

B.E. (Civil Engineering) Eighth Semester (C.B.S.)
Elective – II : Pavement Analysis & Design

P. Pages : 4

Time : Three Hours



TKN/KS/16/7618

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Diagrams and chemical equations should be given whenever necessary.
 11. Illustrate your answers whenever necessary with the help of neat sketches.
 12. Use of non programmable calculator is permitted.

1. a) Discuss the effects of repeated applications of loads on pavements. Explain equivalent wheel load factors for load repetitions. **6**

b) Clearly distinguish between Highway and Airfield pavements. **7**

OR

2. a) With neat sketches enumerate the functions and importance of each component layer both in flexible and rigid pavements. **7**

b) Calculate ESWL for aircraft gear from the following data: **6**

- i) Wheel configuration = Dual in tandem.
- ii) Gear load = 42500kg.
- iii) Tyre pressure = 11kg/cm²
- iv) Clear spacing of duals = 225mm
- v) Clear spacing of tandems = 375mm
- vi) Flexible pavement thickness = 1250 mm.

3. a) Estimate the group index of subgrade soil from following data and discuss its rating as subgrade. **7**

- i) Passing 425 micron = 75%
- ii) Passing 75 micron = 60%
- iii) Liquid limit = 51%
- iv) Plastic limit = 28%.

b) Calculate the cone bearing value from the following data of North Dakota cone test (Half angle of cone = 7°45) **7**

Load (Kg)	Cone penetration (mm)
4.5	2.91
9.0	4.09
18.0	5.96
36.0	8.35

OR

4. The following results were noted in a laboratory CBR tests conducted on sub grade soil:-

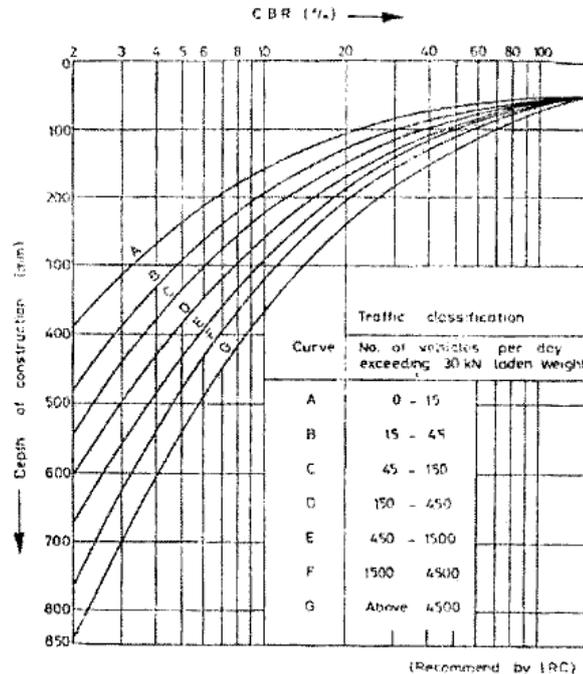
14

Penetration (mm)	0	0.5	1	1.5	2	2.5	3	4	5	7.5	10	12.5
Load (Kg)	0	6	18	32	50	60	65	75	80	90	95	100

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

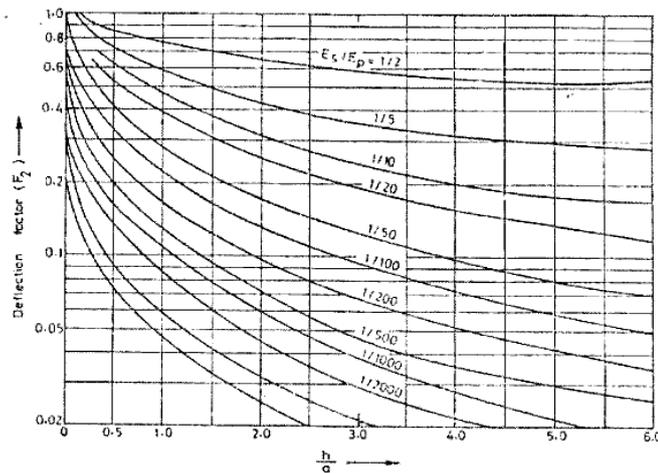
- i) Compacted soil sub grade having CBR = 10%
- ii) Poorly graded gravels having CBR = 22%
- iii) Well graded gravels having CBR = 90%

The traffic survey indicates present ADT of commercial vehicle as 1400 with construction period of 2 years. The design life is 10 years with the expected traffic growth rate of 10%. Suggest the suitable crust composition with neat sketch. (C.B.R. Design chart is attached).



