Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name : Highway Engineering

Subject Code : 4TE04HYE1 **Branch: B.Tech (Civil)**

Semester : 4 **Date : 20/05/2016** **Time : 02:30 To 05:30** **Marks : 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) What is Median? (1)

b) What is Organic soil? (1)

c) Why do we provide joint in RCC road? (1)

d) Write formula of capacity calculation (Q_p) in roundabout. (1)

e) What is full form name of IRC? (1)

f) What is Capillarity? (1)

g) How much displacement permitted by 'burmister' under wheel load? (1)

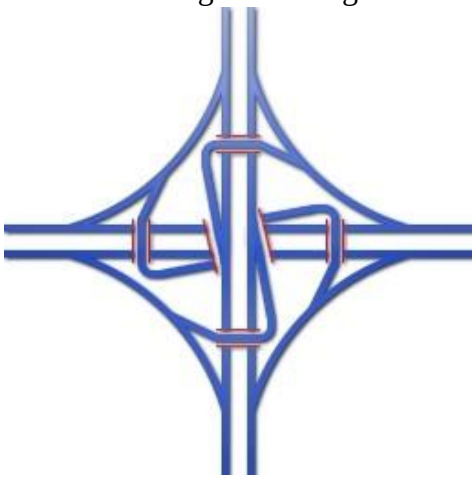
h) Following equipment used for which experiment? (1)

i) Following equipment used for which experiment? (1)

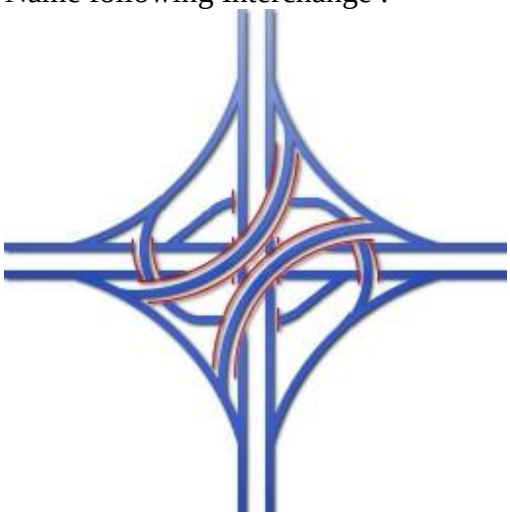
j) Following equipment used for which experiment ? (1)

k) Why do we provide steel at bottom in R.C.C. road ? (1)

l) Name following Interchange : (1)



m) Name following Interchange : (1)

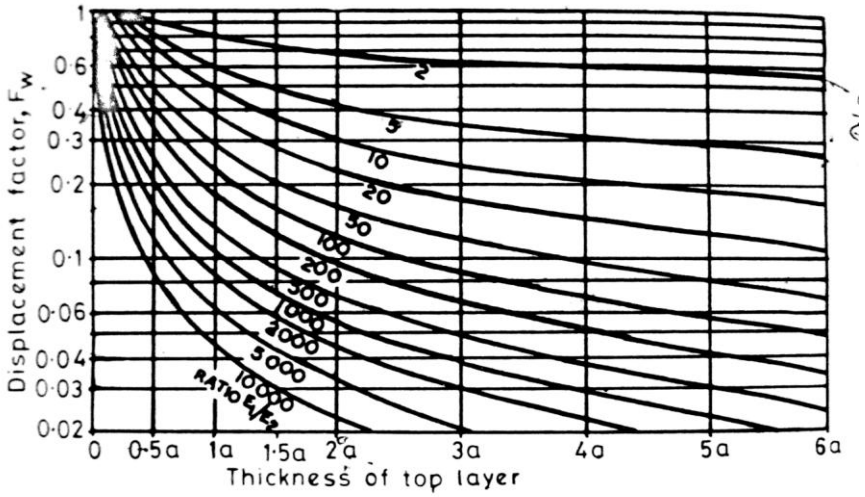


n) Draw 'semi-direction T interchange'. (1)

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(A) Design the thickness of a flexible pavement by burmister's two-layer analysis, for a wheel load of 50000N and a tyre pressure of 0.8MN/m^2. The modulus of elasticity of the pavement material is 200 MN/m^2 and that of the subgrade is 40 MN/m^2. The value of F_w, the displacement factor can be taken from Following chart. (4)



