JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

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

COURSE CODE (CREDITS):18B1WCE639 MAX. MARKS: 35

COURSE NAME: Open Channel Flow and Hydraulic Machine

COURSE INSTRUCTORS: Ashish Kumar MAX. TIME: 2 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 (a)</td><td>Differentiate between inward flow and outward flow reaction turbine</td><td>CO4</td><td>1</td></tr>
<tr><td>Q1 (b)</td><td>A Francis turbine with an overall efficiency of 70% and hydraulic efficiency of 80% is required to produce 150 kW. It is working under a head of 8 meter. The peripheral velocity is $0.3\sqrt{2gH}$ and velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at a speed of 200 rpm. Assuming radial discharge at outlet, determine
(a) guide blade angle (α)
(b) wheel vane angle at inlet (Θ)
(c) diameter of wheel at inlet
(d) width of wheel at inlet</td><td>CO4</td><td>6</td></tr>
<tr><td>Q2</td><td>A trapezoidal channel with side slope of 1to 1 has to be designed to carry 10 m^3/s of water at a velocity of 2 m/s so that the amount of concrete lining for bed and side is minimum. Compute the area of lining required for one metre length of canal.</td><td>CO2</td><td>5</td></tr>
<tr><td>Q3</td><td>A current meter was used to measure the point velocity in the centre line of river across the depth of flow of river. The velocity measured are shown as per details in table below. If the average cross-sectional area of the river is 32.5 m^2, compute the discharge of the river. Take depth of river 3.0 m.
<table>
<tr><td>Depth from bottom of channel (m)</td><td>0</td><td>0.5</td><td>1.0</td><td>1.5</td><td>2.0</td><td>2.5</td><td>3.0</td></tr>
<tr><td>Point Velocity (m/s)</td><td>0</td><td>0.5</td><td>1.25</td><td>1.75</td><td>1.85</td><td>1.87</td><td>1.9</td></tr>
</table></td><td>CO 3</td><td>5</td></tr>
<tr><td>Q4 (a)</td><td>Compare the Kaplan and Pelton wheel turbines, highlighting their differences. Also, specify the range of head conditions under which each turbine is typically used for power generation.</td><td>CO4</td><td>2</td></tr>
<tr><td>Q4 (b)</td><td>The hub diameter of a Kaplan turbine, working under a head of 12 m, is 0.35 times the diameter of the runner. The turbine is running at 100 rpm. If the vane angle of extreme edge of the turbine at outlet is 15° and the flow ratio 0.6 find</td><td>CO4</td><td>6</td></tr>
</table>

	(a) Diameter of the runner (b) Diameter of the boss (c) Discharge through the runner		
Q5	A reciprocating pump is being used — what type of system should be integrated into the pipeline to ensure a continuous and uniform flow of water? Briefly explain its function with neat sketch.	CO5	5
Q6	A single acting reciprocating pump running at 40 rpm is discharging 0.01 m^3 per sec. The pump has a stroke of 400 mm. The diameter of piston is 200 mm. The delivery and suction heads are 20 m and 5 m respectively. Find the theoretical discharge, slip of the pump and the power required to drive the pump.	CO5	5