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END TERM EXAMINATION

SIXTH SEMESTER [B.TECH.] MAY-2010

Paper Code: ETME308 Subject: Fluid Systems
Paper Id: 36308
Time : 3 Hours Maximum Marks :75

Note: Attempt any five questions including Q.1 which is compulsory.

Q1 (a) What is cavitation and where it is likely to occur in turbines and pumps? Also, define Thoma cavitation factor.
(b) Sketch and discuss the main characteristics curves for a Francis turbine.
(c) What are the functions of draft tube? Sketch different types of draft tubes.
(d) What is priming and why it is necessary?
(e) What are the functions of casing in a centrifugal pump? Sketch different types of casings.
(f) What is governing of hydraulic turbines and why is necessary?
(g) Compare briefly the pneumatic system with hydraulic system. **(2x6,3=15)**

Q2 (a) A jet of water having velocity v strikes a single curved moving in the same direction with a velocity u. If the wave deflects jet by 180^0, show that the maximum efficiency will occur at v=3u and its value is 59.2%. **(7)**
(b) A small boat is fitted with jets of total area 0.65m2. The velocity of jet relative to the boat is 9m/s and speed of the boat is 18km per hour. The efficiency of engine and pump are 85% and 65% respectively. If the water is drawn amid ship, determine the propelling force and overall efficiency. It may be assumed that pipe losses amount to 10% of the kinetic energy of the jets. **(8)**

Q3 (a) A single jet Pelton turbine runs under a head of 340m. The diameter of the jet is 170mm and is deflected by 165^0 inside the bucket. Find (i) the power developed by the runner and (ii) hydraulic efficiency of the turbine. Assume, speed ratio as 0.45 and co-efficient of nozzle velocity as 0.98. **(8)**
(b) Differentiate between (i) Impulse turbine and reaction turbine (ii) Radial flow and mixed flow in turbines and (iii) Propeller turbine and Kaplan turbine. **(7)**

Q4 (a) A model of a Francis turbine one-fifth of full size, develops 3kw at 306rpm under a head of 1.77m. Find the speed of and power of full size turbine operating under a head of 5.7m if the efficiency of the model and full size turbine are the same as 76%. What will be the efficiency of the full size turbine if the scale effect is considered? **(8)**
(b) What do you understand by hydraulic similarity as applied to hydraulic turbines? Define the terms unit speed, unit power and unit discharge and derive expressions for these quantities. **(7)**

Q5 (a) A centrifugal pump impeller having external and internal diameters of 480mm and 240mm respectively is running at 1000rpm. The rate of flow through the pump is $0.057m^3/s$ equal to 2.4m/s. The suction and delivery pipes are of equal diameters of 180mm. the suction and delivery pressure gauges readings are 3.8m and 20.2m of water respectively. If the power required to drive the pump is 35kw and

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the outlet vane angle is 45^0 determine (i) manometric head (ii) manometric efficiency and (iii) overall efficiency. **(9)**

(b) Sketch and describe an axial flow pump and where it is used? **(6)**

Q6 (a) Show that the diameter of the nozzle for maximum transmission of power is given by $d = \left(\frac{D^5}{BfL}\right)^{1/4}$ where, D=diameter of pipe, L=length of pipe and f=the coefficient of friction. **(8)**

(b) A value is provided at the end of a cast iron pipe of diameter 150mm and thickness 10mm. the water flow through the pipe with a velocity of 1.566m/s is suddenly stopped by closing the valve. Find the rise in pressure due to sudden closure of valve. Assume K for water=$19.62 \times 10^4 N/cm^2$ and E for cast iron as $11.772 \times 10^6 N/cm^2$. Find also, the pressure rise if pipe is assumed to be rigid. **(7)**

Q7 (a) Explain the terms (i) positive displacement and non-positive displacement pumps and (ii) constant delivery and variable delivery pumps. Describe with a neat sketch a vane pump, explaining how discharge is varied keeping the speed constant. **(8)**

(b) Differentiate between pilot operated and solenoid operated valves. Sketch a flow control valve and a pressure relief valve explain briefly. **(7)**

Q8 (a) Sketch and describe a 'Bleed-off' circuit and explain where it is used and its main advantage over other circuits. **(8)**

(b) Explain with a neat sketch the principle of working of a fluid coupling. How it is different from torque converter? **(7)**

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