

Material stone masonry

Unit weight of soil

$$= 18 \text{ KN/m}^3$$

Angle of repose

$$= 30^\circ$$

Superstructure

= T beam bridge of span

15 m

Loading

= IRC Class AA

Assume suitable dimensions for the components of the super structure.



(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2290064

Roll No.

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**B.TECH.**

**Regular Theory Examination (Odd Sem-VII), 2016-17**

**BRIDGE ENGINEERING**

*Time : 3 Hours*

*Max. Marks : 100*

**Note :** Attempt all Section. If require any missing data; then choose suitably.

**SECTION - A**

**1. Attempt all question in brief. (2×10=20)**

- What do you mean by centrifugal force and also write the formula for calculating the centrifugal force.
- What are the permissible stresses recommended by IRC followed by design of a bridge.
- Write the limitations of Courbon's theory.
- Write design steps for slab culvert.
- Write the conditions where box culvert is used.

- f) What is diaphragms?  
 g) What are the advantages of composite bridges?  
 h) Why stiffeners are provided?  
 i) What do you mean by pier cap?  
 j) Write the functions of abutments.

## SECTION - B

2. Attempt any three of the following : (3×10=30)

- a) Explain the various components of a bridge. Briefly discuss the economic span for bridges
- b) The slab panel of an R.C.C. T beam and slab deck is 2.5 m wide between main beams and 4 m long between cross girder. Find the total design moments for IRC Class A loading. Adopt M-20 grade concrete and Fe 415 grade HYSD bars.
- c) Design a box culvert having inside dimensions 4m×4m for the following data.
- Dead load = 12 KN/m<sup>2</sup>
- Live load = 46 KN/m<sup>2</sup>
- Density of soil = 18 KN/m<sup>3</sup>
- Use M20 concrete and Fe 415 steel.

- d) What do you mean by plate girder? Write the design principles of plate girder.
- e) What is the function of bearings in bridges? Explain the functions of expansion joints and contraction joints.

## SECTION - C

3. Attempt any one part of the following : (1×10=10)

- a) Write notes on the following :
- I) IRC Class AA loading
- II) IRC Class A loading
- III) IRC Class B loading
- b) A deck slab bridge is to be constructed using class A loading. The following details are available. Design deck slab of bridge using effective width method.

Clear span = 6m

Width of supports = 400 mm

Width of carriageway = 7.5 m

Width of kerbs = 600 mm

M20 grade of concrete and Fe 415 grade of steel

4. Attempt any one part of the following : (10×1=10)

- a) Design a reinforced concrete slab culvert for following requirements :

Clear span = 5m

Width of supports = 400 mm

Clear width of roadways = 6.8 m

Width of kerbs = 600 mm

Thickness of wearing coat = 80 mm

Load = class A

- b) Obtain the Courbon's reaction factor and the maximum bending moment in case of a T beam bridge having the following details :

Roadways : 2 lanes

Loading : IRC Class A

No. of main girders : 3, c/c spacing : 2.6 m

Span of the bridge : 16m

Kerb width : 600 mm on either side

5. Attempt any one part of the following: (1×10=10)

- a) Design a box culvert having inside dimension of 3m×3m. This culvert is subjected to a dead load of 1400 KN/m<sup>2</sup> and live load of IRC Class AA tracked vehicle. Assume the unit wt. of soil to be 18KN/m<sup>3</sup>. Angle of repose of soil is 30°. M25 concrete and Fe 415 steel are used. Road width is 7.5 m and span is 3.3 m.

- b) A T beam bridge has to be provided across a channel having the following data. Design the interior panel.

Flood discharge = 30 m<sup>3</sup>/s

Bed width = 12 m

Side slope = 1:1

Bed level = 50 m

HFL = 51.25 m

Maximum allowable afflux = 1.5 cm

General ground level = 52 m

Hard rock available at = 48m

Road formation level = 54m

Road = N.H. (2 lanes)

Footpath	= 1 m wide on either side
Loading	= IRC Class AA
Materials	= M40 concrete and Fe 415 steel
No. of longitudinal girders	= 3

6. Attempt any one part of the following : (10×1=10)

a) Draw and explain the general arrangements of composite bridge. Also write the general features of plate girders.

b) Design a composite bridge deck slab on steel girder. The span of the bridge is 15 m. The other details are:

Road	= Two lane highway
Kerbs	= 600 mm on either side
No. of steel girders	= 4
Spacing of girders	= 2.5 m c/c
Material	= M40 concrete and Fe 415 steel

Bed level	= 150 m
Bed width	= 21 m
Stream bund top	= 152.50 m
Road top level	= 155.50 m
Hard rock level	= 148.50 m
Wing walls	: return type

7. Attempt any one part of the following : (10×1=10)

a) Design a steel rocker roller bearing to transmit a load of 2000 KN. The span of the girder is 50 m. The allowable pressure on rollers is 4 N/mm length. The bearing pressure on the rocker pin is 30 N/mm<sup>2</sup>. The allowable pressure on the steel bearing plate is 2000 N/mm<sup>2</sup>. The allowable pressure on the bed block of the abutment is 1000 N/mm<sup>2</sup>.

b) Verify the stability of the abutment of a bridge with the following details :

Top width	= 1.5 m
Height	= 4m
Back batter	= 1 in 6

Front face of the abutment is vertical