

(3 Hours)

[Total Marks: 80

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

1. **Solve any four** (20 M)
 - A. Compare various modes of transportation on basis of operating speed, initial cost, operating cost and suitability.
 - B. Explain the classification of highways.
 - C. Discuss on O&D study.
 - D. Compare rigid and flexible pavement on basis of material used, flexural strength, suitability and cross section.
 - E. Write note on use of Geosynthetics in highways.
 - F. Explain rigid pavement failures.

2. A. Enlist factors affecting safe stopping distance. Also, on a highway, due to fog, only 20 meters of road was visible. Find the speed to be permitted for the vehicles to avoid accidents if reaction time is 2 sec and $f=0.13$. (08 M)
- B. Discuss on Structural and Functional evaluation of pavements along with the list of equipment's used. (06 M)
- C. Explain conflict points and its types. Also enlist measures to reduce conflict points on roads. (06 M)

3. A.
 - i. Explain the function of sleepers. (08 M)
 - ii. What is equilibrium Cant value of 2^0 curve on a B.G track if 15, 10, 5 and 2 trains are running at 50, 60, 70 and 80 kmph respectively.
- B. Explain the concept of PCU and also discuss the factors affecting PCU. (06 M)
- C. What is Vehicle damage factor? Also find msa for construction of new two-lane bypass 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 & 'n' is 15 years. (06 M)

4. A. Design a rigid pavement for wheel load of 7000 kg, tyre pressure 7.5 kg/cm^2 , spacing between longitudinal joints is 3.75 m & spacing between contraction joints is 4.2 m. Take $E = 3 \times 10^5 \text{ kg/cm}^2$, $\mu = 0.15$, $e = 1 \times 10^{-5}$, $k = 30 \text{ kg/cm}^3$, flexural strength = 45 kg/cm^2 . Assume $C_x = C_y = 1.1$ (08 M)

Thickness (cm)	22	24	26	30
Temp. Difference	14.8	15.6	16.2	16.8

FOS = 1.1 to 1.2.
- B. If the ruling gradient on a stretch of road is 6 % & radius of curve is 60 m, find the grade compensation to be given & the compensated gradient. (06 M)
- C. Discuss procedure of construction of flexible pavement. (06 M)

5. A. Enlist desirable properties of pavement materials and discuss any 1 test on aggregate in detail. (08 M)
- B. Draw a layout of an airport with all its components and also find the increase in runway length if the airport is shifted from a location of 150 meters R.L to 400 meters R.L. (06 M)
- C. Compare different types of road signs and draw 3 examples of each. (06 M)
6. A. Find Median & Modal Speed for the following data. Also determine the design speed, upper limit & lower limit speed for the following: (08 M)

Speed Range	Frequency (qi)	Speed Range	Frequency (qi)
0-5	0	25-30	21
5-10	3	30-35	16
10-15	8	35-40	12
15-20	13	40-45	5
20-25	19	45-50	0

- B. The radius of curve is 100 m & design speed is 50 kmph. Assume $f = 0.15$. Calculate superelevation, if full friction is assumed. Also find 'f' if no superelevation is provided. (06 M)
- C. Deflection values are found on summer mid-day having test temperature as 42°C. find characteristic deflection for the following data. Also apply the corrections. Assume moisture correction factor as 1.1. (06 M)

Initial	Intermediate	Final	D (mm)
0	37	39	1.22
8	42	43	1.30
0	46	49	1.19
