A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U4702

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2024

Fourth Semester

Mechanical Engineering

21UME402 - APPLIED THERMAL ENGINEERING

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Constant pressure cycle is CO1 U

   (a) Otto cycle (b) Dual cycle (c) Diesel cycle (d) Brayton cycle

2. Compression ratio of Otto cycle is CO1 U

   (a) V_1/V_2 (b)V_3/V_2 (c) V_2/V_1 (d) V_2/V_3

3. Spark plug is used in CO1 U

   (a) Petrol engine (b) Marine engine (c) Diesel engine (d) Stirling engine

4. In a diesel engine, the duration between the time of injection and ignition, is known as CO1 U

   (a) pre-ignition period (b) delay period (c)period of ignition (d) burning period

5. The steam governor is used to CO1 U

   (a) Store energy (b) Convert energy

   (c) Maintain speed (d)Balancing weight

6. The ratio of the work one on the blades to the energy supplied to the blades, is called CO1 U

   (a) blading efficiency (b) nozzle efficiency

   (c) gross or stage efficiency (d)mechanical efficiency

7. Multistage compressor is used to obtain CO1 U

   (a) High velocity air (b) High pressure air

   (c) Low velocity air (d) Low pressure air

8. The maximum temperature in a gas turbine is CO1 U

(a) 200°C (b)500°C (c) 700°C (d) 1000°C

9. The humidity ratio or specific humidity is the mass of water vapor present in CO1 U

(a) 1 m^3 of wet air (b) 1 kg of wet air (c) 1 kg of dry air (d) above all

10. A vapour absorption refrigerator uses _____ as a refrigerant. CO1 U

(a) water (b) ammonia (c) Freon (d) aqua-ammonia

PART – B (5 x 2= 10 Marks)

11. Classify the various gas power cycles CO1 U

12. Summarize major parts of I.C. Engines CO1 U

13. Outline stagnation enthalpy CO1 U

14. Classify the various types of air-compressors CO1 U

15. Compare absolute humidity and relative humidity CO1 U

PART – C (5 x 16= 80Marks)

16. (a) Explain the Otto cycle with P-V and T-S diagram and derive the expression for air standard efficiency of the Otto cycle CO1 U (16)

Or

(b) Explain the Dual cycle with P-V and T-S diagram and derive the expression for air standard efficiency of the Dual cycle CO1 U (16)

17. (a) Explain the working of Battery ignition system with neat sketch CO1 U (16)

Or

(b) Explain IC Engines components and its Functions CO1 U (16)

18. (a) Dry saturated steam enters a steam nozzle at a pressure of 12 bar and is discharged to a pressure of 1.5 bar. If the dryness fraction of a discharged steam is 0.95, what will be the final velocity of steam? Neglect initial velocity of steam CO3 App (16)

Or

(b) Steam at 20 bar and 250^0C enters a group of convernt –divergent nozzles. The back-up pressure of nozzle is 0.07bar.Neglect the loss in the convergent part. Assume a loss of 10 %of enthalpy drop available in the divergent part. Find the number of nozzles required to discharge 13.6kg/s. The throat area of each nozzle is 3.97 cm^2.also determine the area of exist of each nozzle CO3 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 27 ^{0} 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 $PV^{1.25} = C$. CO1 App (16)

Or

(b) A single acting two stage air compressor deals with 2.5 litres of air at 1.2 bar and 25^{o}C with speed of 350 rpm delivery pressure is 8 bar. Assuming complete intercooling, find the maximum power required by the compressor and the bore and stroke compressor. Assume a piston speed of 3m/s ,mechanical efficiency of 75 %, volumetric efficiency 80% per stage. Assume polytrophic index of compression in both the stages to 1.35 & neglect clearance CO1 App (16)

20. (a) In a refrigeration plant working on Bell Coleman cycle, air is compressed to 5 bar from 1 bar. Its initial temperature is 10^0 C. After compression, the air is cooled up to 20^0 C in a cooler before expanding back to a pressure of 1 bar. Determine the theoretical C.O.P. of the plant and net refrigerating effect. Take C_p= 1.005 kJ/kg and C_v= 0.718 kJ/kg CO4 App (16)

Or

(b) Find the least power of a perfect reversed heat engine that makes 400kg/kg of ice per hour at -8^{0}C feed water at 18^{0}C. Assume specific heat of ice as 2.09 kJ/kg and latent heat 334 kJ/kg. CO4 App (16)