



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE

PART – A (8 X 5 = 40 Marks)
Answer ALL Questions

- ✓ 1. a) Why is camber necessary for a road? What parameters are considered while deciding the camber as per the IRC guideline? [3]
b) Write the significance of building line in the cross section of a highway. [2]
- ✓ 2. Ruling gradient or the maximum gradient for a highway is 3.3% or 1 in 30. A proposed highway alignment has to climb from a level ground having elevation of 100m (section A) to a level ground having elevation 120m (section C). Calculate the length of road needed to connect these sections.
Now, suppose that the terrain described above is as shown in Figure 1. Show the vertical alignment of this road on this diagram.

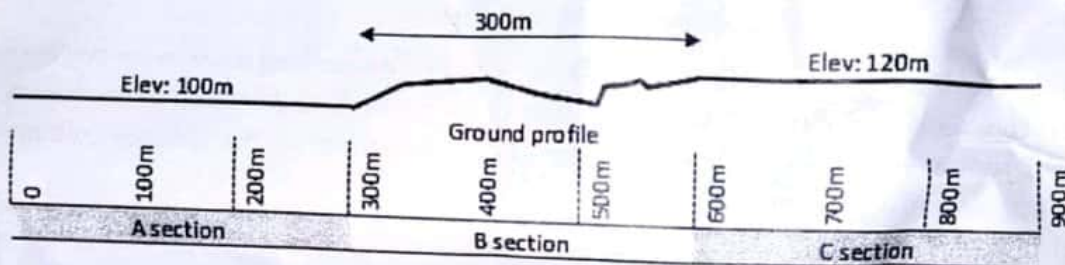


Figure 1

- ✓ 3. A transition curve on a 2-lane highway takes it from a 2% camber to a superelevation of 0.05. Draw the profile diagram for this transition showing the change of levels of centre line and road edges. Show the dimensions assuming that pavement edge level is changed at a rate of 1mm in 150mm distance.
- ✓ 4. Describe the California Bearing Ratio (CBR) test including the equation to calculate CBR value. Describe the significance of CBR test in flexible pavement design.
- ✓ 5. Figure 2 shows the arrangement of rails on sleepers with fastenings. Copy this into your answer sheet and draw the arrangement of ballast and formation to complete the railway track. Write the functions of ballast in this track.

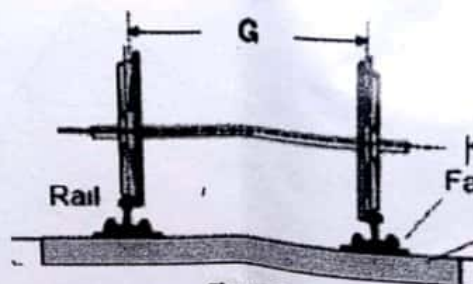


Figure 2



SEARCH VIT QUESTION PAPERS
ON TELEGRAM TO JOIN

6. Consider the broad gauge track in Figure 3. Estimate the ruling gradient in curve section.

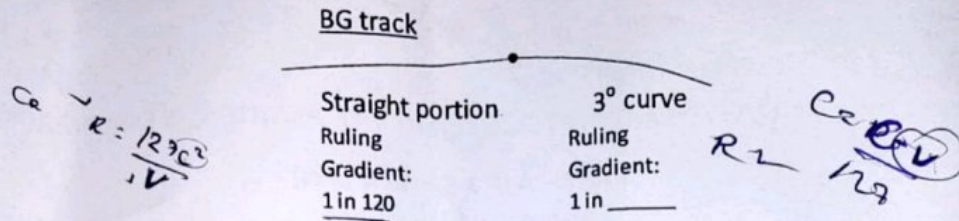


Figure 3. Railway track – plan view

7. Describe any two of the following criteria for selection of site of an airport.
- Proximity to other airport
 - Visibility
 - Ground accessibility
8. Compare roadways, railways and waterways on parameters such as cost, travel time and environment friendliness with respect to goods transport.

