Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2022

Course: Hydraulic Engineering **Semester: V**
Program: B Tech (Civil Engineering) **Time : 03 hrs**
Course Code: CIVL 3060 **Max. Marks: 100**

Instructions:

1) Mention Roll No. at the top of the question paper.
2) Attempt all the parts of a question at one place only
3) Calculators is allowed for the exam.

SECTION A

(5Qx4M=20Marks)

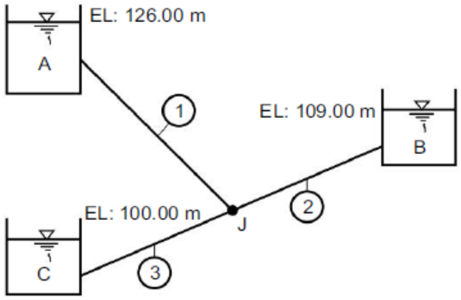
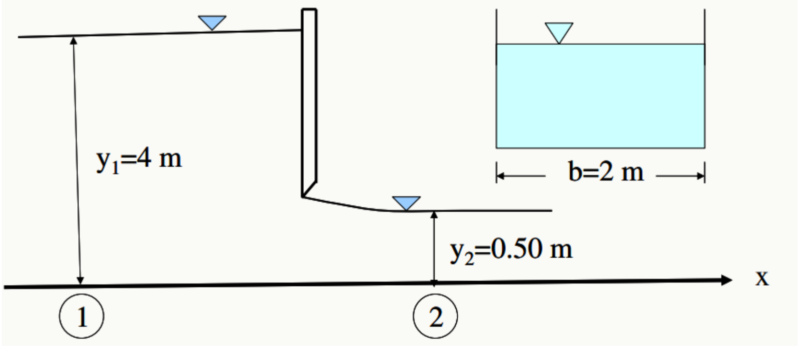
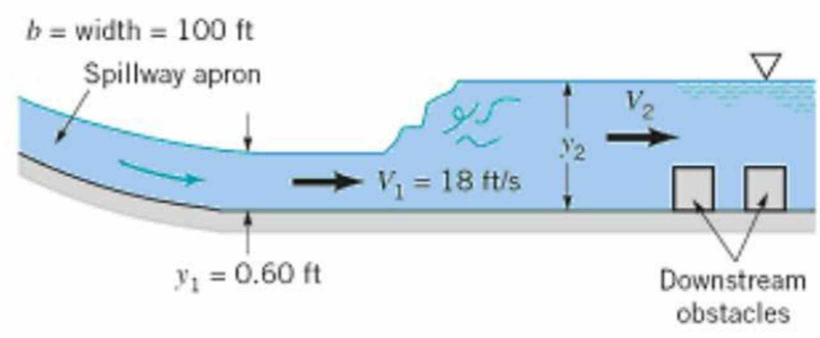
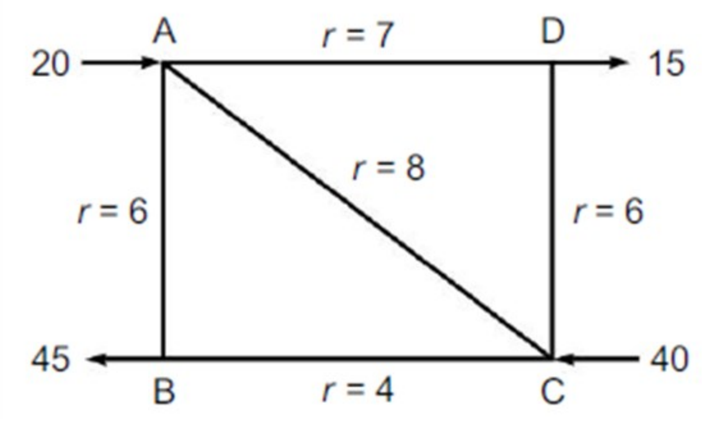
<table>
<tr><th>S. No.</th><th>Question</th><th>Marks</th><th>CO</th></tr>
<tr><td>Q 1</td><td>Explain specific energy and differentiate between hydraulic gradient line and total energy line.</td><td>4</td><td>CO1</td></tr>
<tr><td>Q 2</td><td>Define the following terms: hydraulic jump, conjugate depth, sequent depth, laminar flow, major loss and minor loss.</td><td>4</td><td>CO1</td></tr>
<tr><td>Q 3</td><td>Estimate the discharge passing through the rectangular channel section which width 3m and depth is 1.2m. The bed slope of channels is 1: 4000 and Manning's n is 0.02.</td><td>4</td><td>CO3</td></tr>
<tr><td>Q 4</td><td>Determine the critical depth and critical velocity of flow in a trapezoidal channel with the width of 2 m side slope 1V:2H and flow rate of 8 m^3/s.</td><td>4</td><td>CO3</td></tr>
<tr><td>Q 5</td><td>For the branching system shown in Fig.Q5, calculate the discharge in each pipe. Take f=0.02 for all pipes. Assume that the flow through pipe AJ and BJ is equal and neglect the minor losses.
<table>
<tr><th>Pipe</th><th>Diameter (cm)</th><th>Length (m)</th><th>Connectivity</th></tr>
<tr><td>1</td><td>15</td><td>350</td><td>AJ</td></tr>
<tr><td>2</td><td>10</td><td>200</td><td>BJ</td></tr>
<tr><td>3</td><td>10</td><td>200</td><td>JC</td></tr>
</table>


