Ref. No.: Ex/CE/T/424D/2017

B. CIVIL ENGINEERING 4TH YEAR 2ND SEMESTER EXAMINATION 2017

ADVANCED TRANSPORTATION ENGINEERING (ELECTIVE – II)

Time:3 Hours **Full Marks: 100**

(50 marks for each part)

Part I

Use Separate Answer scripts for each Part

Answer ALL Questions

Answer brief & to the point. Assume standard value for any parameter, if required

1. Write short notes on the following – 5×4
   a. Cumulative Fatigue Damage & Design Life
   b Adhesion Testing of Aggregates & Bitumen
   c. Viscosity Testing of Bitumen
   d Flakiness & Elongation of Aggregates
   e. Rutting

2. What is the Viscosity at 60°c of a bitumen sample, having standard penetration of 22 and softening point of 55°c. 5

3. A bituminous concrete mix was designed in a standard Marshal mould of 100mm diameter and 64mm height. The proportion of Coarse Aggregates, Fine Aggregates and Fine Soils in a 20down mix of aggregates were taken following Fuller's Postulate with n=0.4. The specific gravities of these aggregate solids and Bitumen were found to be 2.7, 2.65 & 2.6 and 1.05 respectively. The maximum specific gravity of mix may be determined considering no loss of bitumen and absence of any non-penetrable voids. The accepted values may be taken as – Minimum Stability – 7.5KN; Flow = 1.75mm to 2.25mm; Minimum VMA = 11%; VA = 3% to 5% and VFB = 60% to 75%. Design the optimum bitumen content from the following results – 25

	Bitumen Content (as percentage of aggregate)			
	4.25	4.75	5.0	5.5
Wt of Sample in air (gm)	1190	1219	1230	1241
Stability (kN)	6.098	8.335	9.164	8.247
Flow (mm)	1.7	1.9	2.1	3.1

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Ref No. Ex/CE/T/424D/2017 (Old)

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2017 (Old)

(~~1st~~/2nd Semester/~~Repeat/Supplementary/Spl. Supplementary/Old/Annual/Bi-Annual~~)

SUBJECT: ADVANCED TRANSPORTATION ENGINEERING

(Name in full)

PAPER ××××

Time: ~~Two hours~~/ Three hours/~~Four hours/Six hours~~ **Full Marks ~~30~~/100**

(~~15~~/50 marks for each part)

Use a separate Answer-Script for each part

No. of Question		Marks

- *Maintain neatness.*
- *Assume reasonable data if it is not supplied.*
- *Answer any two questions*
- All drawings-must be drawn by pencil
- Code IRC: 37-2001 will be allowed with the students to answer the questions

(1)(a) What are the assumptions involved for each layer in the stress distribution theories? What is meant by deflection factor? 2× 3= 6

(b) Using the following data find the equal deflection ESWL for a 30 cm thick pavement : 10
(i) tyre pressure : 5 kg/cm^2,
(ii) two single wheels carrying load : 5400 kg/each
(iii) Centre to centre distance of tyres : 30 cm
(iv) Clear spacing: 10 cm (of tyres)

(c) Using a 25 cm diameter rigid plate, load tests conducted on soil subgrade and over a 15 cm trial base course yielded 2.4 mm deflection at 1.0 and 4.0 kg/cm^2 respectively. Estimate the thickness of base for a wheel load of 4100 kg with a tyre pressure of 5.8 kg/cm^2, if permissible deflection is 2.5 mm. 7

(d) What is meant by "semi rigid pavement"? 2

(3)(a) Design a flexible pavement using the following data by any conventional method: 8+2=10
CBR value of subgrade = 8%
CBR value of sub base = 20%
CBR value for base = 85%
Present traffic = 1600 vehicles per day
Life of pavement = 18 years
Annual growth = 8%
Show the pavement section with neat sketch.

(b) During design of pavement, what are the factors which may affect the design? Discuss. 6

(c) How AASHTO method differs in approach of designing the pavements w.r.t. the other conventional approaches? 3

(d) What is meant by "pavement design"? 1

(e) How the serviceability of a pavement does vary with age and maintenance? 5

(2)(a) Write short notes on "Two layer system" 5

(b) Design a flexible pavement by AASHTO method for the following conditions and data given: 16

CBR value of Base: 80%	CBR value of Sub base: 20%	CBR value of Subgrade: 8%	Design life:16 Year
Reliability (Z_r)=90%	Standard Deviation (S_d)=0.4	Terminal and Initial Serviceability: 2 & 4.5	

Here CBR value of Kentucky may be taken as CBR value of any other places for deciding corresponding M_R from CBR.

