BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : IV**
BRANCH: CIVIL **SESSION : SP/19**

SUBJECT: CE4005 TRANSPORTATION ENGINEERING-I

TIME: 3.00 Hrs. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What are the different modes of transportation? What is the uniqueness of road transportation system? [1+2]

Q.1(b) List with sketch the different types of road pattern. [4]

Q.1(c) Discuss the salient features of the Third Twenty Year Road Plan (Lucknow Road Plan). [5]

Q.2(a) What are the basic requirements of an alignment between two terminal stations proposed to be connected by a roadway? [3]

Q.2(b) What information should be incorporated in the drawings and Detailed Project Report (DPR) to be prepared after detailed survey of an alignment? [4]

Q.2(c) Describe the factors controlling highway alignment. [5]

Q.3(a) A valley curve is formed when a descending grade of 1 in 25 meets an ascending grade of 1 in 30. Design the length of valley curve to fulfill both comfort condition and head light sight distance requirements for a design speed of 80 km/hr. Assume allowable rate of change of centrifugal acceleration C = 0.6 m/sec^3. [5]

Q.3(b) Describe the detailed methodology (with sketches) for attainment/introduction of full superelevation on a horizontal curve. [7]

Q.4(a) Define the following terms w.r.t. traffic engineering: [3]
Median Speed, ith percentile speed, ADT, Operational Delay, Travel Time Delay, Parking accumulation

Q.4(b) Using Greenshield's Model, show that [4]
i. At maximum flow, space mean speed is half of mean free-flow speed.
ii. At maximum flow, density is half of jam density.

Q.4(c) What are the different steps involved in traffic accident studies and methodologies to report and record the accidents? [5]

Q.5(a) The design thickness of a CC pavement is 26 cm considering a design axle load (98th percentile load) of 12000 kg on single axle and M-40 grade concrete with characteristic compressive strength of 400 kg/cm^2. The radius of relative stiffness is found to be 62.2 cms. If the elastic modulus of dowel bar steel is 2X10^6 kg/cm^2, modulus of dowel-concrete interaction is 41,500 kg/cm^3 and the joint width is 1.8 cm, design the dowel bars for 40% load transfers considering edge loading. [6]
$F_{bmax} = M_c P_t (2+ßz)/4ß^3E_sI$ and $ß = (M_cb/4E_sI)^{1/4}$; F_b in kg/cm^2= F_{cs} (10.16-b)/9.525, notations having usual meaning and units. Use Clause 7.2.6 Table 5 of IRC 58-2011 as reproduced in Table 1.

Q.5(b) Determine an Equivalent Single Wheel Load (ESWL) for a set duals spaced 35 inches apart centre to centre. Load on each tyre is 25000 pounds, tyre pressure 100 psi, and the flexible pavement is 25 inches thick. [1 pound = 0.453 kg; 1 inch = 2.54 cms; but then conversion to SI units is not required]. Use graph paper and Figure 1.]. Use Equal Deflection Criteria. [6]

Q.6(a) The specific gravities and weight proportions for aggregate and bitumen are as under for the preparations of Marshall Mix Design. The volume and weight of one Marshall specimen was found to be 475 cm^3 and 1100 gm. Assuming absorption of bitumen in aggregate as zero, find V_v, V_b, VMA and VFB. [5]

Item	A_1	A_2	A_3	A_4	B
Wt (gms)	825	1200	325	150	100
Sp. Gr.	2.63	2.51	2.46	2.43	1.05

PTO

Q.6(b) Discuss the Aggregate Impact Test for aggregates and Penetration Test for bitumen (with neat sketches). [3.5+3.5]

Q.7 Discuss the different types of failures and distresses in bituminous pavements and describe their maintenance/repair methods. [12]

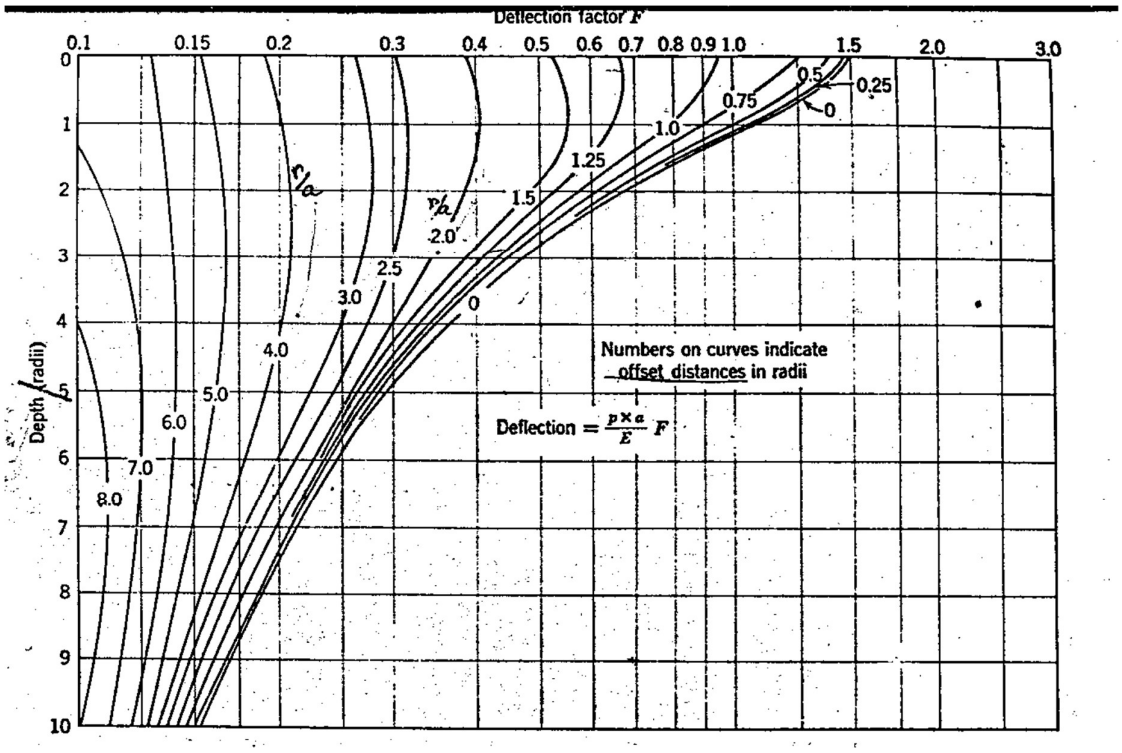

Figure 1. Vertical Deflection (Poisson's Ratio =0.5)

Slab thickness mm	Dowel bar details		
	Diameter, mm	Length, mm	Spacing, mm
200	25	360	300
230	30	400	300
250	32	450	300
280	36	450	300
300	38	500	300
350	38	500	300

Table 1. Recommended dimensions of dowel bars as per IRC 58-2011

:::::26/04/2019 E::::