Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), MAY 2024
MECHANICAL ENGINEERING
(2020 SCHEME)

Course Code : 20MET206

Course Name: Fluid Machinery

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. List the broad classifications of Hydraulic Turbines.
2. Derive expressions for the force exerted by the jet of water on a flat stationary vane, when the jet strikes normally.
3. Explain the phenomenon of Cavitation in Turbines along with its effects.
4. Give the classification of pumps with examples.
5. Define slip, percentage slip and negative slip of a reciprocating pump.
6. Why air vessels are used in reciprocating pumps
7. List the advantages of a Multi-stage compressor over Single stage compressor
8. What is surging and chocking in centrifugal compressor?
9. Draw the schematic diagrams and Temperature entropy diagram of constant pressure closed cycle gas turbine.
10. How a Gas Turbine engine differs from an Internal Combustion Engine?

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) The flat plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through an angle of 90°. Assuming the plate perfectly smooth find: (i) Force exerted on the plate in the direction of the jet, (ii) Power of the jet, and (iii) Efficiency of the jet, if the jet strikes the plate with a velocity of 24m/s (7)

    b) Explain the constructional features of Kaplan turbines with a neat sketch. (7)

OR

12. a) A Pelton wheel is to be designed for the following specifications: Shaft power 11,772kW; Head= 380 metres; Speed = 750r.p.m.; Overall efficiency= 86%; Jet diameter is not to exceed one-sixth of the wheel diameter. Determine: (i) The wheel diameter, (ii) The number of jets required, and (iii) Diameter of the jet. Take the Coefficient of velocity as 0.985 and the Speed ratio as 0.45 (7)

b) Explain the operating principle of impulse and reaction turbines. (7)

MODULE II

13. a) Write short notes on the following terms (6)
   i. Manometric head
   ii. Types of impeller vanes

b) A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s. If the efficiency is 90%, determine the performance of the turbine under a head of 20 m. (8)

OR

14. a) Define and obtain an expression for the specific speed of turbine. (7)

b) Explain the characteristic curves of Hydraulic turbines. (7)

MODULE III

15. a) A single-acting reciprocating pump running at 60 rpm delivers 0.53 m3 of water per minute. The diameter of the piston is 200 mm and the stroke length is 300 mm. The suction and delivery heads are 4 m and 12 m respectively. Determine the theoretical discharge, coefficient of discharge, percentage slip and power required to run the pump. (7)

b) With a neat sketch, explain the construction and working of a Jet pump. (7)

OR

16. Prove that the percentage work saved against friction by using air vessel in the case of single acting reciprocating pump is 84.8% and double acting pump is 39.2%. (14)

MODULE IV

17. a) With the help of an indicator diagram derive an expression for work done in a reciprocating compressor neglecting the clearance volume (10)

b) Explain the isothermal efficiency of a reciprocating compressor. (4)

OR

18. a) With a neat sketch, explain the principle of operation, construction and working of the centrifugal compressor. Explain 'Surging' in centrifugal compressor (10)

b) Define the Degree of reaction in Axial flow compressors. Mention the expression for the degree of reaction in Axial flow compressors. (4)

MODULE V

19. a) A simple closed-cycle gas turbine receives air at 1 bar and 15°C and compresses it to 5 bar and then heats it to 800^0C in the heating chamber. The hot air expands in a turbine back to 1 bar. Calculate the power developed per kg of air supplied per second. (8)

Take Cp for the air as 1 kJ/kg K and $\gamma = 1.4$

b) With neat sketches explain the isentropic efficiencies of turbines and compressors. Also, deduce its expression. (6)

OR

20. Explain the performance improvement methods used in basic gas turbine cycles with neat block diagrams and T-S diagrams. (14)

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