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2017 (Old)

(~~1st /~~2nd Semester~~/Repeat/Supplementary /Spl. Supplementary /Old/Annual/Bi-Annual~~)

SUBJECT: **ADVANCED TRANSPORTATION ENGINEERING**

(Name in full)

PAPER ××××

Time: ~~Two hours~~/ Three hours~~/Four hours/Six hours~~ **Full Marks ~~30~~/100**

(~~15~~/50 marks for each part)

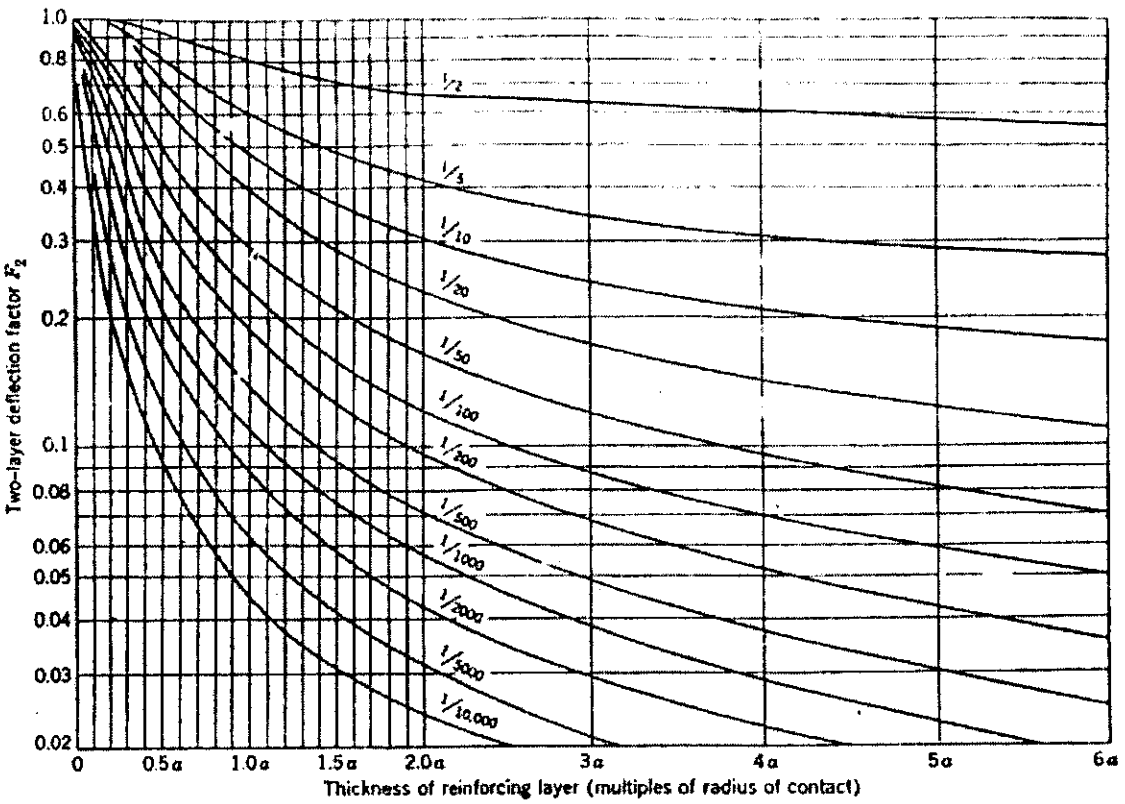
Use a separate Answer-Script for each part

Origin	Destina-tion	No. of Lanes	Length	Time of Journey	Bus			2 Wheeler			Cars		
Sulekha Mor	8B Bus Stand	2	0.5	260	6	1	0	11	0	0	10	0	0
8B Bus Stand	Sulekha More	2	0.5	143	10	0	0	8	0	0	10	0	0
8B Bus Stand	Jadavpur P.S.	2	0.9	422	25	1	1	12	0	2	27	3	2
Jadavpur P.S.	8B Bus Stand	2	0.9	94	17	1	0	7	0	2	21	1	2

Use following Table:

Type	Axle load (t)	HV Eq. factor
Bus/ Truck	10.2	1
2 Wheelers	0.5	1/6
Cars	3.2	1/3

