

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014****Subject code: 1721302****Date: 18-06-2014****Subject Name: Pavement Design and Evaluation****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of IRC and relevant codes permitted.

- Q.1** (a) Explain the various types of failures in flexible pavement with neat sketch. **07**
 (b) Compare the Flexible and Rigid Pavement. **07**

- Q.2** (a) Explain the factors affecting pavement design. **07**
 (b) Explain the Boussinesq's theory of flexible pavement **07**

OR

- (b) Calculate the Vehicle Damage Factor from the following data **07**
- | Axle load range (Tonnes) | % Frequency |
|--------------------------|-------------|
| 18-16 | 08 |
| 16-14 | 18 |
| 14-12 | 32 |
| 12-10 | 26 |
| 10-08 | 15 |
| 08-06 | 06 |

- Q.3** (a) Explain the Westergaard's theory of rigid pavement **07**
 (b) It is proposed to widen an existing 2 lane road to 4 lane divided road. Design the pavement for new carriage way for the following data as per IRC. **07**
 Initial Traffic in each direction $\approx$ 6000 CV/ day
 Design Life $\approx$ 20 Years
 Design CBR of subgrade $\approx$ 5%
 Traffic Growth Rate $\approx$ 8%
 Vehicle Damage Factor $\approx$ 4.5

OR

- Q.3** (a) Write a short note on 'Equivalent Single Wheel Load' **07**

- (b) The CBR test carried out on a subgrade soil gave the following readings. **07**

Penetration in mm	Load in Kg	Penetration in mm	Load in Kg
0.0	0.0	3.0	58.0
0.5	4.0	4.0	70.0
1.0	14.0	5.0	77.5
1.5	30.0	7.5	93.2
2.0	41.0	10.0	102.5
2.5	50.0	12.5	110.8

The different pavement materials available near the site are as follows

- (i) Sandy soil with CBR value $\approx 8\%$
- (ii) Soil $\approx$ Kankar mix with CBR value $\approx 28\%$
- (iii) Yellow soil mixed with kankar, CBR value $\approx 90\%$
- (iv) Bituminous concrete for surfacing $\approx$ Minimum 10 cm thick

Design the pavement structure for commercial vehicles of 3000 per day with 8% growth rate by CBR method.

- Q.4 (a)** Calculate the stresses at interior, edge and corner regions of a cement concrete pavement using Westergaards's stress equation from the following data **07**

Wheel Load = 6000 Kg

Modulus of elasticity of cement concrete, $E = 3 \times 10^5 \text{ Kg / cm}^2$

Pavement thickness, $h = 20 \text{ cm}$

Poisson's ratio of concrete, $\mu = 0.15$

Modulus of subgrade reaction, $K = 6 \text{ Kg / cm}^3$

Radius of contact area, $a = 18 \text{ cm}$

- (b) Explain the design considerations for spacing of Expansion Joint and Contraction Joint. **07**

OR

- Q.4 (a)** Design a suitable concrete pavement (4.5 m x 3.5 m) as per IRC, for design wheel load of 5100 kg and tyre pressure of 7 kg/cm^2 . The CBR Value of subgrade soil is 5%. The traffic intensity at the end of design life is 2500 CV/day. **07**

- Q.4 (b)** Explain the design steps of Dowel bars.

- Q.5 (a)** What are the factors causes waves & corrugations in flexible pavement ? **07**

- (b) Explain various types of overlay. **07**

OR

- Q.5 (a)** Benkleman Beam deflection studies were carried out on various points of flexible pavement during summer season with a test vehicle of 8170 kg rear axle load. Observations recorded at a pavement temperature of 42⁰ C. Length of the stretch is 400 m. **07**

Serial Number of sub section	Rebound Deflection in mm	Serial Number of sub section	Rebound Deflection in mm
1	1.45	7	1.78
2	1.62	8	1.76
3	1.60	9	1.92
4	1.80	10	1.52
5	1.96	11	1.60
6	1.74	12	1.70

Compute the thickness of overlay of bituminous concrete, taking allowable deflection as 1.30 mm, if the factor for subgrade moisture correction is 2.0

- (b)** Discuss the importance of maintenance of highway. **07**