5. a) Explain AASHTO method of flexible pavement design. 5

b) The pressure for 5 mm deformation in both tests was recorded as 2.3 kg/cm² and 4.5 kg/cm² resp. For flexible pavement of 30 cm base course, find the pavement deformation, vertical and radial stress, stress at the subgrade under the load of 5100 kg acting at a tyre pressure of 6.2 kg/cm². Assume Poisson's ratio of subgrade as 0.38. (Ref. Chart given). A plate load test was conducted on subgrade and also on 20 cm thick base with 30 cm diameter plate. 9



OR

6. Design a flexible pavement for design traffic volume of 3770 CVD, if the permissible deflection is 0.5cm by Triaxial Method. Data: 14
- i) Wheel load = 5200kg
 - ii) Tyre pressure = 6.5 kg/cm²
 - iii) Annual rainfall = 92cm
 - iv) Modules of elasticity of : Sub grade = 80 kg/cm², Sub base = 415 kg/cm², Base = 1950 kg/cm²
 - v) Bituminous surfacing = 4400 kg/cm²
 - vi) Traffic coefficient = 8/6
 - vii) Rainfall coefficient = 0.9.

7. a) Explain P.C.A. method of design of rigid pavement with neat sketches of charts. 7
- b) Write short note on LCN method of Airfield pavement design. 6

OR

8. Estimate the load factor at all the regions of runway concrete pavement of 275 mm thickness under ESWL = 20,000 kg at 10.5 kg/cm² tyre pressure. Assume grade of concrete M : 300 and K for subgrade soil = 8.0 kg/cm³. Also locate the position of failure and draw failure pattern. 13

9. a) With neat sketches explain how you will determine modulus of subgrade reaction by plate load test. How is the value influenced by plate diameter and the moisture content? 6
- b) Design a bituminous overlay for a pavement section 3 km long the Benkelman Beam test is conducted at a rate of one test for 250m length over a two section. The following values of deflection are recorded 1.38, 1.52, 1.67, 1.31, 1.7, 1.92, 1.68, 1.2, 1.84, 1.93, 1.46, 1.55mm. The test temp, of pavement is 26°C. Present traffic volume is 750 CVD. Assume growth rate of 9.5% per year for service life of 10 years with delay of 1 year. 7

OR

10. a) Write short note on profilometers. 4
- b) A plate load test with 30cm dia plate conducted a subgrade gave following data:- 9

Deformation (mm)	Load on plate (Kg)
0.25	200
0.50	480
0.75	730
1.00	1005
1.25	1240
1.50	1475
1.75	1720
2.00	1975

Estimate the modulus of subgrade reaction.

11. Design a rigid pavement-for 2-lane highway from following data: 13
- i) Design wheel load = 5100kg
 - ii) Tyre pressure = 6.0 kg/cm²
 - iii) Modulus of subgrade reaction = 7.5 kg/cm²

- iv) Grade of concrete = M₂₅₀
- v) Temperature Gradient = 0.6° C/cm
- vi) Panel dimensions = 3.0 m x 6.0 m
- vii) Initial traffic volume = 860 CVD
- viii) Design life = 20 years.

OR

12. Check the adequacy of rigid pavement from IRC criteria.

13

- i) Slab thickness 150 mm
- ii) 'E' of concrete $3 \times 10^5 \text{ kg/cm}^2$
- iii) Poissons ratio of concrete 0.15
- iv) Thermal expansion coeff. $10 \times 10^{-6}/^\circ\text{C}$
- v) M. O. R. of concrete 48 kg/cm^2
- vi) Anticipated Thermal Gradient across slab 0.5°C/cm
- vii) 'K' of subgrade soil $6.5 \text{ kg/cm}^2/\text{cm}$
- viii) C_x and C_y 0.82 and 0.45 respectively.
- ix) Wheel load (ESWL) 5100kg
- x) Tyre pressure = 6.0 kg/cm^2

Assume any other data suitable if necessary.
