



PAPER ID-411517

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Subject Code: BCE403

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BTECH
(SEM IV) THEORY EXAMINATION 2023-24
HYDRAULIC ENGINEERING AND MACHINES

TIME: 3 HRS**M.MARKS: 70****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 7 = 14**

Q no.	Question	Marks	CO
a.	What is the most economical channel section condition?	2	1
b.	What is the application of specific energy?	2	1
c.	What is the principle of hydraulic jump?	2	2
d.	Write the impact of jets on plane and curved plates.	2	3
e.	What is the difference between deep and shallow-water waves?	2	4
f.	Write the classifications of turbines according to direction of flow.	2	4
g.	What is the difference between impulse and reaction turbine?	2	5

SECTION B**2. Attempt any three of the following:****7 x 3 = 21**

a.	Find the critical depth for a specific energy head of 2.5 m in the following channels. (i) Triangular channel $n = 2$ (ii) Trapezoidal channel $b = 4\text{m}$ and $n = 1.5$	7	1
b.	Derive the equations of GVF for a wide rectangular channel using (a) Manning's formula (ii) Chezy's formula	7	2
c.	Give the neat sketches of classifications of jump based on Froude number F_1 of super critical flow.	7	3
d.	Draw neat sketch of velocity triangles for an impeller vane and write important terms with their relation involve in velocity triangles.	7	4
e.	A Pelton turbine develops 8421 kw of shaft power under a head of 320 m. Speed of rotation of wheel is 700 rpm and its overall efficiency is 87%. Assuming coefficient of velocity of jet 0.98, speed ratio as 0.45 and jet ratio as 6, find the wheel diameter, diameter of jet and the number of jets required.	7	4

SECTION C**3. Attempt any one part of the following:****7 x 1 = 7**

a.	Water flows through a circular channel of diameter 600 mm at the rate of $0.142 \text{ m}^3/\text{s}$. If the slope of the channel is 1 in 500 and the depth of water is 450 mm, calculate Chezy's coefficient and the velocity of flow.	7	1
b.	An irrigation channel of trapezoidal section has side slope of 1.5 horizontal to 1 vertical and bed slope of 1 in 4000. The channel has passed a discharge of $15 \text{ m}^3/\text{s}$ the channel is to lines for which the value of N in Operating formula is 0.012. Find the dimension of most economical section of the channel.	7	1

4. Attempt any one part of the following:**7 x 1 = 7**

a.	A flow of $5.0 \text{ m}^3/\text{sec}$ is passing at a depth of 1.50 through a rectangular Channel of width 2.50 m. What is the specific energy of the flow? What is the value of the alternate depth to the existing depth?	7	2
b.	Sketch the GVF profile for the following cases three slopes (i) Mild (ii) Steeper mild (iii) milder are in series. The last slope has a sluice gate in the middle of the reach and the downstream end of the channel has a free overfall.	7	2



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TIME: 3 HRS**M.MARKS: 70****5. Attempt any one part of the following:****7 x 1 = 7**

a.	Find the sequent depth ratio and energy loss for a hydraulic jump in a horizontal rectangular channel.	7	3
b.	A rectangular channel 3m wide has a flow of 3.6 m ³ /s with the velocity of 0.8 m/s. If the sudden release of additional flow at the upstream end of the channel causes the depth to raise by 50%. Determine the absolute velocity of the resulting surge and the new flow rate,	7	3

6. Attempt any one part of the following:**7 x 1 = 7**

a.	With neat diagram find out the forces of jet on a stationary vertical plate.	7	4
b.	Find out the vane angle at the outer periphery of the impeller of a centrifugal pump. Data given Q= 0.118 m ³ /s, N= 1400 rpm, H _m =25 m., D ₂ =250 mm, η_{mano} = 75%, B ₂ =0.05 m	7	4

7. Attempt any one part of the following:**7 x 1 = 7**

a.	Derive an expression for specific speed of a turbine. How does it influence the geometry of runner?	7	5
b.	What do you understand by model testing of turbines? Also, explain their three parameters.	7	5