction = 30kg/cm³ 'Thermal co. eff. of cc per°C=1×10^{-5} /CC, Flexural strength of CC=45kg/cm², Max temperature differential at the location for pavement thickness values of 24,26 and 30cm are respectively 15.6, 16.2 and 16.8°C. Calculate the desired factor of safety with respect to load stress and warping stress at edge region.

L/1	C	L/1	C	L/1	CG`
1	0.00	5	0.720	9	1.080
2	0.04	6	0.920	10	1.075
3	0.175	7	1.030	11	1.050
4	0.440	8	1.077	12	1.000

(b) What do you understand by penetration macadam? Describe the method of construction.   **10**

5. (a) The BBD studies were carried out on a highway pavement with 50mm thick bituminous surface course, when the mean pavement surface temperature was 40°C and the field moisture content of Subgrade soil was 5.5%. the soil is found to be sandy soil. Determine the corrected deflection value after applying corrections.   **10**

(b) A failed cement concrete pavement is to be strengthened by providing bituminous concrete overlay. Briefly discuss the method to be adopted.   **10**

6. (a) A vehicle is accelerating on a gradient of 15% (upwards) with a rate of 0.8m/sec² from initial speed of 15 to 25KMPH. Calculate the various resistance encountered by the vehicle using the following data   **10**
1. Mass of the vehicle =1500kg, 2.Co. eff. For rolling resistance = 0.02
3. Frontal area of vehicle = 3.5m2, 4. Co.eff. for air resistance = 0.45kg/m² Assume the data if required.

(b) State the classification of the live load to be considered in the design of bridges   **10**

(c) Briefly describe the significance of drainage systems in highway   **10**