MANIPAL INSTITUTE OF TECHNOLOGY
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MANIPAL INSTITUTE OF TECHNOLOGY

7TH SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATION, NOV 2022

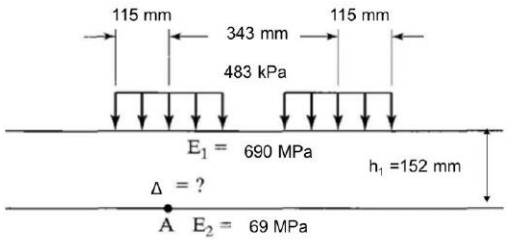
PAVEMENT MATERIALS AND DESIGN (CIE 4069)

(28 - 11 - 2022)

TIME: 3 HRS. **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. Any missing data may be suitably assumed.
3. Use of Formula book, Design charts and IRC 37:2012 (selected pages) are permitted

Q. NO	QUESTION	MARKS	CO	BL
1A	List out the materials used in the road construction and their importance.	**3**	**2**	**1**
1B	Using numerical method, find ESWL at depths of 5cm, 20cm and 40cm for a dual wheel carrying 2044 kg each. The centre to centre tyre spacing is 20cm and distance between the walls of the two tyres is 10cm.	**3**	**3**	**5**
1C	Differentiate between flexible and rigid pavement.	**4**	**1**	**4**
2A	Define CBR and explain the brief test procedure.	**3**	**2**	**1**
2B	Estimate the design traffic as per IRC 37:2012 for the following data: – Type of Road = State highway – Lane configuration = Four lane Single carriageway – Number of commercial vehicles counted in the year 2010 = 1000 CVPD in both direction – Highway is planned to be opened for traffic in the year 2013 – State highway passes through Hilly terrain	**3**	**4**	**4**
2C	Figure shows a set of dual tires, each having contact radius 115 mm and contact pressure 483 kPa. The center-to-center spacing of the dual is 343 mm. Layer 1 has thickness 152 mm and elastic modulus 690 MPa; layer 2 has elastic modulus 69 MPa. Determine the vertical deflection at point A, using Burmister's two-layered analysis.	**4**	**5**	**5**

<table>
<tr><td></td><td> 
</td><td></td><td></td><td></td></tr>
<tr><td>3A</td><td>The specific gravities and weight proportions for aggregate and bitumen for the preparation of Marshall mix design are given below. The volume and weight of one Marshall specimen was found to be 475 cc and 1100 gm. Assuming absorption of bitumen in aggregate is zero, find Vv , Vb , VMA and VFB.
<table>
<tr><td>Item</td><td>A_1</td><td>A_2</td><td>A_3</td><td>A_4</td><td>B</td></tr>
<tr><td>Wt. (gm)</td><td>825</td><td>1200</td><td>325</td><td>150</td><td>100</td></tr>
<tr><td>Sp. Gr.</td><td>2.63</td><td>2.51</td><td>2.46</td><td>2.43</td><td>1.05</td></tr>
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.</td><td>4</td><td>2</td><td>4</td></tr>
<tr><td>3B</td><td>Explain viscosity test and flash & Fire point test carried out on bitumen.</td><td>6</td><td>2</td><td>2</td></tr>
<tr><td>4A</td><td>What are the different types of rigid pavements? Explain.</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>4B</td><td>Determine the warping stresses at interior, edge and corner regions in a 25cm thick concrete pavement with traverse joints at 11m interval and longitudinal joints at 3.6m intervals. Modulus of subgrade reaction (K) is 6.9 kg/cm^3. Assume temperature differential for day conditions to be 0.6 ^{o}C per cm slab thickness. Assume radius of loaded area as 15cm for computing warping stress at the corner. Additional data given below: Co-efficient of thermal expansion = 10 * 10^{-6} per ^{o}C; Elastic modulus of concrete = 3*10^5 kg/cm^2; poisson ratio = 0.15.</td><td>5</td><td>3</td><td>5</td></tr>
<tr><td>4C</td><td>What is the need for soil stabilization and list out the various methods of soil stabilization.</td><td>3</td><td>5</td><td>3</td></tr>
<tr><td>5A</td><td>Explain the mix design procedure of concrete pavement constructions based on IS recommendations.</td><td>5</td><td>4</td><td>2</td></tr>
<tr><td>5B</td><td>Explain briefly the following types of flexible pavement failures by mentioning causes and remedial or maintenance measures.
• Potholes
• Rutting</td><td>5</td><td>5</td><td>4</td></tr>
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