

# C.U.SHAH UNIVERSITY

## Summer Examination-2019

**Subject Name: Highway Engineering**

**Subject Code: 4TE04HYE1**

**Branch: B.Tech (Civil)**

**Semester: 4**

**Date: 01/05/2019**

**Time: 02:30 To 05:30**

**Marks: 70**

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  - (2) Instructions written on main answer book are strictly to be obeyed.
  - (3) Draw neat diagrams and figures (if necessary) at right places.
  - (4) Assume suitable data if needed.
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**Q-1                      Attempt the following questions:                      (14)**

- |    |  |   |
|----|--|---|
| a) | Draw a neat sketch of simple circular curve.                                 | 1 |
| b) | What are the requirements of an ideal alignment of road?                     | 1 |
| c) | Enlist the different types of camber provided on road surface.               | 1 |
| d) | What is joint filler?  | 1 |
| e) | Define carriageway.  | 1 |
| f) | Enlist the test on bitumen.  | 1 |
| g) | NHAI stands for.....   | 1 |
| h) | Draw a sketch showing component parts of road pavement structure.            | 1 |
| i) | What is soil stabilization?  | 1 |
| j) | Define widening of road on curves.   | 1 |
| k) | Define construction joint.   | 1 |
| l) | IRC stands for.....  | 1 |
| m) | Define design speed.   | 1 |
| n) | Enlist the methods, which are commonly used for design of flexible pavement. | 1 |

**Attempt any four questions from Q-2 to Q-8**

**Q-2                      Attempt all questions                      (14)**

- |          |  |          |
|----------|--|----------|
| <b>A</b> | What are the various surveys to be carried out before planning a highway system for a given area? Explain briefly.                     | <b>7</b> |
| <b>B</b> | Explain obligatory points. With sketches, discuss how these control the alignment.   | <b>4</b> |
| <b>C</b> | Calculate the values of head light sight distance for a highway with a design speed of 65 kmph. Assume suitably all the data required. | <b>3</b> |



- Q-3 Attempt all questions (14)**
- A** The speed of overtaking and overtaken vehicles are 70 and 40 kmph, respectively on a two-way traffic road. If the acceleration of overtaking vehicle is  $0.99 \text{ m/sec}^2$ . **7**
- (a) Calculate safe overtaking sight distance  
 (b) Mention the minimum length of overtaking zone and  
 (c) Draw a neat-sketch of the overtaking-zone and show the positions of signposts.
- B** What are the objects and scope of traffic engineering? Explain briefly. **3**
- C** With neat sketches show various types of traffic signs, classifying them in proper group. **4**
- Q-4 Attempt all questions (14)**
- A** What are the various causes of formation of waves and corrugation in flexible pavements? Suggest remedial measures. **7**
- B** Explain with sketches how the subsurface drainage system is provided to lower the water table, and control seepage flow. **7**
- Q-5 Attempt all questions (14)**
- A** Write a short note on: Horizontal transition curves **7**
- B** Calculate the extra widening required for a pavement of width 7m on a horizontal curve of radius 250 m if the longest wheelbase of vehicle expected on the road is 7.0 m. design speed is 70 kmph. Compare the value obtained with IRC recommendations. **3**
- C** Explain PIEV theory. **4**
- Q-6 Attempt all questions (14)**
- A** Why is it important for a highway engineer to study the behavior of soil? What are the desirable properties of subgrade soil? Enumerate the identification and classification tests of soils. **7**
- B** Explain the method of construction of cement concrete road. **7**
- Q-7 Attempt all questions (14)**
- A** What are the various tests carried out on road stone? Explain any one in detail. **7**
- B** Explain the recommended design procedure for the design of rigid pavement by IRC. **7**
- Q-8 Attempt all questions (14)**
- A** Write down the construction steps for water bound macadam road. **7**
- B** Soil subgrade sample was obtained from the project site and the CBR tests were conducted at field density. The following were the results:

Penetration mm	Load kg	Penetration mm	Load kg
0.0	0.0	3.0	56.5
0.5	5.0	4.0	67.5
1.0	16.2	5.0	75.2
1.5	28.1	7.5	89.0
2.0	40.0	10.0	99.5
2.5	48.5	12.5	106.5

It is desired to use the following materials for different pavement layers.

