

Third Semester(Special/Back) Examinations, 2013

FLUID MECHANICS AND MACHINES

Full marks: 70

Time: 3hrs.

Question 1 is compulsory and answer any five from the rest.

Figures in the right hand margin indicate marks

1. Answer the followings (2X10)
- a) Differentiate between Newtonian and Non-Newtonian fluid.
- b) Define surface tension of a hydraulic fluid.
- c) Distinguish between gauge pressure, absolute pressure and vacuum pressure.
- d) What do you mean by Metacentric height in case of floating body.
- e) What do you mean by laminar and turbulent flow.
- f) What is notch? How is it different from a weir?
- g) Write down the assumptions in Bernoulli's theorem.
- h) Differentiate turbine on the basis of head? Give examples.
- i) What do you mean by positive displacement type of pump.
2. a) Classify the fluids on the basis of viscosity.
- b) Calculate the capillarity effect in millimetres in a glass tube of 4mm diameter, when immersed in (i) water and (ii) mercury. The temperature of the liquid is 20°C and the values of surface tension of water and mercury at 20°C in contact with air are 0.0735N/m and 0.51N/m respectively. The contact angle for water and mercury are 0° and 130° respectively. (4+6)
3. a) State and prove Pascal's law. Explain the consequence of the law
- b) A rectangular surface 3m (width) ×6m (height) lies in a vertical plane. Determine force and centre of pressure on the plate when its upper edge is 10m below the water surface. (5+5)
4. a) Derive the differential form of continuity equation in Cartesian coordinates.
- b) Define the following i) Uniform and Non uniform flow ii) Steady and Unsteady flow (5+5)

5. a) Derive the Bernoulli's energy equation from Euler's motion equation.
b) A 150 mm inlet \times 75mm throat venturimeter is used to measure the flow rate of oil having specific gravity of 0.9. The reading shown by differential manometer connected to the venturimeter is 150mm mercury column. Calculate the coefficient of discharge for the venturimeter if the flow rate is $1.7\text{m}^3/\text{min}$. (5+5)
6. a) Define the following i) coefficient of velocity ii) Coefficient of contraction ii) coefficient of discharge
b) The head of water over an orifice of diameter 10cm is 10m. the water coming out from orifice is collected in a circular tank of diameter 1.5m. The rise of water level in this tank is 1m in 25s. also the co-ordinates of a point on the jet measured from the vena contracta are 4.3m horizontal and 0.5 vertical. Find the coefficients, C_d, C_v, C_c . (3+7)
7. An inward flow reaction turbine runs at 375 rpm, the head being 65mm. the inlet diameter is 100 cm. the flow area is 0.5m^2 . at the inlet the blade angle is 60° . the guide blade angle is 25° . assuming radial exit, determine i) the volume rate, ii) the power developed iii) hydraulic efficiency iv) specific speed. (10)
8. Write short notes on (5+5)
a. Reciprocating compressor
b. Kaplan Turbine.

