

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]