(c) How the serviceability of a pavement does vary with age and maintenance? 4



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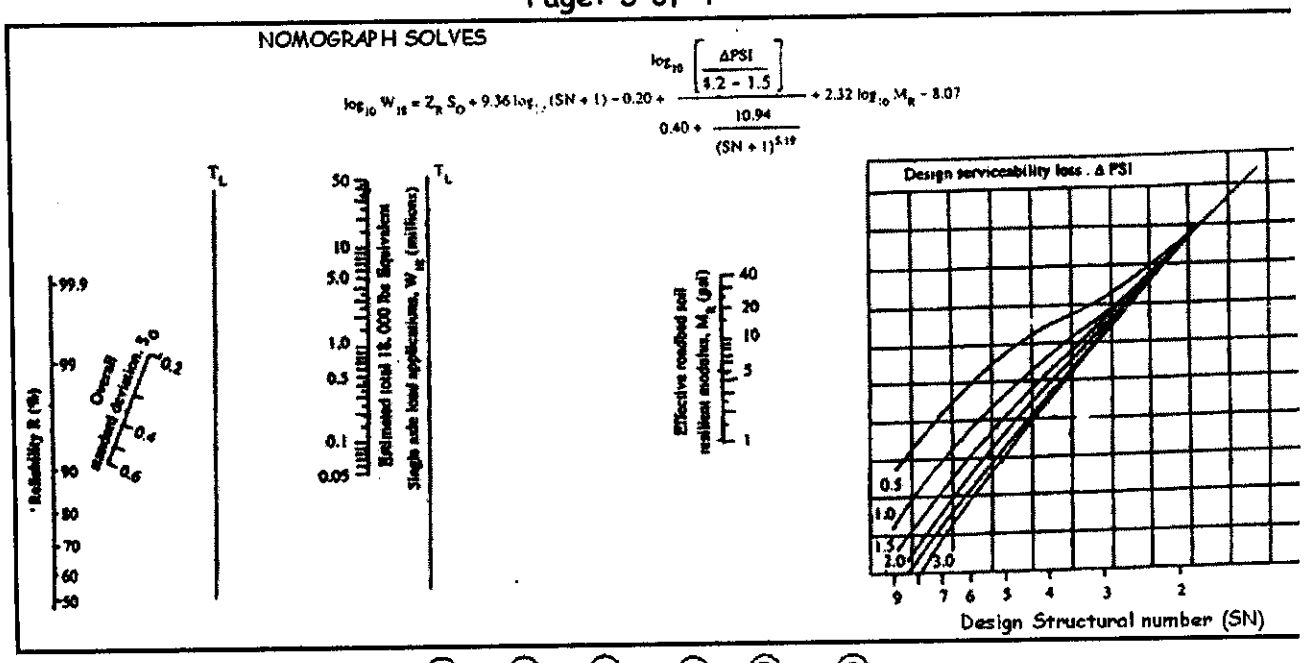

