Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

ME200: FLUID MECHANICS AND MACHINERY (AN, AU, IE, MP, PE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions.

1. a. Explain the terms dynamic viscosity and kinematic viscosity with their units. (4)
   b. A $1m^2$, 10kg flat plate slides down a 30° inclined plane over a 0.1cm uniform layer of oil, dynamic viscosity 0.05 Ns/m^2. Determine the steady state velocity. (6)
2. a. Distinguish between intensity of pressure and pressure head (3)
   b. How does the atmospheric pressure vary with altitude? (3)
   c. Prove that the pressure at a point in a fluid at rest has the same magnitude in all directions. (4)
3. a. Differentiate between simple manometer and differential manometer. (5)
   b. The right limb of a simple U-tube manometer containing mercury was open to atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.8 is flowing. The centre of the pipe is 14 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe, if the difference of mercury level in the two limbs was 18 cm. (5)
4. a. Define the term 'buoyancy' and ' centre of buoyancy'. (3)
   b. Explain the term 'metacentre' and 'meta-centric height'. (3)
   c. What do you understand by 'Total pressure' and 'centre of pressure'? (4)

PART B

Answer any three questions.

5. a) Define the equation of continuity. (3)
   b) A 30cm diameter pipe, conveying water, branches into two pipes of diameter 20cm and 15cm respectively. If the average velocity in the 30cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15cm pipe, if the average velocity in 20cm diameter pipe is 2m/s. (7)
6. a. Explain the phenomenon of water hammer. (5)
   b. What is the difference between a laminar flow and turbulent flow? (5)

7. State Bernoulli's theorem of an incompressible fluid. Derive an expression for the Bernoulli's theorem. State the assumptions made for such a derivation. (10)
8. In a pipe of diameter of 350 mm and length 75m, water is flowing at a velocity of 2.8 m/s. Find the head lost due to friction (i) Darcy- Weisbach formula (ii) Chezy's formula. Assume kinematic viscosity of water as 0.012 stoke. (10)

PART C

Answer any 4 questions.

9. Find an expression for the efficiency of a series of curved vanes when a jet of water strikes the vanes at one of its tips. Prove that maximum efficiency is when u = V and the value of maximum efficiency is 50%. (10)
10. A Kaplan turbine runner is to be designed to develop 7456 kW. The net available head is 5.50 m. Assume that the speed ratio is 2.09 and flow ratio is 0.68 and the overall efficiency is 60%. The diameter of the boss is 1/3rd of the diameter of the runner. Find the diameter of the runner, its speed and its specific speed. (10)
11. a. What is a draft tube? Why is it used in a reaction turbine? (5)
    b. What is cavitation? How it can be avoided in reaction turbine? (5)
12. a. What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump? (4)
    b. With a neat sketch explain the principle and working of a centrifugal pump? (6)
13. What is the effect of acceleration and friction in suction and delivery pipes on indicator diagram? Does the area of the indicator diagram change as compared to the area of ideal indicator diagram. (10)
14. The length and diameter of a suction pipe of a single acting reciprocating pump are 5 m and 10 cm respectively. The pump has a plunger of diameter 15 cm and a stroke length of 35 cm. The centre of the pump is 3 m above the surface in the pump. The atmospheric pressure head is 10.3 m of water and pump is running at 35 rpm. Determine:
    (i) Pressure head due to acceleration at the beginning of the suction stroke,
    (ii) Maximum pressure head due to acceleration,
    (iii) Pressure head in the cylinder at the beginning and at the end of the stroke. (10)

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