Course No: CE G567   Course Title: Highway Design

Nature of Exam: Closed Book   Max. Marks: 60 (Weightage: 35%)

Duration: 180 Min   Date of Exam: 19/12/2022

Note:

1. All questions are compulsory.

2. Figures to the right indicate full marks

Q.1	A vertical summit curve is formed by n1= +2.5% and n2= -4.0%. Design the length of summit curve to provide a stopping sight distance for vehicle travelling at 80 kmph. Take f=0.35. [6]
Q.2	The speed of overtaking and overtaken vehicles are 80 and 40 kmph respectively. Knowing that the gradients are 3% uphill and -2% downhill. (a) Calculate minimum length of vertical curve for two-way traffic road by following AASHTO approach. [12]
Q.3	Explain in details the following emergency escape ramps a) Sandpile ramp [4] b) Descending-grade arrester-bed ramps [4]
Q.4	Explain in detail the residential traffic circle [6]
Q.5	Explain the different components of Superelevation [9]
Q.6	Explain different types of gradients used in vertical alignment of road [9]
Q.7	Write the IRC criteria for provision of grade separator [4]
Q.8	Write the justification for a) Reduction in travel time and vehicle emission due to provision of left turn lane at intersection [2] b) Maximum gradient of 3% should be provided for signalized intersection on higher design speed facilities (80 km/h and greater) [2] c) Higher decision sight distance for signalized intersections located in rural areas [2]

Component of passing maneuver	Metric				US Customary			
	Speed range (km/h)				Speed range (mph)			
	50-65	66-80	81-95	96-110	30-40	40-50	50-60	60-70
	Average passing speed (km/h)				Average passing speed (mph)			
	56.2	70.0	84.5	99.8	34.9	43.8	52.6	62
Initial maneuver:								
a= average acceleration[a]	2.25	2.3	2.37	2.41	1.4	1.43	1.47	1.5
t_1 = time (sec)[a]	3.6	4.0	4.3	4.5	3.6	4	4.3	4.5
d_1 = distance traveled	45	66	89	113	145	216	289	366
Occupation of left lane:								
t_2 = time (sec)[a]	9.3	10.0	10.7	11.3	9.3	10	10.7	11.3
d_2 = distance traveled	145	195	251	314	477	643	827	1030
Clearance length:								
d_3 = distance traveled	30	55	75	90	100	180	250	300
Opposing vehicle:								
	97	130	168	209	318	429	552	687
Total distance, d1+d2+d3+d4	317	446	583	726	1040	1468	1918	2383

Note: In the metric portion of the table, speed values are in km/h, acceleration rates in km/h/s, and distances are in meters. In the U.S. customary portion of the table, speed values are in mph, acceleration rates in mph/sec, and distances are in feet.