Birla Institute of Technology & Science, Pilani- Pilani Campus

First Semester 2023-2024

Comprehensive Exam

Course No: CE G547 Course Title: Pav. Fai. Eva. & Reh.
Nature of Exam: Closed Book Max. Marks: 60 (Weightage: 35%)
Duration: 180 Min Date of Exam: 20/12/2023

Note:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume the suitable data from the code if necessary.

Q.1 Estimate the safe thickness of concrete overlay by using the following data: [20]

Design Life = 20 years
Traffic Growth Rate = 7.5%
Commercial traffic = 1842 cvpd
Grade of concrete = M40
CBR of Subgrade = 4%; Corresponding 'K' value = 3.43 Kg/cm^3
Percentage of different Axle loads:

Single Axle		Tandem Axle	
Axle load class (Tons)	% Axle loads	Axle load class (Tons)	% Axle loads
15-17	0.5		
13-15	0.7	26-30	0.2
11-13	1.0	22-26	0.5
9-11	24.5	18-22	1.0
7-9	40	14-18	3.0
Less than 7	25	Less than 14	3.6
	91.7		8.3

'K' value of existing layer = 10 Kg/cm^3
Modulus of Rupture = 45 Kg/cm^2
Elastic Modulus of Concrete = 30,000 MPa = 305914.86 Kg/cm^2
Length of square slab = 150 cm
Poisson's ratio of concrete = 0.15
Temperature differential = -0.15 °C/cm
Coefficient of Thermal Expansion = 10 x 10^{-6} per °C

Design concrete overlay.

Q.2 Design life = 20 years [30]
Traffic growth rate = 7.5%
Commercial Traffic = 2000 cvpd
The deflections measured for a road section are as given below;
1.03, 1.05, 1.15, 1.08, 1.22, 1.18, 1.28, 1.14, 1.29, 1.17.
Pavement Temperature = 40 °C
Subgrade moisture content = 16% Clayey soil, PI < 15
Modulus of Rupture = 60 Kg/cm^2
Elastic Modulus of concrete = 305914.86 Kg/cm^2
Length of square slab = 1.4 m
Poisson's ratio of concrete = 0.15

Temperature differential = -°C/cm
Coefficient of thermal expansion = 10 x 10^{-6} per °C

Design a concrete overlay for National Highway.
Percentage of different axle loads are;

Single Axle		Tandem Axle	
Axle load class (Tons)	% Axle loads	Axle load class (Tons)	% Axle loads
19-21	1	30-34	4
17-19	3	26-30	3
15-17	10	22-26	5
13-15	27	18-22	3
11-13	16	14-18	1
9-11	5		
7-9	4		
Less than 7	18		
	84		16

Q.3 Estimate the safe thickness of concrete overlay by using the following data: [10]
Design Life = 20 years
Traffic Growth Rate = 7.5%
Commercial traffic = 1600 cvpd
Grade of concrete = M40
'K' of subgrade = 45 MPa/m
Thickness of granular base = 245 mm
Thickness of asphalt surface = 130 mm
Modulus of rupture = 50 Kg/cm^2
Elastic Modulus of concrete = 30,000 MPa = 305914.86 Kg/cm^2
Length of square slab = 1.25 m
Poisson's ratio of concrete = 0.15
Temperature differential = -0.15 °C/cm
Coefficient of Thermal expansion = 10 x 10^{-6} per °C
Design a concrete Overlay
Percentage of different axle loads:

Single Axle		Tandem Axle	
Axle load class (Tons)	% Axle loads	Axle load class (Tons)	% Axle loads
19-21	1	30-34	4
17-19	3	26-30	3
15-17	10	22-26	5
13-15	27	18-22	3
11-13	16	14-18	1
9-11	5		
7-9	4		
Less than 7	18		
	84		16