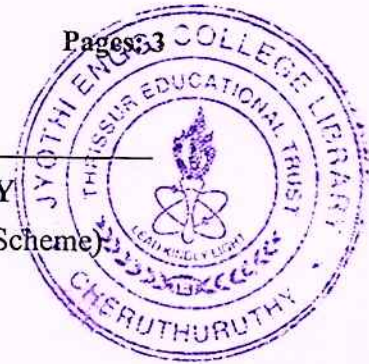




Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT/WP/S3PT) Examinations June 2026 (2019 Scheme)

Course Code: MET303

Course Name: THERMAL ENGINEERING

Max. Marks: 100

Duration: 3 Hours

Use of Steam tables, Refrigeration tables, Charts and Psychrometric charts are permitted

PART A

(Answer all questions; each question carries 3 marks)

Marks

- | | | |
|----|---|---|
| 1 | Draw the P-V and T-S diagram for a simple Rankine cycle where the inlet condition of steam to turbine is dry saturated. | 3 |
| 2 | Give the classification of boilers based on any three criteria and give one example for each type. | 3 |
| 3 | Explain pressure compounding of steam turbines. | 3 |
| 4 | What is meant by bypass governing? | 3 |
| 5 | Define mechanical efficiency and indicated thermal efficiency of an IC engine. | 3 |
| 6 | Explain the procedure for conducting a Morse test. | 3 |
| 7 | Define Octane number and Cetane number. | 3 |
| 8 | What is pre-ignition and why does it occur in SI engine? | 3 |
| 9 | What are the main components of a simple vapour compression refrigeration system? Draw its T-S diagram. | 3 |
| 10 | Differentiate between sensible heating and sensible cooling. | 3 |

PART B

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

Module -1

- | | | |
|----|--|---|
| 11 | a) Dry saturated steam is supplied to a steam turbine at 12 bar and after expansion its condenser pressure is 1 bar. Find the Rankine cycle efficiency and specific steam consumption. Neglect feed pump work. | 8 |
| | b) With a neat sketch explain the working of a reheat Rankine cycle. | 6 |
| 12 | a) Dry saturated steam enters a frictionless adiabatic nozzle with negligible velocity at a temperature of 300 °C. It is expanded to a pressure of 50 bar. The mass flow rate is 1 kg/s. Calculate the exit velocity of steam. | 8 |

- b) With a neat sketch explain the working of a Cochran boiler. 6

Module -2

- 13 a) The velocity of steam leaving the nozzle of an impulse turbine is 1000 m/s and the nozzle angle is 20° . The blade velocity is 350 m/s and the velocity coefficient is 0.85. Assuming no losses due to shock at inlet, calculate for a mass flow of 1.5 kg/s and symmetrical blading a) blade inlet angle b) driving force on the wheel c) axial thrust on the wheel and d) power developed by the turbine. 10
- b) Give four differences between impulse turbine and reaction turbine. 4
- 14 a) Derive an expression for maximum blade efficiency for a single stage impulse turbine. 7
- b) With a neat sketch explain throttle governing. 7

Module -3

- 15 a) A single cylinder 4 stroke Diesel engine having a swept volume of 750 cm^3 is tested at 300 rpm. when a breaking torque of 65 N-m is applied, the mean effective pressure is 1100 kN/m^2 . Calculate the break power and mechanical efficiency of the engine. 6
- b) What is supercharging? With neat sketches, explain different types of supercharging methods. 8
- 16 a) A six cylinder four stroke engine of 340 mm bore and 390 mm stroke was tested and the following observations were made. Engine speed = 360 rpm, Brake power = 180 kW, Mean effective pressure = 3.8 bar, Fuel per minute = 0.77 kg, CV = 45000 kJ/kg. Flow of cooling water = 64 kg/min with a temperature rise of 9°C . Draw the heat balance sheet for this engine 8
- b) With P-V diagram explain the deviation of actual cycle from ideal cycle for a four stroke SI engine 6

Module -4

- 17 a) The fuel used in an engine is C_6H_{14} . The percentage of dry exhaust gases by volume in a particular load and speed of the engine are given below. $\text{CO}_2 = 9\%$, $\text{CO} = 8\%$ and N_2 rest. Find a) A/F ratio for theoretically complete combustion, b) mass of air supplied and c) Decide whether the process is complete combustion or not. 8
- b) With neat sketches explain any two types of SI engine combustion chambers. 6

- 18 a) With the aid of a pressure – crank (P- θ) angle diagram, explain various stages of combustion in SI engine. 8

- b) Discuss any four factors affecting delay period in CI engine 6

Module -5

- 19 a) A simple vapour compression plant produces 5 tonnes of refrigeration. The enthalpy values at inlet to compressor, at exit from the compressor and at exit from the condenser are 183.19, 209.41 and 74.59 kJ/kg respectively. 8

Estimate a) the refrigerant flow rate b) The COP c) the power required to drive the compressor and d) the rate of heat rejection to the condenser.

- b) Explain the two main components of a cooling load imposed on an air conditioning plant operating during hot weather. 6

- 20 a) Explain the summer air conditioning system with the help of a schematic diagram. 8

- b) Write any six factors that affect human comfort. 6
