U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 20CV6PEPAD **Max Marks: 100**
Course: Pavement Design

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Discuss briefly the functions of each layer in flexible pavement with a neat sketch. **07**

b) Discuss the factors influencing design of pavement. **07**

c) A Tandem wheel load assembly has 5100 kg load on each wheel with tyre pressure of 7 kg/cm^2. The clear spacing between the dual wheels is 22 cm and centre to centre spacing between tandem axles is 100 cm. Determine the ESWL at a depth of 80 cm. **06**

UNIT - II

2 a) List the assumptions and limitations of Boussinesq's theory. **06**

b) Determine the thickness of pavement by single layer elastic theory so as to limit the deflection on Subgrade to 5 mm due to **08**
i) Wheel load of 50 KN and contact pressure of 0.7 N/mm^2 due to truck loading.
ii) Wheel load of 5 KN and contact pressure of 5 N/mm^2 due to bullock cart loading.
Assume $E_{subgrade}$=10 N/mm^2.

c) Discuss briefly on Frost action and measures to overcome frost action. **06**

UNIT - III

3 a) Design a highway pavement using McLeod method for a wheel load of 6000 kg with a tyre pressure of 6 kg/cm^2. The plate load test conducted on subgrade soil using 30 cm diameter plate yielded pressure of 2.8 kg/cm^2 after 10 load repetitions at 0.5 cm deflection. **10**

b) The plate bearing tests were conducted with 30 cm plate diameter on soil Subgrade and over 15 cm base course. The pressures yielded at 0.5 cm deflection are 1.15 kg/cm^2 and 4 kg/cm^2 respectively. Design the pavement section for 4100 kg wheel load with tyre pressure of 5 kg/cm^2 for an allowable deflection of 0.5 cm using Burmister's approach. **10**

OR

4 a) Design a flexible pavement by CBR method based on IRC:37-2001 recommendations using the following data:- **08**

i) Pavement: 2 lane
ii) Traffic volume: 900 CVPD
iii) Road Construction Period: 3 years
iv) Rate of growth of Traffic: 8%
v) Lane Distribution factor: 0.75
vi) Design life: 15 years
vii) VDF: 2.5
viii) Subgrade CBR: 6%

b) Discuss briefly on Empirical and semi-empirical methods. **04**

c) Discuss the steps involved in design of pavement thickness by Group index method. **08**

UNIT - IV

5 a) Discuss briefly about warping stress developed in CC pavements. **05**

b) Determine the wheel load stresses at interior, edge and corner region of CC pavement using Westergaard stress equations from the following data: Wheel load= 5100 kg, Radius of contact area=15 cm, K=6 kg/cm^3, E= 3x10^5 kg/cm^2, Poisson's ratio=0.15, slab thickness=20 cm. **07**

c) Determine the warping stress at interior, edge and corner region in a 25 cm thick concrete pavement with transverse joints at 11m interval and longitudinal joints at 3.6 m interval. The modulus of subgrade reaction is 6.9 kg/cm^3. Assuming temperature differential for day condition to be 0.6^{0}C/cm slab thickness, radius of contact area= 15 cm, co-efficient of thermal expansion=10 x 10^{-6}/^{0}C, modulus of elasticity of concrete= 3 x 10^5 kg/cm^2 and poisson's ratio=0.15. **08**

UNIT - V

6 a) Enumerate the design steps of rigid pavement thickness as per IRC-58-2015. **08**

b) Write short notes on i) Conventional white topping **06**
ii) Thin white topping
iii) Ultra thin white topping

c) Check the adequacy of dowel bar system for a concrete pavement using the following data: Slab thickness=33 cm, Joint width = 2 cm, Radius of Relative stiffness=103.53 cm, Design wheel load=8000 kg, Percentage of load transfer=40%, Grade of concrete to be used = M40, Diameter of dowel bar= 32mm, Spacing of dowel=32cm, Modulus of dowel/concrete interaction=41500 kg/cm^2/cm, E for steel= 2x10^6 kg/cm^2. **06**

OR

7 a) Design the tie bars for Concrete pavement using the following data: Lane width=3.5 m, slab thickness=20 cm, Co efficient of friction=1.5, Density of concrete=2400 kg/m^3, Allowable tensile stress in deformed bars=2000kg/cm^2, Allowable tensile stress in plain bars=1250 kg/cm^2, Allowable bond stress for plain tie bars=17.5 kg/cm^2, Allowable bond stress for deformed bars=24.6 kg/cm^2, Diameter of tie bar=12 mm, Give design details separately for deformed bars and plain tie bars. **10**

b) Write short notes on i) Continuously reinforced concrete pavement (CRCP) **10**
ii) Steel Fibre reinforced concrete pavement (SFRC)
iii) Interlocking concrete block pavement (ICBP)

******