B.E. Civil Engineering Eighth Semester

CE806 - Elective-III: Pavement Design

P. Pages : 3 **GUG/W/18/1988**

Time : Three Hours * 1 5 2 1 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Answer **all** questions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. a) Discuss in details the basic structural design difference between flexible pavement and Rigid pavement. **8**

b) Estimate "ESWL" for an aircraft Dual-in-tandem gear for flexible pavement from following data. **8**

Data:

i) Gear load = 36000kg. ii) Tyre Pressure = $9 \cdot 5 \text{kg}/\text{cm}^2$

iii) Dual spacing = 180mm (clear) iv) Tandem Spacing = 250mm (Clear)

v) Pavement thickness = 85, 110, 135, cm.

OR

2. a) What are the characteristics of airfield. Pavement and how it differs from highway pavement. **8**

b) Calculate the total fatigue in terms of standard axle load repetitious from following data. Assume service life of 15 years, Traffic growth rate 8.6% per year and delay in opening to traffic of 3 yrs. **8**

Data.

Axle load (kg)	A.D.T
2000	186
4000	165
6000	138
8000	152
10,000	118
12,000	96
14,000	74

3. a) Calculate the cone bearing value from following data of North Dacota Cone test. Half angle of cone = 7º 45' **8**

Data

Load (kg)	Penetration of cone (mm)
5.0	22.6
10.0	36.1
20.0	54.2
40.0	73.4

b) Explain "Marshalls' method of Bituminous mix design. **8**

OR

4. a) Following are the data of field CBR test conducted an subgrade soil during the month of May 2017, Estimate the CBR value of subgrade. **8**

Penetration (mm)	Load (kg)	Penetration (mm)	Load (kg)
0.0	0.0	5.0	422.2
0.5	14.4	7.5	644.8
1.25	49.5	10.0	767.4
2.50	132.5	12.5	844
375	265.8		

b) Explain plate load test for evaluation of modulus of subgrade reaction and correction to be applied. **8**

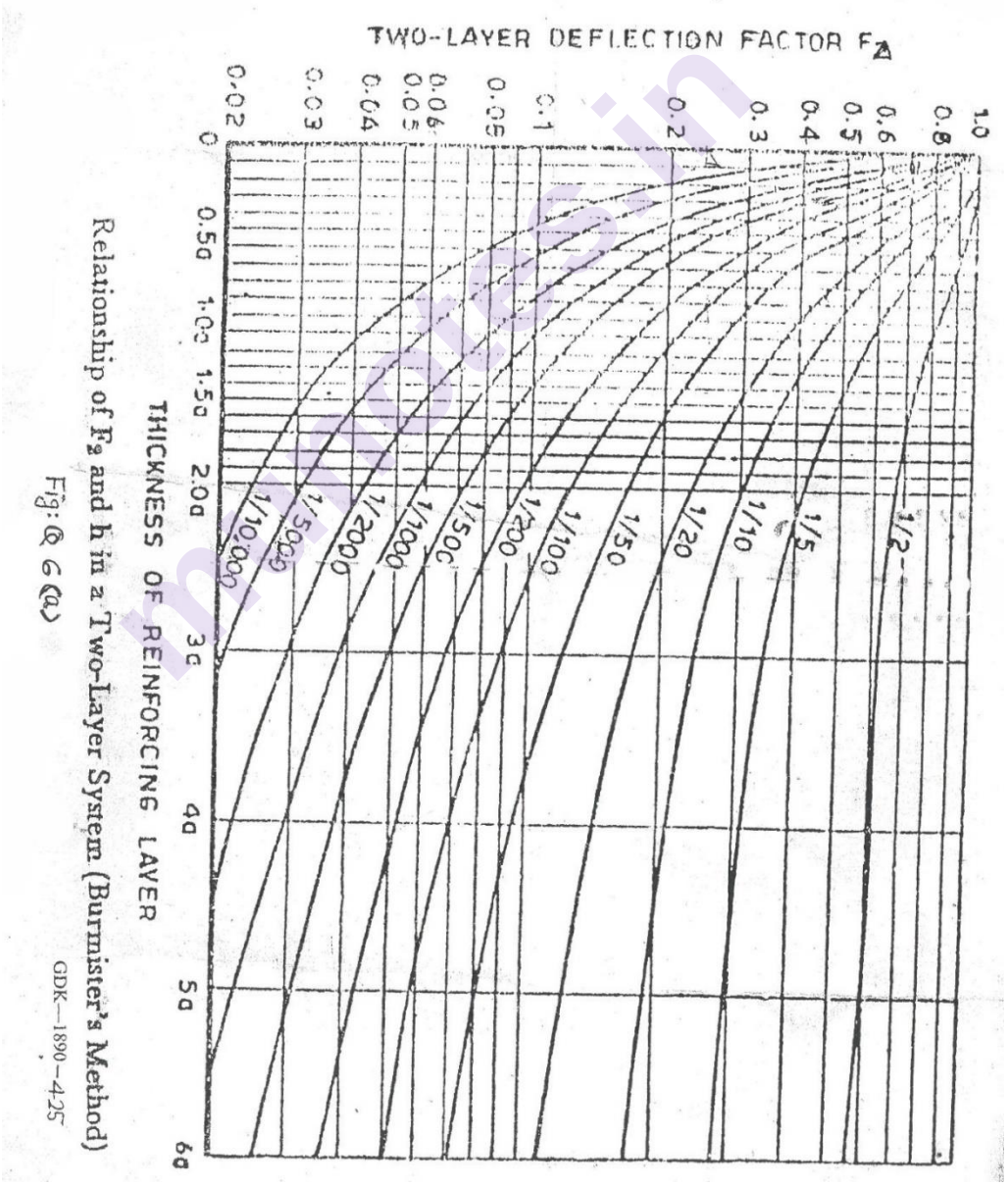
5. a) Estimate the vertical compressive stress in subgrade at a depth "2a" and surfaces deflection from following data. **8**

