Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

Course Code: ME200
Course Name: FLUID MECHANICS AND MACHINERY

Max. Marks: 100 Duration: 3 Hours

PART A
Answer any three questions, each carries 10 marks.

Marks

1 a) Differentiate Specific Volume, Specific weight and Specific Gravity of a fluid (4)

   b) A body weighs 382.4N in air and 186.2 N in water. Compute the volume of body and its specific gravity. (6)

2 a) Find the capillary rise of water in a tube 0.03cm diameter. The surface tension of water is 0.0735N/m (4)

   b) Illustrate surface tension. Also derive the expression for capillary rise. (6)

3 a) Distinguish between Absolute, Gauge and Vacuum pressures (4)

   b) A pipe contains an oil of specific gravity 0.8. A differential manometer connected at the two points A and B shows a difference in mercury level as 16cm. Find the difference of pressure at the two points. (6)

4 a) Explain the terms metacentre and metacentric height. (4)

   b) A solid cylinder of diameter 4m has a height of 6m. Find the metacentric height of the cylinder if the specific gravity of the material of the cylinder is 0.7 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. (6)

PART B
Answer any three questions, each carries 10 marks.

5 a) Define Stream line, Stream tube and Streak line. (4)

   b) A pipe line of 0.65 m diameter is 1.5 km long. To decrease the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. If f = 0.01 and the head at inlet is 0.3 m calculate the decrease in discharge. Neglect minor losses. (6)

6 a) Find the loss of head when a pipe of diameter 200mm is suddenly enlarged to a diameter of 350 mm. The rate of flow of water through the pipe is 200 lps. (4)

b) State and derive Bernoulli's theorem, mentioning clearly the assumptions underlying it. (6)

7 a) With a neat sketch, illustrate boundary layer. (4)

b) A thin plate is moving in still atmospheric air at a velocity of 6m/s. The length of the plate is 0.6m and width 0.5m. Calculate (i) the thickness of the boundary layer at the end of the plate, and (ii) drag force on one side of the plate. Take density of air =1.23 kg/m^3 and kinematic viscosity = 0.15 stokes. (6)

8 a) A pitot static tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 7m and static pressure head is 4m. Calculate the velocity of flow assuming Cv =0.95 (4)

b) Formulate the expression for the discharge through a venturimeter. (6)

PART C
Answer any four questions, each carries 10 marks.

9 a) Obtain an expression for the force exerted by a jet of water on an inclined fixed plate in the direction of jet. (4)

b) A jet of water of diameter 40mm moving with a velocity of 30 m/s impinges on a fixed curved plate tangentially at one end at an angle of 30^0 to the horizontal. Calculate the resultant force of the jet on the plate if the jet is deflected through an angle of 45^0. Take g = 10 m/s^2 (6)

10 a) Illustrate various efficiencies of a turbine. (4)

b) A Pelton wheel is having a mean bucket diameter of 0.9m and is running at 1000 rpm. The net head on the pelton wheel is 710m. If the side clearance angle is 15^0 and discharge through nozzle is 0.1 m^3/s, find: (i) Power available at the nozzle, (ii) Hydraulic efficiency of turbine. Cv = 0.97 (6)

11 a) What is cavitation? How can it be avoided in reaction turbine? (4)

b) An inward flow reaction turbine has external and internal diameters as 1m and 0.6m respectively. The hydraulic efficiency of the turbine is 95% when the head on the turbine is 40m. The velocity of flow at outlet is 2.5m/s and discharge at outlet is radial. If the vane angle at outlet is 15^0 and width of the wheel is 100mm at inlet and outlet, determine: (i) the guide blade angle, (ii) speed of the turbine, (iii) vane angle of the runner at inlet. (6)

12 a) State slip, percentage slip and negative slip of a reciprocating pump. (4)

b) A single acting reciprocating pump has a stroke length of 15cm. The suction (6)

pipe is 7m long and the ratio of the suction diameter to plunger diameter is ¾. The water level in the sump is 2.5m below the axis of the pump cylinder, and the pipe connecting the sump and pump cylinder is 7.6cm diameter. If the crank is running at 80 rpm, determine the pressure head on the piston: (i) in the beginning of the suction stroke.(ii) in the middle of the suction stroke. f = 0.01

13 a) With a neat sketch discuss the performance characteristics of a centrifugal pump. (4)

    b) The outer diameter of an impeller of a centrifugal pump is 410 mm and outlet width 50 mm. The pump is running at 800 rpm and is working against a total head of 15m. The vanes angle at outlet is 40^0 and manometric efficiency is 78%. Determine: (i) velocity of flow at outlet (ii) velocity of water leaving the vane. (6)

14 a) Differentiate the specific speed of a centrifugal pump and a turbine. (4)

    b) The diameter of a centrifugal pump, which is discharging $0.03m^3$/s of water against a total head of 20m is 0.4m. The pump is running at 1500 rpm. Find the head, discharge and ratio of powers of a geometrically similar pump of diameter 0.3m when it is running at 4000rpm. (6)

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