

Full marks: 70

Time: 3hrs.

*Answer Q.1 & Q.5 and any two of the rest from each half**Use of IRC codes are permitted***FIRST HALF**

1. Determine the maximum force in the member ***pq*** of a **truss** of the steel trussed bridge as shown in Fig.Q1 for single lane IRC class70R **tracked** vehicle moving from left to right. Use IRC-6. (11)
2. Determine the maximum vehicle load bending moment in a solid slab bridge as shown in Fig.Q2 for single lane IRC classAA **wheeled** vehicle moving along its effective span of 10.5m. Use IRC-6. (12)
3. Determine the **combined** stress at the base of the pier **along traffic** direction as shown in the Fig.Q38 at **high flood** condition due to i) dead load reaction (2000kN) from each span (16m) and pier (with cap) self-weight( $W_p$ ) considering square ended pier  $9 \times 3 \times 9.5$ m and pier cap  $10 \times 4 \times 0.5$ m, ii) live load reaction (1000kN) from each span, iii) breaking force for IRC class70R **tracked** vehicle and iv) maximum velocity(3.5m/sec) of water current( $45^\circ$ ) at HFL. Use IRC-6&78.(12)
4. Check the adequacy of the restrained elastomeric pad bearing as shown in Fig.Q4 for a RC teebeam deck of span 16 m with the following data. i) Dead and live load reactions are 300kN and 700kN respectively. ii) Breaking force is 45kN. iii) Longitudinal strain due to creep, shrinkage and temperature is 0.0006. iv) Grade of concrete for beam and pedestal is M25. v) Shear modulus of elastomer is 1MPa. vi) Longitudinal rotation of the deck at support is 0.0013. Use IRC-21&83. (12)

**SECOND HALF**

5. Determine the maximum bending moment at support **B** of a balanced cantilever bridge as shown in Fig.Q5 for single lane IRC classAA **tracked** vehicle moving from left to right. Use IRC-6. (11)
6. Determine the maximum live load bending moment in the exterior girder (span 16m) of the teebeam deck as shown in Fig.Q6 for **two lane** IRC classA vehicle. Use IRC-6. (12)
7. Check the stability, under **span loaded** condition, of 10 m wide abutment as shown in Fig.Q7 which is carrying a teebeam girder deck of span 16m with single lane IRC class70R **tracked** vehicle. Consider properties of backfill material as  $\gamma=18\text{kN/m}^3$  and  $\phi=35^\circ$ . Take span dead load reaction as 2000kN and span live load reaction as 1000kN. Neglect force due to temperature variation and shrinkage. Use IRC-78. (12)
8. Determine the resultant base pressure of the well foundation with external diameter 10m as shown in Fig.Q38, considering design tilt and sift as per IRC code. Take self-weight( $W_c$ ) of the well as 10000kN. Relief of moment at base due to active and passive earth pressure is 60000kNm without FOS. Take data from Q.3 for vehicle class, span load reactions and pier weight( $W_p$ ). Use IRC-78.(12)

**Note:**

- Answers must be to the point otherwise marks will be deducted. Mention of codal clause number is must in steps of solution, when utilized. Neglect wind and seismic effect.
- Solution of this paper will be sent to the candidates e-mail (if available) after the examination is over. Scanned copy of the answer script of the candidate will be sent to his/her e-mail (if available) after the evaluation is over.

