NCE-031

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

Paper ID : 2290064   Roll No. ☐☐☐☐☐☐☐☐☐☐

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)

a)   What do you mean by centrifugal force and also write the formula for calculating the centrifugal force.

b)   What are the permissible stresses recommended by IRC followed by design of a bridge.

c)   Write the limitations of Courbon's theory.

d)   Write design steps for slab culvert.

e)   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 grider. 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/m²

Live load   = 46 KN/m²

Density of soil   = 18 KN/m³

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/m² and live load of IRC Class AA tracked vehicle. Assume the unit wt. of soil to be 18KN/m³. 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 m³/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 slide
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 in 50 m. The allowable pressure on rollers is 4 N/mm length. The bearing pressure on the rocker pin is 30 N/mm². The allowable pressure on the steel bearing plate is 2000 N/mm². The allowable pressure on the bed block of the abutment is 1000 N/mm².

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

Material stone masonry	
Unit weight of soil	= 18 KN/m³
Angle of repose	= 30⁰
Superstructure	= T beam bridge of span 15 m
Loading	= IRC Class AA

Assume suitable dimensions for the components of the super structure.

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