

B.E DEGREE EXAMINATIONS:DEC 2014

(Regulation 2013)

Third Semester

MECHATRONICS ENGINEERING

U13MCT304: Mechanics of Fluids for Mechatronics

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The density of a fluid is sensitive to changes in pressure. The fluid will be known as
 - a) Newtonian fluid
 - b) Perfect fluid
 - c) Real fluid
 - d) Compressible fluid
2. The inability of fluids to resist ----- gives them the characteristics property to change shape or flow.
3. Existence of velocity potential implies that the fluid flow is
 - a) steady
 - b) uniform
 - c) irrotational
 - d) in continuum
4. Euler's equation of motion is a statement expressing conservation of -----
5. An equivalent pipe corresponding to series arrangement of different pipes has same
 - a) Length and discharge
 - b) Frictional head loss and discharge
 - c) Friction factor and diameter
 - d) Flow velocity and diameter
6. For a laminar flow between two fixed parallel plates, the shear stress is ----- at the wall boundary.
7. Regulation of Pelton turbine is done by changing the
 - a) Head available at the nozzle
 - b) Annular area of the nozzle
 - c) Velocity of flow from the nozzle
 - d) Length of the nozzle
8. A ----- turbine can adjust both guide vane and runner vane angles according to the rate of discharge.

23. a) Show that the difference of pressure head for a given length of the two parallel plates which are fixed and through which the viscous fluid is flowing is given by

$$h_f = \frac{12\mu UL}{\rho g t^3}$$

(OR)

- b) A pumping plant forces water through a 600mm diameter main, the friction head being 27m. In order to reduce the power consumption, it is proposed to lay another main of appropriate diameter along the side of the existing one, so that two pipes may work in parallel for the entire length and reduce the friction head by 9.6m. Find the diameter of the new main if, with the exception of diameter, it acts similarly to the existing one in all respect.

24. a) A Kaplan turbine working under a head of 20m develops 11,772-KW shaft power. The outer diameter of the runner is 3.5M and hub diameter is 1.75-M. The guide blade angle at the extreme edge of the runner is 35°. The hydraulic and overall efficiencies of the turbines are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine: (i) Runner vane angles at inlet and outlet at the extreme edge of the runner, and (ii) Speed of the turbine.

(OR)

- b) The three- jet Pelton turbine is required to generate 10,000-KW under a net head of 400/M. The blade angle at the outlet is 15° and the reduction in relative velocity while passing over the blade is 5%. If the overall efficiency of the wheel is 80%, $C_v = 0.98$ and speed ratio = 0.46, determine : (i) the diameter of the jet, (ii) total flow in m³/s and (iii) the force exerted by a jet on the buckets.

25. a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m works against a total head of 40M. The velocity of flow through the impeller is constant and equal to 2.5M/S. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500MM and width at outlet is 50MM, determine: (i) Vane angle at inlet, (ii) Work done by the impeller, and (iii) Manometric efficiency

(OR)

- b) (i) What is an air vessel? Describe the function of air vessel for reciprocating pumps. (8)
- (ii) A single acting reciprocating pump, running at 50 r.p.m., delivers $0.01\text{m}^3/\text{s}$ of water. The diameter of the piston is 200-MM and stroke length 400-MM. Determine: (a) theoretical discharge of the pump, (b) Co-efficient of discharge, and (c) Slip and the Percentage slip of the pump. (6)
