

FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) I – Semester (Main) Examination, November 2013

Subject : Hydraulic Machinery and Systems

Time : 3 hours

Max. Marks : 75

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (25 Marks)

1. The magnitude of the force exerted by a jet of cross-sectional area 2000 mm^2 and of velocity 25 m/s on a fixed smooth curved vane which deflects the jet by 120° is
 - a) 21.65 kN
 - b) 21.75 kN
 - c) 21.50 kN
 - d) 21.80 kN

3
2. The efficiency of a jet of water impinging normally with a velocity 'V' on a series of vanes moving with a velocity (V) is given by the relation (with usual notations)
 - a) $\frac{2(V-v)}{V^2}$
 - b) $\frac{(V-v)}{V^2}$
 - c) $\frac{(V-v)^2}{2V}$
 - d) $\frac{(V-v)^2}{V}$

3
3. A double acting reciprocating pump has a stroke of 300 mm and a piston of diameter 150 mm . The delivery and suction heads are 26 m and 4 m respectively including friction heads. If the pump is working at 60 r.p.m. The power required to drive the pump with 80% efficiency is
 - a) 4.10 kW
 - b) 4.20 kW
 - c) 4.05 kW
 - d) 4.70 kW

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4. By fitting air vessel in the reciprocating pump, there is always some saving in power. This saving in a single acting reciprocating pump is
 - a) 39.20%
 - b) 48.8%
 - c) 84.8%
 - d) 88.4%

2
5. A centrifugal pump is required to lift water to a total head of 40 metres at the rate of 50 lit/s . If the over all efficiency is 62% , the power required for the pump is
 - a) 30.6 kW
 - b) 31.6 kW
 - c) 32.3 kW
 - d) 30.7 kW

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6. The pump is required to deliver 150 lit./s at head of 45 m when running at 1750 rpm . The specific speed of the pump is
 - a) 18
 - b) 125
 - c) 39
 - d) 1260

3
7. The water turbines may be arranged in the following decreasing order of specific speed as,
 - a) Propeller, Francis and Pelton
 - b) Pelton, Francis, Kaplan
 - c) Kaplan, Pelson, Francis
 - d) Francis, Kaplan and Pelson

3
8. For a model and prototype turbine the following parameters are common
 - a) unit speed
 - b) unit discharge
 - c) unit power
 - d) all the above

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9. Fluid power can be transmitted through either linear or rotary motion by using
- | | | |
|---------------------|------------------------|---|
| a) linear actuators | b) hydraulic cylinders | |
| c) rotary actuators | d) all the above | 2 |
10. A multistage pump is used to
- | | | |
|------------------------|-----------------------|---|
| a) give high discharge | b) produce high heads | 1 |
| c) pump viscous fluids | d) pump chemicals | |

PART – B (50 Marks)

11. A water jet with a velocity of 40 m/s strikes a blade moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of the blade at inlet and leaves at an angle of 90° to the direction of motion of the blade at outlet. Find out the blade angled at inlet and outlet, so that the water enters and leaves the blade without shock.
12. Define cavitation and causes for creating the cavitation. Mention the effects of cavitation and methods of its prevention.
13. The inlet and outlet diameters of a impeller of a centrifugal pump are 30 cm and 50 cm. The velocity of flow at the outlet is 2.5 m/s and vane outlet angle is 45° . Find the minimum speed of the pump required to start the flow. Take manometric efficiency = 0.75.
14. The bore and stroke of a double acting reciprocating pump are 12cm and 30 cm and piston rod diameter is 2 cm. The suction and delivery heads are 3m and 5m. The speed of the pump is 50 rpm. Find the force on the piston during inward and outward stroke. Also find the discharge and power of motor required to run the pump if the pump $\eta = 80\%$ and motor $\eta = 90\%$.
15. Give classification of hydraulic turbines. Discuss the different factors that form basis of selection of the type of turbine.
16. Design a Pelton wheel to generate a power of 2.0 MW when working under a head of 150m and a speed of 40 r.p.m. Assume necessary data.
17. Describe about basic components of hydraulic circuits and properties, types of hydraulic oils.
