

**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022**

Fourth Semester

**Mechanical Engineering****20MEPC404 - APPLIED THERMAL SCIENCES**

(Regulations 2020)

(Usage of Steam Tables, Refrigeration Table &amp; Molier Chart are Permitted)

Duration: 3 Hours

Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**

Answer ALL Questions

- |  | <i>Marks,</i><br><i>K-Level, CO</i> |
|--|-------------------------------------|
| 1. Write any four differences between Otto and Diesel cycle.   | 2,K2,CO1                            |
| 2. Define mean effective pressure.   | 2,K1,CO1                            |
| 3. What is the working principle of reaction turbine?  | 2,K1,CO2                            |
| 4. Define nozzle efficiency.   | 2,K1,CO2                            |
| 5. Define clearance ratio of an air compressor.  | 2,K1,CO4                            |
| 6. What are the advantages of multistage compression with inter-cooling over single stage compression for the same pressure ratio? | 2,K1,CO4                            |
| 7. What is the function of camshaft and crank shaft?   | 2,K1,CO5                            |
| 8. Why a choke is used in carburetor?  | 2,K1,CO5                            |
| 9. What is commonly used unit of refrigeration?  | 2,K1,CO6                            |
| 10. Define relative humidity and wet bulb temperature.   | 2,K1,CO6                            |

**PART - B (5 × 13 = 65 Marks)**

Answer ALL Questions

11. a) Define Brayton Cycle with Derivation for Air Standard Cycle & Mean Effective Pressure. 13,K3,CO1
- OR**
- b) An Engine-working on Otto cycle has a volume of 0.45 m<sup>3</sup>, pressure 1 bar and temperature 30°C at the beginning of compression stroke. At the end of compression stroke, the pressure is 11bar and 210KJ of heat is added at constant volume. Determine:
- (i) Pressure, Temperature and Volumes at salient points in the cycle.  
(ii) Efficiency. 13,K2,CO1
12. a) The inlet condition to a steam nozzle are 10 bar and to 250°C. The exit pressure is 2 bar. Assuming isentropic condition and negligible. Determine velocity at inlet for 1 kg/s of mass of steam, 13,K2,CO2
- (i) Throat area  
(ii) Exit velocity  
(iii) The exit area of the nozzle.

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

**11662**

**OR**

- b) Derive the expression for critical pressure ratio in terms of index of expansion. *13,K2,CO2*
13. a) Explain the construction working of multistage compressor and discuss the perfect and imperfect intercooling with neat sketch. *13,K3,CO4*

**OR**

- b) A multi stage air compressor is to be designed to evaluate the pressure from 1 bar to 120 bar. Such that the single stage pressure ratio not to exceed 4. Find : *13,K2,CO4*
- (i) Number of stages
  - (ii) Exact stage pressure ratio
  - (iii) Intermediate pressure.

14. a) Explain with neat sketch air cooling of engines and explain any one lubrication system adopted in multi cylinder SI engines. *13,K3,CO5*

**OR**

- b) Explain the combustion phenomenon in SI engines. What are the factors influencing the flame speed in SI engines? *13,K3,CO5*
15. a) Explain the construction and working of vapour compression refrigeration system. *13,K3,CO6*

**OR**

- b) Explain the construction and working of summer and winter air conditioning systems. *13,K3,CO6*

**PART - C (1 × 15 = 15 Marks)**

16. a) A single row impulse turbine develops 132.4 kW at a blade speed of 175 m/s. using 2 kg of steam per second. Steam leaves the nozzle at the 400 m/s. Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Determine nozzle angle, blade angles at entry and exit. Assuming no shock. *15,K3,CO3*

**OR**

- b) Steam enters the blade row of an impulse turbine with a velocity of 600 m/s at an angle of  $25^\circ$  to the plane of rotation of blades. The mean blade speed is 200 m/s. The blade angle at the exit is  $30^\circ$ . The Blade friction is 10%. Determine: *15,K2,CO3*
- (i) The blade angle at inlet
  - (ii) The work done per kg of steam
  - (iii) The diagram efficiency.