- (1) Compacted sandy soil with 7 percent CBR
- (2) Poorly graded gravel with 20 percent CBR
- (3) Well graded gravel with 95 percent CBR
- (4) Minimum thickness of bituminous concrete surfacing may be



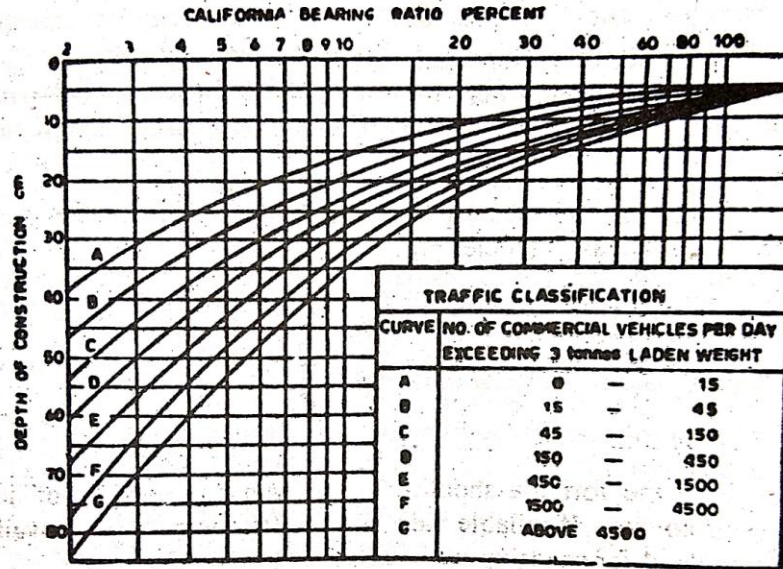
taken as 5 cm

The traffic survey revealed the present ADT of commercial vehicle as 1200. The annual rate of growth of traffic is found to be 8 percent. The pavement construction is to be completed in three years after the last traffic count.

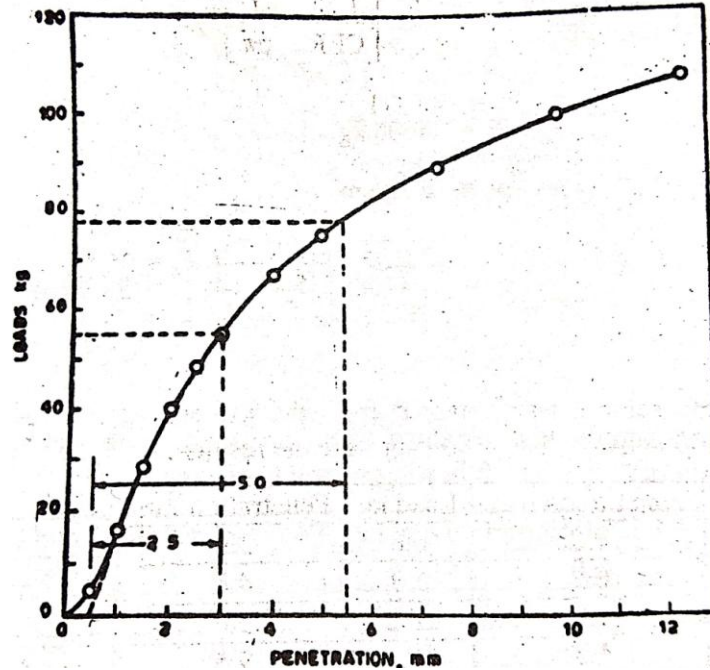
(a) Design the pavement section by CBR method as recommended by IRC, using all the four pavement materials.

(b) Suggest alternate design without using poorly graded gravel.

Discuss the limitation of CBR method of pavement design in the light of the above results.



CBR design chart (Recommended by IRC)



Load-Penetration Curve

