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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019**

**Course Code: ME200**

**Course Name: FLUID MECHANICS AND MACHINERY**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any three questions. Each question carries 10 marks.*

- 1 a) Distinguish between dynamic and kinematic viscosities. Explain the effect of temperature on viscosity of liquids and fluids. (6)
- b) Differentiate the following: (4)
  - i) Newtonian and non-Newtonian fluids
  - ii) Real and ideal fluids
- 2 A circular disc of 0.3 m diameter and weight 50 N is kept on an inclined surface with a slope of  $45^\circ$ . The space between the disc and the surface is 2 mm and is filled with oil of dynamic viscosity 1 Pa.s. What force will be required to pull the disc up the inclined plane with a velocity of 0.5 m/s. (10)
- 3 a) Define the following and write the relation between them. (5)
  - i) Atmospheric pressure
  - ii) Gauge pressure
  - iii) Absolute pressure
  - iv) Vacuum pressure
- b) What is a piezometer? Explain the working and limitations of it. (5)
- 4 A square opening in the vertical side of a tank has one diagonal vertical and is completely covered by a plane hinged along one of the upper sides of the opening. The diagonals of the openings are 2m long and the tank contains a liquid of specific gravity 1.15. The centre of opening is 1.5 m below the free surface. Calculate the thrust exerted on the liquid and the position of its centre of pressure. (10)

**PART B**

*Answer any three questions. Each question carries 10 marks*

- 5 a) Explain the following: i) Streamline ii) Path line iii) Streak line. (3)
- b) Derive Euler's equation along a streamline. State the assumptions. (7)
- 6 a) A pipe line carrying oil of specific gravity 0.87 changes in diameter from 200mm diameter to a position A to 500 mm diameter at a position B which is 4m at a higher level. If the pressure at A and B are  $9.81 \text{ N/cm}^2$  and  $5.88 \text{ N/cm}^2$  respectively and the discharge is 200 litre/s. Determine the loss of head and the direction of flow. (6)
- b) Explain the siphon effect. (4)
- 7 a) With a neat sketch explain the constructional features of a venturimeter. (4)

- b) The venturimeter with 200 mm at inlet and 100 mm throat is laid with axis horizontal, and is used for measuring the flow of oil of specific gravity 0.8. The difference of levels in the levels of U-tube differential manometer reads 180 mm of mercury while 11520 kg of oil is collected in 4 minutes. Calculate the coefficient of discharge for the venturimeter. Take specific gravity of mercury as 13.6. (6)
- 8 a) With the help of a neat sketch, explain the formation of boundary layer and mark the different regions on it. (6)
- b) Explain any four methods to control boundary layer separation. (4)

### PART C

*Answer any four questions. Each question carries 10 marks.*

- 9 Which turbine is to be installed if the availability of water is large and head is less? With a neat sketch explain its constructional features and working. (10)
- 10 a) What is surge tank? What are the different types? Explain its operation. (5)
- b) Explain main and operating characteristics of impulse turbine. (5)
- 11 An inward flow reaction turbine works under a total head of 28 m. The velocity of wheel periphery at inlet is 15 m/s. The outlet pipe of the turbine is 30 cm in diameter and the turbine is supplied with 250 litres of water per second. The radial velocity of flow through the wheel is same as velocity in outlet pipe. Neglecting friction, determine a) vane angle at inlet b) guide blade angle c) power developed by the turbine. (10)
- 12 a) Differentiate between positive displacement and rotodynamic pumps. (4)
- b) With a neat sketch explain the components and working of centrifugal pumps. (6)
- 13 The centrifugal pump impeller has diameter of 60 cm and width of 6 cm at the outlet. The pump runs at 1450 rpm and delivers  $0.8 \text{ m}^3/\text{s}$  against a head of 80 m. The leakage loss after the impeller is 4% of discharge, the external mechanical loss is 10 kW and the hydraulic efficiency is 80%. Determine the blade angle at outlet, the power required and the overall efficiency of the pump. (10)
- 14 a) With the help of a neat sketch, explain the functions of an air vessel in a reciprocating pump. (5)
- b) The diameter and stroke of a single acting reciprocating pump are 10 cm 20 cm respectively. The pump is fed by a suction pipe 5 cm in diameter and 6 m long, the suction lift being 3 m. What is the maximum speed at which pump can be run without separation in the suction pipe? Given that separation occurs when pressure in the pump falls below 2.5 m of water absolute and the manometer reads 760 mm of mercury. (5)