Ref No Ex/Prod/T/224/2018(OLD)

B.E. RODUCTION ENGINEERING 2ND YR 2ND SEM (Old) 2018

FLUID SYSTEMS

THREE HOURS FULL MARKS 100

Answer Any five Questions

1(a) Define fluid (2)

(b) Derive the expression of resultant hydrostatic force on an inclined plate submerged in a fluid of specific weight is γ N/m^3. Also determine the expression of centre of pressure of that resultant force. (10)

(c) A cylindrical gate of diameter 2m and 3 m long (Perpendicular to the paper) has water on its both sides as shown in fig 1 . Determine the magnitude , location and direction of the resultant hydrostatic force exerted on the gate. Also calculate the minimum weight of the gate so that it will not float away from the floor. (8)

2(a) A pipe having 20cm diameter branches into two pipes. One of the branch pipes has a diameter of 10cm whereas the other has 5cm. The flow in the larger branch pipe is two third of the main pipe and the remaining is discharged through the smaller diameter branch pipe. If the average velocity of flow in any of the pipes, main or branch does not exceed 3m/s, find the rate of flow and velocities in the main as well as branch pipes. (7)

(b) Define

(i) Unsteady Flow
(ii) Irrotational Flow
(iii) Uniform Flow (6)

(c) Define circulation. Establish a relation between vorticity and circulation? (7)

3(a) Stating the assumptions derive Bernoulli's equation. (8)

(b) Obtain an expression for the actual discharge when fluid flows in an horizontal pipe with the help of a venture-meter. (8)

(c) State the advantages of orifice meter over venture meter (4)

[Turn over

4(a) What are repeating variables in connection with Buckingham's pi (π) theorem ? State the criterions for the selection of repeating variables (7)

(b) The resistance R experienced by a partially submerged body in a liquid depends upon the velocity V , length of the body l ,dynamic viscosity of the liquid μ , density of the liquid ρ , and gravitational acceleration g . Using Buckingham's pi (π) theorem obtain a dimensionless expression for R . (8)

(c) Define Reynolds number and show that it is a dimensionless number (5)

5(a) Prove that shear stress gradient is equal to pressure gradient for two dimensional incompressible viscous laminar flow. (4)

(b) Prove that for a steady laminar flow through a circular pipe , the velocity profile varies parabolically and the average velocity is half of the maximum local velocity. (8)

(c) Derive the expression of time of emptying a cylindrical vessel by an orifice that is placed at the bottom of the vessel. (8)

6(a) The impeller of a centrifugal pump having outer diameter 20 cm and inner diameter 10 cm is 1.7 cm wide at outlet and 3.5 cm wide at inlet. The blade vane angles at inlet and outlet are 16° and 30° respectively. The impeller rotates at 1500 rpm. Neglecting vane thickness determine
(i) the discharge for shock less radial entry (ii) theoretical head
(iii) power required if overall efficiency is 75% . Also draw the inlet and outlet velocity diagrams. (8)

(b) Define specific speed of centrifugal pump and hence derive the expression for it . (7)

(c) Explain with neat diagram the arrangement of pumps when the required total head of a system is greater than the permissible head generated by a single pump. (5)

7(a) Explain with neat sketch the working principle of Francis turbine. (5)

(b) At a particular power station , a single jet Pelton wheel turbine produced 23080 KW under a head of 1770 m while running at 750 r p m . Calculate (i) jet diameter (ii) mean diameter of the bucket. Assume co-efficient of velocity and speed ratio are 0.97 and 0.46. Overall efficiency is 85% . Also draw the velocity diagrams. (8)

(c) Derive the expression of torque exerted by the fluid on the turbine runner. (7)

8(a) With the aid of neat sketch explain the working principle of GEAR PUMP (5)

(b) With the aid of neat sketch explain the working principle of SPOOL TYPE DIRECTION CONTROL VALVE (5)

(c) With the aid of neat sketch explain the working principle of SPOOL TYPE PREESURE RELIEF VALVE (5)

(d) With the aid of neat sketch explain the working principle of THROTTLE VALVE (5)

9(a) Define fluidics (4)

(b) Describing the working principle of industrial type amplifier, sketch the following logic gate with the help of industrial type amplifier.
(i) AND (ii) NAND (iii) NOT (10)

(c) Describe with neat sketch explain the working principle of the following fluid logic elements
(i) wall attachment, turbulence amplifier (6)

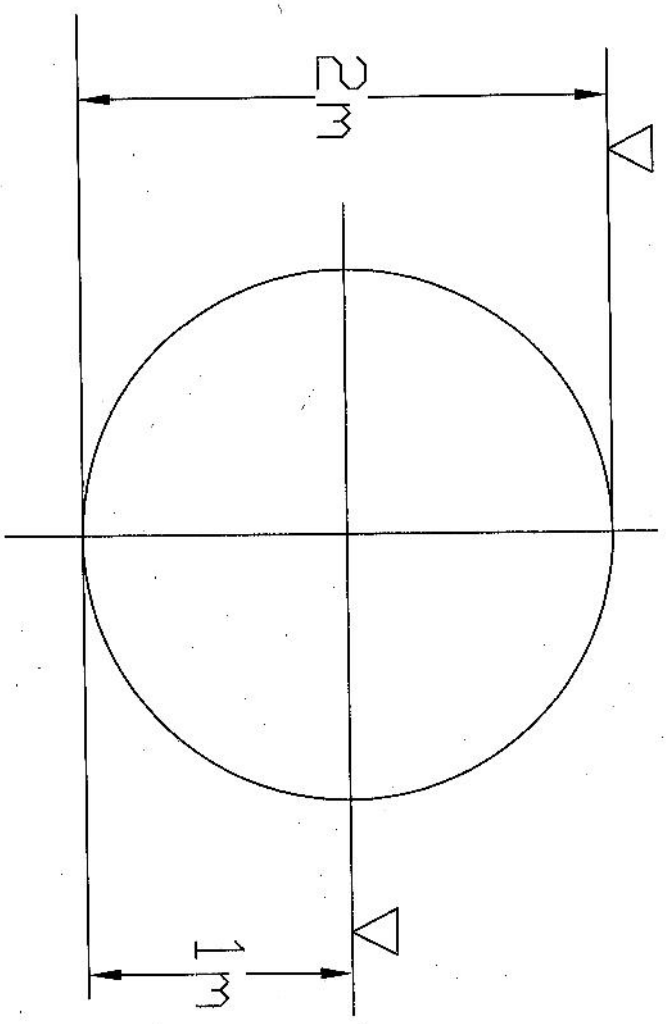

Fig. 1