

(3Hours)

Total marks=80

- Note**
1. Question No 1 is compulsory.
  2. Attempt Any 3 out of remaining
  3. Assume any suitable data wherever required.

**Q.1**

- a. Distinguish between surface drainage and sub-surface drainage system. Draw suitable diagrams **5**
- b. Draw the traffic signs for: i) Stop ii) Steep slope ahead iii) Pune 120 km iv) Overtaking prohibited v) Give way **5**
- c. Calculate the equivalent radius of resisting section of 20cmthick slab , given that the radius of contact area wheel load is 12cm **5**
- d. Define and State the situation under which following gradients are provided. **5**
  - i.) Ruling gradient
  - ii.) Limiting gradient
  - iii.) Exceptional gradient
  - iv.) Minimum gradient

**Q 2**

- a. What are the significant recommendations of Jayakar committee report? Explain how it is implemented in the road development of a country. Name some the ongoing project around your vicinity in brief. **10**
- b. On a national highway, Two cars A and B travelling with same design speed decides to overtake other car C. Car driver A accelerates the car at  $0.99\text{m/sec}^2$  and car B accelerates the car at  $0.77\text{m/sec}^2$ . Compute the overtaking distance of both the cars when they try to overtake the Car C. Also compute the time taken by Car A and car B to overtake the car C. **10**

**Q.3**

- a. Design the flexible pavement using the IRC 37:2001, for highway expansion of four lane having an initial traffic of 3784 , rate of growth 5%, VDF= 3.5, CBR is 5%, construction period is 2 years and design life is 15 years. Use the design chart provided to read the thickness. Also Explain the two critical failures that are in-cooperated while designing the pavement using IRC 37:2001. **10**

- b.** Design a rigid pavement making use of Westergaards wheel load and warping stress equations at edge of the slab. The design data are given below Bradbury's warping stress coefficient chart may be used as given below: **10**

Design wheel load  $P=7000\text{kg}$ , Contact pressure  $p=7.5\text{ kg/cm}^2$

Spacing between longitudinal joints = 3.75 m

Spacing between contraction joints= 4.2 m

Elastic modulus of pavement material / CC,  $E = 3 \times 10^5\text{ kg/cm}^2$

Poissons ratio  $\mu= 0.15$

Thermal coefficient of CC per  $^{\circ}\text{C}$ ,  $e= 1 \times 10^{-5}$

Flexural strength of CC= 45  $\text{kg/cm}^2$

Modulus(K- value) of base course = 30  $\text{kg/cm}^3$

Maximum temperature differential at the location for pavement thickness values of 22, 24, 26 and 30 cm are respectively 14.8, 15.6, 16.2 and 16.8  $^{\circ}\text{C}$

- Q.4 a** Design Superelevation at a horizontal curve of radius 300m for speed of 65kmph .Assume suitable data and justify your answer. **10**

b) Calculate extra width of pavement required on a horizontal curve of radius 700m on a two lane highway , Design speed being 80kmph.

Assume  $l=6\text{m}$

- b.** Explain the stage wise construction of Bituminous Macadam. **5**
- c** What are the advantages of geo-synthetics in highway construction. **5**

- Q.5 a.** While conducting BBD studies the initial dial gauge reading and intermediate reading and final reading obtained at three deflection observations points A, B and C re given below . If the least count of the dial gauge reading is 0.01mm and the value of K of the Benkelman beam is 2.91, determine the rebound deflection values at the three points. **10**

Point A: 0, 46, 44, Point B: 0, 33, 29 and Point C: 05, 60, 59.

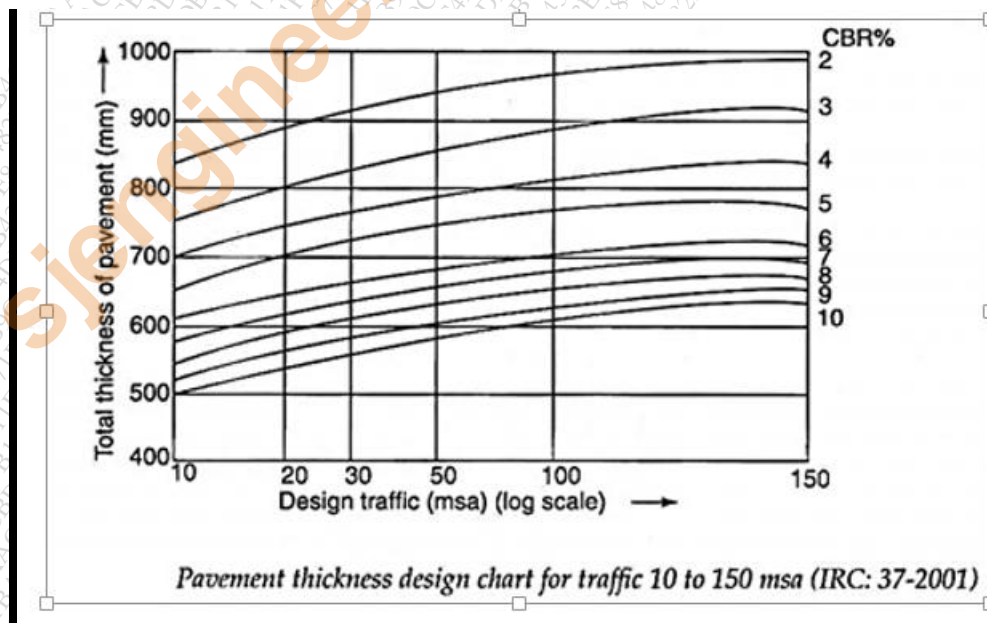
For the same also determine the mean deflection, standard deviation and characteristic deflection for heavy traffic.

- b.** How important it is to conduct the basic testing of bitumen and why? Explain the test that is conducted to identify the grade of the bitumen. Suggest some of the grades that are suitable for using in higher temperature regions. **10**

- Q.6**
- a. To identify the location of congestion, causes and to reduce delays and increase the travel speed, which Traffic Engineering study is conducted? Name the study, discuss the objective, and briefly explain one of the methods of conducting the study and the data collected in the conduction of the study. **8**
  - b. Express the relation between traffic volume, density and speed? If  $V_{sf}$  is the free mean speed to be 80 kmph and if jam density  $K_j$  is 145 vehicles /hour. Compute the maximum capacity flow? **6**
  - c. Explain in details the general concept of level of service with figure. **6**

Wrapping Stress coefficient chart by Bradbury

L/1	C	L/1	C	L/1	C
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



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