(B) Plate bearing tests were conducted with a 75cm dia. Plate on soil subgrade and a granular base. The stress noticed, when the deflection was 0.25cm on the subgrade soil, was 0.07 MN/m^2. On the base course the same plate yielded 0.25cm deflection under a stress of 0.14 MN/m2. Design the pavement for an allowable deflection of 0.5cm, under a wheel load of 40kN and a tyre pressure of 0.5 MN/m^2. The value of F_w, the displacement factor can be taken from chart given in Q-2 (A). (6)

(C) Write note on 'Cutbacks'. (4)

Q-3 **Attempt all questions** **(14)**

(A) Write note on 'Dual tyres'. (5)

(B) Write brief note on 'Human factors governing road user behavior' (5)

(C) Write disadvantages of rotary intersection. (4)

Q-4 **Attempt all questions** **(14)**

(A) A chowk named 'Upasna' located in surendranagar city has traffic flow as shown in following table. Design round about for this chowk. (10)

Data to be used =

- e1 = e2 = 20 m
- Island radius = 30m
- Entry radius = exit radius = 30m
- Weaving length = 55m
- Assume other necessary data.

Direction	**Left**		**Straight**		**Right**	
	Car	scooter	Trucks	Bus	Tractor	Bikes
North	200	200	200	150	100	200
East	250	250	250	200	250	150
South	300	250	200	150	250	200
West	400	250	150	150	200	300

(B) Write down classification of highway. (4)

Q-5 **Attempt all questions** **(14)**

(A) Write note on Consistency and plasticity of fine grained soil. (7)

(B) Write note on 'Boussinesq's Theory'. (7)

Q-6 **Attempt all questions** **(14)**

(A) Write note on 'Shear box test'. **(7)**

(B) Write the'factors affecting pavement design'. Explain. **(7)**

Q-7 **Attempt all questions** **(14)**

(A) Draw 'Textural classification system' of soil and show how to find percentage of 'SAND'. (5)

(B) Write note on 'Burmister's theory'. (5)

(C) Write a short note on 'Soundness test'. (4)

Q-8 A cement concrete pavement is to be designed for a two lane – two-way national highway in the Gujarat state. The total two-way traffic is 3000 commercial vehicles per day. Also do check for temperature stresses, corner stress. The design parameters are: (14)

Flexural strength of cement concrete = 4.5 Mpa

CBR of sub-grade = 6%

Corresponding Modulus of subgrade reaction = 45 kPa/mm

Thickness of DLC subbase = 150mm

Effective modulus of subgrade reaction = 242.5 kPa/mm

Elastic modulus of concrete = 30000 Mpa

Poison's ratio = 0.15

Coefficient of thermal expansion of concrete = 10×10^{-6} / °C

Tyre pressure = 0.8 Mpa

Rate of traffic growth r = 6%

Temperature differential = 15.8 °C

Life of Road : 30 years

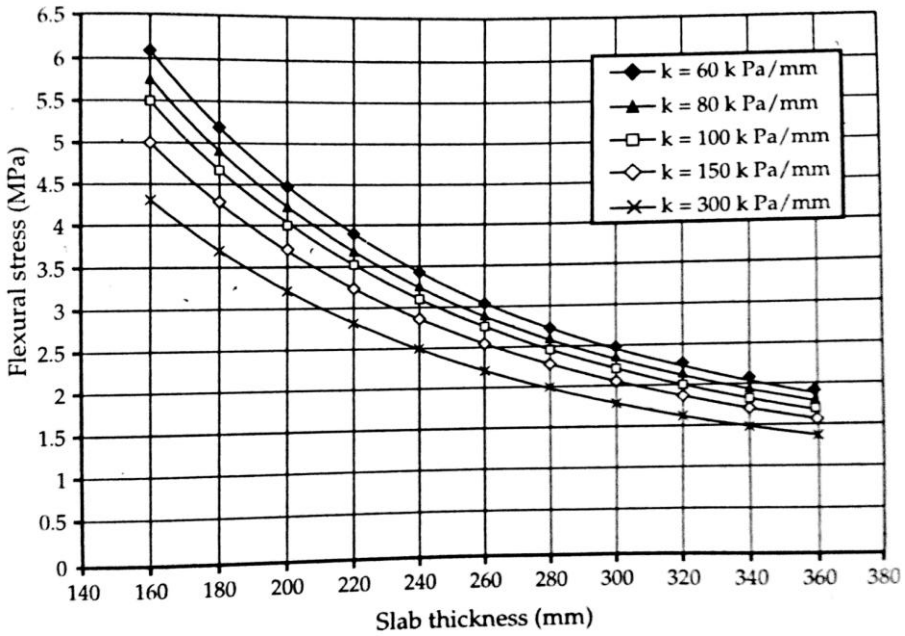
The axle load spectrum obtained from axle load survey is given in following table:

