Hall Ticket Number:

Code No. : 31404

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.) III Year I-Semester (Main) Examinations, Nov./Dec.-2016

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. Draw a general layout of a hydraulic power plant.
2. A jet of water, 50mm in diameter, issues with a velocity of 10 m/s and impinges on a stationary flat plate which destroys its forward motion. Find the force exerted by the jet on the plate and the work done.
3. Sketch the effect of acceleration on the indicator diagram of a reciprocating pump.
4. What is an Air vessel? What are the functions of Air vessel?
5. Define static head and manometric head in a centrifugal pump.
6. What is cavitation? What are the necessary precautions against cavitation in a centrifugal pump?
7. What is specific speed? State its significance in the study of hydraulic turbines.
8. Define hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine.
9. What are the basic components of hydraulic circuits?
10. What is the difference between single acting and double acting actuators?

Part-B (5 × 10 = 50 Marks)

11. a) Derive an expression for force exerted by a jet on a stationary symmetrically curved plate striking at the center. [4]

    b) A jet of water having a velocity of 35 m/s impinges on a series of vanes moving with a velocity of 20 m/s. The jet makes an angle of 30^0 to the direction of motion of vanes while entering and leaves at an angle of 120^0. Draw the velocity triangles and find [6]
    i) the angles of vane tips so that water enters and leaves without shock,
    ii) the work done per kg of water entering the vanes, and
    iii) the efficiency.

12. a) Derive an expression for pressure head due to acceleration of the piston of a reciprocating pump. Assume motion of the piston to be simple harmonic. [4]

    b) A single acting reciprocating pump has a plunger diameter 20cm and stroke length 30cm. It draws water from a sump 3.5m below the centre of pump cylinder. Find the least diameter of suction if it is 6 m long. The pump runs at 50 r.p.m. with simple harmonic motion and separation occurs at 2.5 m of water absolute pressure. Barometric pressure = 10.3 m of water. [6]

13. a) Describe multi stage pump with impellers in parallel and series. [4]

    b) A centrifugal pump impeller whose outer and inner diameters are 400mm and 200mm respectively is running at 950 r.p.m. The rate of flow through the pump is 0.035 m^3/s. The suction and delivery heads are 5 m and 25 m respectively. The diameters of suction and delivery pipe are 120mm and 80mm. If the outlet vane angle is 45^0, the flow velocity is constant and equal to 1.8 m/s and power required to drive the pump is 15 kW, determine [6]
    i) Inlet vane angle, *ii)* The overall efficiency and *iii)* The manometric efficiency.

Contd... 2

14. a) Draw inlet and outlet velocity triangles for a Pelton wheel. [4]

    b) A vertical shaft Francis turbine runs at 420 r.p.m. while the discharge is 15 m^3/s. The velocity and pressure head at entrance of the runner are 10 m/s and 230 m respectively. The elevation above the tail race is 5 m. The diameter of runner is 2 m and width at inlet is 270 mm. The overall and hydraulic efficiencies are 92% and 98% respectively. Calculate [6]
    i) Total head across the turbine, *ii)* Power output, *iii)* The guide vane angle and *iv)* Vane angle at the inlet. Density of water may be taken as 1000 kg/m^3.

15. a) List out the properties for oils used in hydraulic circuits. [4]

    b) Describe with the aid of neat sketch, the principle and working of vane pump. [6]

16. a) A jet of water of 30mm diameter, moving with a velocity of 15m/s, strikes a hinged square plate of weight 245.25N at the centre of the plate. The plate is of uniform thickness. Find the angle through which the plate will swing. [5]

    b) Describe the principle and working of a reciprocating pump with a neat sketch. [5]

17. Write short notes on any ***two*** of the following:
    a) Explain the main components of a centrifugal pump briefly. [5]
    b) What is a draft tube? What are its functions? [5]
    c) Explain meter-in, meter-out and bleed off briefly. [5]