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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

END SEMESTER EXAMINATION-2015

[B.Tech 8^{th} & M.Tech 4^{th}] Semester

COURSE CODE: 11M1WCE133 MAX. MARKS: 45

COURSE NAME: Bridge Engineering

COURSE CREDITS: 03 MAX. TIME: 3 HRS

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

IRC - [5, 6, 21, 78 and 83], IS 456:2000 codes and steel tables are allowed

Pigeaud's Curves are allowed. Draw neat figures wherever required.

Suitably assume any missing data.

This question paper contains 5 pages.

Section A [3x3 = 9 marks]

1. Design a mild steel rocker bearing for transmitting the superstructure reactive load of 1100 kN. Take thickness of plate as 50mm

   Allowable pressure on bearing block = 3.8 MPa
   Permissible bending stress = $0.66f_y$
   Permissible bearing stress = 120MPa
   Permissible shear stress = 100MPa

2. A plate girder railway bridge of clear span 5m. The bridge is meant for a single track on broad gauge main line. The following data is provided for bridge design

   Dead Load of sleeper = 7.5kN/m
   Dead Load of rails and fitting = 9.5kN/m

   Design the steel bridge for Dead load and live load. Calculate the economical depth.

3. Obtain Courbon's reaction factor and the minimum bending moment in the case of a T-Beam bridge having the following details:

Roadway:	2 Lanes
Loading:	IRC Class A
No. of main Girders:	3 c/c spacing = 2.6m
Span of the bridge:	16m
Kerb width:	600mm on either side

Section B [4x4marks = 16Marks]

4. Obtain the values of short span and long span bending moments in case of an interior panel of T-beam bridge having the following details:

Dimension of the panel:	3m X 3.5m
Loading:	IRC class A
Loading pattern:	One wheel (57kN) at the centre of the panel

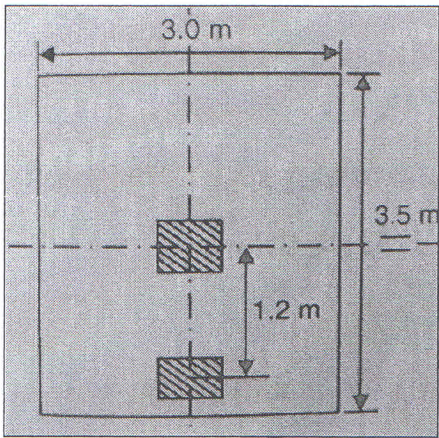


Figure for Question 4

5. A T- Beam Bridge has to be provided. Design the Cantilever slab Portion for the data given:

Interior panel slab Dimensions:	3m X 3.5m
Span of the bridge:	14m
Road:	2 Lane
Footpath:	1m wide on either side
Loading:	IRC class AA tracked
Material:	M40 Concrete, Fe415 steel
No. of Longitudinal Girder:	3 at c/c spacing of 3m

6. For the same T- Beam Bridge. Design the Interior panel slab for the Same IRC class AA.

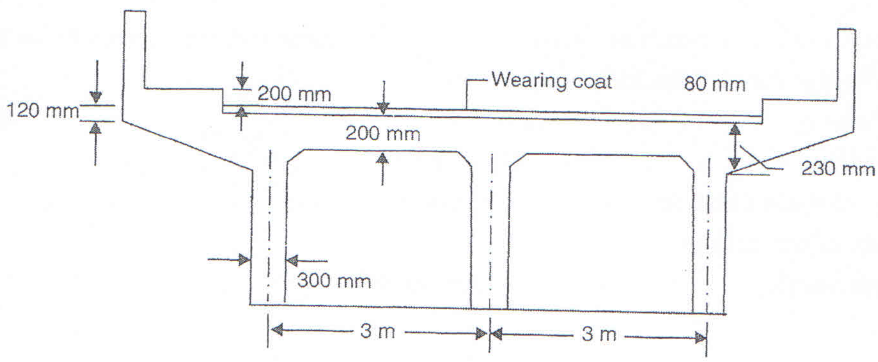


Figure for Question 5 & 6

7. Design an elastomeric unreinforced neoprene pad bearing to suit the following data:

Vertical Load (sustained):	200kN
Vertical Load (Dynamic):	70kN
Horizontal force:	90kN
Modulus of rigidity of elastomer:	$1 N/mm^2$
Friction co-efficient:	0.3

Section C [4x5 = 20 marks]

8. Calculate the design loads (DL, LL and Lateral Pressure) for the box culvert having inside dimensions of 3m X 3m. This culvert is subjected to a dead load of $14{,}000 N/m^2$ and a live load of IRC class AA tracked vehicle. The unit weight of soil as $18{,}000 N/m^3$, the angle of repose of soil is 30°, Road Width is 7.5m and span is 3.3m.Take slab and wall thickness as 300mm and wearing course 80mm.

