

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3154008**Date: 31-05-2024****Subject Name: Highway and Traffic Engineering****Time: 02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1** (a) Define: Expressway, VR, Camber. **03**
 (b) Explain the scope of Transportation Engineering and importance of Road transport in development of any nation. **04**
 (c) Determine SSD on levelled road for (i) two-lane two-way section, and (ii) single lane two-way section. Take design speed=90 kmph, $f = 0.35$. **07**

- Q.2** (a) Define: SSD, OSD, HSD. **03**
 (b) Explain with sketch, why widening on horizontal curve is required? **04**
 (c) Determine maximum allowable speed on a horizontal curve of radius (i) 200 m and (ii) 250 m, considering allowable maximum superelevation and lateral friction. **07**

OR

- (c) Determine OSD on two-lane one-way and two-lane two-way highway for the design speed of 95 kmph. Take acceleration of overtaking vehicle = 2.0 kmph/s. **07**
- Q.3** (a) Define: Flakiness index, Modulus of subgrade reaction, Attrition value of aggregates. **03**
 (b) Explain with sketches Los Angeles abrasion value test of aggregates. **04**
 (c) 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. **07**

Mean Settlement values (mm)	0	0.25	0.5	0.75	1.05	1.2	1.5	1.7
Load Values (kg)	0	450	910	1120	1340	1510	1620	1690

OR

- Q.3** (a) Define: Flash point of bitumen, Cutback, Emulsion. **03**
 (b) Explain with sketches Standard Penetration test of Bitumen. **04**
 (c) Determine total extra widening and setback distance on two lane highway horizontal curve of 220 m radius for the design speed of 80 kmph, wheelbase length = 6 m, $f = 0.36$. **07**

- Q.4 (a)** Define: CBR, Bottom-Up Crack, Dowel bar. **03**
(b) Explain with sketches CBR test procedure. **04**
(c) The CBR test carried out on a subgrade soil gave the following readings. **07**

Penetration (mm)	Load (kg)	Penetration (mm)	Load (kg)	Penetration (mm)	Load (kg)
0	0	2.0	43.4	5.0	78.9
0.5	3.3	2.5	54.1	7.5	94.7
1.0	14.3	3.0	60.2	10.0	104.8
1.5	32.1	4.0	72.0	12.5	112.6

Determine the CBR of subgrade and total MSA after 15 years for commercial vehicles of 2300/day with annual 7.5% Growth factor.

OR

- Q.4 (a)** Define: Prime coat, Tack coat, Seal coat. **03**
(b) Explain with sketches Marshall Stability test procedure. **04**
(c) Briefly describe: ESWL and EWLF. **07**

Determine the total thickness of flexible pavement assuming single layer elastic theory and using the data: Design wheel load = 5100kg, Tyre pressure=7kg/cm², Elastic modulus= 160kg/cm², permissible deflection=0.25cm.

- Q.5 (a)** Define: Traffic flow rate, Traffic density, Space headway. **03**
(b) Describe with sketches, field survey procedure to obtain speed-flow relationship of traffic on any road section. **04**
(c) From the following data of spot-speed study, draw graphs for frequency (%) –vs- Speed range and Cumulative frequency (%) - vs-Speed. Determine TMS, SMS, Speed for traffic regulation. **07**

Speed range (kmph)	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
No. of vehicles	8	14	20	28	35	27	19	13	6

OR

- Q.5 (a)** Define: SMS, PCU, AADT. **03**
(b) Explain with sketches: Rotary Intersection, Full Cloverleaf Interchange. **04**
(c) From the given data, draw a Speed-Density graph and develop the Greenshield's model of Speed-Density. Determine maximum speed, maximum flow and Jam density. **07**

Density (vpk)	10	20	30	40	50	60	70	80	90	100
Speed (kmph)	84	77	73	65	61	57	43	34	30	25
