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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
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. Deduce the expression for force exerted by a water jet, striking a flat, fixed vane normally at its centre.
2. What are the different types of efficiencies in hydraulic turbine?
3. Define the unit speed with reference to hydraulic turbine
4. List the various types of draft tubes.
5. Is negative slip possible in reciprocating pump? Explain.
6. What is the purpose of air vessels in reciprocating pumps?
7. How surging affects the performance of a compressor?
8. List the advantages of multistage compressor
9. Which cycle is taken as the ideal cycle for gas turbines? Draw the P-V and T-s diagram of the same
10. What is reheating in gas turbine engines?

PART B

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

MODULE I

11. Draw the inlet and outlet velocity triangle for the pelton turbine and derive a condition for maximum hydraulic efficiency of the turbine. Also, obtain an expression for the maximum hydraulic efficiency. (14)

OR

12. a) Explain the working of a Francis turbine with neat sketch. (10)
    b) Why draft tubes are used in reaction turbines? (4)

MODULE II

13. a) Explain the working of an oil pressure governor used in Pelton turbine (8)

b) What is the significance of specific speed of turbine? Give an expression for the same. (6)

OR

14. a) Draw and explain the performance characteristic curves of a pump (6)
b) Explain the constructional features and working of a centrifugal pump. Neat diagrams are mandatory. (8)

MODULE III

15. a) With the help of a neat sketch explain the working of a single acting reciprocating pump. Also derive an expression for the minimum power required to drive the pump (8)
b) A double acting reciprocating pump with a discharge of 0.015 m3/sec is running at 60 rpm. The pump has a stroke of 400 mm and diameter of piston is 250 mm. The delivery and suction head are 25 m and 4m respectively. Find the percentage of slip and power required to run the pump (6)

OR

16. a) Derive an expression for pressure head due to acceleration of liquid in suction and delivery pipe of a reciprocating pump. Also explain the effect of acceleration in reciprocating pump using and indicator diagram (8)
b) With a neat diagram, explain the working of a gear pump (6)

MODULE IV

17. a) Using a P-V diagram, derive an expression for work input/cycle to compress the air in a single acting single stage air compressor without clearance volume (7)
b) A single stage reciprocating air compressor takes in 8 m^3/min of air at 1 bar and 30 ^{0} C, and delivers it at 6 bar. The clearance is 5% of the stroke. Assume the expansion and compression are polytropic with polytropic index = 1.3. Calculate the temperature of the delivered air, volumetric efficiency and power of the compressor (7)

OR

18. a) Define volumetric efficiency of a reciprocating air compressor. Give an expression for the volumetric efficiency, in terms of clearance ratio. (4)
b) With neat diagram explain the construction and working of an axial flow compressor (10)

MODULE V

19. a) With the help of neat sketches explain the working of open cycle and closed cycle gas turbines (6)

b) In an air standard Brayton cycle air at 300 K is supplied to a compressor whose pressure ratio is 5. Mass flow rate of air is 3kg/sec, air fuel ratio is 80:1, calorific value of fuel is 42MJ/kg. Determine the (8)

i) Thermal efficiency
ii) Maximum temperature
iii) Work ratio
iv) Net power

OR

20. Draw the P-V and T-S diagram of an ideal constant pressure gas turbine cycle (Brayton cycle) and derive an expression for its air standard efficiency, in terms of pressure ratio. (14)

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