PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20 %   Max Marks: 40   Max Time: 1 hr.   Tuesday, 25 September 2018

TEST – 1

Course: **CIV 301 Pavement Design**   V Semester: Civil

Odd Semester 2018-19

Instruction:

(i)   Read the question properly and answer accordingly.

(ii)   Question paper consists of 3 parts.

(iii)   Scientific and Non-programmable calculators are permitted.

Part A

(3 Q x 4 M = 12 Marks)

1. Give the different Types of Pavement and its sub-types.

2. List the types of failure in flexible and rigid pavement.

3. Explain Fixed Vehicle Approach of traffic consideration in pavement design.

Part B

(2 Q x 8 M = 16 Marks)

4. Explain about the various factors affecting the pavement design.

5. Four new roads A, B, C and D are planned in a district. Using the concept of maximum utility value, find the order of priority for these roads and also conclude which road should be constructed first. The data for these roads is given below-

Roads	Length (km)	Number of villages with population		
		<2000	2000-5000	>5000
A	38	5	15	2
B	19	19	9	1
C	26	20	8	3
D	46	16	13	4

(1Q x 12 M = 12 Marks)

6. Single Axle Dual Wheel assembly of truck has two tyres with a clear inside distance as 20cm and center to center distance of tyres 45cm. The load on each tyre is 40kN. Determine Equivalent single Wheel Load at depth of

    a) 60cm from road surface   (8M)

    b) 10cm from road surface   (2M)

    c) 90cm from road surface   (2M)

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TEST 2

Odd Semester: 2018-19

Course Code: CIV 301

Course Name: Pavement Design

Branch & Sem: CIV & V Sem

Date: 28 November 2018

Time: 1 Hour

Max Marks: 40

Weightage: 20%

Instructions:
(i)   Read the question properly and answer accordingly.
(ii)   Question paper consists of 3 parts.
(iii)   Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** question carries **four** marks.   (3x4=12)

1. What is deflection at the surface of flexible pavement due to wheel load of 38 kN and a tyre pressure of 0.7 MPa? (Take value of modulus of elasticity is 200 MPa)

2. The modulus of elasticity for soil subgrade and base course are $200 kg/cm^2$ and $800 kg/cm^2$ respectively. Find the thickness of base course if thickness of subgrade is 15cm. (Use triaxial method concept)

3. What are assumptions of the Burnister layered system Method.

Part B

Answer **all** the Questions. **Each** question carries **eight** marks.   (2x8=16)

4. Calculate the equivalent – C value of a three-layer pavement having individual material as shown below-

Material	Thickness(cm)	C- Value
Bituminous layer	15	75
Cement treated base	25	180
Well graded gravel	35	50

5. A soil subgrade sample collected from the site was analyzed and the results obtained are given below-

    (i) Soil portion passing 0.074 mm sieve, percent = 55%

    (ii) Liquid Limit, percent = 50%

    (iii) Plastic Limit, percent = 20 %

Determine the group index of subgrade and design pavement thickness using group index method. Using following data:

G.I Values	Total Thickness Required (cm)
0	22
5	35
10	43
15	48
20	52
25	56

Part C

Answer the Question. Question carries **twelve** marks.   (1x12=12)

6. A soil subgrade sample was obtained from project site and the CBR test was conducted at field density. The following results were obtained-

Penetration (mm)	0	0.5	1	1.5	2.0	2.5	3.0	4.0	5.0	7.5
Load (Kg)	0	4	15.2	28.1	40.0	48.5	56.5	67.5	75.2	89.0

After plotting this data on graph sheet, it was found that tangent drawn on greatest slope point cut the penetration axis at 0.5mm from origin. Find the CBR for soil subgrade. It is desired to use the following material for different pavement layers- Compacted layer (CBR= 7%), poorly graded gravel (CBR=10%), Well graded gravel (CBR= 80%), Bituminous surface (thickness= 6 cm). Design the pavement using CBR if wheel load is 4100kg and contact pressure 7 kg/cm^2.

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END TERM FINAL EXAMINATION

Odd Semester: 2018-19   **Date**: 29 December 2018

Course Code: CIV 301   **Time**: 2 Hours

Course Name: Pavement Design   **Max Marks**: 80

Programme & Sem: CIV & V Sem   **Weightage**: 40%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) The question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** question carries **five** marks.   (4Qx5M=20)

1. What is the formula for radius of relative stiffness of slab to subgrade? Explain all notations.
2. What is the function of expansion joint and contraction joint?
3. The width of expansion joint gap is 2 cm in a cement concrete pavement. Find the spacing between expansion joint for a maximum rise in a temperature of 25°C. (assume thermal coefficient of concrete is $12 \times 10^{-6}/°C$)
4. If the modulus of subgrade reaction of standard plate of 30 cm diameter is 20 kg/cm^3 then find the value of modulus of subgrade reaction for 75 cm diameter plate.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks.   (4Qx10M=40)

5. Cement concrete pavement has a thickness of 32 cm and has two lane width 7.0 m with a longitudinal joint in between them. Design the dimensions and spacing of the tie bar using the following data-
   Allowable tensile stress in steel= 1400 kg/cm^2, Unit weight of concrete= 2400 kg/m^3, Coefficient of friction= 1.5, Bond stress between steel bar and concrete= 24.6 kg/cm^2
6. Explain the function of dowel bar in rigid pavement. What are the steps involved in the design of dowel bars?
7. What are the constituents for Marshall mix? A bituminous concrete consists 68% coarse aggregate, 25% fine aggregate and 7% bitumen by weight. The air voids after compaction are 6%. Specific gravity of coarse aggregate, fine aggregate and bitumen is 2.82, 2.62, and 1.01 respectively. Calculate the VMA (%) and VFB (%).

8. Draw the following standard curve for Marshall mix design-
    (i)   % Bitumen vs Flow value
    (ii) % Bitumen vs Unit weight
    (iii) % Bitumen vs Stability value
    (iv) % Bitumen vs VFB
    (v)   % Bitumen vs Air voids
    Also explain, how to determine the optimum amount of bitumen using these curves.

Part C

Answer the Question. Question carries **twenty** marks.   (1Qx20M=20)

9. Explain the nature of various stresses developed in cement concrete pavement.
   A pavement slab 32 cm thick is constructed over a soil subgrade having modulus of subgrade reaction 6 kg/cm^3. Spacing between the transverse joint and longitudinal joint are 4.5 m and 3.6 m respectively. Find out the stresses and worst combination of stresses by using following data-
   Wheel load= 4500 kg, Temperature difference= 15°C, Radius of contact area= 15 cm, Elastic modulus of cement concrete= 3x10^5 kg/cm^2, Poisson's ratio=0.15, Coefficient of friction= 1.5, Unit weight of Concrete= 2400 Kg/m^3 Coefficient of thermal expansion= 10x10^{-6}/°C, C$_x$= 0.80, C$_y$= 0.45.

   Wheel load stress

   $$\sigma_i = \frac{0.316\, P}{h^2}\left[4\,\log_{10}\left(\frac{l}{b}\right) + 1.069\right]$$

   $$\sigma_e = \frac{0.572\, P}{h^2}\left[4\,\log_{10}\left(\frac{l}{b}\right) + 0.359\right]$$

   $$\sigma_c = \frac{3\, P}{h^2}\left[1 - \left(\frac{a\sqrt{2}}{l}\right)^{0.6}\right]$$