Ref. No.: Ex/CE/PC/B/T/324/2024

**B.E. CIVIL ENGINEERING THIRD YEAR SECOND SEMESTER EXAM 2024**

**TRANSPORTATION ENGINEERING II**

**Part - I (60 Marks)**

**Answer each part in separate answer script**

**Time: 3 Hours** **Full Marks: 100**

**Answer brief & to the point. Assume standard value for any parameter, if required**

1. Answer the following questions in brief

a) Answer any five of the following [CO1] 5 x 2

i. Name two methods of collecting O&D Survey data
ii. Define external cordon line related with traffic survey
iii. State the major difference between cruising time and journey time
iv. State two inferences which can be drawn from parking accumulation value
v. State why "fixed" delay is so named
vi. Name two major preventive steps against road accident hazards

b) Answer any five of the following [CO2] 5 x 2

i. Illustrate the major difference between a firm line and a broken line road marker
ii. State two situations demanding all red period in a signal system
iii. Following Webster's method of optimum signal cycle design explain how a pedestrian phase timing is designed
iv. Illustrate the major difference between an erected and an inverted triangular road signboard
v. State the significance of a center line road marker consisting of a pair of bold and dashed white line
vi. Name any two of the typical cross road markers mentioning their purposes

2. Answer any two of the following [CO1] 2 x 10

a) Determine the Time Mean Speed, Space Mean Speed, Design Speed, Maximum Allowable Speed, Minimum Allowable Speed and Modal Speed from the following observations of a NH.

| Speed Range (Kmph) | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 | 60 – 70 | 70 – 80 |
|---|---|---|---|---|---|---|
| Frequency | 25 | 70 | 90 | 100 | 90 | 25 |

b) Illustrate about the following –

i. Stapes of Parking and different types of on street parking facility
ii. Delay and its types

c) State major differences between collision diagram and condition diagram
The Motor vehicle consumption in a city is 5,082 million litres, there were 3114 fatal motor vehicle accidents and 355,799 non-fatal motor vehicle accidents; 6,721,049 motor vehicle registrations and an estimated population of 18,190,238. Kilometre of travel per litre of fuel is 12.42 km/litre. Calculate registration death rate, population death rate and accident rate per vehicle km.

[ Turn over

3. Answer any one of the following [CO2] 20

a) Illustrate in details on the warrants of installing a traffic signal
Design optimum signal cycle time for an at grade intersection of 2nos. 2-Lane 2-way mutually perpendicular roads with the following data –

| From | North (N) | | | South (S) | | | East (E) | | | West (W) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| To | E | S | W | W | N | E | S | W | N | N | E | S |
| PCU | 21 | 223 | 11 | 26 | 228 | 13 | 23 | 248 | 16 | 28 | 233 | 18 |

Pedestrian Green Time and crossing speed are 6 secs and 1m/s respectively. Average lane width 3.5m. Amber time and starting delay are 4sec and 3sec respectively. No accumulation of vehicles demanding clearance red. Saturation flow for 1-lane and 2-lane approaches are 1890 PCU and 3675 PCU respectively. Right turning radius of 25m. Traffic data is as recorded below with E, W, N, S indicating four directions

b)

i. Name the types of conflicts in an intersection and calculate the category wise conflicts expected in the merging of one two-lane two-way road with another two-lane two-way road as a T-Junction.

ii. Suggest and draw a suitable grade separated solution for the same and determine the change in the distribution of conflicts

iii. Estimate the safe radius for a rotary at the junction of 4 nos 4-lane 2-way approaches with uniform freeway design speed of approaches as 60KmpH. Consider coefficient of lateral friction 0.45.

iv. Explain the procedure of determining the saturation flow and maximum possible turner in a right turning intersection