Single Axle Loads		Tandem Axle Loads	
Axle Load class, kN	Percentage of axle loads	Axle Load class, kN	Percentage of axle loads
190-210	0.5	340-380	0.3
170-190	1.5	300-340	0.3
150-170	4.8	260-300	0.6
130-150	10.8	220-260	1.8
110-130	22.0	180-220	1.5
90-110	23.3	140-180	0.5
Less than 90	30.0	Less than 140	2.0
Total	93.0	Total	7.0

The repetitions of the single axle and tandem axle loads are as follows:

Single Axles		Tandem Axles	
Load in kN	Expected repetitions	Load in tons	Expected repetitions
200	129853	36	64927
180	324633	32	64927
160	1038825	28	129853
140	2337355	24	389559
120	4761279	20	324633
100	5042628	16	108211
Less than 100	6492654	Less than 14	432844

Useful Charts for Values are given below :



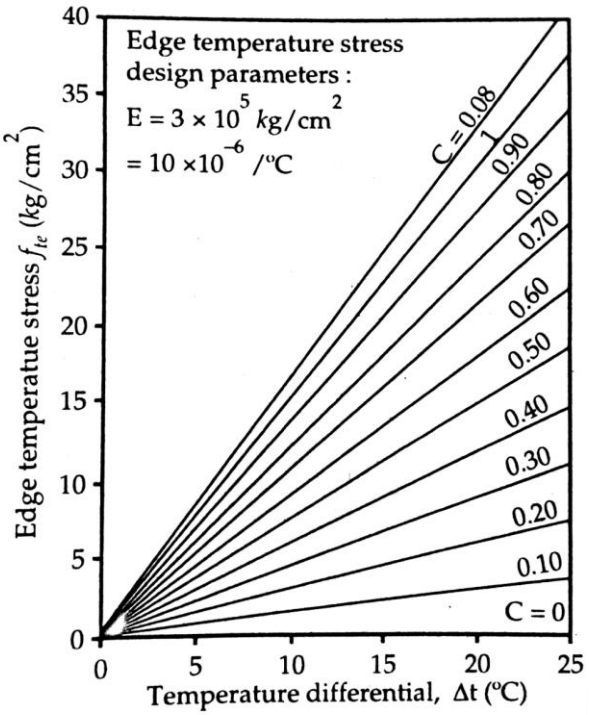


Chart for determination of coefficient, C

L/I or W/I	C	L/I or W/I	C
1	0.000	7	1.030
2	0.040	8	1.077
3	0.175	9	1.080
4	0.440	10	1.075
5	0.720	11	1.050
6	0.920	12	1.000

Stress ratios and allowable repetitions in cement concrete

Stress Ratio	*Allowable Repetitions*	*Stress Ratio*	*Allowable Repetitions*
0.45	6.279×10^7	0.66	5.83×10^3
0.46	1.4335×10^7	0.67	4.41×10^3
0.47	5.2×10^6	0.68	3.34×10^3
0.48	2.4×10^6	0.69	2531
0.49	1.287×10^6	0.70	1970
0.50	7.62×10^5	0.71	1451
0.51	4.85×10^5	0.72	1099
0.52	3.26×10^5	0.73	832
0.53	2.29×10^5	0.74	630
0.54	1.66×10^5	0.75	477
0.55	1.24×10^5	0.76	361
0.56	9.41×10^4	0.77	274
0.57	7.12×10^4	0.78	207
0.58	5.4×10^4	0.79	157
0.59	4.08×10^4	0.80	119
0.60	3.09×10^4	0.81	90
0.61	2.34×10^4	0.82	68
0.62	1.77×10^4	0.83	52
0.63	1.34×10^4	0.84	39
0.64	1.02×10^4	0.85	30
0.65	7.7×10^3		