VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.) III Year I-Semester Supplementary Examinations, May/June-2017

Hydraulic Machinery and Systems

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

1. List the various components of a hydro-electric power plant.

2. A jet of water of cross sectional area 0.00049 m^2, moving with a velocity of 10 m/s, strikes at the centre of a hinged square plate of weight 98.1 N. What is the angle through which the plate will swing?

3. Classify reciprocating pumps and give their applications.

4. Why reciprocating pump is not coupled directly to the motor?

5. Identify the main parts of a centrifugal pump.

6. Illustrate the importance of characteristic curves of centrifugal pumps.

7. Define overall efficiency of a hydraulic turbine.

8. Why the draft tube is always immersed in tail race in case of a reaction turbine?

9. What is the function of hydraulic actuator?

10. Name three speed control circuits.

Part-B (5 × 10 = 50 Marks)
(All bits carry equal marks)

11. a) Derive an expression for force exerted and work done on a vertical flat moving plate when the jet of water strikes the plate horizontally.

    b) Velocity of a jet of liquid coming out of nozzle is 25 m / sec and it exerts a force of 4000 N on a fixed flat plate held normal to the jet. If the velocity of jet is increased to 30 m/sec, find the increase in force acting on the same plate.

12. a) Differentiate between, (i) single acting and double acting reciprocating pump and (ii) single cylinder and double cylinder reciprocating pump.

    b) A single acting reciprocating pump running at 30 r.p.m. delivers 0.012 m^3/s water. The diameter and stroke of the piston is 25 cm and 50 cm respectively. Determine the theoretical discharge, coefficient of discharge, slip, and percentage slip of the pump.

13. a) Define the terms suction head, delivery head, static head and manometric head with respect to a centrifugal pump.

    b) Determine the number of pumps required to take water from a deep well under a total head of 89 m. All the pumps are identical and are running at 800 r.p.m. The specific speed of each pump is 25 and rated capacity of each pump is 0.16 m^3/s.

14. a) A Kaplan turbine develops 24647.6 kW power at an average head of 39 m. The speed ratio and flow ratio are 0.2 and 0.6 respectively. The diameter of the boss is 0.35 times the diameter of runner and overall efficiency of the turbine is 90%. Calculate the diameter.

    b) For above Kaplan turbine calculate speed and specific speed of the turbine.

15. a) Explain the working of any one type of flow control valve used in hydraulic circuit with its symbolic representation.

    b) Explain the working principle of vane pump with the help of a neat diagram.

16. a) Draw the inlet and outlet velocity triangles for an un-symmetrical, curved, moving blade when the jet strikes tangentially at one of the tips of the vane.

    b) A single acting reciprocating pump raises water to a height of 20 m through a delivery pipe of 35 m long and 140 mm in diameter. The bore and stroke of the pump are 250 mm and 400 mm respectively. Cavitation occurs at 2.5 m of water absolute. Determine the speed at which pump can run without separation on delivery side if the pipe rises first vertically and then horizontally.

17. Write short notes on any *two* of the following:
    a) Conditions of similarity for centrifugal pump.
    b) Compare between impulse and reaction turbine.
    c) Hydraulic oils.

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