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B.TECH
BEME2209

3rd Semester Regular / Back Examination 2015-16
FLUID MECHANICS AND MACHINES
BRANCH: BIOTECH,ENV,PLASTIC
Time: 3 Hours
Max Marks: 70
Q.CODE: T622

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) How viscosity varies with respect to temperature for gas and liquids?

b) Which properties are cause for surface tension and capillarity of fluid?

c) What is weir? Differentiate between notch and orifice.

d) Define Mach number. Define its importance with respect to fluid compressibility.

e) Assuming own notations find the buoyant force on a body floating at the surface of separation between two fluid.

f) Write the continuity equation for compressible unsteady 3-D flow and incompressible steady 2-D flow.

g) What do you mean by total hydrostatic pressure and centre of pressure? Give examples of three hydraulic structures whose design based on the magnitude of this force and its location.

h) Draw the velocity diagram at inlet and outlet for a jet striking at the centre of an impulse turbine blade. Consider three possible cases at outlet side.

i) Define the terms speed ratio, flow ratio and jet ratio as in case of hydraulic turbine.

j) Define Indicator diagram. Draw the diagram after consideration of the effect of the acceleration and friction in suction and delivery pipes.

Q2 a) Find the density of metallic body which floats at the interface of mercury and water such that 40% of its volume is submerged in mercury and 60% in water. **(5)**

b) Derive expressions for total pressure and centre of pressure for vertical plane surface submerged in liquid. **(5)**

Q3 a) A horizontal venturimeter with inlet and throat diameters 35 cm and 15 cm respectively is used to measure flow of water. The pressure at inlet is 130 kPa and the vacuum pressure at throat is 350 mm of mercury. Assuming 3% of differential head is lost between the sections, find the rate of flow. Assume C_d =0.97. **(5)**

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b) A monometer containing mercury is connected to two points 15 m apart, on a pipeline conveying water. The pipeline is straight and slopes at an angle of 15^0 with the horizontal. The monometer gives a reading of 150 mm. Determine the pressure difference between the two points of the pipeline. **(5)**

Q4 **a)** A circular disc of diameter D is immersed vertically in a liquid of density ρ.The top most point of the disc just touches the liquid surface. Derive an expression for the depth of the centre of pressure. **(5)**

b) In 2-D incompressible flow, the fluid velocity components are given by u = x - 4y and v = -y - 4x.Show that velocity potential exists and find its form as well as stream function. **(5)**

Q5 **a)** Describe what do you mean by pumps in series and pumps in parallel as in case of centrifugal pump? What advantage we get from the above two arrangement? **(5)**

b) The internal and exit diameter of an outward flow reaction turbine are 2m and 2.75m respectively. The turbine is running at 250 rpm and rate of flow of water through the turbine is $5m^3$/sec. The width of runner is constant at inlet and outlet and is equal to 250mm.The head on the turbine is 150m.Neglecting the thickness of vanes and taking discharge radial at outlet, determine (a) Vane angles at inlet and outlet. (b) Velocity of flow at inlet and outlet. **(5)**

Q6 **a)** Where do the draft tubes are used? State its functions. **(3)**

b) A Pelton wheel turbine working under a head of 350 m runs a 9560 KW generator at 750 rpm. The overall efficiency=85%, Jet ratio=6, Coefficient of velocity=0.985, Speed ratio= 0.45, No. of poles in generator = 36. Determine (a) Runner diameter (b) jet diameter(c) No. of jets required (d) Synchronous speed of generator (e) Specific speed of turbine. **(7)**

Q7 A single acting reciprocating pump has a piston diameter 0.15m and stroke length 0.3m.The centre of the pump is 5m above the level of water in sump and 33m below delivery water level. The lengths of suction and delivery pipes are 6.5m and 39m respectively and both the pipes have the same diameter of 75mm. if the pump is working at 30rpm, find the pressure head on the piston at the beginning, middle and end of both suction and delivery stroke, and find the power required to drive the pump. Take atmospheric pressure as 10.3m of water and Darcy's friction factor for both the pipes as 0.04. **(10)**

Q8 Write short notes on any TWO. **(5 x 2)**

a) NPSH

b) Current Meter

c) Types of Motion of Fluid Elements

d) Hydraulic Accumulator