PART – B (6 X 10 = 60 Marks)

Answer any SIX Questions

9. The alignment of a highway shown in figure 4 is changing at point I. A horizontal curve connecting the two straight sections needs to be designed. On the inner side of the curve, there is an obstruction. It needs to be at a distance (set back distance) from the centre line of the highway so that safe sight distance is available. Design speed is 80 kmph.

Answer the following questions:

- Calculate the minimum radius to be provided for this curve. [3]
- Calculate the curve radius for which a camber of 2% is sufficient and no additional superelevation is required. [3]
- Suppose that the radius of this curve is 280m and the superelevation provided is 0.04. Calculate the maximum speed limit for this highway. [4]

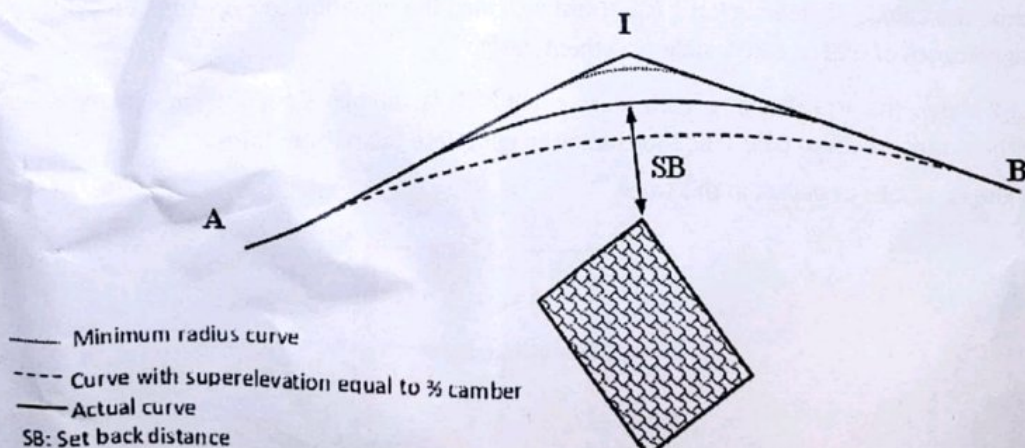


Figure 4

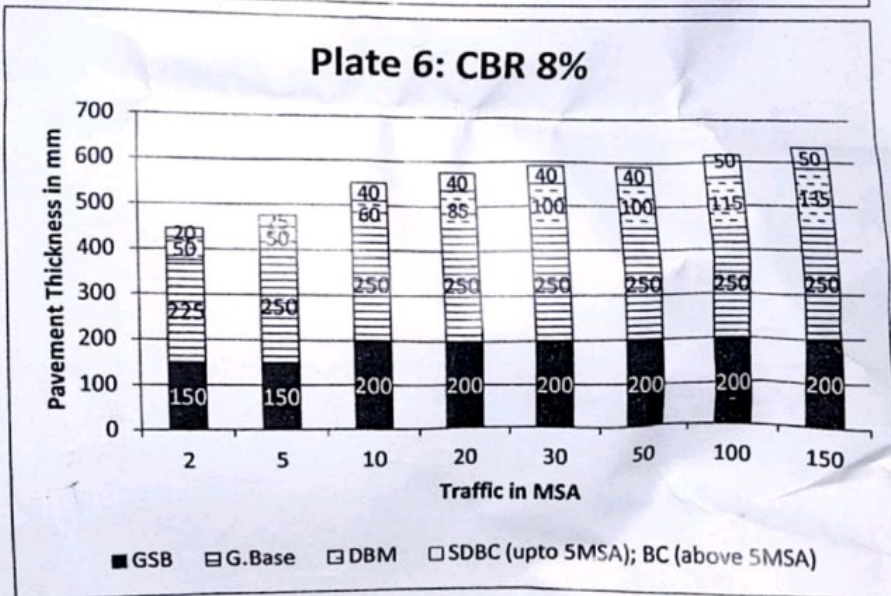
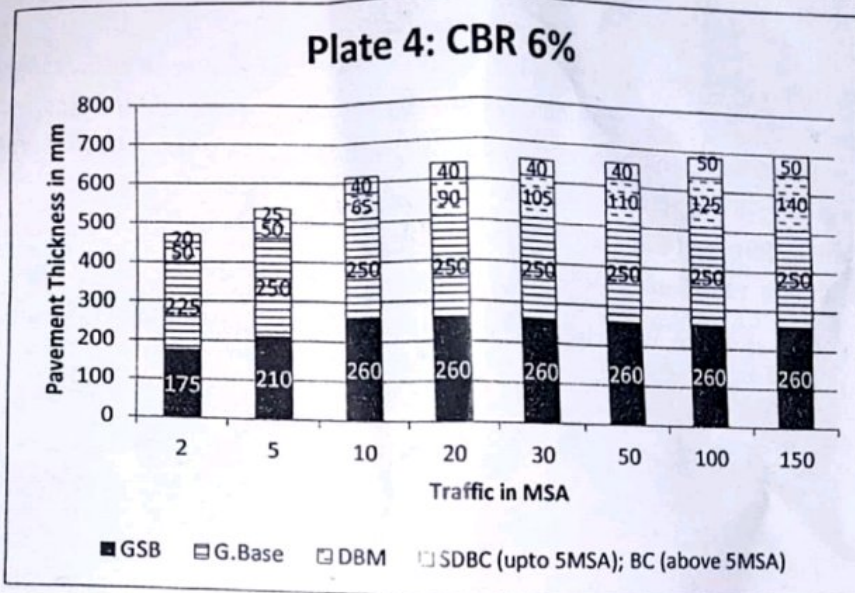
10. Answer the following questions

