

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: R4702

B.E. / B.Tech. DEGREE EXAMINATION, APRIL/MAY 2025

Fourth Semester

Mechanical Engineering

R21UME402 – APPLIED THERMAL ENGINEERING

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Heat addition takes place in diesel cycle at CO1- U
(a) $V=C$ (b) $P=C$ (c) $T=C$ (d) $S=C$
2. Compression ratio and expansion ratio are equal in CO1- U
(a) Otto cycle (b) Dual cycle (c) Diesel cycle (d) Brayton cycle
3. Function of carburetor is CO1-U
(a) To mix diesel with air (b) To mix diesel with petrol
(c) To mix petrol with air (d) none
4. In a diesel engine, the duration between the time of injection and ignition, is CO1-U
known as
(a) pre-ignition period (b) delay period (c) period of ignition (d) burning period
5. The flow through a nozzle is regarded as CO1-U
(a) constant volume flow (b) constant pressure flow
(c) isothermal flow (d) isentropic flow
6. The ratio of the work done on the blades to the energy supplied to the blades, is CO1- U
called
(a) blading efficiency (b) nozzle efficiency
(c) gross or stage efficiency (d) mechanical efficiency

7. In a reciprocating air compressor work done is minimum during _____ compression CO1- U
- (a) Isothermal (b) Isentropic (c) Polytropic (d) None of these
8. Multistage compressor is used to obtain CO1- U
- (a) High velocity air (b) High pressure air (c) Low velocity air (d) Low pressure air
9. The formation of frost on cooling coils in a refrigerator CO1- U
- (a) increases heat transfer (b) improves C.O.P. of the system
- (c) increases power consumption (d) reduces power consumption
10. The leakage of refrigerant from a system is detected by CO1- U
- (a) halide torch test (b) sulphur candle test
- (c) soap and water test (d) all of these

PART – B (5 x 2= 10 Marks)

11. Compare Otto and Diesel Cycle CO1- U
12. Summarize major parts of I.C. Engines. CO1- U
13. Explain the different types of Compounding CO1- U
14. Outline Isothermal efficiency CO4- U
15. Classify any four commonly used refrigerants CO5- U

PART – C (5 x 16= 80 Marks)

16. (a) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27° C. The amount of heat added to the air per cycle is 1500 kJ/kg. Calculate the pressure and temperatures at all points of the air standard Otto cycle. Also calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8:1. Take for air: $C_v = 0.72 \text{ kJ/kg K}$ and $\gamma = 1.4$ CO2- App (16)
- Or
- (b) An Engine working on an ideal air standard diesel cycle has the compression ratio as 15 and heat transfer as 1400 kJ/kg. find the pressure and temperature at the end of the each processes if the Intet conditions are 280K and 1.1 bar. Also find the air standard efficiency and mean effective pressure CO2- App (16)
17. (a) Explain the working of Battery ignition system with neat sketch CO1- U (16)
- Or
- (b) Explain the working of pressure lubrication system with a neat sketch CO1- U (16)

18. (a) Steam enters the blade row of an impulse turbine with a velocity of 600 m/s at an angle of 25° to the plane of rotation of the blades, the mean blade speed is 250 m/s. The blade angle at the exit side is 30° . The blade friction loss is 10 %. Determine the Blade angle inlet, The work done per kg of steam and blade efficiency. CO2- App (16)

Or

- (b) A single stage Impulsion turbine 1m in diameter rotates at 3000 rpm. The steam is supplied from the nozzles with a velocity of 300 m/s and nozzle angle is 20° . The blades are equiangular. Assuming that the friction loss in the blade passages 33% of the K.E. corresponding to the relative velocity at inlet to the blade, find the power developed by the turbine. The axial thrust on the bearing of turbine is 15 N. CO2- App (16)

19. (a) A single acting reciprocating air compressor has cylinder diameter and stroke of 200mm and 300mm respectively. The compressor sucks air at 1 bar and 270°C and delivers at 8 bar while running at 100 rpm. Find (i) Indicated power of the compressor (ii) Mass of air delivered by the compressor per min. (iii) Temperature of the air delivered by the compressor. The compression follows the law $PV^{1.25} = C$. CO3- Ana (16)

Or

- (b) A three –stage reciprocating air compressor compresses air from 1 bar and 17°C to 35bar. The law of compression is $PV^{1.25} = C$ and is same for all the stages of compression. Assume perfect inter cooling and neglecting clearance and valve resistance, find the minimum power required to compress $15\text{ m}^3/\text{min}$ of free air. Also find the intermediate pressure. CO3- Ana (16)

20. (a) With a neat sketch, explain vapour compression refrigeration system CO1- U (16)

Or

- (b) Explain the construction and working of Ammonia-water vapour absorption refrigeration system CO1- U (16)

