7. (a) What are the various types of piers ? What are the various forces which are considered in the design of piers ? 10

(b) What are the main features which are taken up for the design of abutment including forces acting on the abutments ? 10

8. (a) What is the function of wing wall and how can you classify wing walls ? 10

(b) Design a well foundation for the pier of a major highway bridge to suit the following data : 10

Internal diameter of well = 2.5 m

Depth of well = 25 m below bed level

Type of soil strata = Clayee (K = 0.033)

Materials = M20 Grade of concrete

= Fe-415 Grade of HYSD bars.

Dec 13 (Kurk)

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BRIDGE ENGINEERING

CE-402-E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt any *Five* questions. All questions carry equal marks. Use of design curves, tables IS-456 and IS 800 is permitted.

1. (a) What are the requirements for site selection for a bridge and aesthetics considerations ? 10

(b) What is meant by Economical Span ? Derive the condition for an economical span mentioning the assumptions made in the derivation. 10

2. (a) What is the significance of Impact Factor ? How is it estimated for the design of substructure and super structure ? 10

(b) Explain the IRC Class AA Loading with the help of a sketch. 10

3. Design a reinforced concrete slab culvert for a National highway to suit the following data :

Carriage way = 7.5 m wide

Clear Span = 7 m

Wearing Coat = 100 mm

Width of Bearing = 0.4 m

Use M25 Grade Concrete and Fe 415 Steel. Design the RC Deck Slab for IRC Class AA Loading and sketch the Reinforcement details in Longitudinal and Cross Section. **20**

4. (a) Explain briefly about different types of T-beam bridges with sketches. **5**

(b) Design the L-girder of a *t*-beam bridge and design the Cantilever Slab of a T-beam bridge for IRC class A a loadings. Use the following data :

Clear Width of roadway = 7.5 m

Span (Center to centre of bearings) = 16 m

Average thickness of wearing cost = 80 mm

Spacing of Main Girders = 2.5 m

Spacing of Cross Girders = 4 m

Assume the thickness of deck slab = 200 mm

Width of Main Girders & Cross Girder = 300 mm

Depth of Main Girders & Cross Girder = 1800 mm

Kerbs 600 mm wide and 300 deep

Concrete mix M25 Grade and Steel Fe 415.

5. Design the plate girder bridge to conform to the IRC loadings and IRC specifications with the following data :

Effective span of the girder	= 40 m
Dead load of track (open floor)	= 7.5 kN/m
EULL for BM calculations/track	= 3498 kN
EULL for SF calculations/track	= 3815 kN
Impact factor	= 0.324
Wind load	= 1.5 kN/m^2
Racking forces	= 6.0 kN/m^2

6. (a) Explain briefly different types of bridges bearings. **10**

(b) Design a reinforced concrete rocker bearing to transmit a support reaction of 800 kN. Adopt M_{30} Grade Concrete and Fe_{415} Grade HYSD bars. Permissible bearing stress in concrete is 8 N/mm^2. Sketch the details of reinforcements in the rocker bearing. **10**