Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- Vth MECHANICAL CBCS REGULAR EXAMINATION, NOV-DEC 2015

2ME504: FLUID POWER ENGINEERING

TIME: 3 HRS

TOTAL MARKS: 70

Instructions: (1) Attempt all questions.
(2) Figures on right indicate full marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Q.1 (a) Derive an expression for head loss in a pipe due to sudden expansion. (04)

(b) Find the head loss due to friction in a pipe of diameter 300 mm and length 50 m through which water is flowing at a velocity of 3 m/s. Using (i) Darcy formula (ii) Chezy's formula for which C=60. Take kinematic viscosity ν for water = 0.01 stoke. (04)

(c) Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 400 mm and length 500 m. The rate of flow of water through the pipe is 200 liters/s. Consider all losses and take the value of f=0.009 (04)

OR

Q.1 (a) Derive an expression for the power transmission through pipes. What is the condition for maximum transmission of power and corresponding efficiency of transmission? (04)

(b) A horizontal pipe-line 50 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 30 m of its length from the tank, the pipe is 200 mm diameter and its diameter is suddenly enlarged to 400 mm. The height of water level in the tank is 10 m above the centre of the pipe. Considering all minor losses, determine the rate of flow. Take f=0.01 for both sections of the pipe. (04)

(c) Water is flowing through a pipe of diameter 200 mm with a velocity of 3 m/s. Find the head lost due to friction for a length of 5 m if the co-efficient of friction is given by $f = (0.002 + \frac{0.09}{R_e^{0.3}})$ where R_e is the Reynold's number. The kinematic viscosity of water = 0.01 stoke. (04)

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%. (04)

(b) 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)

(c) A jet of water of diameter 150 mm strikes a flat plate normally with a velocity of 12 m/s. The plate is moving with a velocity of 6 m/s in the direction of the jet and away from the jet. Find: (i) the force exerted by the jet on the plate, (ii) work done per second (iii) power (iv) efficiency of jet. (03)

OR

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 = $\rho a V_1 [V_{w1} \pm V_{w2}] \times u$. (04)

(b) A jet of water having a velocity of 20 m/s strikes a curved vane, which is moving with a velocity of 10 m/s. The jet makes an angle of 20° with direction of motion of vane at inlet and leaves at an angle of 130° to the direction of motion of vane at outlet. Calculate (i) vane angles, so that the water entre and leaves the vane without shock. (ii) work done (04)

per second per unit weight of water striking the vane per second.

(c) Derive an expression for the force exerted by a jet on a flat inclined plate moving in direction of jet. (03)

Q.3 **Attempt any two from the following.** (12)

(a) A pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The pelton wheel develops 95.65 kW shaft power. The velocity of the buckets = 0.45 times the velocity of jet, overall efficiency= 0.85 and co-efficient of the velocity is equal to 0.98.

(b) Describe briefly the function of various main components of pelton turbine with neat sketch.

(c) The penstock supplies water from a reservoir to the pelton wheel with a gross head of 500 m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is 2 m^3/s. The angle of deflection of the jet is 165^0. Determine the power given by the water to the runner and also hydraulic efficiency of the pelton wheel. Take speed ratio = 0.45 and C_v=1.0

SECTION: II

Q.4 (a) Define the term 'governing' of turbine. Explain the governing of pelton wheel with neat sketch. (04)

(b) Define: (i) Gross head (ii) Hydraulic efficiency (iii) Volumetric efficiency (iv) Hydraulic turbine. (04)

(c) Define specific speed of a turbine. Derive its expression. (04)

OR

Q.4 (a) Explain the governing of Francis turbine with neat sketch. (04)

(b) What is draft tube? What are its functions? (04)

(c) Define: (i) Lift (ii) Drag (iii) Surging (iv) Stalling (04)

Q.5 (a) A centrifugal pump works against a mean lift of 6.1 m when the impeller rotates at 200 rpm. If the impeller diameter is 1.22 m. Determine minimum speed to start pumping if the ratio of external to internal diameter is 2. (06)

(b) Enlist the various losses occurring in centrifugal pumps. Define a) η_{mano} b) η_{vol} c) η_{mech} d) $\eta_{overall}$ in context of centrifugal pumps. (05)

OR

Q.5 (a) A pump delivers water from a tank A (water surface elevation= 110 m) to a tank B (water surface elevation= 170). The suction pipe is 45 m long (f=0.024) and 35 cm in diameter. The delivery pipe is 950 m long (f=0.022) and 25 cm in diameter. The head discharge relationship for the pump is giving by Hp= (90-8000 Q^2). Where Hp is in meter and Q in m^3/s. Calculate (06)

(i) The discharge in pipeline

(ii) The power delivered by the pump

(b) Describe in detail with neat sketch about the working of axial flow pump (05)

Q.6 (a) Describe with the aid of neat sketch the construction and working of a hydraulic Crane. (06)

(b) What is hydrology? Give classification and applications of hydro power plant. (06)

END OF PAPER