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B.E. DEGREE EXAMINATIONS: APRIL / MAY 2010

Third Semester

U07ME303: FLUID MECHANICS AND MACHINERY

(Common to B.E-Aeronautical Engineering and Mechanical Engineering)

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Specific weight of the fluid

   (a) weight / volume (b)volume / weight (c) mass / volume (d) volume / mass

2. A real fluid in which the shear stress is directly proportion to the rate of shear strain is called

   (a) ideal fluid (b) real fluid (c) newtonian fluid (d) non - newtonian fluid

3. Venturimeter is based on the principle of

   (a) continuity equation (b) bernoullis's equation

   (c) euler's equation (d) navier stroke's equation

4. Which one of the following device is used for measuring the velocity flow at any point in a pipe or a channel?

   (a) nozzle (b) venturimeter (c) orifice meter (d) pitot tube

5. Which one of the following flow is the loss of pressure head is proportional to the mean velocity of flow?

   (a) turbulent (b) laminar (c) viscous (d) non viscous

6. Darcy Weisbach equation is used for finding loss of

   (a) head due to friction in pipes (b) force due to friction in pipes

   (c) mass due to friction in pipes (d) weight due to friction in pipes

7. If at the inlet of a turbine, the energy available is only kinetic energy, the turbine is known as

   (a) keplan turbine (b) reaction turbine (c) francies turbine (d) impulse turbine

8. For the maximum efficiency of the pelton wheel, the maximum condition is

   (a) $V_1 = u / 2$ (b) $V_1 = u / 3$ (c) $u = V_1 / 2$ (d) $u = V_1 / 3$

   Where u – speed of bucket, V_1 – velocity of jet

9. The hydraulic machines which convert the hydraulic energy into mechanical energy are called

   (a) pumps (b) turbines (c) impellers (d) pelton wheels

10. Which one of the following pump acts as a reverse of an inward radial flow reaction turbine?

    (a) centrifugal (b) reciprocating (c) pelton wheel (d) francies turbine

PART B (10 x 2 = 20 Marks)

11. What are the types of fluid?
12. Define: Kinematic viscosity.
13. Define: Stream function.
14. State Buckingham's π theorm.
15. State Navier Stroke equation.
16. Write the expression for drag and lift.
17. Differentiate between the turbines and pumps.
18. List out the important characteristic curves of a turbine.
19. Define: Specific speed of a centrifugal pump.
20. Define: Cavitation factor in centrifugal pump.

PART C (5 x 14 = 70 Marks)

21. (a) (i) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m per sec requires a force of 98.1 N to maintain the speed. Determine (i) the dynamic viscosity of the oil in poise and (ii) the kinematic viscosity of the oil in strokes if the specific gravity of the oil is 0.95. (6)

(ii) An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100 mm. The thickness of oil film is 1.0 mm. (8)

(OR)

(b) (i) A simple manometer is used to measure the pressure of oil (specific gravity of the oil is 0.8)flowing in a pipe line. Its right limp is open to the atmosphere and left limb is connected to the pipe. The centre of the pipe is 9 cm below the level of mercury (specific gravity of the mercury is 13.6) in the right limb. If the difference of mercury level in the two limbs is 15 cm, determine the absolute pressure of the oil in the pipe in N/cm^2. (8)

(ii) A pipe contains an oil of specific gravity 0.8. A differential manometer connected at the two points A and B of the pipe shows a difference in mercury level as 20 cm. Find the difference of pressure at the two points. (6)

22. (a) (i) List out the types of flow (4)

(ii) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s. (10)

(OR)

(b) (i) The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of coefficient of discharge of venturimeter. (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 specific gravity 0.9 when the coefficient of discharge of the meter = 0.64. (6)

23. (a) (i) What is minor loss of energy? What are the causes for minor losses? (4)

(ii) At a sudden enlargement of a water main from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate the rate of flow. (10)

(OR)

(b) A pumping plant forces water through a 600 mm diameter main, the friction head being 27 m. 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 to 9.6 m only. Find diameter of the new main if, with the exception of diameter, it is similar to the existing one in every respect.

24. (a) A Pelton wheel is working under a gross head of 400 m. The water is supplied through penstock of diameter 1 m and length 4 km from reservoir to the Pelton wheel. The coefficient of friction for the penstock is given as 0.008. The jet of water of diameter 150 mm strikes the buckets of the wheel and gets deflected through an angle of 1650. The relative velocity of water at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of the buckets is 0.45 times the jet velocity at inlet and mechanical efficiency as 85% determine (i) Power given to the runner (ii) Shaft power and (iii) Hydraulic efficiency and overall efficiency.

(OR)

(b) A Kaplan turbine develops 24647.6 kW power at an average head of 39 metres. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine.

25. (a) The outer diameter of an impeller of a centrifugal pump is 400 mm and outlet width 50 mm. The pump is running at 800 rpm and is working against a total head of 15 m. The vanes angle at outlet is 40^0 and manometric efficiency is 75%. Determine (i) velocity of flow at outlet (ii) velocity of water leaving the vane (iii) angle made by the absolute velocity at outlet with the direction of motion at outlet and (iv) discharge

(OR)

(b) (i) Compare : Centrifugal pump and Reciprocating pump (8)

(ii) Write short notes on Indicator diagram (6)

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