Code No. 3049

FACULTY OF ENGINEERING
B.E. 3/4 (Mech.) First Semester (Suppl.) Examination, June/July 2011
HYDRAULIC MACHINERY AND SYSTEMS

Time : Three Hours]   [Maximum Marks : 75

Note :— Answer ALL questions from Part A. Answer any FIVE questions from Part B.

PART—A (Marks : 25)

1. A water jet of area 0·008 m² strikes a fixed flat vertical plate under a head of 100 m. The force exerted on the plate (C_v = 0·98) is (kN) :

   (a) 15·1   (b) 25·1   (c) 20·5   (d) 32·8   2

2. A water jet 0·025 m² area strikes a hinged plate at its centre with a velocity of 8 m/sec. If the plate swing is 30°, weight of plate is (kN) :

   (a) 2·3   (b) 3·2   (c) 4·8   (d) 6·4   2

3. A single acting reciprocating pump having piston area 0·08 m² and 0·5 m stroke runs at 120 rpm. The (C_d = 0·9) actual discharge is (m³/sec) :

   (a) 0·1   (b) 0·08   (c) 0·072   (d) 0·064   3

4. If 84·8 % of work can be saved by fitting an air vessel on a single acting reciprocating pump, then the work saved by fitting an air vessel on a double acting reciprocating pump is :

   (a) 42·4 %   (b) 78·4 %   (c) 39·2 %   (d) 32·9 %   1

5. If the η_{mano} and η_{mech} of a Centrifugal pump are 90 % and 80 % respectively, its η_o is :

   (a) 72 %   (b) 64 %   (c) 85 %   (d) 90 %   3

6. A 1/5th scale model of a Centrifugal pump runs at 1000 rpm under 16 m head. If the prototype pump works under 25 m head, its speed is (rpm) :

   (a) 18   (b) 24   (c) 32   (d) 27   3

7. In a Pelton wheel the vanes deflects the jet through an angle of 120°. The η_{max} is :

   (a) 60 %   (b) 75 %   (c) 80 %   (d) 50 %   3

8. In a Francis turbine the guide blade angle is 45° and the moving vanes are radial at inlet. The flow velocity is constant. Its η_{hyd} is :

   (a) 66·67 %   (b) 75 %   (c) 85·35 %   (d) 50 %   3

HVS—837   1   (Contd.)

9. A turbine develops 7225 kW power under a head of 81 m at 243 rpm. The specific speed of the turbine is :

   (a) 170   (b) 85   (c) 255   (d) 765   3

10. The displacement volume of a Hydraulic accumulator is 0·115 m³. If the plunger diameter is 0·35 m its stroke length is (m) :

    (a) 0·1195   (b) 11·95   (c) 1·195   (d) 2·12   2

PART—B (Marks : 5×10=50)

11. A jet of water with a velocity of 60 m/sec strikes a curved vane moving at 30 m/sec. The jet enters an angle of 20° and the angle between relative velocities is 120°. Draw velocity triangles and determine (a) blade angles at inlet and exit (b) work done/N of water, and (c) η_{hyd}.

12. A single acting reciprocating pump has a plunger diameter of 0·375 m and 0·6 m stroke. The delivery pipe is 90 m long and 0·15 m diameter. Find the power saved by fitting an air vessel near the cylinder. The pump runs at 50 rpm and friction factor (f) = 0·008.

13. An impeller of a Centrifugal pump with inner and outer diameters of 0·6 m and 1·2 m runs at 200 rpm and discharges 1·8 m³/sec of water under a head of 6 m. The vane exit angle is 26° and exit flow velocity is 2·5 m/sec. Determine η_{mano} and minimum starting speed of the pump. Neglecting impeller losses, determine the specific speed of the pump.

14. In a Francis turbine the vane velocity at inlet, constant flow velocity and whirl velocity at inlet are 24 m/sec, 3 m/sec and 30 m/sec respectively. Assuming radial discharge and η_{hyd} = 78 %, determine head of the turbine, guide vane angle, rotor vane angle at inlet and exit.

15. A Kaplan turbine produces 20600 kW of power under a head of 22 m with η_o = 85%. If speed ratio = 1·6 and flow ratio = 0·5 find the diameter of the runner, speed of the runner and specific speed of the turbine. Take the hub diameter = 0·35 times the runner diameter.

16. (a) Describe the working of a Hydraulic Ram with a sketch.   6

    (b) 0·2 m³/sec of water is supplied from a height of 3 m to a Hydraulic Ram which raises 0·002 m³/sec of water to a height of 20 m from the Ram. Determine D' Aubuisson's and Rankine's efficiencies of the Hydraulic Ram.   4

17. Write short notes on :—

    (a) Functions of Air vessels of Reciprocating pumps   3

    (b) Performance curves of Centrifugal pumps   3

    (c) Conditions of similarity of Turbines.   4