

Uw Singh

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MID SEMESTER EXAMINATION-2015

B.Tech 8th Semester-M.Tech IVnd Semester

COURSE CODE: 11M1WCE133

MAX. MARKS: 30

COURSE NAME: Bridge Engineering

COURSE CREDITS: 03

MAX. TIME: 2 HRS

Note: All questions are compulsory. Assume any missing data suitably. Question paper has 2 printed sides. Attempt the questions of a section together.

Section A

(Marks: 6x1 = 6)

1. Draw the clearance diagram of typical bridge for highway traffic.
2. List the two factors involved in design of pipe culverts.
3. Make the typical sketch for a 1st class bedding of pipe culvert
4. What are the various methods for determination of design discharge?
5. Define effective linear waterway, and write the expression for it in the case of large alluvial stream with undefined bank.
6. Show the details of IRC class 70R Wheeled Load Vehicle and calculate the impact factor for 8m span RCC Bridge.

Section B

(Marks: 3x3 = 9)

1. List the Factors on which overall cost of the bridge depends. Derive the expression for effective economical span, along with all the assumptions followed in the derivation.
2. A unit hydrograph is to be developed for a 190 sq. km catchment with 3-h rainfall that has produced the following data:

Time (h)	0	3	6	9	12	14	18	21	24
Flow (m ³)	15	20	55	80	60	48	32	20	15

Based on this data develop a 3-h UH, assume a base flow of 15 m³.

3. Design a waterway for a bridge over a trapezoidal channel having side slope of 1:1 with a discharge of 25 m³/s, a bed fall of 1:1000 and a bed width of depth ratio of 6:1. The bed material is sand with a safe velocity of 2.5m/s. The afflux should not be more than 8cm. Take Manning coefficient $n = 0.025$ and width of stream at HFL = 10.88m

Section C

(Marks: 3x5 = 15)

1. Design a pipe culvert through a road embankment of height 6m. The width of the road is 7.5m and the formation width is 10m. The side slope of embankment is 1.5:1. The maximum discharge is 5m³/s. The safe velocity is 3m/s. Class AA tracked vehicle is to be considered as live load. Assume bell-mouthed entry. Given $C_e = 1.5$, $C_s = 0.010$, the unit weight of soil = 20kN/m³ and three edge bearing strength for NP3 pipe with internal dia (1m) and external dia (1.23m) as 72kN/m.

2. Design a Reinforced slab culvert for a National Highway Crossing to suit the following data:
- 2 lane Carriageway with footpath 750mm wide both side
 - Effective span = 6.2m
 - Width of Bearing = 300mm
 - Loading IRC Class AA tracked Vehicle
 - Provide thickness of wearing coat = 80mm
 - Use M25 concrete and Fe 415 steel

What is the total design bending moment and total design shear force. Design the RCC slab deck and Sketch the details of reinforcement in L-sec and X-sec of the slab. The design should be based on IRC: 6:2000 and IRC: 21-2000. Use 20mm \emptyset , HYSD bars with clear cover of 30mm and Thickness of slab is 500mm. Assume Value of 'K' for simply supported slabs as 2.6. Check for Shear stresses not required.

Permissible Stresses:

$$\sigma_{cb} = 8.33\text{N/mm}^2$$

$$\sigma_{st} = 200\text{N/mm}^2$$

$$m = 10$$

$$Q = 1.1$$

$$j = 0.9$$

3. Calculate the Live Load bending moment for the same Reinforced slab culvert (question 2) for the following conditions
- Loading IRC Class AA Wheeled Vehicle.
 - Loading IRC Class A Wheeled Vehicle.