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Question Paper Code: U4702

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2023

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. At same compression ratio, efficiency of Otto cycle while comparing diesel cycle is CO1-U
(a) more (b) equal (c) less (d) none
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 of the above
4. The thermal efficiency of diesel engines is about CO1-U
(a) 15% (b) 30% (c) 50% (d) 70%
5. A nozzle is used to CO1-U
(a) Increase velocity (b) decrease velocity (c) Increase pressure (d) Decrease pressure
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. Positive displacement compressor CO1- U
 (a) Centrifugal compressor (b) Axial compressor
 (c) Reciprocating compressor (d) Roots blower
8. The maximum temperature in a gas turbine is CO1-U
 (a) 200°C (b) 500°C (c) 700°C (d) 1000° C
9. Air conditioning means CO1-U
 (a) cooling (b) heating (c) dehumidifying (d) all of these
10. In summer air conditioning, the air is CO1-U
 (a) Cooled and humidified (b) heated and humidified
 (c) Cooled and dehumidified (d) heated and dehumidified

PART – B (5 x 2= 10Marks)

11. Construct the dual cycle on P-V plane and mention the five thermodynamic processes involved CO1 -U
12. Compare between two stroke and four stroke IC engines CO2 -U
13. Explain the different types of Compounding CO3- U
14. Explain the advantage of multistage compressor over single stage compressor. CO4- U
15. Distinguish between absolute humidity and relative humidity. CO5 -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-App (16)
 Or
 (b) An engine with 200 mm cylinder and 300 mm stroke works on theoretical diesel cycle. The initial pressure and temperature of air used are 1 bar and 270 C .The cut –off is 8% stroke. Determine Pressure and Temperatures at all salient points, Theoretical air standard Efficiency, Mean Effective Pressure, Power of engine if the working cycles per minute are 380.Assume that compression ratio is 15 and working fluid is air. Consider all conditions to be ideal CO1-App (16)
17. (a) Explain the working of Simple carburetor with neat sketch CO1- U (16)
 Or
 (b) Explain full pressure lubrication system in I.C Engine. CO1- U (16)

18. (a) The inlet condition of a steam nozzle is 10 bar and 250⁰C. The exit pressure is 2 bar. Assuming isentropic expansion and negligible inlet velocity, determine the throat area, exit velocity and exit area of the nozzle for a flow rate of 0.2 kg/s. CO2- App (16)
- Or
- (b) 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, blade efficiency. 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 27° 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 $PV^{1.25} = C$. CO2- App (16)
- Or
- (b) A two stage single acting reciprocating air compressor with perfect inter-cooling with a suction pressure of 100 kN/m² and temperature of 20°C & final pressure is 4200 kN/m². Compression & expansion follows the law $PV^{1.25} = C$. Find per kg of air (i) Work done (ii) The mass of water necessary for abstracting the heat in the inter-cooler, if the temperature rise of the cooling water is 25°C. CO2- App (16)
20. (a) With a neat sketch, explain vapor compression refrigeration system CO5- U (16)
- Or
- (b) The amount of air supplied to an air conditioned hall is 300 m³ / min. The atmospheric conditions are 35⁰ DBT and 55% RH. The Required conditions are 20⁰ C DBT and 60% RH. Find out the sensible heat and latent heat removed from the air per minute. Also find sensible heat factor for the system. CO5 -U (16)

