Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2150601 **Date: 12/05/2017**

Subject Name: Highway 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.**

Q.1 **Reply to following Short Questions:** **[14]**

1 Which road authority works under Indian Road Congress?
(a) BRO (b)HRB (c) CRRI

2 Target density of road as per Nagpur Plan was ____km per 100 sq.km area
(a) 20 (b) 10 (c) 16

3 Braking distance is obtained by equating Work Done in stopping the vehicle with
a) Potential Energy b) Kinetic Energy c) Design Speed

4 The Property of the aggregate to withstand the adverse action of weather is called _____
a) Toughness b) Soundness c) Elasticity

5 Hardness property of the aggregates is evaluated by _____
a) Crushing Test b) Impact Test c) Abrasion Test

6 Consistency of bituminous material is measured by _____
a) Ductility Test b) Float Test c) Viscosity Test

7 The position of center-line of the highway on ground is called _____
(a) Highway Alignment (b) Hill Pass (c) Link Road

8 _____ is one of the basic principles of highway planning.
(a) Socio-economic development (b) Co-ordinated planning
(c) Economic prosperity

9 Transverse drains are useful for _____.
a) less permeable soils b) surface drainage in rural area
c) more permeable soils

10 Enlist two important pavement surface characteristics
(a) _____ (b) _____

11 _____ comes under modified road classification system
(a) Arterial Roads (b) Collector Streets (c) Expressway

12 If b is wheelbase and h is ht. of c.g. of vehicle, to avoid overturning, Centrifugal Ratio should be _____ b/2h
(a) Less than (b) More than (c) Equal to

13 In Hill roads, the curves having convexity on inner edges of road are known as _____ curves
(a) Re-entrant (b) Salient (c) Hair Pin Bend

14 Turfing and Stone-pitching are provided to prevent _____
(a) Erosion of Side slopes (b) Water logging (c) Capillary rise

Q.2 **(a)** Describe importance of highway drainage. **[03]**

(b) Write short note on Road Patterns. **[04]**

(c) The following data were collected for planning the road development of a backward district: **[07]**

(1) Total area = 12000 sq. km. (2) Agricultural area= 5000 sq. km.

(2) Existing rail length = 150 km (4) Existing metalled road = 350 km.

(5) Existing Non-metalled road = 450 km.

(6) Town – Population data:

Population	> 5000	2001-5000	1001 - 2000	501 - 1000	< 500
Towns	15	60	200	300	500

Calculate:

(a) Total & Additional length of metalled road

(b) Total & Additional length of Un-metalled road

(c) Density of road per 100 sq. km area.

OR

(c) A valley curve is formed by a descending gradient of 1 in 30 which meets an ascending gradient of 1 in 40. Design total length of valley curve if design speed is 90 kmph to fulfill both Comfort condition and Head light sight distance after calculating required SSD. Take t = 2.5s and f = 0.35 **[07]**

Q.3 **(a)** Draw neat sketch of Road Cross-Section in embankment with proper labelling. **[03]**

(b) Find total extra widening for a pavement on horizontal curve on a new national highway along a rolling terrain with minimum ruling radius. The highway is two-lane with design speed 100kmph. Take e = 0.07 and f = 0.15. The standard wheelbase is 6m. **[04]**

(c) Enlist various highway cross-section elements and explain pavement surface characteristics in detail. **[07]**

OR

Q.3 **(a)** Write short-note on Camber with recommended values for different road surfaces. **[03]**

(b) Calculate minimum sight distance required to avoid head-on collision of two cars approaching from opposite directions on a road having 2.5% gradient. Ascending car is travelling at 90 kmph and descending car is travelling at 75 kmph. Friction co-efficient is 0.8 & braking efficiency is 50%. Take t = 2.5s. **[04]**

(c) Define Overtaking Sight Distance. Describe the three stages of analysis of overtaking operation to obtain expression of OSD. **[07]**

Q.4	**(a)**	State advantages of arboriculture on rural and urban roads.	**[03]**
	(b)	Enlist various properties of Bitumen and describe Softening Point test for Bitumen with neat sketch.	**[04]**
	(c)	Enlist various properties of Road aggregates and describe Flakiness-Elongation tests for it.	**[07]**

OR

Q.4	**(a)**	Differentiate between Flexible & Rigid pavements with neat sketches.	**[03]**
	(b)	Describe the maintenance of bituminous road.	**[04]**
	(c)	Enlist various factors to be considered for design of Pavement and describe ESWL in details	**[07]**
Q.5	**(a)**	Write short note on Road Users Characteristics.	**[03]**
	(b)	State objectives and uses of Traffic volume studies.	**[04]**
	(c)	Define Road Safety Audit (RSA). What are the benefits of RSA? Explain various audit stages.	**[07]**

OR

Q.5	**(a)**	Define: Running Speed, Spot Speed & Journey Speed.	**[03]**
	(b)	Enlist various types of conflict points and Draw neat sketch of conflict points at intersection of two-way roads with total number of conflicts and its break-up.	**[04]**
	(c)	Enlist the various traffic studies. Explain Origin and Destination studies with their application.	**[07]**

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