G 513

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Mechanical Engineering/Production Engineering

ME 010 403/PE 010 403—HYDRAULIC MACHINES (ME, PE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Maximum : 100 Marks

Time : Three Hours

Part A

Answer all questions.
Each question carries 3 marks.

1. Differentiate between: Laminar and Turbulent flow.

2. What is meant by Impulse turbine ?

3. What is the function of the Impeller in a centrifugal pump ?

4. What factors affecting cavitation in pump ?

5. What is meant by self-priming pump ?

(5 × 3 = 15 marks)

Part B

Answer all questions.
Each question carries 5 marks.

6. Define Newtonian and Non-Newtonian fluids.

7. Compare pelton wheel and Kaplan turbines in all aspects.

8. How pumps are selected with performance curves ? Explain.

9. What are the factors affecting cavitation in turbines ?

10. What are uses of air vessels in pumps ?

(5 × 5 = 25 marks)

Part C

Answer all questions.
Each question carries 12 marks.

11. A uniform flow of 12 m³ /s occurs in a long rectangular channel of 5 m width and depth of flow of 1.50 m. A flat hump is to be built at a certain section. Assuming a loss of head equal to the upstream velocity head, compute minimum height of the hump to provide a critical flow.
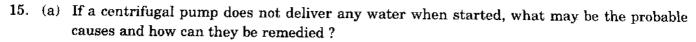
Or

Turn over

12. A square plate weighing 110 N and of uniform thickness and 30 cm edge is hung so that horizontal jet 3 cm diameter and having a velocity of 12 m/s impinges on the plate. The center line of the jet is 15 cm below the upper edge of the plate, and when the plate is vertical, the jet strikes the plate normally and at its center. Find what force must be applied at the lower edge of the plate in order to keep plate vertical. If the plate is allowed to swing freely, find the inclination to vertical which the plate will assume under the action of jet.

13. (a) Tests were conducted on a Francis turbine of 0.8 m diameter under a head of 9 m. The turbine developed 115 kW running at 240 r.p.m. and consuming 1.2 m³/sec. If the same turbine is operated under a head of 16 m predict its new speed, discharge and power.

    (b) What are the requirements of a governor in hydropower Installation ?

    (6 + 6 = 12 marks)

Or

14. Design a Pelton wheel for the following data :—

    (a) Gross head available   =   170 m

    (b) Losses in penstock   =   10% of gross head

    (c) Power to be developed   =   600 kW.

    (d) Speed of the wheel   =   360 r.p.m.

    (e) Overall efficiency   =   86%

    Assume any missing data suitably.

15. (a) If a centrifugal pump does not deliver any water when started, what may be the probable causes and how can they be remedied ?

    (b) The impeller of a centrifugal pump is 35 cm outside diameter and 17.5 cm internal diameter. The vane angles of the impeller at inlet and outlet are 30° and 25° respectively. The pump runs at 1400 r.p.m. The velocity of flow through the impeller is constant. Find the work done by the impeller per second per kg of water.

    (6 + 6 = 12 marks)

Or

16. (a) Define a centrifugal pump. Explain the working of a single stage centrifugal pump.

    (b) The water is to be pumped out of a deep well under a total head of 90 m. A number of identical pumps of design speed 1000 r.p.m. and specific speed 900 r.p.m. with a rated capacity of 150 lps are available. How many pumps will be required and how should they be connected ?

    (6 + 6 = 12 marks)

17. A jet of water having a velocity of 20 m/sec strikes a curved vane, which is moving with a velocity of 10 m/sec. The jet makes an angle of 20° with the direction of motion of vane at inlet and leaves at an angle of 130° to the direction of motion of the vane at outlet. Calculate :

    (a) Vane angles, so that the water enters and leaves the vane without shock.

    (b) Work done per second per unit weight of water striking the vane.

    (6 + 6 = 12 marks)

18. (a) Explain with suitable example about the collapse of bubble theory.

    (b) How we can prevent cavitation damage in pumps and turbines ? Explain.

<div align="right">(6 + 6 = 12 marks)</div>

19. With neat sketch explain the working principle of following pumps :—

    (a) Reciprocation pump and

    (b) Jet pump.

<div align="right">(6 + 6 = 12 marks)</div>

<div align="center">*Or*</div>

20. With neat sketch explain the working principle of following pumps :—

    (a) Gear pump and

    (b) Vane pump.

<div align="right">(6 + 6 = 12 marks)</div>
<div align="right">[5 × 12 = 60 marks]</div>