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PAPER ID-311412

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

# BTECH
## (SEM III) THEORY EXAMINATION 2023-24
## FLUID MECHANICS & FLUID MACHINES

**TIME: 3HRS**  **M.MARKS: 70**

**Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

## SECTION A

**1.** **Attempt *all* questions in brief.**

| Q no. | Question | Marks | CO |
|---|---|---|---|
| a. | What is specific weight and specific gravity? | 2 | 1 |
| b. | Define the terms $C_c$, $C_v$ in case of orifice meter. | 2 | 1 |
| c. | Differentiate between laminar and turbulent flow. | 2 | 2 |
| d. | Differentiate between rotational and irrotational flow. | 2 | 2 |
| e. | What is the expression of Reynold number? | 2 | 3 |
| f. | What is the Mechanical efficiency of a Pump? | 2 | 4 |
| g. | What is slip in case of reciprocating pump? | 2 | 5 |

## SECTION B

**2.** **Attempt any *three* of the following:**

| | | | |
|---|---|---|---|
| a. | What is the use of venturimeter? Also derive the expression of discharge through venturimeter. | 7 | 1 |
| b. | Explain the principal of continuity equation. Also explain steady and unsteady flow. | 7 | 2 |
| c. | The velocity distribution in the boundary layer is given by $u/U = 2(y/\delta)-(y/\delta)^2$ Where, $\delta$= boundary layer thickness. Calculate the following: Displacement thickness Momentum thickness | 7 | 3 |
| d. | Derive an expression for the work done per second by water on the runner of the Pelton wheel using velocity triangles and also find the expression for maximum efficiency. | 7 | 4 |
| e. | Explain the working of air vessel with neat diagram? What is the importance of the air vessel for reciprocating pump? | 7 | 5 |

## SECTION C

**3.** **Attempt any *one* part of the following:**

| | | | |
|---|---|---|---|
| a. | Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size 0.8m x 0.8m and an inclined plane with angle of inclination 30°. The weight of square plate is 300m and it slides down the inclined plane with a uniform velocity 0.3m/s. The thickness of the oil film is 1.5mm. | 7 | 1 |
| b. | Explain the concept of viscosity. Also explain the impact of temperature on viscosity. | 7 | 1 |

**4.** **Attempt any *one* part of the following:**

| | | | |
|---|---|---|---|
| a. | Water flows through a pipe AB 1.2 m diameter at 3m/s and then passes through a pipe BC 1.5m diameter. At C the pipe branches, Branch CD is 0.8 m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. | 7 | 2 |
| b. | Derive an expression for continuity equation in three dimensions for Cartesian | 7 | 2 |

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| | | | |
|---|---|---|---|
| | co-ordinate which is applicable for steady and incompressible. | | |
| **5.** | **Attempt any *one* part of the following:** | | |
| a. | What do you mean by boundary layer separation? What is the effect of pressure gradient on boundary layer separation? | 7 | 3 |
| b. | Derive an expression of velocity distribution when water is flowing in a circular pipe. | 7 | 3 |
| **6.** | **Attempt any *one* part of the following:** | | |
| a. | A reaction turbine works at 450 r.p.m. under a head of 120m. Its diameter at inlet is 1.2m and the flow area is 0.4m$^2$.The angle made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocities. Determine:<br>(i)     The volume flow rate<br>(ii)    The power developed | 7 | 4 |
| b. | Explain the phenomenon of cavitation in case of turbine. Also write the method to avoid it. | 7 | 4 |
| **7.** | **Attempt any *one* part of the following:** | | |
| a. | What are the difference between centrifugal pump and reciprocating pump? | 7 | 5 |
| b. | Draw an indicator diagram for reciprocating pump. Prove that work done by the pump is proportional to the area of the indicator diagram. | 7 | 5 |