INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.Tech IV Semester End Examinations (Regular / Supplementary) - May, 2019
Regulation: IARE – R16
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

Time: 3 Hours   **(ME)**   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Define the following fluid properties and mention their units **[7M]**
   - (i) Density, (ii) Weight density, (iii) Specific volume,
   - (iv) Specific gravity (v) Viscosity

   (b) If 5.27 m^3 of certain oil weighs 44 kN, calculate the specific weight, mass density and specific gravity of the oil. **[7M]**

2. (a) Define vapour pressure. Explain in detail the formation of vapour pressure, cavitation with examples. **[7M]**

   (b) An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9mX0.9m and an inclined plane having an angle of inclination 20^0. The weight of the square is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the dynamic viscosity of the oil. **[7M]**

UNIT – II

3. (a) Discuss the following in brief with neat sketches **[7M]**
   - (i) Stream line, (ii) Path line
   - (iii) Streak line (iv) Stream tube

   (b) Water flows through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s. **[7M]**

4. (a) Differentiate the following: **[7M]**
   - (i) Steady and unsteady flow
   - (ii) Uniform and Non uniform flow
   - (iii) Laminar and turbulent flow

   (b) A 300 mm diameter pipe carries water under a head of 20 m with a velocity of 3.5 m/s. If the axis of the pipe turns through 45^0, find the magnitude and direction of the resultant force at the bend. **[7M]**

UNIT – III

5. (a) What do you mean by boundary layer separation? What is the effect of pressure gradient on boundary layer separation? **[7M]**

   (b) An oil of specific gravity 0.8 is flowing through a Venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal Venturimeter. Take C_d=0.98. **[7M]**

6. (a) Write Darcy weisbach equation and deduce the same. **[7M]**

   (b) The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameter 300 mm, 200 mm, and 400 mm respectively, is 12 m. Determine the rate of flow of water if coefficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering minor losses. **[7M]**

UNIT – IV

7. (a) Obtain an expression for the force exerted by a jet of water on an inclined plate moving in the direction of the jet. **[7M]**

   (b) A jet of water 50 mm in diameter impinges with a velocity of 10m/sec and normally on a stationary flat plate. Determine the force exerted by the jet on the plate and the work done.

   [7M]

8. (a) When do you use pelton turbine? Explain the governing of pelton turbine. **[7M]**

   (b) A pelton wheel is revolving at a speed of 190 rpm and develops 5150.25kW when working under a head of 220 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. Also find the speed, discharge and power when this turbine is working under a head of 140 m. **[7M]**

UNIT – V

9. (a) Define a centrifugal pump. Explain the working of a single stage centrifugal pump with sketch.

   [7M]

   (b) A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. **[7M]**

10. (a) Write an expression for work done by reciprocating pump. Describe the working of a reciprocating pump. **[7M]**

    (b) A single acting reciprocating pump, running at 50 rpm, delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine: **[7M]**
    (i) The theoretical discharge of the pump,
    (ii) Co-efficient of discharge
    (iii) Slip and the percentage slip of the pump.

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