U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

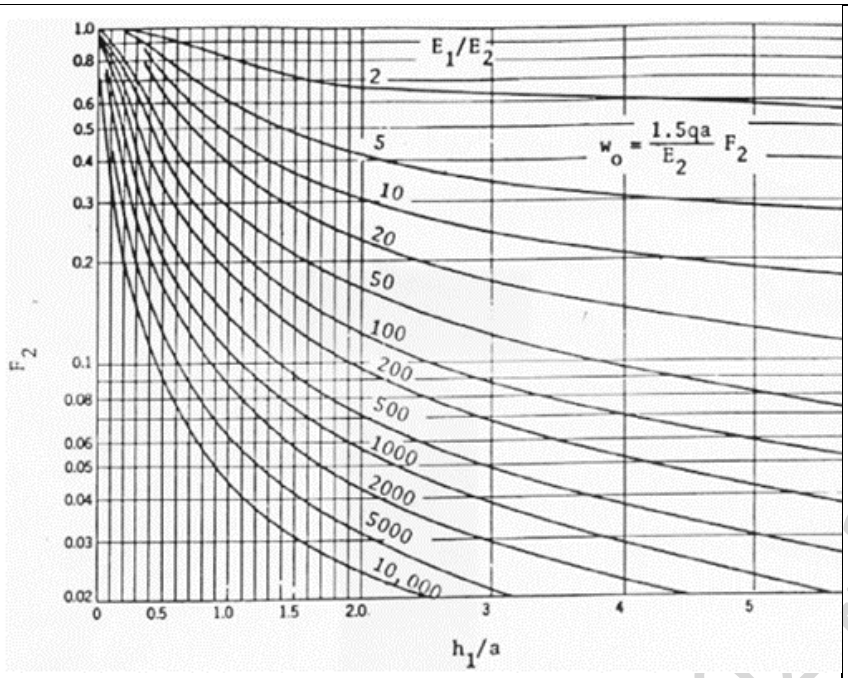
Programme: B.E. **Semester: VI**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 20CV6PEPAD **Max Marks: 100**
Course: Pavement Design

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of IRC-37-2018 is permitted

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	PO	Marks
		UNIT - I			
1	a)	Differentiate types of pavements outlining its important characteristics.	*CO1*	*PO1*	**6**
	b)	With the aid of a neat sketch, illustrate and explain the functions of various components in a flexible pavement.	*CO1*	*PO1*	**8**
	c)	List and explain the factors affecting the design and performance of flexible pavement.	*CO1*	*PO1*	**6**
		OR			
2	a)	Discuss the difference between Highway pavement and Air field pavement	*CO1*	*PO1*	**6**
	b)	Discuss the functions of i. Base course ii. Surface course	*CO1*	*PO1*	**8**
	c)	Calculate ESWL of a dual wheel assembly carrying 2044 kg each for trial pavement thickness values of 180, 220 and 260mm. Centre to centre spacing between the two tyres = 270mm and clear gap between the walls of the tyres = 110mm.	*CO1*	*PO2*	**6**
		UNIT - II			
3	a)	A Plate Load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30 cm. The load values corresponding to the mean settlement dial readings are given below. Determine the modulus of subgrade reaction for the standard plate.	*CO1*	*PO2*	**10**

