Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B. TECH DEGREE EXAMINATION (S), SEPT 2022

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. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet
2. Differentiate between impulse and reaction turbine
3. What is governing of a turbine? Why is it important?
4. Define the terms suction head, delivery head, static head and manometric head
5. How will you classify reciprocating pumps?
6. Define slip, percentage slip and negative of reciprocating pump
7. What is rotary compressor? Classify them
8. What are the advantages of multistage compression?
9. Differentiate between open cycle gas turbine and closed cycle gas turbine
10. Define compressor efficiency and turbine efficiency in a gas turbine cycle.

PART B

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

MODULE I

11. a) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find: the force on the plate, the work done, and the efficiency of the jet. (6)

    b) A jet of water having a velocity of 20 m/s strikes a curved vane, which is moving with a velocity of 10 m/s. 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 vane at outlet.
    Calculate: (8)
    (i) Vane angles, so that the water enters and leaves the vane without shock.
    (ii) Work done per second per unit weight of water striking (or work done per unit weight of water striking) the vane per second

OR

12. a) Explain the working of a Pelton turbine with neat sketches (8)
    b) Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine (6)

MODULE II

13. a) A Pelton wheel is revolving at a speed of 190 rpm and develops 5150.25 kW when working under a head of 220 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio for the turbine is given as 0.47. Find the speed, discharge and power when this turbine is working under a head of 140 m. (9)
    b) What do you understand by the characteristic curves of a turbine? Describe the important types of characteristic curves. (5)

OR

14. a) What is the difference between single—stage and multistage pumps? Describe the working of a multistage pump with impellers in parallel. (8)
    b) Define cavitation. What are the effects of cavitation? Give the necessary precautions against cavitation (6)

MODULE III

15. a) Find an expression for the head lost due to friction in suction and delivery pipes of a reciprocating pump. (6)
    b) Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump? (8)

OR

16. a) A single-acting reciprocating pump, running at 50 r.p.m, delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine: (6)
        (i) The theoretical discharge of the pump,
        (ii) Coefficient of discharge, and
        (iii) Slip and the percentage slip of the pump.

    b) Show from first principle that the work saved, against friction in the delivery pipe of a single-acting reciprocating pump, by fitting an air vessel is 84.8%. (8)

MODULE IV

17. a) Define volumetric efficiency of a reciprocating air compressor. What are the various factors affecting volumetric efficiency (6)
    b) A single acting, single cylinder reciprocating air compressor has a cylinder diameter of 200 mm and a stroke of 300 mm. Air enters the cylinder at 1 bar, 27° C. It is then compressed polytropically to 8 bar according to the law $PV^{1.3}$ Constant. The speed of the compressor is 250 rpm. Calculate: (8)
        (i) the mass of air compressed per minute and
        (ii) The power required in KW for driving the compressor, if mechanical efficiency is 80%. Neglect clearance

OR

18. With neat diagrams, explain the construction and working of the following machineries (14)
    (i) Centrifugal compressor.
    (ii) Axial flow air compressor

MODULE V

19. a) In an air standard Brayton cycle air at 1 bar, 20°C is supplied to. a compressor where pressure ratio is 4.5. The maximum temperature is 1000 K. Determine. (4)
    (i) Thermal efficiency
    (ii) Net work and
    (iii) Work ratio

    b) A gas turbine unit receives air at 100 kPa and 300 K and compresses it adiabatically to 600 kPa with the efficiency of the compressor 88%. The fuel has a heating value of 44180 kJ/kg and the air fuel ratio is 0.017 kg fuel/kg air. The turbine internal efficiency is 90%. Calculate the compressor work, turbine work and thermal efficiency. Take C_P= 1.005 kJ/kgK, γ = 1.4 for air and C_p= 1.147 kJ/kg, γ = 1.3 for products of combustion (10)

OR

20. a) Derive the expression for efficiency in gas turbine plant in terms of pressure ratio (5)
    b) What are the improvements made to the basic gas turbine cycle? Explain with temperature entropy diagram. (9)

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