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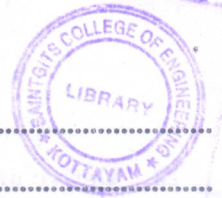
B.TECH. DEGREE EXAMINATION, MAY 2015

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]

Time : Three Hours　　　　　　　　　　　　　　　　Maximum : 100 Marks

Part A

Answer all questions.
Each question carries 3 marks.

1. Differentiate between axial flow and radial flow hydraulic machines.

2. Define "degree of reaction".

3. Define forced vortex theory.

4. Define Euler's number and Weber's number.

5. Why a gear pump is known as a positive displacement pump ?

　　　　　　　　　　　　　　　　　　　　　　　　　$(5 \times 3 = 15 \text{ marks})$

Part B

Answer all questions.
Each question carries 5 marks.

6. Derive an expression for work done in jet propulsion.

7. Draw the velocity triangles for a Kaplan turbine.

8. Write a note on shapes of impellers.

9. Discuss the principle of similitude.

10. What is the importance of indicator diagram in a reciprocating pump ?

　　　　　　　　　　　　　　　　　　　　　　　　　$(5 \times 5 = 25 \text{ marks})$

Part C

Answer all questions.
Each question carries 12 marks.

11. The water in a jet propelled boat is drawn mid-ship and is discharged at the back with an absolute velocity of 30 m/s. The cross-sectional area of the jet at the back is 0.04 m^2 and the boat is moving in sea water with a speed of 30 km/hour. Determine :

　　(i)　propelling force on the boat.　　　　　　　　　　　　　　(4 marks)

　　(ii)　power.　　　　　　　　　　　　　　　　　　　　　　　(4 marks)

　　(iii)　efficiency of jet propulsion.　　　　　　　　　　　　　(4 marks)

　　　　　　　　　　　　　　　Or　　　　　　　　　　　　　**Turn over**

12. Derive an expression for the force exerted by a jet of water on an unsymmetrical moving curved plate when jet strikes tangentially at one of the tips.

13. The following data is related to a pelton wheel :—

Head at the base of the nozzle	=	80 m
Diameter of the jet	=	100 mm
Discharge of the nozzle	=	0.30 m³/s
Power at the shaft	=	206 kW
Power absorbed in mechanical Resistance	=	4.5 kW

Determine :

   (i) power lost in nozzle ; and

   (ii) power lost due to hydraulic resistance in the runner.

Or

14. What is a draft tube ? Derive an expression for the efficiency of a draft tube.

15. Find the power required to drive a centrifugal pump which delivers 0.04 m³/s of water to a height of 20 m through a 15 cm diameter pipe and 100 m long. The overall efficiency of the pump is 70% and co-efficient of friction $f = 0.15$.

Or

16. What are the multistage centrifugal pumps ? Discuss all the performance characteristics of a multistage centrifugal pump.

17. Explain :

   (i) specific speed.   (4 marks)

   (ii) capacity coefficient.   (4 marks)

   (iii) Rayleigh's method.   (4 marks)

Or

18. Explain the phenomenon of cavitation in (i) turbines and ; (ii) pumps. Discuss the significance of Thoma's parameter.

19. What is an air vessel ? Explain with sketches. Derive an expression for the head lost due to friction in a reciprocating pump.

Or

20. The water is supplied at the rate of 30 litres per second from a height of 4 m to a hydraulic ram, which raises 3 litres per second to a height of 18 m from the ram. Determine D'Aubuison's and Rankine's efficiencies of the hydraulic ram.

[5 × 12 = 60 marks]