			Mean settlement values,mm	0.0	0.26	0.52	0.76	1.02	1.26	1.53	1.76			
			Load values,(kg)	0.0	540	1010	1290	1510	1600	1720	1840			
		b)	Enumerate the procedure to be adopted while preparing Remoulded test CBR specimens by dynamic compaction assuming that pavement is designed for the construction of an Expressway.									*CO1*	*PO1*	**10**
			OR											
	4	a)	The load-penetration values of CBR tests conducted on two soil specimens of a particular soil are given below. Determine the average CBR value of the soil if 10 divisions of the load dial represents 20kg load in the calibration chart of the proving ring.									*CO1*	*PO2*	**14**
			Penetration of plunger, mm		**0.0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**4.0**	**5.0**	**7.5**	**10.0**	**12.5**
			Load dial readings, divisions	**Specimen-1**	0	10	18	26	34	40	50	62	70	87	95	109
				Specimen-2	0	0.5	3.5	9.0	18	30	40	54	64	80	88	102
		b)	Determine ESWL by equivalent vertical stress criteria.									*CO1*	*PO1*	**06**
			UNIT - III											
	5	a)	A plate load bearing test conducted on 30 cm diameter plate on soil subgrade and over a base course of thickness 45 cm. The pressure yielded at 0.5 cm deflection on the subgrade and base course were 1.25 kg/cm^2 and 8.0 kg/cm^2 respectively. Design the thickness requirement of flexible pavement of a wheel load of 5100 kg with tyre pressure of 7.0 kg/cm^2 for an allowable deflection of 0.5 cm using Burmisters two layer deflection factor chart given in figure 3a.										*CO2*	*PO2*	**10**

			 **Figure 3a**			
	b)	Demonstrate the procedure to determine stresses and strains developed in the flexible pavements as per three layer system.	*CO3*	*PO1*	**10**
		OR			
6	a)	Compute the wheel load stresses at critical locations of a cement concrete pavement using appropriate equations. Wheel load = 5100 kg, Modulus of elasticity of cement concrete, E= 3.0 x 10^5 kg/cm^2, pavement thickness h = 18 cm, modulus of subgrade reaction K = 6 kg /cm^3 , Radius of contact area a =15 cm, Poisson ratio is 0.15	*CO3*	*PO2*	**10**
	b)	Outline the design factors to be considered while designing a Rigid Pavement.	*CO2*	*PO1*	**10**
		UNIT - IV			
7	a)	Design a rigid pavement making use of westergaards wheel load and warping stress equations at edge region of the slab. The design data are given below Design wheel load P= 7000 kg, contact pressure=7.5 kg/cm^2, spacing between longitudinal and contraction joints are 3.75 and 4.2 m. Elastic modulus of pavement materials E = 3 x 10^5 kg/cm^2. Poisson ratio =0.15, Thermal coefficient of CC per degree Celsius e= 1 x 10^{-5}, Modulus of base course = 30kg/cm^3. Maximum temperature differential at the location for pavement thickness 22,24,26 and 30 are respectively 14.8,15.6,16.2 and 16.8degree Celsius. FOS is 1.1 to 1.2.	*CO3*	*PO2*	**12**
	b)	Write a short note on 1) critical combined stresses 2) Frictional stresses	*CO3*	*PO1*	**08**
		OR			

	8	a)	Enumerate the steps involved in the design of concrete pavements as per IRC guidelines.	*CO2*	*PO1*	**10**
		b)	Calculate the stress at interior, edge and corner regions of CC pavement using Westergaard's stress equation. Also determine the probable location where the crack is likely to develop due to corner loading. Use the following data. Wheel load = 5100kg, E = 3 x 10^5 kg/cm^2, μ = 0.15 Pavement thickness = 18cm Modulus of subgrade reaction = 6 kg/cm^3 Radius of contact area = 15cm	*CO3*	*PO2*	**10**
			UNIT - V			
	9	a)	Write short notes on 1) White Topping, 2) Requirements of Joints	*CO2*	*PO2*	**10**
		b)	Explain the steps for the design of Cement concrete pavement thickness as per IRC guidelines.	*CO2*	*PO2*	**10**
			OR			
	10	a)	The design thickness of a CC pavement is 26 cm considering a design axle load of 12,000 kg on single axle and M40 concrete with characteristic compressive strength of 400 kg/cm^2.The radius of relative stiffness is found to be 62.2 cm. If the elastic modulus of dowel bar steel is 2 x 10^6 kg/cm^2, Modulus of dowel concrete interaction is 41,500 kg/cm^3 and joint width is 1 cm. Design the dowel bar for 40 % load transfer considering the edge loading.	*CO2*	*PO2*	**10**
		b)	Enumerate the design steps for CRCP and ICBP.	*CO3*	*PO2*	**10**

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