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Total Number of Pages: 2

B.TECH
BEME2209

3rd Semester Back Examination 2016-17

FLUID MECHANICS AND MACHINES

BRANCH(s): BIOTECH, ENV, PLASTIC

Time: 3 Hours

Max Marks: 70

Q.CODE: Y639

**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) Define surface tension. What are the factors that affect surface tension?
- b) Define compressibility.
- c) What do you mean by manometric efficiency and mechanical efficiency of centrifugal pump?
- d) What is governing of turbine?
- e) What are the methods of describing fluid flow?
- f) What is manometer? How are they classified?
- g) Write the difference between notch and weir.
- h) Distinguish between impulse turbine and reaction turbine.
- i) Draw actual indicator diagram for reciprocating pump
- j) When the water surface coincides with the top edge of rectangular gate 2.5m wide and 3m deep, what is the depth of centre of pressure?

Q2 a) 0.0113 m³ of liquid at pressure 6.87 MPa was compressed to 0.0112 m³. The final pressure becomes 13.73 MPa. Determine the Bulk modulus of elasticity. (4)

b) A differential manometer is used to measure the difference of pressure of oil contained in two pipes at the same level. If the deflection of the manometric liquid which is mercury, be 100 mm, determine the difference of pressure of oil in the two pipes in kPa. (6)

Q3 a) Define specific speed of centrifugal pump. Derive its expression. (4)

b) For a two dimensional potential flow, the velocity potential is given by $\Psi = 4x(3y - 4)$, determine the velocity at point (2,3). Determine also the stream function and its value at a point (2,3). (6)

Q4 a) A turbine develops 9000 KW when running at 10 rpm. The head available for the turbine is 30 m. If the head is reduced to 18 m, determine the speed and power developed by the turbine. **(5)**

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

Q5 a) A solid cylinder of diameter 5.0 m has a vertical height of 5.0 m. Find the meta-centric height of the cylinder if the specific gravity of the material of cylinder is 0.7 and it is floating in water with the axis vertical. State whether the equilibrium is stable or unstable. **(5)**

b) A single acting reciprocating pump has its piston diameter 15 cm and stroke of 30 cm. It discharges 300 litres of water per minute at 60 rpm. The suction and delivery heads are 5 m and 15 m respectively. Find the theoretical discharge, coefficient of discharge and percentage of slip of the pump. How much HP will be required to drive the pump with its efficiency is 70%. **(5)**

Q6 a) Derive Euler's motion equation. Mention the assumption made in the derivation. **(5)**

b) A centrifugal pump is required to deliver 40 litres of water per second to a height of 25 m through a 150 mm diameter and 100m long pipe. The overall efficiency of pump is 75% and Darcy's friction factor for pipe is 0.06. Determine the motor power to drive the pump. Assume no other losses in the pipe line. **(5)**

Q7 a) A Kaplan turbine develops 9000 KW under a net head of 7.5 m. Mechanical efficiency of the wheel is 86%. The speed ratio based on the outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of the runner and the specific speed of the runner. **(5)**

b) Find the discharge of water through a pipe 20 cm diameter placed in an inclined position, where a venturimeter is inserted having a throat diameter of 10 cm the difference of pressure between the main and throat is measured by liquid of specific gravity 0.4 in an inverted U-tube, which gives a reading of 30 cm the loss of head between the main and throat is 0.2 times the kinematic head of pipe. **(5)**

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

- a) Pascal's Law
- b) Types of Fluid Flow
- c) Pump Characteristic
- d) Hydraulic Intensifier