JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2025

B.Tech-I Semester (CSE/IT/ECE/CE/BT/BI)

COURSE CODE (CREDITS): 11M1WCE133 (3) MAX. MARKS: 15

COURSE NAME: BRIDGE ENGINEERING

COURSE INSTRUCTORS: Dr. KAUSHAL KUMAR MAX. TIME: 1 Hour

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

<table>
<tr><th>Q.No</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>Q1.</td><td>Classify bridges based on structural form and explain any three types with suitable examples.</td><td></td><td>2</td></tr>
<tr><td>Q2.</td><td>A highway bridge is to be constructed over a wide river with a navigational requirement. The site is in an earthquake-prone zone with strong winds and variable water levels. Suggest the most suitable type of bridge for this location and justify your answer.</td><td></td><td>2</td></tr>
<tr><td>Q3.</td><td>Rain falls on a 250 ha composite catchment which drains two subareas as follows:
(1) Subarea X, steep, draining 30% with concentration time 10 min and $C = 0.75$ and (2) Subarea Y, mild, draining 70% with concentration time 60 min and $C = 0.35$.
Calculate the peak runoff corresponding to 25-year frequency. Use the following IDF function: $I = \frac{1000T^{0.2}}{(t_r+20)^{0.7}}$
where I = rainfall intensity in mm/h, T = return period in years, and t_r = rainfall duration in minutes. Assume linear concentration at the catchment outlet</td><td></td><td>3</td></tr>
<tr><td>Q4.</td><td>The approximate costs of one superstructure and one pier for a multispan bridge are given below. Estimate the economic span
<table><tr><th>Span (m)</th><th>Superstructure Cost (Rs)</th><th>Sub-structure Cost (Rs)</th></tr><tr><td>15</td><td>50,000</td><td>60,000</td></tr><tr><td>20</td><td>90,000</td><td>65,000</td></tr><tr><td>25</td><td>160,000</td><td>70,000</td></tr></table></td><td></td><td>2</td></tr>
<tr><td>Q5.</td><td>Design the waterway for a bridge over a trapezoidal channel having the side slope of 1:1 with a discharge of 30 cumecs, bed fall of 1:1200 and a bed width to depth ratio of 5:1. The bed material can withstand a safe velocity of 2.5 m/s. The afflux is limited to 10 cm. Take Manning coefficient $n = 0.025$.</td><td></td><td>3</td></tr>
<tr><td>Q6.</td><td>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.</td><td></td><td>3</td></tr>
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Helpful Formulas:

• Rational formula for Peak Discharge:	$Q = 0.273CIA$
• Kirpich formula for t_c	$t_c = \dfrac{0.06628L^{0.77}}{S^{0.385}}$
• Hathaway formula for t_c	$t_c = \dfrac{0.606(Ln)^{0.467}}{S^{0.234}}$
• ***Molesworth formula for Afflux***	$x = \left(\dfrac{v^2}{17.9} + 0.015\right)\left(\dfrac{A^2}{a^2} - 1\right)$
• ***Marriman's formula for Afflux***	$x = \dfrac{v^2}{2g}\left[\left(\dfrac{A}{Ca}\right)^2 - \dfrac{A}{A_1}\right]$
• ***Drown Weir formula for Afflux***	$x = \dfrac{v^2 d^2}{2g(d+x)^2}\left[\dfrac{L^2}{C^2 L_1^2} - 1\right]$
• ***Normal scour depth for alluvial streams***	$d = 0.473\left(\dfrac{Q}{f}\right)^{1/3}$
• ***Normal scour depth for Quasi-alluvial streams, when the width of the stream is very large compared to the depth.***	$d = \dfrac{1.21Q^{0.63}}{f^{0.33} w^{0.60}}$
• ***Normal scour depth for streams, when the With constriction***	$d' = d\left(\dfrac{w}{L}\right)^{0.61}$