Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: ME200

Course Name: FLUID MECHANICS AND MACHINERY (MC, SF)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions. Each question carries 10 marks.

1 a) State Newton's law of viscosity. Classify fluids based on it. (4)

b) Two horizontal plates are placed 1.25 cm apart, the space between them being filled with oil of viscosity 14 poise. Compute the shear stress in the oil if the upper plate is moved with a velocity of 2.5 m/s. (6)

2 a) Derive the relation for surface tension force acting on a soap bubble. (5)

b) A 0.6-mm-diameter glass tube is inserted into water at 20°C in a cup. Determine the capillary rise of water in the tube. The surface tension of water at 20°C is 0.073 N/m. The contact angle of water with glass is 0° and take the density of liquid water to be 1000 kg/m^3. (5)

3 a) Define vacuum pressure, gauge pressure and absolute pressure. (3)

b) Two pipes on the same elevation convey water and oil of specific gravity 0.88 respectively. They are connected by a U-tube manometer with the manometric liquid having a specific gravity of 1.25. If the manometric liquid in the limb connecting the water pipe is 2 m higher than the other, find the pressure difference in two pipes. (7)

4 a) Define metacentric height. What is its significance? (4)

b) Derive an expression for metacentric height of a floating body. (6)

PART B

Answer any three questions. Each question carries 10 marks

5 a) Differentiate between (8)

i) Steady & unsteady flow

ii) Uniform & non-uniform flow.

iii) Laminar and turbulent flow

iv) 1-D flow and 2-D flow

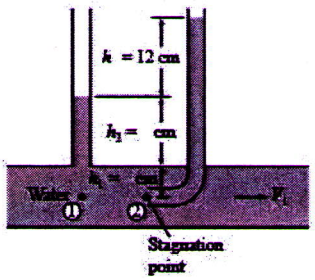
b) Distinguish between a streamline and a streakline (2)

6 a) State Bernoulli's theorem. Also give its assumptions (4)

b) Derive Hagen- Poiseuille equation (6)

7 a) Explain the working of pitot tube. (4)

b) (6)



A piezometer and a Pitot tube are tapped into a horizontal water pipe, as shown in Fig, to measure static and stagnation pressures. For the indicated water column heights, determine the velocity at the center of the pipe.

8 a) Explain displacement, momentum & energy thickness. (6)

b) Explain the working of orificemeter. (4)

PART C

Answer any four questions. Each question carries 10 marks.

9 a) Draw the velocity triangle for the finding out the force exerted by a jet of water on n unsymmetrical moving curved plate when jet strikes tangentially at one of its tips. (4)

b) A jet of water 50 mm diameter strikes a flat plate held normal to the direction of jet. Estimate the force exerted and work done by the jet if. (6)

i) The plate is stationary

ii) The plate is moving with a velocity of 1 m/s away from the jet along the line of jet.

iii) When the plate is moving with a velocity of 1 m/s towards the jet along the same line.

The discharge through the nozzle is 76 litres/s.

10 a) What do you mean by hydraulic efficiency and mechanical efficiency of a turbine? (2)

b) The head at the base of the nozzle of a Pelton wheel is 640 m. The outlet vane angle of the bucket is 15°. The relative velocity at the outlet is reduced by 15% due to friction along the vanes. If the discharge at outlet is without whirl find the (8)

ratio of bucket speed to the jet speed. If the jet diameter is 100 mm while the wheel diameter is 1.2 m, find the speed of the turbine in rpm, the force exerted by the jet on the wheel and the Power developed. Take C_v=0.97.

11 a) Define degree of reaction for a reaction turbine. What is its significance? (3)

b) Draw a neat sketch of a Kaplan turbine. Name the parts. Explain the working. (7)

12 a) What do you mean by slip of reciprocating pump? State the conditions responsible for creating negative slip. (4)

b) A single acting reciprocating pump running at 50 rpm delivers 0.01 m^3/s of water. The diameter of piston is 200 mm and stroke length is 400.Find (6)

i) Theoretical discharge

ii) Coefficient of discharge

iii) Percentage slip of the pump.

13 a) What do you mean by specific speed of a pump? Derive an expression for the same. (4)

b) A six stage centrifugal pump delivers 7.5m^3/ min of water against a net pressure rise of 5 MPa. Determine the specific speed of the pump if it runs at 1440 rpm. (6)

14 a) Explain priming of centrifugal pumps? Sate why is it necessary? (4)

b) Explain characteristic curves of a centrifugal pump? (6)