Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- 5th [ME, ME(Int)], REGULAR EXAMINATION, NOV-DEC 2016

2ME504: FLUID POWER ENGINEERING

TIME: 3 HRS

TOTAL MARKS: 60

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Q.1

(a) Prove that the velocity through nozzle is given by $v = \sqrt{\frac{2gH}{1+\frac{4fL}{D}\times\frac{a^2}{A^2}}}$ where a = Area of nozzle and A = Area of the pipe. **(03)**

(b) The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2. Determine: (i) Loss of head due to sudden enlargement (ii) Pressure intensity in the large pipe (iii) Power lost due to enlargement. **(03)**

(c) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the center of the pipe. Considering all losses occur, determine the rate of flow. Take f = 0.01 for both sections of the pipe. **(04)**

OR

Q.1 (a) Show that the loss of head due to sudden expansion in pipe line is a function of velocity head. **(03)**

(b) Find the head lost due to friction in a pipe of diameter 250 mm and length 60 m, through which water is flowing at a velocity of 3 m/s using (i) Darcy formula (ii) Chezy's formula for which C = 55. Take kinematic viscosity υ for water = 0.01 stoke. **(03)**

(c) Three pipes of 400 mm, 200 mm and 300 mm diameters have lengths of 400 m, 200m and 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water level is 16 m. If co-efficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe considering minor losses. **(04)**

Q.2 (a) Prove that the work done per second on a series of moving curved vanes by a jet of water striking at one of the tips of the vane is given by, Work done/sec = $\rho a V_1 [V_{w1} \pm V_{w2}] \times u$. **(03)**

(b) A jet of water of diameter 100 mm strikes a curved plate at its center with a velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet. The jet is deflected through an angle of 150^0. Assuming the plate is smooth. Find: (i) force exerted on the plate in the direction of the jet (ii) power of the jet and (iii) efficiency. **(03)**

(c) A jet of water having a velocity of 15 m/s, strikes a curved vane which is moving with a velocity of 5 m/s in the same direction as that of the jet at inlet. The vane is so shaped that the jet is deflected through 135^0. The diameter of jet is 100 mm. Assuming the vane is to be smooth, find: (i) Force exerted by the jet on the vane in the direction of motion (ii) Power exerted on the vane and (iii) Efficiency of the vane. **(04)**

OR

Q.2 (a) Show that the efficiency of free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%. (03)

(b) Show that the force exerted by a jet of water on an inclined fixed plate in the direction of the jet is given by $F_x = \rho a V^2 \sin^2\theta$. (03)

(c) A jet of water having a velocity 30 m/s strikes a curved vane, which is moving with a velocity of 15 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 120° to the direction of motion of vane at outlet. Calculate (i) Vane angles, if the water enters and leaves the vane without shock, (ii) Work done per second per unit weight of water striking the vanes per second. (04)

(10)

Q.3 **Attempt any two from the following.**

(a) Define following terms related to centrifugal pump: (i) Suction lift (ii) Delivery head (iii) Hydraulic machine (iv) Manometric head (v) Overall efficiency.

(b) The internal and external diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. The vane angles at inlet and outlet are 20^0 and 30^0 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.

(c) Derive an expression for minimum speed required to start a centrifugal pump.

SECTION: II

Q.4 (a) Explain in detail with the help of a neat sketch about the working of Axial flow compressor. (05)

(b) What is back pressure? In which turbine it is commonly seen and how it gets originate? Differentiate between Impulse and Reaction turbines. (05)

OR

Q.4 (a) What do you mean by specific speed in context of turbines? Derive an equation for the maximum efficiency of Pelton wheel. (05)

(b) Explain in detail about the performance characteristics curves of hydraulic turbines. (05)

Q.5 (a) Draw the layout of hydropower plant and explain the function of Trash Rack and Penstock. (05)

(b) A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/sec. If the η_o is 90%. Determine a) Power generated b) Specific speed and c) Type of turbine. (05)

OR

Q.5 (a) What is hydrology? Give classification of hydropower plant in detail. (05)

(b) A Pelton wheel generates 8000 kW under a net head of 130 m at a speed of 200 rpm. Assuming the coefficient of velocity for nozzle 0.98 and $\eta_o = 65.25$ %, speed ratio 0.46 and d/D = 1/9. Determine a) Discharge b) Diameter of wheel c) specific speed and d) no. of jets required. (05)

(10)

Q.6 **Attempt any two from the following.**

(a) Write a short note about Hydraulic accumulator with neat sketch.

(b) Explain the construction and working of hydraulic press with neat sketch.

(c) Derive an expression for loss of head due to sudden contraction of pipe.

END OF PAPER