Reg.No.										

प्रज्ञानं ब्रह्म

Manipal

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INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

II SEMESTER B.S. DEGREE EXAMINATION – JUNE 2016

SUBJECT: FLUID MECHANICS (ME 122)

(BRANCH: MECH / AVI)

MONDAY, 13TH JUNE, 2016

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A) If $\Phi = x(2y-1)$ represents velocity potential function for a 2-D irrotational flow, then determine the value of velocity at P(4,5) Also determine the value of stream function at P.

1B) Define and derive Pascal' s law.

1C) What is capillarity? Derive an expression for capillary fall of mercury in terms of surface tension force and diameter of the tube.

(08+06+06)

2A) Derive an expression to find the resultant pressure force and center of pressure for a vertical body immersed in a liquid.

2B) A differential U tube manometer is used to measure the pressure difference between two sections of a vertical pipe through which water flows upwards and shows a deflection of 10 cm. distance between the two sections is 30 cm. Determine the difference of pressure between the two sections. Assume density as 13600 kg/m^3 and density of water as 1000kg/m^3

2C) A shaft of diameter 90 mm is rotating inside a journal bearing of 95 mm at a speed of 240 rpm. The space between the shaft and the bearing is filled with a lubricating oil of viscosity 2 poise. Find the power absorbed in the oil if the length of the bearing is 50 cm.

(08+06+06)

3A) A pump has a tapering pipe running full of water. The pipe is placed vertically with the diameters at the base and top being 1.2 m and 0.6 m respectively. The pressure at the upper end is 240 mm of Hg vacuum, while the pressure at the lower end is 15 kN/m^2. Assume the head loss to be 20% of the difference of velocity head. Calculate the discharge, considering the flow is vertically upwards with the difference of elevations is 3.9

3B) Differentiate between (a) Laminar and Turbulent flow

(b)Dynamic and Kinematic viscosity

(b)Gauge pressure and Absolute pressure

3C) Explain the different types of similarities in model studies

(08+06+06)

4A) Derive the Bernoull's equation for the flow of an incompressible frictionless fluid from the consideration of the momentum. Mention the assumptions made.

4B) A solid cone floats in water with its apex downwards. Determine the least apex angle of the cone for stable equilibrium. Take Specific gravity of the material of the cone as 0.8

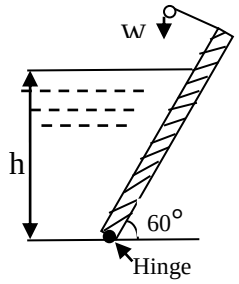
(10+10)

5A) Derive the expression for shear stress and velocity distribution for viscous flow through a circular pipe. Also plot the variation across the section.

5B) An oil of specific gravity 0.9 and viscosity 0.003 Pas is required to transport through a pipe of 1 m diameter at the rate of 0.3 m3/s. Tests were conducted in 10 cm pipe diameter using water at 20°C. Density and viscosity of water at 20°C are 1000 kg/m^3 and 0.001Pas. Determine the average velocity and rate of flow in the model.

(10+10)

6A) A rectangular gate 5 m × 2 m is hinged at its base and inclined at 60° to the horizontal as shown in Figure below. To keep the gate in stable position, a counter weight of 49050 N is attached to the upper end of the gate. Find the depth of water at which the gate begins to fall. Neglect the weight of the gate and also friction at the hinge and pulley.



6B) Find the discharge over a triangular notch of angle 60° when the head over the notch is 0.3 m Assume Cd =0.3. Derive the equation you use.

(10+10)

7A) Derive an expression to determine discharge through a venturi meter kept in an inclined position in terms of diameter of the pipe , throat and pressure head .

7B) The discharge Q from a centrifugal pump is dependent upon pump speed N(rpm), diameter of the impeller D, head (H), acceleration due to gravity g, density of the fluid ρ, and viscosity μ. Show by dimension analysis that

$$Q = D^2\sqrt{gD}\,\Phi\left(\frac{N\sqrt{D}}{\sqrt{g}}, \frac{H}{D}, \frac{\mu D^2}{\rho Q}\right)$$

(10+10)

8A) Oil of relative density 0.9 and dynamic viscosity 2.5 poise is pumped through a 100 mm diameter pipe 500 m long at the rate of 2 liter/s. Find (a) Reynolds's number of the flow.(b) Calculate the pressure required at the pump if the outlet end which is free is at 20 m above the pump level, (c) What should be the power input if the overall efficiency of the pump is 65%?

8B) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into atmosphere at the other end. For the first 25 m length from the tank the pipe is 150 mm diameter and is suddenly enlarged to 300 mm. the height of the water in the tank is 8 m above the center of the pipe. Considering all the types of losses determine the discharge. Take friction factor as 0.04 for sections of the pipe.

(10+10)