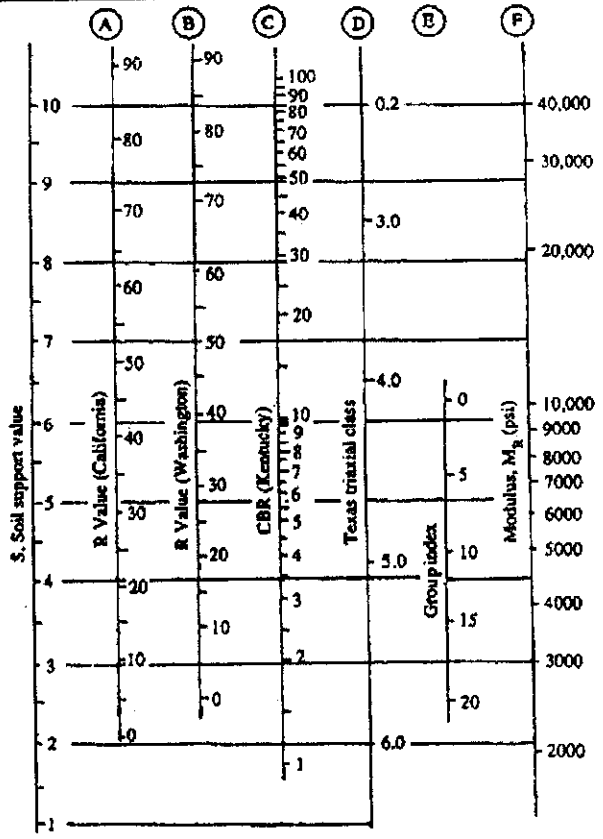

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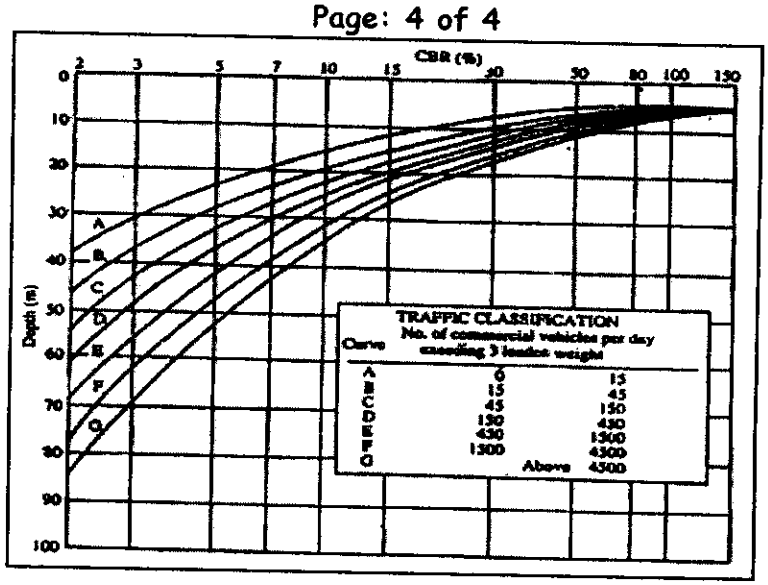

Table 1

Single axles, TSI = 2.0

Axle load (kips)	*Structural number (SN)*					
	1	2	3	4	5	6
2	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
4	0.002	0.003	0.002	0.002	0.002	0.002
6	0.01	0.01	0.01	0.01	0.01	0.01
8	0.03	0.04	0.04	0.03	0.03	0.03
10	0.08	0.08	0.09	0.08	0.08	0.08
12	0.16	0.18	0.19	0.18	0.17	0.17
14	0.32	0.34	0.35	0.35	0.34	0.33
16	0.59	0.60	0.61	0.61	0.60	0.60
18	1.00	1.00	1.00	1.00	1.00	1.00
20	1.61	1.59	1.56	1.55	1.57	1.60
22	2.49	2.44	2.35	2.31	2.35	2.41
24	3.71	3.62	3.43	3.33	3.40	3.51
26	5.36	5.21	4.88	4.68	4.77	4.96
28	7.54	7.31	6.78	6.42	6.52	6.83
30	10.38	10.03	9.24	8.65	8.73	9.17
32	14.00	13.51	12.37	11.46	11.48	12.17
34	18.55	17.87	16.30	14.97	14.87	15.63
36	24.20	23.30	21.16	19.28	19.02	19.93
38	31.14	29.95	27.12	24.55	24.03	25.10
40	39.57	38.02	34.34	30.92	30.04	31.25

Tandem axles, TSI = 2.0

10	0.01	0.01	0.01	0.01	0.01	0.01
12	0.01	0.02	0.02	0.01	0.01	0.01
14	0.02	0.03	0.03	0.03	0.02	0.02
16	0.04	0.05	0.05	0.05	0.04	0.04
18	0.07	0.08	0.08	0.08	0.07	0.07
20	0.10	0.12	0.12	0.12	0.11	0.10
22	0.16	0.17	0.18	0.17	0.16	0.16
24	0.23	0.24	0.26	0.25	0.24	0.23
26	0.32	0.34	0.36	0.35	0.34	0.33
28	0.45	0.46	0.49	0.48	0.47	0.46
30	0.61	0.62	0.65	0.64	0.63	0.62
32	0.81	0.82	0.84	0.84	0.83	0.82
34	1.06	1.07	1.08	1.08	1.08	1.07
36	1.38	1.38	1.38	1.38	1.38	1.38
38	1.76	1.75	1.73	1.72	1.73	1.74
40	2.22	2.19	2.15	2.13	2.16	2.18
42	2.77	2.73	2.64	2.62	2.66	2.70
44	3.42	3.36	3.23	3.18	3.24	3.31
46	4.20	4.11	3.92	3.83	3.91	4.02
48	5.10	4.98	4.72	4.58	4.68	4.83

Table 12.11b *AASHTO equivalency factors for flexible pavement*

Single axles, TSI = 2.5

Axle load (kips)	*Structural number (SN)*					
	1	2	3	4	5	6
2	0.0004	0.0004	0.0003	0.0002	0.0002	0.0002
4	0.003	0.004	0.004	0.003	0.002	0.002
6	0.011	0.017	0.017	0.013	0.010	0.009
8	0.032	0.047	0.051	0.041	0.034	0.031
10	0.078	0.102	0.118	0.102	0.088	0.080
12	0.168	0.198	0.229	0.213	0.189	0.176
14	0.328	0.358	0.399	0.388	0.360	0.342
16	0.591	0.613	0.646	0.645	0.623	0.606
18	1.00	1.00	1.00	1.00	1.00	1.00
20	1.61	1.57	1.49	1.47	1.51	1.55
22	2.48	2.38	2.17	2.09	2.18	2.30
24	3.69	3.49	3.09	2.89	3.03	3.27
26	5.33	4.99	4.31	3.91	4.09	4.48
28	7.49	6.98	5.90	5.21	5.39	5.98

End of the Question