- Calculate intermediate sight distance for a highway with design speed 65kmph. [4]
- On this road, a 2% grade meets a -2% grade. Determine the length of the summit curve so that intermediate sight distance is available for overtaking (i.e., use object height corresponding to overtaking). [6]

11. A section of a four-lane undivided national highway is being designed for a life of 12 years starting from 2020. Annual average daily traffic estimated for this section in 2020 is 35,000. Traffic is expected to grow at a compounded annual growth rate (CAGR) of 8%. The share of commercial vehicles is expected to be 7%. CBR of subgrade soil is found to be 6%. Vehicle damage factor is estimated as 3.0.

Design a flexible pavement using IRC method. Show all calculations. Show your result as a pavement cross-section diagram. IRC charts are given below.

Estimate the total volume of bituminous concrete to be used if the length of highway section is 20km.



12. A falling gradient of 1 in 133 meets a rising gradient of 1 in 133 on a BG group A route. The intersection point has a chainage of 1000 m. and its reduced level (RL) is 100.000m. Calculate the length of the vertical curve and the RL and the chainage of the various points in order to set out a vertical curve at this location. Show the calculations in a tabular format mentioned below. Draw a neat diagram showing all the dimensions.

| Chainage | x | Point on chord | RL of point on chord | Offset= $\frac{x(L-x)}{(2R)}$ | Point on vertical curve | RL of point on curve |
|----------|---|----------------|----------------------|----------------------------------|-------------------------|----------------------|
|----------|---|----------------|----------------------|----------------------------------|-------------------------|----------------------|

13. The railway track at a simple block station is shown in Figure 5.

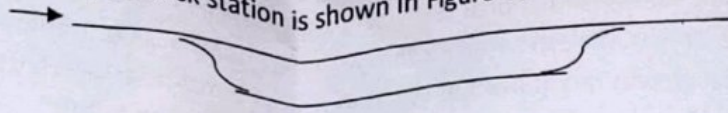


Figure 5

- a) Show the location of signals along the main line and describe their operation. [5]
b) For the first turnout, draw a schematic diagram and show all the elements. [5]
14. Describe how the actual runway length for a primary runway should be determined as per ICAO design manual.
Basic runway length for take-off and landing for the airplanes to be flying at an airport is given as 1900m and 2100m respectively. This is at zero elevation, standard atmospheric considerations and zero slope. Determine the actual runway length to be provided. Show the procedure you followed and calculations.
Given: Elevation of site: 400m above mean sea level
Aerodrome reference temperature: 30 degC.
Runway effective gradient: 0.48%.
15. Draw the layout of a well-developed harbour and mark its components. Describe briefly any four terminal facilities of a harbour.

