Code No: 113BX

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, December-2014
FLUID MECHANICS AND HYDRAULIC MACHINERY
(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

Part- A (25 Marks)

1.a) Distinguish between Compressibility and Bulk Modulus. [2M]
   b) A soap bubble 60 mm diameter has an internal pressure in excess of the outside pressure of 35 N/mm^2. What is tension in the soap film? [3M]
   c) Differentiate between the Eulerian and Lagrangian method of representing fluid flow. [2M]
   d) Integrate the Euler's equation of motion in differential form and get Bernoulli's equation. [3M]
   e) What is firm power and secondary power? [2M]
   f) Draw inlet and outlet velocity triangles when a jet strikes a moving curved vane tangentially at one end and leaving at the other. [3M]
   g) Explain under what circumstances, Pelton Wheel, Francis Turbine and Kaplan Turbine are preferred to. [2M]
   h) What is Runaway Speed? What is the significance of it? [3M]
   i) Define Speed Ratio and Flow Ratio of Centrifugal pump. [2M]
   j) Draw Muschel curves and explain the use of it. [3M]

Part-B (50 Marks)

2.a) Differentiate between: (i) Liquids and gases, (ii) Real fluid and ideal fluids, (iii) Specific weight and specific volume of a fluid.
   b) Determine the intensity of shear of an oil having viscosity = 1.5 poise and is used for lubrication in the clearance between a 12 cm diameter shaft and its journal bearing. The clearance is 1.2 mm and shaft rotates at 220 r.p.m.

OR

3.a) Define the following:
   (i) Steady flow   (ii) Non-uniform flow   (iii) Laminar flow
   (iv) Two-dimensional flow.
   b) The water is flowing through a taper pipe of length 55 m having diameters 42 cm at the upper end and 22 cm at the lower end, at the rate of 58 litres/s. The pipe has a slope of 1 in 45. Find the pressure at the lower end if the pressure at the higher level is 25.55 N/cm^2.

4.a) Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of energy.
   b) A 40° reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 42 cm and 22 cm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet of bend is 22.00 N/cm^2. The rate of flow of water is 500 litres/s.

OR

5.a) Derive an equation for head loss due to friction in pipes.
  b) An orifice-meter with orifice diameter 16 cm is inserted in a pipe of 34 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 12.75 N/cm^2 and 10.00 N/cm^2 respectively. Find the rate of flow of water through the pipe in litres/s. Take $C_d = 0.6$.

6. A jet water having a velocity of 16 m/s strikes a curved vane which is moving with a velocity of 6 m/s. The vane is symmetrical and it so shaped that the jet is deflected through 110^0. Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water? Assume the vane to be smooth.

OR

7.a) Distinguish between (i) Gross head and effective head (ii) Installed capacity and dependable capacity (iii) Utilization factor and capacity factor.
  b) A hydropower plant is having an installed capacity of 32 000 KW. The annual output of the plant is 161×10^6 KW hr. The Peak load is 24500 KW. Determine (i) annual load factor (ii) Plant use factor and (iii) Capacity factor.

8.a) What do you mean by gross head, net head and efficiency of turbine. Explain the different types of efficiencies of a turbine.
  b) A Pelton wheel has a mean bucket speed of 38 m/s with a jet of water flowing at the rate of 1.5 m^3/s under a head of 270 m. The buckets deflect the jet through an angle of 160°. Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.90.

OR

9.a) Explain the surge tank with the help of a neat sketch.
  b) Define cavitation. What are the effects of cavitation? Give the necessary precautions against cavitation.

10.a) What is priming. Why is it necessary? Explain in detail.
  b) A centrifugal pump discharges 1100 lit/minute against a head of 18.5m when the speed is 1600 rpm. The diameter of the impeller is 36 cm and the power required is 6.5 h.p. A geometrically similar pump of 46 cm is to run at 1850 rpm. Assuming equal efficiencies, find.
  i) the head developed
  ii) the discharge
  iii) power developed by 45 cm pump.

OR

11.a) Discuss the concept of multistage pumps in detail.
  b) A centrifugal pump has three stages discharging 125 lit/s, working against a head of 48m, running at 1450 rpm. Calculate the specific speed of the pump.

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