(3 Hours) [ Total Marks:80]

QP-10068257

**Note:** i. Q. No. 1 is **compulsory**
ii. Attempt **any 3** out of remaining 5
iii. Support **theory and numerical** with neat sketch Wherever required

1. Solve any four (20M)
   A. Compare Roadways, Railways, Airways and Waterways on basis on Speed, Cost of construction, Operation cost and suitability.
   B. Classify roads as per Nagpur road plan and Modified Nagpur road plan
   C. Explain concept of PCU.
   D. Compare rigid and flexible pavement and also draw neat sketch showing all the layers.
   E. Write a note on Highway drainage.
   F. Discuss on various pavement failures.

2. A. What would be the corrected runway length if the runway length required at sea level in standard atmospheric condition is 2500 m. The airport is to be designed at an elevation of 220 m. ART is $31^0$ Celsius. Consider effective gradient is 0.10 percent. (10M)
   B. During Traffic survey on a road, following observations were made. Find the Design speed, Upper and Lower limit speed for the road. (10M)

| Sr. No | Frequency | Speed range (KMPH) |
|---|---|---|
| 1 | 4 | 0-10 |
| 2 | 19 | 10-20 |
| 3 | 25 | 20-30 |
| 4 | 32 | 30-40 |
| 6 | 30 | 40-50 |
| 7 | 26 | 50-60 |
| 8 | 15 | 60-70 |
| 9 | 6 | 70-80 |

3. A. Explain PIEV theory and find the SSD required for a one-way road having design speed of 50 kmph and 3% gradient. Consider break efficiency as 50%. (10M)
   B. Write the steps for construction of rigid pavement. (10M)

4. A. Explain Equilibrium Cant, Cant deficiency and Cant Excess. Also, On B.G $3^0$ curve, equilibrium Cant is provided for a speed of 70kmph. calculate value of equilibrium Cant. (10M)
   B. Find the value of Load and Temperature stresses on 20 cm thick CC pavement for the following data: (10M)
   Wheel load 4500 kg, E = 3 x $10^5$ kg/cm$^2$,
   Pavement thickness = 20 cm,
   Poisson's ratio = 0.15,
   Modulus of Subgrade reaction = 6 kg/cm$^3$,
   Radius of contact area = 15 cm.
   Transverse joint at 5 m & longitudinal joint at 3.6 m interval.
   Temperature difference is 15°C,
   Expansion Coefficient 'e' = 10 x $10^{-6}$/°C,
   Radius of relative stiffness = 87.2 cm.
   Coefficient of friction between the interfaces is 1.1,
   Unit weight of cement concrete is 2400 kg/cm$^3$. Consider Cx = Cy = 1.

5. A. Calculate Superelevation required on a road having radius of curve as 100 m & design speed as 40 kmph. Assume f = 0.15. Also calculate the amount of friction "f" required if no superelevation is provided. (10M)

B. Explain Vehicle damage factor. Also find Million standard axle (msa) for construction of new single lane road having initial traffic 400 cvpd in both directions. Rate of growth is 7.5 %, VDF is 2.5, CBR is 4 %, construction period is 2 years & Design period is 15 years. (10M)

6. A. Compare Regulatory, Warning and Informatory sign based on Purpose and Shape. Draw any 3 signs of each type. (10M)

B. Enlist various test on Bitumen and explain any one in detail. (10M)

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