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Total Number of Pages : 03

B.Tech.  
PCI4I102

4<sup>th</sup> Semester Regular / Back Examination 2017-18

HIGHWAY & TRAFFIC ENGINEERING

BRANCH : CIVIL

Time : 3 Hours

Max Marks : 100

Q.CODE : C668

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks.

Answer all parts of a question at a place.

**Part – A (Answer all the questions)**

**Q1 Answer the following questions : (2 x 10)**

- a) The shape of the camber, best suited for cement concrete pavements, is
- a) Straight line
  - b) Parabolic
  - c) Elliptical
  - d) Combination of straight and parabolic
- b) For water bound macadam roads in ties of heavy rainfall, the recommended value of camber is
- a) 1 in 30
  - b) 1 in 36
  - c) 1 in 48
  - d) 1 in 60
- c) The radius of a horizontal curve is 100 meters. The design speed is 50 kmph and the design coefficient of lateral friction is 0.15. What would be the rate of superelevation if full lateral friction is considered?
- a) 1 in 21.2
  - b) 1 in 15.8
  - c) 1 in 25.0
  - d) 1 in 32.6
- d) As per IRC recommendations, the maximum limit of superelevation for mixed traffic in plain terrain is
- a) 1 in 15
  - b) 1 in 12.5
  - c) 1 in 10
  - d) equal to camber
- e) The critical combination of stresses for corner region in cement concrete roads is
- a) load stress + warping stress - frictional stress
  - b) load stress + warping stress + frictional stress
  - c) load stress + warping stress
  - d) load stress + frictional stress
- f) To calculate the minimum value of ruling radius of horizontal curves in plains, the design Speed is given by
- a) 8 kmph
  - b) 12 kmph
  - c) 16 kmph
  - d) 20 kmph
- g) In a bituminous pavement, alligator cracking is mainly due to.
- a) inadequate wearing course
  - b) inadequate thickness of sub-base course of pavement
  - c) use of excessive bituminous material
  - d) fatigue arising from repeated stress applications
- h) If ruling gradient is 1 in 20 and there is also a horizontal curve of radius 76 m, then the compensated grade should be
- a) 3 %
  - b) 4 %
  - c) 5 %
  - d) 6 %
- i) If the average centre to centre spacing of vehicles is 20 metres, then the basic capacity of a traffic lane at a speed of 50 kmph is
- a) 2500 vehicles per day
  - b) 2000 vehicles per hour
  - c) 2500 vehicles per hour
  - d) 1000 vehicles per hour

- j) When the speed of traffic flow becomes zero , then
- traffic density attains maximum value Whereas traffic volume becomes zero
  - traffic density and traffic volume both attain maximum value
  - traffic density and traffic volume both become zero
  - traffic density becomes zero whereas traffic volume attains maximum value

**Q2 Answer the following questions : (2 x 10)**

- What are the different classifications of road in Urban area ?
- What is the scope of aerial surveys in preliminary survey for highway location?
- What are the factors on which stopping sight distance depend?
- Why should the psychological widening be added to the mechanical widening?
- Differentiate between ruling gradient and minimum gradient.
- Define level of service.
- Define Perpetual Pavement as per IRC: 37-2012.
- Why dowel bar and tie bar are provided in rigid pavement?
- Differentiate between flakiness index and elongation index.
- What are the factors which cause the mud pumping in rigid pavement failure?

**Part – B (Answer any four questions)**

- Q3 a)** Calculate the road length required for a district based on Nagpur road plan, (7)  
Following data are given below:
- Total area = 8100 km<sup>2</sup>
  - Agricultural area = 3200 km<sup>2</sup>
  - Length of railway track = 75 km
  - Numbers of villages with population range < 500, 501-1000, 1001-2000, 2001-5000 and above 5001 are 408, 310, 100, 55 and 18 respectively.
  - Number of towns and village with population range 2001-5000 and 5001-10000 are 130 and 45 respectively.
- b)** Explain briefly the modified classification of road system in India as per third (8)  
twenty year road development plan.
- Q4 a)** What are the disadvantages of improper highway alignment? Discuss briefly the (7)  
special care to be taken while aligning hill road.
- b)** Explain how the final location and detailed survey of a highway are carried out. (8)
- Q5 a)** Calculate the safe passing sight distance for a four lane two-way NH. The speed (8)  
of overtaking vehicle is 70 kmph and acceleration of overtaking vehicle is 0.9 m/sec<sup>2</sup>. Assume any other data as per IRC.
- b)** The design speed of a two lane NH is 85kmph. There is horizontal curve of (7)  
radius 240 m on a certain locality. Design the rate of super elevation for mixed traffic. By how much should the outer edges of the pavement be raised with respect to the centre line, if the pavement is rotated with respect to the centre line?
- Q6 a)** What are the factors on which the design of widening depends? Derive an (8)  
expression for finding the extra widening required on horizontal curve.
- b)** A valley curve is formed by descending gradient of 2.5% which meets an (7)  
ascending gradient of 5%. Design the total length of valley curve if the design speed is 22 m/sec so as to fulfill both comfort condition and head light sight distance. Allowable rate of change of centrifugal acceleration is 0.6 m/sec<sup>3</sup>, beam angle is 1° and height of the head light above carriageway is 0.8 m. Assume any other data as per IRC.
- Q7 a)** Briefly explain the floating car method for speed and delay study. (8)
- b)** What are the various uses of origin and destination studies? Explain any one (7)  
method for carrying out O & D survey.

- Q8** a) What are the various tests for judging the suitability of bitumen? Briefly explain the Ductility test of bitumen. (8)
- b) What are the various factors to be considered in pavement design? Explain the significance of each (7)
- Q9** a) Explain the various types of failures in flexible pavements and their causes. (8)
- b) Specify the materials required for construction of WBM roads. Write down the construction steps for WBM road. (7)