Fig. Q5: Three reservoir network</td><td>4</td><td>CO2</td></tr>
</table>

SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Proved that regular hexagon section is a hydraulically efficient and economical trapezoidal channel section. Design the hydraulically efficient and economical trapezoidal channel section for 100 m^3/s discharge carries in channel section with bed slope of 1:2500 and manning's n is 0.015.	**10**	**CO3**
Q 7	Hydraulic jump occurs in a rectangular channel with the width of 9 m. If the depths of flow before and after the jump are 1.55 m and 3.08 m respectively, what would be the flow rate in the channel.	**10**	**CO1**
Q 8	Water flows under a sluice gate in a horizontal rectangular channel of 2 m wide. If the depths of flow before and after the gate are 4 m and 0.5 m compute the discharge in the channel (no head loss).  Fig. Q8: Flow channel with sluice gate **OR** If, in a hydraulic jump occurring in a horizontal rectangular channel, the Froude number before the jump is 10 and energy loss is 3.20 m estimate the (i) Sequent depths (ii) Discharge intensity, (iii) Froude number after the jump and (iv) power dissipated.	**10**	**CO2**
Q 9	The Drag force (F_D) on an sphere in laminar flow is known to depend on its diameter (D), velocity of flow (V), density of fluid (ρ), and coefficient of viscosity (μ). Obtain an expression for (F_D) using Buckingham Π method.	**10**	**CO1**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	Water downstream of an spillway flows in a 100 ft wide rectangular channel with the depth of 0.6 ft and velocity of 18 ft /s. Determine the depth after the jump, Froude numbers before and after the jump, height of the jump, the head loss and power dissipated during the jump And plot the y vs specific energy. (1m=3.28ft, g=32.17 ft/s^2)	**20**	**CO3**

	 Fig. Q10: Flow channel with downstream obstacles. **OR** Two reservoirs with a difference in water surface elevation of 10 m are connected by a pipeline ABC which consists of two pipes of AB and BC joined in series. Pipe AB is 10 cm in diameter, 20m long and has a value of f=0.02. Pipe BC is of 16 cm diameter, 25 m long and has an f = 0.018. The junctions with the reservoirs and between the pipes are abrupt. (a) Calculate the discharge. (b) What difference in reservoir elevations is necessary to have a discharge of 15 L/s? [Include all minor losses].		
Q 11	For the network shown in figure Q11.1, the head loss is given by hf = rQ^2 . The values of r for each pipe, and the discharge (m^3/s) into or out of various nodes are shown in the sketch. The discharges are in an arbitrary unit. Obtain the distribution of discharge in the network. Carry out at least three iterations.  Figure Q11: Pipe network with flow.	**20**	**CO1**