Reg. No. : | | | | | | | | | | |

Question Paper Code: 41734

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Third Semester

Mechanical Engineering

14UME304- FLUID MECHANICS AND MACHINERY

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. A fluid in which resistance to deformation is independent of the shear stress is known as

   (a) Pseudo plastic fluid (b) Bingham plastic fluid
   (c) Dilatant fluid (d) Newtonian fluid

2. A stream line is a line

   (a) which is along the path of a particle
   (b) which is always parallel to the main direction of flow
   (c) across which is no flow
   (d) on which tangent drawn at any point gives the direction of velocity

3. A point, in a fluid flow where the velocity of fluid is zero is called

   (a) Critical point (b) Vena contract
   (c) Stagnation point (d) Static point

4. The range for co-efficient of discharge (C_d) for a venture-meter is

   (a) 0.6 to 0.7 (b) 0.7 to 0.8 (c) 0.8 to 0.9 (d) 0.95 to 0.99

5. Reynold's number is given by

   (a) Viscous force / Inertial force (b) Inertial force / Viscous force
   (c) Gravitational force / Viscous force (d) Pressure force / Viscous force

6. Models are known as undistorted model if

(a) the prototype and model are having different scale ratios
(b) the prototype and model are having same scale ratio
(c) the prototype and model are kinematically similar
(d) none of these

7. A draft tube is used with

(a) Centrifugal pump
(b) Axial flow pump
(c) Reaction turbine
(d) Reciprocating compressor

8. Kaplan turbine is a propeller turbine in which the vanes fixed on the hub are

(a) non-adjustable
(b) adjustable
(c) fixed
(d) none of these

9. In axial flow turbines fluid enters and leaves as follows

(a) Radially, axially
(b) Axially, axially
(c) Axially, radially
(d) Combination of axial & radial

10. Cavitation can take place in case of

(a) Pelton Wheel
(b) Francis Turbine
(c) Centrifugal Pump
(d) Both (b) and (c)

PART - B (5 x 2 =10 Marks)

11. Define surface tension.

12. Define boundary layer thickness.

13. State the methods of dimensional analysis.

14. Compare an impulse turbine with a reaction turbine.

15. What is meant by priming?

PART - C (5 x 16 = 80 Marks)

16. (a) The space between two square flat parallel plates is filled with oil. Each side of plate is 60 *cm*. The thickness of the oil film is 12.5 *mm*. The upper plate, which moves at 2.5 *m/s* requires a force of 98.1 *N* to maintain the speed. Determine:

(1) The dynamic viscosity of the oil in poise

(2) The kinematic viscosity of the oil in strokes if the specific gravity of the oil is 0.95. (16)

Or

(b) The diameter of a pipe at the section 1-1 and 2-2 are 200 *mm* and 300 *mm* respectively. If the velocity of water flowing through the pipe at section 1-1 is 4 *m/s*,find

(i) Discharge through the pipe and

(ii) Velocity of water at section 2-2. (16)

17. (a) The water is flowing through a tapering pipe having diameter 300 *mm* and 150 *mm* at section 1 and 2 respectively. The discharge through the pipe is 40 *lit/s*. The section 1 is 10 *m* above datum and section 2 is 6 *m* above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2. (16)

Or

(b) (i) A horizontal venturimeter with inlet diameter 20 *cm* and throat diameter 10 *cm* is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 *cm* of mercury. Find the discharge of water through venturimeter. Take C_d = 0.98. (8)

(ii) An orifice meter with orifice diameter 15 *cm* is inserted in a pipe of 30 *cm* diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 *cm* of mercury. Find the rate of flow of oil of sp.gr 0.9 when the co-efficient of discharge of the meter = 0.64. (8)

18. (a) The power developed by hydraulic machines is found to depend on the head *h*, flow rate *Q*, density ρ, speed *N*, runner diameter *D*, and acceleration due to gravity, *g*. Obtain suitable dimensionless parameters to correlate experimental results. (16)

Or

(b) Water is flowing through a pipe of diameter 30 *cm* at a velocity of 4 *m/s*. Find the velocity of oil flowing in another pipe of diameter 10 *cm*, if the condition of dynamic similarity is satisfied between the two pipes. The Viscosity of water and oil is given as 0.01 *poise* and 0.025 *poise*. The specific gravity of oil = 0.8. (16)

19. (a) A Kaplan turbine delivering 40 *MW* works under a head of 35 *m* and runs at 167 *rpm*. The hub diameter is 2.5 *m* and runner tip diameter is 5 *m*. The overall efficiency 87%. Determine the blade angles at the hub and tip and also at a diameter of 3.75 *m*. Also find the speed ratio and flow ratio based on tip velocity. Assume η_H = 90%. (16)

Or

(b) Explain the working principle of Pelton turbine with neat sketch. (16)

20. (a) Explain the working principle of lobe pump and vane pump with a neat sketch. (16)

Or

(b) Explain about working principle of reciprocating pump with neat sketch. (16)

———————