JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- MAY-2023

COURSE CODE (CREDITS): 11M1WCE133 (3) MAX. MARKS: 25

COURSE NAME: BRIDGE ENGINEERING

COURSE INSTRUCTORS: Mr. KAUSHAL KUMAR MAX. TIME: 1 Hour 30 Minutes

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Note: *All questions are compulsory. Marks are indicated against each question in square brackets. IRC – 6: 2000 and IRC – 21: 2000 are allowed.*

Q1. What is scouring? Briefly explain the effect of scouring in different types of streams i.e. Streams with rigid boundaries, Quasi-alluvial and Alluvial streams. **[2 Marks]**

Q2. A stream with hard banks has a width of 80 m. Its bed is alluvial (f = 1.1) and discharge through the section is ***500 m^3/s***. Calculate the maximum scour depth under the bridge having a single span of *50 m.* **[4 Marks]**

Q3. Define Afflux? What is the use of afflux in bridge design? **[2 Marks]**

Q4. Design a waterway for a bridge over a trapezoidal channel having side slope of *1:1* with a discharge of ***25 m^3/s***, a bed fall of *1:1000* and a bed width to depth ratio of *6:1*. The bed material is sand with a safe velocity of *2.5 m/s*. The afflux should not be more than 8 cm. Take Manning coefficient, n = 0.025. **[5 Marks]**

Q5. List out the different types of live load as per IRC-6: 2000 on a bridge. Explain any one in detail. **[2 Marks]**

Q6. In the design of a deck slab, following particulars are given: **[10 Marks]**

Clear span: 5.5 m
Width of the footpath: 1 m on either side
Wearing coat: 100 mm
Loading: IRC Class AA (Tracked)
Materials: M35 concrete and Fe 415 steel.
Modular ratio: 10 and Max. Permissible stress in steel: 200 MPa.

Design the slab and check for shear. [Use effective width method]

Datas & Important formulas:

① Afflux formula: (a) Drown Weir formula

$$\text{Afflux, } x = \frac{V^2 d^2}{2g(d+x)^2}\left(\frac{L^2}{C^2 L_1^2} - 1\right) \quad \text{Take, } C = 0.95$$

(2) Manning's Formula,

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

③ Normal depth of scour with constriction:

$$d' = d\left(\frac{W}{L}\right) \quad \& \quad d = \frac{1.21 Q_1^{0.63}}{f^{0.33} W^{0.6}}$$

where, $W \rightarrow$ width of stream (Natural waterway)
$L \rightarrow$ Artificial linear waterway

Table 7.1 Values of α for slabs (IRC 21)

B/l	*α for sss**	*α for cs**	*B/l*	*α for sss*	*α for cs*
0.1	0.40	0.40	1.1	2.60	2.28
0.2	0.80	0.80	1.2	2.64	2.36
0.3	1.16	1.16	1.3	2.72	2.40
0.4	1.48	1.44	1.4	2.80	2.48
0.5	1.72	1.68	1.5	2.84	2.48
0.6	1.96	1.84	1.6	2.88	2.52
0.7	2.12	1.96	1.7	2.92	2.56
0.8	2.24	2.08	1.8	2.96	2.60
0.9	2.36	2.16	1.9	3.00	2.60
1.0	2.48	2.24	2.0 and above	3.00	2.60

Table 12B. Permissible Shear Stress in Concrete

$\frac{100 A_s}{bd}$	Permissible Shear Stress in Concrete, τ_c N/mm² Grade of Concrete				
	M20	M25	M30	M35	M40
(1)	(2)	(3)	(4)	(5)	(6)
0.15	0.18	0.19	0.20	0.20	0.20
0.25	0.22	0.23	0.23	0.23	0.23
0.50	0.30	0.31	0.31	0.31	0.32
0.75	0.35	0.36	0.37	0.37	0.38
1.00	0.39	0.40	0.41	0.42	0.42
1.25	0.42	0.44	0.45	0.45	0.46
1.50	0.45	0.46	0.48	0.49	0.49
1.75	0.47	0.49	0.50	0.52	0.52
2.00	0.49	0.51	0.53	0.54	0.55
2.25	0.51	0.53	0.55	0.56	0.57
2.50	0.51	0.55	0.57	0.58	0.60
2.75	0.51	0.55	0.58	0.60	0.62
3.00 and above	0.51	0.57	0.60	0.62	0.63

The End.