i) Wheel load = 5100 kg

ii) Tyre pressure = $6.5 kg/cm^2$

iii) CBR of soil = 3.0%

iv) Poisson's ratio of soil = 0.35.



b) Explain method of deflection, stress and strain analysis of 2 layer flexible pavements and explain how vertical compressive stress on subgrade is reduced by a pavement layer. **8**

OR

6. a) A plate load test was conducted an subgrade and also on 20cm thick base course with 30cm diameter plate the pressure intensity for 5mm deformation in both the test was recorded as $2.3 kg/cm^2$ and $4.5 kg/cm^2$. **8**

For a flexible pavement of 30 cm thick, determine pavement deformation (Δ), vertical compressive stress, (σ_z) and Radial. Stress, Shear stress $(\mathcal{J})$ under wheel load of 5100kg acting at a tyre pressure of $6.2 kg/cm^2$. [Assume Poisson's ratio of subgrade soil $(N_s) = 0.38$] see fig. Q. 6 (a).

b) Calculate the warping stress for a concrete pavement of 20cm thickness at all regions of a slab concrete for the following given data. **8**

Data:

i) Grade of concrete - M_{30}
ii) Poisson's ratio of concrete = 0.15
iii) Temperature Gradient = 0.9ºC/cm
iv) Thermal coefficient of concrete = 10×10^{-6} per °C
v) $C_x = 0.98, C_y = 0.52$.

7. a) Explain Triaxial method of pavement design. **8**

b) A flexible pavement is to be constructed over a subgrade of CBR=6%. Estimate Total Crust thickness for a maximum wheel load of 9000kg at tyre pressure $7.0 kg/cm^2$. Suggest a crust composition for High rainfall area. **8**

OR

8. a) Explain A.A.S.H.T.O method of Rigid pavement design for Airfield pavements. **8**

b) Design a typical longitudinal Tie bar joint of 17.5cm pavement thickness. Unit weight of concrete is $2350 kg/m^3$, Expansion joint spacing is 12m and panel width is 3.5m. Coefficient of subgrade restraint is 1.25m. draw neat sketch of a joint. Assume other suitable wherever necessary. Permissible tensile stress in steel $= 1400 kg/cm^2$ and permissible band stress is tie bars $= 24.6 kg/cm^2$. **8**

9. A 3km long section of a certain highway was identified as due for overlay. Benkelman beam test conducted at 15 randomly selected locations recorded following observations of rebound deflection:- **16**

1.81, 1.83, 1.70, 1.76, 1.90, 2.03, 1.99, 1.90, 1.93, 1.74, 1.78, 1.92, 1.87, 1.80 and 1.82mm. Temperature during test was 29ºC. Design a suitable overlay for a projected traffic of 3560CVD.

OR

10. a) Write a note on "Overlays and design method". **8**

b) Explain briefly various types of failures in flexible pavement and its causes. **8**

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