9. An RCC deck Slab Bridge is to constructed over a trapezoidal channel of 6m base width and side slope 1.1 laid at a bed slope (i) of 0.2m/km. The following details are available. Design the Deck slab for the culvert:

   Chezy's constant = 60
   Bed Level of the stream = 100m
   Full supply level = 101.4m
   Bottom slab level = 103m
   Material M30 Concrete and Fe-415 steel
   Loading IRC class AA (Tracked Vehicle)
   Road width = 7.5m
   Footpath = 600mm on either sides
   Use 20mm dia bar and clear cover of 40mm
   Chezy's Formula, the velocity of normal flow in stream = $c\sqrt{Ri}$, R is hydraulic mean depth, Limiting the afflux = 20cm

10. Check for stability for the abutment. Having following design data:

   Superstructure: T beam two lane bridge of effective span 16.1m and overall length 17.26m
   Type of abutment : reinforced concrete
   Loading: IRC Class AA tracked
   Backfill: gravel with angle of repose ø = 35°
   Unit weight of backfill: $18 kN/m^3$
   Angle of internal friction of soil on wall : $\delta = 17.5°$
   Approach slab: R.C. slab 300mm thick
   Load from super structure per running foot of abutment wall (act over a width of 8.5m)

      Dead Load = 200kN/m

Live Load = 115kN/m

Bearings: Neoprene pads of overall size 320x500x65mm, embedding 5 plates of 3mm thickness and 6mm clearance in plan. G = 1kN/mm^2

11. Prepare the stress summary for dry and flood condition of the pier for the following data:

    Superstructure: 11m span simply supported T-beam

    Dead load from each span : 1700kN

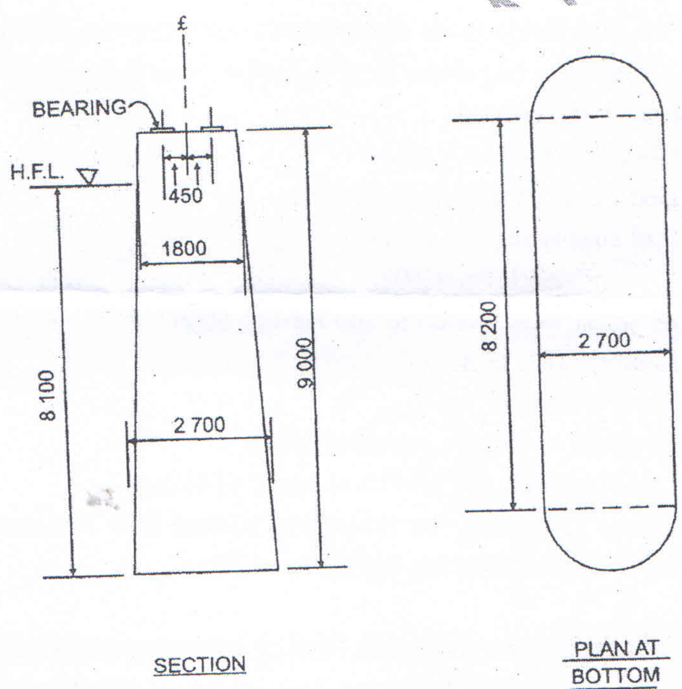
    Reaction due to live load on one span: calculate as per IRC class AA tracked.

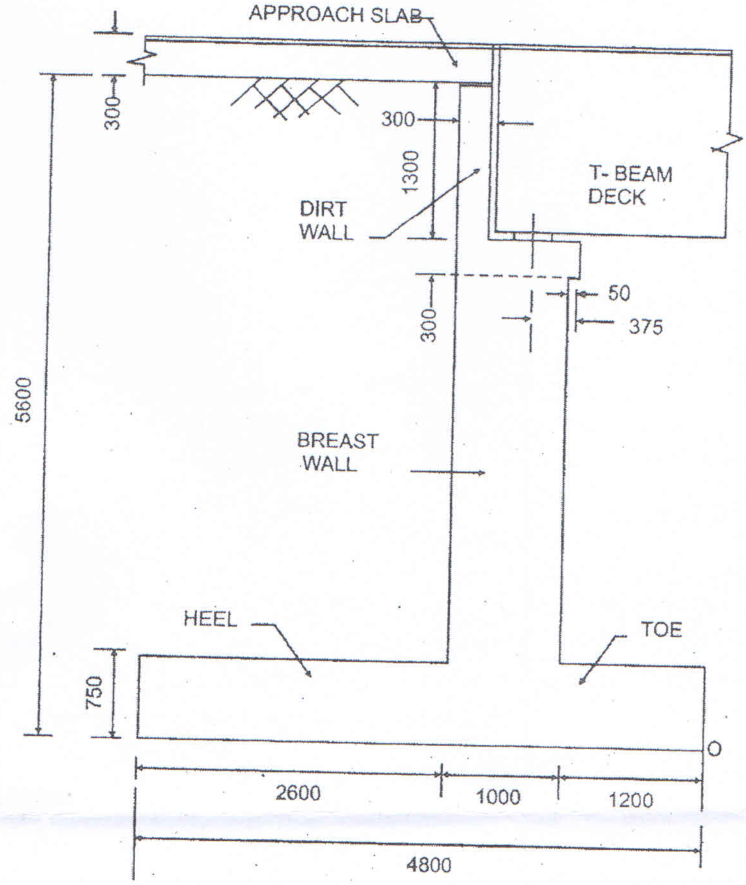
    Maximum mean velocity of current: 3.6m/s

    Material of Pier: M20 cement concrete

    Live load: IRC class AA tracked

    Only straight portion of the pier is considered for design, Assume max force due to wind force as 200kN.




APPROACH SLAB
300
300
1300
DIRT
WALL
T- BEAM
DECK
300
50
375
5600
BREAST
WALL
HEEL
TOE
750
O
2600
1000
1200
4800