Form A: Paper-setting Blank

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**(Name in full)**

**PAPER ××××**

**Time: Three hours** **Full Marks =100**

**(60 marks for part I and 40 Marks for part II)**
**Use a same Answer-Script for each part**

| No. of Question | ***Part –II*** | CO | Marks |
|---|---|---|---|
| | *1) Answer question number 1, question number 2 and question number 3 2) Assume reasonable values of data if it is not supplied,*<br>*3) Answer the Part 1 and Part 2 separately.*<br>*4) There is no need of any code etc. for answering Part- II,*<br>*5) In the cases where excess number of questions will be answered exceeding the required number of question/s, the first required number of question/s will be evaluated only.*<br>*6) All notations used in these questions for their conventional meanings.* | | |
| **Sl. No.** | **Question** | | |
| | ***Answer any one between 1 (a) to 1 (b)*** | | |
| **1 (a)** | What are the types of airport planning studies? | [CO3] | [2] |
| **1 (b)** | What is meant by airport master plan? | [CO3] | [2] |
| | ***Answer any one between 1 (c) to 1 (d)*** | | |
| **1 (c)** | An airport master plan typically consists of which elements? | [CO3] | [3] |
| **1 (d)** | What are the objectives of the airport master plan? | [CO3] | [3] |
| | ***Answer question 1 (e)*** | | |
| **1 (e)** | For a country like India, which should be given more preference in your view (state with logic): (a) much more expansion and spreading of Railway network, (b) opening of more airways root with increase in the number of aircrafts (for carrying people from one place to other place)? | [CO3] | [5] |
| | ***Answer any one between 2 (a) to 2 (b)*** | | |
| **2 (a)** | What is "gauge"? | [CO4] | [2] |
| **2 (b)** | Using a sleeper density of 'M+6', find out the number of sleepers required for constructing a B. G. railway track 704 m long. | [CO4] | [2] |
| | ***Answer any one between 2 (c) to 2 (d)*** | | |
| **2 (c)** | What are the differences between wind resistance and atmospheric resistance? | [CO4] | [3] |
| **2 (d)** | Clarify the term: "rolling resistance". | [CO4] | [3] |
| | ***Answer any ten MCQ from the following MCQs between 2 (e) to 2 (s)***<br>*• Each of the MCQ (within all of the MCQ in this part) is mandatory. Each MCQ is carrying 1 mark.*<br>*• Some MCQ question may have more than one correct alternative, so examine each alternative of each MCQ before giving your choice of the concerned MCQ.*<br>*• Giving all alternatives of any MCQ as your choices as correct answers of the concerned MCQ, will lead to zero marks for the concerned MCQ.*<br>*• In case of answering more than 10 MCQs, the first 10 MCQs will be considered only for evaluation.* | | |
| **2 (e)** | Gauge selection is dependent upon<br>(A) Cost of construction<br>(B) Volume and nature of the traffic<br>(C) Physical features of the vehicle<br>(D) All the above | [CO4] | [1] |
| **2 (f)** | Coning of wheels can only be provided in situations where | [CO4] | [1] |

Form A: Paper-setting Blank

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| | | | |
|---|---|---|---|
| | (A) Adzing of sleepers ate there<br>(B) Tilting of rail is there<br>(C) Wheel is made up of tungsten<br>(D) All the above | | |
| **2 (g)** | Super elevation is set on curved tracks via<br>(A) Rail<br>(B) Ballast<br>(C) Sleeper<br>(D) All the above | [CO4] | [1] |
| **2 (h)** | The high weight of sleeper, is helpful in:<br>(A) keeping the super elevation properly at the curves<br>(B) keeping the proper level of rails in straight reach<br>(C) minimizing joint maintenance<br>(D) all of the above | [CO4] | [1] |
| **2 (i)** | The following rail section has been made first<br>(A) Flat footed rail<br>(B) Bull headed rail<br>(C) Double headed rail<br>(D) None of the above | [CO4] | [1] |
| **2 (j)** | The advantage/s for coning of wheels is/ are<br>(A) To provide possibility for lateral movement<br>(B) To prevent wear and tear of vehicle bogies<br>(C) To prevent bogies from slipping<br>(D) All the above | [CO4] | [1] |
| **2 (k)** | Straightening of bent rails is a somewhat more challenging task for<br>(A) Flat footed rail<br>(B) Bull headed rail<br>(C) Double headed rail<br>(D) None of the above | [CO4] | [1] |
| **2 (l)** | "The _____ sleepers are only suitable for stone ballasts"- the blank space should be filled by :<br>(A) Timber<br>(B) Concrete<br>(C) Metal<br>(D) None of the above | [CO4] | [1] |
| **2 (m)** | The various important aspects that must be taken into account while choosing the weight of the rail to be utilized include:<br>(A) The axle load and nature of traffic<br>(B) The wheel gauge concerned<br>(C) Maximum permissible wear at side of rail<br>(D) None of the above | [CO4] | [1] |
| **2 (n)** | Keys and heavy chains are needed for<br>(A) Flat footed rail<br>(B) Double headed rail<br>(C) Bull headed rail<br>(D) None of the above | [CO4] | [1] |
| **2 (o)** | Generally the anticipated maximum design life is from<br>(A) Wooden sleeper<br>(B) Metal sleeper<br>(C) Concrete sleeper | [CO4] | [1] |

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(D) (A) and (B) of the above

**2 (p)** Trolley rescue is generally provided at the level of: [CO4] [1]
(A) Subgrade level
(B) Ballast level
(C) Sub-ballast level
(D) Depending upon the situation, in any one of (A), (B) or (C)

**2 (q)** The primary causes of the rails' wear are: [CO4] [1]
(A) Fluctuation of temperatures between day and night
(B) Fast speed of the moving vehicles
(C) Heaviness of the axle load
(D) All of the above

