**BACHELOR OF ENGINEERING (CIVIL ENGG.) FIRST YEAR FIRST SEMESTER EXAM 2023**

**FLUID MECHANICS- II**

Time: Three hours                                                        Marks: 100

*(Answer any **FIVE** questions)*

***Different parts of the same question should be <u>answered together</u>.***
***All symbols carry their usual meanings unless otherwise mentioned.***
***Assume any relevant data if necessary.***

1.  a) What are the common fluid flow measurement devices used?                5

    b) Derive the expression for the discharge over a triangular notch.                7

    c) Water is flowing through a horizontal Venturi meter of pipe and throat diameters are 32 cm and 18 cm respectively. The pressure intensity at inlet pipe is 12 N/cm$^2$ while the vacuum pressure at the throat is 30 cm of mercury column. Determine rate of flow if co-efficient of discharge is 0.96.                8

2.  a) Derive an expression for Hagen Poiseuille's equation stating its assumptions.        12

    b) A fluid of viscosity 0.2 Ns/m$^2$ and density 800 kg/m$^3$ is flowing through a circular pipe of diameter 60 mm and length 300 m. The rate of flow of fluid through the pipe is 6 litres/s. Find the pressure drop in a length of 300 m and shear stress at the pipe wall.                8

3.  a) What are the different losses in pipe flow?                4

    b) Derive the expression of the head loss due to sudden enlargement in pipe flow.        8

    c) The rate of flow of water through a horizontal pipe of diameter 30cm which is suddenly enlarged to 60cm diameter. If the pressure in the smaller pipe is 20N/cm$^2$ and discharge is 0.4 m$^3$/s, estimate the head loss due to sudden enlargement and pressure in the large pipe.                8

4.  a) What do you mean by open channel flow? Derive the expression for the discharge over an open channel.                8

    b) What is most economical cross section of a channel? Determine the condition of most economical cross section of a rectangular channel?                6

    c) A rectangular channel carries water at the rate of 500litres/s when bed slop is 1 in 2500. Find the most economical dimensions of the channel if C is 50.                6

[ Turn over

5.  a) How water turbines are classified?                                                    4

    b) Draw a schematic diagram of a hydro-electric power plant showing its major    6
       components.

    c) A Pelton wheel having tangential velocity 20 m/s operates under a net head of 60 m.
       Bucket deflects at 165° and discharges 0.03m³/s.  Determine power developed and
       hydraulic efficiency by the turbine if coefficient of velocity is 0.98. Draw velocity    10
       triangles


6.  a) Explain the working principle of a centrifugal pump with a neat sketch.              6

    b) The outer diameter and width of the impeller of a centrifugal pump are 30cm and
       5cm respectively and are bent back at 30° to the tangent at exit. Pump delivers a    10
       discharge of 0.0.04m³/s of water against a head of 15m at a speed of 1000rpm.
       Determine the discharge of the pump if manometric efficiency is 95%.

    c)  What is specific speed of a pump?                                                     4


7.      Write short note on: (any **FOUR**) 4 X 5                                            20

    a) Pitot tube

    b) Equivalent pipe

    c) Specific energy curve

    d) Draft Tube

    e) Hydraulic Jump

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