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DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute Affiliated to VTU, Belagavi)

UG Semester End Examination, December 2017

Course: Transportation Engineering-1 Code: **CV53**

Maximum marks: 100 Duration: 3 hours

Answer five full Questions. All questions carry equal marks
Assume suitable data, wherever necessary

			Marks
1	a	List the characteristics of road transport? Explain Vision 2021.	10
	b	The area of a certain district in India is 13,400 sq.km and there are 12 towns as per 1981 census. Conclude the lengths of different categories of roads to be provided in the district by the year 2001.	10

(OR)

2	a	List and explain the studies involved in planning surveys.	10
	b	Three new roads A, B and C are to be completed in a district during a five year plan period. Using the data given below identify the order of priority for phasing the plan programme by the principle of maximum utility per unit length. Adopt utility unit of 1.0 for serving a village with population range 2000to 5000, for catering for 1000t of agricultural products or 100t of industrial products.	10

Road	Length,km	No. of villages served population			Productivity, 1000 tonnes	
		<2000	2000-5000	>5000	Agricultural	Industrial
A	15	10	8	3	15	1.2
B	12	16	3	1	11	0.0
C	18	20	10	2	20	0.8

3	a	Mention the factors controlling alignment and explain each of them with sketches.	10
	b	Describe the stages in engineering surveys for highway alignment.	10

(OR)

4	a	Explain in detail the various steps in new highway project.	10
	b	Describe camber? Explain the necessity of providing camber. Give IRC recommended values and shape of various types of camber.	10

5	a	Explain the factors on which stopping sight distance depends. Determine the safe overtaking sight distance for a design speed of 96kmph.	10
	b	What is superelevation? Design the rate of superelevation for a horizontal highway. curve of radius 200m and speed 80kmph.	10

(OR)

6	a	While aligning a highway in a built up area, it was necessary to provide a horizontal curve of radius 325m. the design speed is 65kmph, length of wheel base of largest truck is 6.0m and width of pavement is 10.5m. Calculate the length of transition curve.	10
	b	Mention the desirable properties of aggregates. Mention the tests conducted to evaluate these properties and object of each test.	10
7	a	With neat sketch analyze the components of typical flexible pavement structure and functions of each of them.	10
	b	Outline the various steps of design of flexible pavement.	10

(OR)

8	a	Illustrate with neat sketch explain the various joints in Cement concrete pavements.	10
	b	Examine the factors affecting the design and performance of rigid pavements.	10
9	a	Elaborate the steps for construction of new highway.	10
	b	Describe with neat sketches recommend the different types of rollers used for soil compaction.	10

(OR)

10	a	Why highway drainage is important and explain its significance?	10
	b	The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is $0.9m^3/sec$. Design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1m and cross slope to be 1.0 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.2m/sec and Manning's roughness co-efficient is 0.02.	10

Transportation Engineering - I

Dayananda Sagar College of Engineering
An Autonomous Institute Affiliated to VTU, Belagavi
Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru

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Examination UG Semester End Examination, December 2017
Semester V Total no of pages 04
Course Transportation Engineering - I
Course Code CV53
Branch/ department Civil Engineering
Scheme & Solution Prepared by: Mrs. J. Ranjitha
College Dayananda Sagar College of Engineering

Signature

Q no.	Description	Marks
1a	Characteristics of road transport – (*) used by various vehicle types (*) infrastructure cost (*) flexibility and convenience (*) Speed of movement (*) Offering whole section of society Vision 2021 – (*) prepared by Indian Roads Congress (*) need for overall development (*) target length of primary and secondary system (*) Tertiary system in phased manner (*) special attention to North-East region.	5 × 2 = 10

Q no.	Description	Mark
1b	Length of NH = 168 km Length of SH = 536 km Length of MDR = 1080 km Density of road length = 82 km / 100 sq. km Length of ODR + VR = 9104 km	2×5 = 10
2a	Studies involved in planning surveys – (*) economic studies (*) financial studies (*) traffic or road use studies (*) engineering studies } listing (2) + explanation on each of them (8)	2+8 = 10
2b	(*) Calculation of total utility units served by the road – Road A – 46 Road B – 24 Road C – 52 (*) Utility per unit length – Road A – 3.07 Road B – 2.0 Road C – 2.89 (*) Priority – Road A – I Road B – III Road C – II	4+4+2 = 10
3a	Factors controlling alignment – (*) obligatory points (*) traffic (*) geometric design (*) economics (*) other considerations } listing and explanation of each with suitable sketches.	2×5 = 10