**2 (r)** The ratio of concrete sleeper to wooden sleeper generally varies between: [CO4] [1]
(A) 2.0 to 2.5
(B) 2.5 to 3.0
(C) 3.0 to 3.5
(D) None of the above

**2 (s)** When comparing between timber, metal and concrete sleepers, more ballast is required for (when all the surrounding conditions are same): [CO4] [1]
(A) Metal sleeper
(B) Concrete sleeper
(C) Timber sleeper
(D) None of the above

***Answer any one between 3 (a) to 3 (b)***

**3 (a)** Why the concept of average speed is important? [CO5] [2]

**3 (b)** What is gradient? [CO5] [2]

***Answer any one between 3 (c) to 3 (d)***

**3 (c)** What is the equilibrium cant on a 3 degree MG curved track if 15 trains, 12 trains, 7 trains and 3 trains run at speeds of 55 kmph, 60 kmph, 75 kmph and 80 kmph respectively? [CO5] [3]

**3 (d)** What are differences between overturning and derailment? [CO5] [3]

***Answer any ten MCQ from the following MCQs between 3 (e) to 3 (s)***
*• Each of the MCQ (within all of the MCQ in this part) is mandatory. Each MCQ is carrying 1 mark.*
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**3 (e)** Mainly _____ types of gradients are observed in case of railway geometric design. The blank should be filled by [CO5] [1]
(A) Three
(B) Four
(C) Five
(D) None the above

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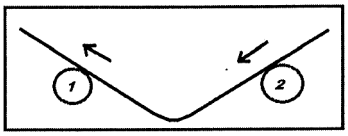
| | | | |
|---|---|---|---|
| **3 (f)** | The momentum gradient is being represented here (in the following schematic diagram) by the number   (A) 2 (B) 1 (C) Both 1 and 2 (D) None the above | [CO5] | [1] |
| **3 (g)** | On tracks, gradients are mostly used to (A) Reduce the cost of earth work (B) Reach the various stations situated at different areas (C) Helping in proper drainage from the track (D) All the above | [CO5] | [1] |
| **3 (h)** | The equilibrium cant is being provided on the basis of: (A) Safe speed calculated from Martin's formula over the section (B) average speed of the trains passing over the section (C) maximum permissible speed of the trains passing over the section (D) None of the above | [CO5] | [1] |
| **3 (i)** | In accordance with guideline of IS, BG's curvature compensation is (A) being determined depending upon the situation (B) 0.05% per degree of the curve (C) 0.04% per degree of the curve (D) 0.03% per degree of the curve | [CO5] | [1] |
| **3 (j)** | The helper gradient is equal to (A) Pusher Gradient (B) Ruling Gradient (C) Momentum Gradient (D) Assistant Gradient | [CO5] | [1] |
| **3 (k)** | The following/s determine/s the safe speed to negotiate the curves (A) The gauge of the concerned track (B) The radius of the concerned curve (C) The nature of rail (D) All of the above | [CO5] | [1] |
| **3 (l)** | In the Martin's formula, the safe speed for non-transitioned curve is less than the transitioned curve (for all the other same surrounding conditions) by: (A) 15% (B) 20% (C) 25% (D) 30% | [CO5] | [1] |
| **3 (m)** | Super elevation is most cases are being used to (A) Counteract the effect of frictional force (B) Counteract the effect of centripetal force (C) Counteract the effect of centrifugal force (D) All of the above | [CO5] | [1] |
| **3 (n)** | The train's speed is determined by (A) The power of locomotive (B) The strength of the track (C) The strength of the vehicle (D) All of the above | [CO5] | [1] |
| **3 (o)** | For B.G., the maximum super elevation limit is (A) 16.5 Cm | [CO5] | [1] |

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(B) 10 Cm
(C) 7.6 Cm
(D) (A) and (B) of the above

**3 (p)** For the formula D = (1720/R), the concerned arc length is almost: [CO5] [1]
(A) 30m
(B) 32 m
(C) 35 m
(D) None of the above

**3 (q)** The premise for providing the equilibrium cant is: [CO5] [1]
(A) Average speed
(B) Highest speed
(C) Equilibrium speed
(D) requirement of the actual situation

**3 (r)** The negative super elevation is needed when: [CO5] [1]
(A) The main line and branch line are in contrary flexure
(B) The main line and branch line are in flexure in the same direction
(C) The main line and branch line are parallel
(D) (A) and (B) of the above

**3 (s)** The maximum permissible speed on a straight reach is the lowest of followings: [CO5] [1]
(A) Safe speed calculated from Martin's formula
(B) Maximum sanctioned speed on the section
(C) Speed calculated from the length of the transition curve
(D) All of the above

***End of Questions***