PAPER ID-411517

Roll No: | | | | | | | | | | | | | |

**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<br>(ii) Trapezoidal channel b = 4m 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 $m^3/s$. 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 $m^3/s$ 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 $m^3$/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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**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 m3/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., D2=250 mm, $\eta_{mano}$ = 75%, B2=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 |