Q no.	Description	Marks
3b	Engineering surveys are — (*) map study (*) reconnaissance survey (*) preliminary survey (*) final location and detailed surveys. } (2) listing and explanation (8)	2+8 = 10
4a	Steps in new highway project — (*) map study (*) reconnaissance survey (*) preliminary survey (*) location of final alignment (*) detailed survey (*) materials survey (*) design (*) earth work (*) pavement construction (*) construction controls (*) construction planning and programming	10
4b	(*) Definition of camber (*) necessity to provide camber (*) IRC recommended values based on road surface and rainfall. (*) shapes of camber with sketch.	2+3+3+2 = 10

5a	Factors on which stopping sight distance depends— (i) total reaction time of driver (ii) speed of vehicle (iii) efficiency of brakes (iv) frictional resistance between the road and the tyres (v) Gradient of the road. Determination of overtaking sight distance — (i) Assumptions of $V_b = 80$ kmph, $t = 2$ sec, $A = 2.5$ kmph/sec (ii) $d_1 = 44.8$ m (iii) $s = 22$ m, $T = 11.3$ sec $\Rightarrow d_2 = 297$ m (iv) $d_3 = 303.7$ m (v) OSD for one-way traffic road = $d_1 + d_2 \simeq 342$ m OSD for two-way traffic road = $d_1 + d_2 + d_3 \simeq 646$ m.	5+5 = 10
5b	(i) Explanation of superelevation (ii) Superelevation for 75% of daign speed, $e = 0.14 \geq 0.07$ check for value of friction, $f = 0.18 > 0.15$ Allowable maximum speed, $V_a = 74.75$ kmph.	1+3+3+3 = 10
6a	Length of transition curve — (i) by rate of change of centrifugal acceleration $C = 0.57$ m/sec^3 and $L_s = 31.9$ m (ii) by rate of introduction of superelevation $B = 11.05$ m, $e = 0.058$, and $R = 0.64$ m $\Rightarrow L_s = 32$ m (Assuming pavement rotated about centreline) (iii) by IRC formula, $L_s = 35.1$ m (iv) Length of transition curve required = 35 m. (highest of 3 conditions)	3+4+2+1 = 10

6b Desirable properties of aggregates —

- (*) resistance to impact or toughness
- (*) resistance to abrasion or hardness
- (*) resistance to getting being polished
- (*) resistance to crushing
- (*) resistance to weathering or durability
- (*) good shape factors
- (*) good affinity

} any (5)

Tests conducted —

- (*) Impact test
- (*) Abrasion test
- (*) polished stone value test
- (*) crushing test
- (*) shape tests
- (*) soundness or durability tests
- (*) specific gravity and water absorption
- (*) Adhesion test

} listing & object of any (5) tests

5+5 = 10

7a (*) Sketch showing components of flexible pavement structure

(*) components – prepared soil subgrade, granular sub-base cum drainage layer, granular base course, bituminous binder and/or surface course.

(*) functions of the above four component layers.

2+4+4 = 10

Q no.	Description	Marks
7b	① CBR value of subgrade ② Initial traffic, N ③ Design life, n years ④ growth rate, r% per year ⑤ Vehicle damage factor VDF (or ESWLF) ⑥ lane distribution factor, D. ⑦ Cumulative number of standard axles CSA ⑧ Using CBR design chart, total design thickness ⑨ As per IRC guidelines, composition of pavement component layers	10
8a	① Sketch ② longitudinal and transverse joints	10
8b	① wheel load ② temperature variations at the location of road ③ types of joints and their spacing ④ subgrade and supporting layers ⑤ drainage characteristics	2×5=10
9a	① steps for highway construction on embankment ② steps for highway construction in cutting	5+5=10
9b	① sketches for rollers ② types and description of different rollers — smooth wheel rollers, vibratory rollers, pneumatic tyred rollers and sheeps-foot rollers.	2+8=10

10a	Importance and significance of highway drainage } any (10) points	10
10b	(*) Cross-section $A = 0.75\ m^2$ Depth of flow, d = 0.45 m (actual) ~~Actual~~ Allowing free board of 0.15 m, d = 0.6 m (*) slope n for clay = 0.02 wetted ~~wetted~~ perimeter = 2.62 m Hydraulic radius, R = 0.286 Slope, S = 0.0031 or 1 in 322.5	5+5 = 10