JHARKHAND UNIVERSITY OF TECHNOLOGY

Diploma 3rd Semester Sample Paper (DIPLOMA WALLAH)

FLUID POWER ENGINEERING (MEC 304)

Time: 3 Hours   **Full Marks: 70**   **SET: 3**

INSTRUCTIONS:
1. Question No. 1 is Compulsory.
2. Answer any **FOUR** questions from the remaining (Q.2 to Q.7).
3. Use the provided figures for numerical problems.

Q.1. Multiple Choice Questions   [2 × 7 = 14]

(i) The ratio of inertia force to viscous force is called:

(a) Reynolds Number   (b) Froude Number
(c) Weber Number   (d) Euler Number

(ii) Discharge (Q) through an orifice is given by:

(a) $Cd \times a \times \sqrt{(2gh)}$ (b) $Cd \times a \times 2gh$
(c) $a \times \sqrt{(2gh)}$ (d) None

(iii) In a Pelton wheel, the bucket shape is:

(a) Flat   (b) Single hemispherical cup
(c) Double hemispherical cup   (d) Elliptical

(iv) NPSH stands for:

(a) Net Positive Suction Head   (b) Net Pressure Suction Head
(c) Normal Pump Suction Head   (d) Nominal Positive Suction Head

(v) A Hydraulic Intensifier is used to:

(a) Increase discharge   (b) Increase pressure intensity
(c) Store energy   (d) Measure pressure

(vi) Loss of head due to friction in pipes is given by:

(a) Chezy's Formula   (b) Darcy-Weisbach Formula
(c) Manning's Formula   (d) All of these

(vii) Mercury is used in manometers because:

(a) Low vapor pressure & High density   (b) High vapor pressure
(c) Low density   (d) Transparent

SECTION B (Long Answer Type)

Q.2. (a) [Theory] Derive the **Darcy-Weisbach Equation** for loss of head due to friction in pipes: $hf = 4fLv^2 / (2gd)$.   [7]

Q.2. (b) [Numerical] Find the force exerted by a jet of water of diameter 50mm striking a **Stationary Symmetrical Curved Plate** at the center with velocity 20 m/s.   [7]

V=20m/s   Fixed Plate
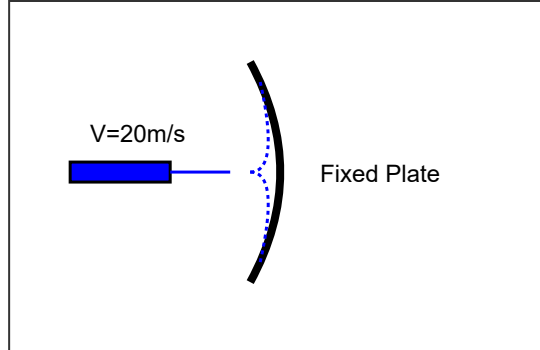
Q.3. (a) [Theory] Explain the construction and working of a **Hydraulic Accumulator**. What is its capacity? **[7]**

Q.3. (b) [Theory] Explain the working of a **Hydraulic Lift**. Differentiate between Direct Acting and Suspended Hydraulic Lifts. **[7]**

Q.4. (a) [Theory] Explain the **Main Characteristic Curves** of a Hydraulic Turbine (Unit speed, Unit discharge, Unit power). **[7]**

Q.4. (b) [Theory] Define **Manometric Efficiency**, **Mechanical Efficiency**, and **Overall Efficiency** of a Centrifugal Pump. **[7]**

Q.5. (a) [Theory] What are **Air Vessels**? Explain their function in a reciprocating pump (Smoothing flow, saving work). **[7]**

Q.5. (b) [Numerical] Calculate the **Slip** and **Percentage Slip** of a reciprocating pump if Theoretical Discharge is 0.02 m³/s and Actual Discharge is 0.018 m³/s. **[7]**

Q.6. (a) [Theory] Explain the different **Types of Fluid Flow**: (i) Steady & Unsteady, (ii) Uniform & Non-uniform, (iii) Laminar & Turbulent. **[7]**

Q.6. (b) [Theory/Diagram] Explain the principle of operation of a **Gear Pump** (Rotary Pump) with a sketch. Where is it used? **[7]**

Out

In
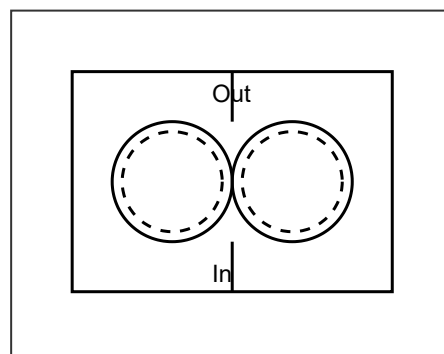
Q.7. Write Short Notes on (Any FOUR): **[3.5 × 4 = 14]**

    a. Reynolds Number (Re)

    b. Orifice Meter

c. Hydraulic Crane

d. Water Hammer

e. Submersible Pump

Diploma Wallah: Solution Key

MCQ: (i) a, (ii) a, (iii) c, (iv) a, (v) b, (vi) b, (vii) a.

Q2(b) Hint: For semi-circular curved plate, Force = $2\rho a V^2$. F = 2 * 1000 * (π/4 * 0.05²) * 20². F = 1570 N.

Q5(b) Hint: Slip = Q_{th} - Q_{act} = 0.002 m³/s. % Slip = (0.002 / 0.02) * 100 = 10%.

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