A

Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code: U4702

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 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. 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 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. The frictional power (F.P.) is given by   CO1 U

   (a) F.P. = B.P. - I.P   (b) F.P. = I.P. - B.P   (c) F.P. = B.P./I.P   (d) F.P.= I.P./B.P

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

   (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   CO1 U
   blades, is called

   (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 volumetric efficiency for reciprocating air compressors is about   CO1 U

    (a) 10 to 40%   (b) 40 to 60%   (c) 60 to 70%   (d) 70 to 90%

9. Air conditioning means   CO1 U

    a) cooling   (b) heating   (c) dehumidifying   (d) all of these

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. Illustrate the assumption made in deriving the air-standard efficiency of Carnot   CO1 U
    engine

12. Construct typical valve timing diagram and mention ideal angles   CO1 U

13. Explain stagnation enthalpy   CO1 U

14. Classify the different type of Compounding   CO1 U

15. Classify any four commonly used refrigerants   CO1 U

PART – C (5 x 16= 80Marks)

16. (a) The minimum pressure and temperature in an Otto cycle are 100   CO2 App   (16)
         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: Cv = 0.72 kJ/kg K and γ = 1.4

                                        Or

    (b) In an air standard Otto cycle, the pressure and the temperature at   CO2 App   (16)
         the beginning of the cycle 42^{0}C and 0.1MPa. The compression
         ratio and maximum temperature of the cycle are 8 and 1250^{0}C
         respectively. Find the temperature and pressure at all the points of
         the cycle, heat supplied per kg of air, work done per kg of air,
         cycle efficiency and Mean effective pressure.

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)

U4702

18. (a) An impulse turbine having a set of 16 nozzles receives steam at 20   CO3 App   (16)
bar, 400° C. The pressure of steam at exist is 12 bar. If the total
discharge is 260 kg/min and nozzle efficiency is 90%. Find the
cross sectional areas of each nozzle, if the steam has velocity of
80m/s at entry to the nozzle, find the percentage.

Or

(b) Dry saturated steam at a pressure of 8 bar enters a convergent   CO3 App   (16)
divergent nozzle leaves it at a pressure of 1.5 bar. If the steam flow
process is isentropic and the corresponding expansion index is
1.135, find the ratio of cross sectional area at exit and throat for
maximum discharge

19. (a) A two stage single acting reciprocating air compressor with   CO1 App   (16)
complete intercooling delivers to 2kg/s of air at 15 bar. Assume
the intake state as 1 bar and 25^OC.Both compression and
expansion follow the law of PV1.25=C Find the power

Or

(b) Air is to be compressed in a single stage reciprocating compressor   CO1 App   (16)
from 1.013bar and 15OC to 7 bar. Find the indicated power
required for a delivery of 0.3m3/min when the compression
process is isentropic and polytrophic n=1.12

20. (a) Explain the Concepts of RSHF, GSHF, ESHF   CO1 U   (16)

Or

(b) Exp1ain winter Air Conditioning with a neat layout   CO1 U   (16)

U4702