A   Reg. No. :

Question Paper Code: 94702

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2022

Fourth Semester

Mechanical Engineering

19UME402 - Applied Thermal Engineering

(Regulations 2019)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1.   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

2.   Heat addition takes place in diesel cycle at   CO1- U

    (a) V=C   (b) P=C   (c) T=C   (d) S=C

3.   The ratio of the volume of charge admitted at N.T.P. to the swept   CO1- U
    volume of the piston is called

    (a) mechanical efficiency   (b) overall efficiency

    (c) volumetric efficiency   (d) relative efficiency

4.   Spark plug is used in   CO1- U

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

5.   The steam governor is used to   CO1- U

    (a) Store energy   (b) Convert energy   (c) Maintain speed   (d) Balancing weight

6.   A nozzle is used to   CO1- U

    (a) Increase velocity   (b) decrease velocity

    (c) Increase pressure   (d) Decrease pressure

7.   Positive displacement compressor   CO1- U

    (a) Centrifugal compressor   (b) Axial compressor

    (c) Reciprocating compressor   (d) Roots blower

8. The volume of air sucked by the compressor during its suction stroke is   CO1- U

   (a) free air delivery   (b) swept volume

   (c) compressor capacity   (d) none of these

9. The formation of frost on cooling coils in a refrigerator   CO5- U

   (a) increases heat transfer   (b) improves C.O.P. of the system

   (c) increases power consumption   (d) reduces power consumption

10. The formation of frost on cooling coils in a refrigerator   CO5- U

   (a) increases heat transfer   (b) improves C.O.P. of the system

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PART – B (5 x 2= 10 Marks)

11. Illustrate the factors that affect the air standard efficiency of diesel cycle.   CO1- U

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

13. What are the different loss involved in Steam Turbine   CO1- U

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

15. Classify any four commonly used refrigerants   CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) An engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance volume is 0.00263 m^3. The initial pressure and temperature are 1 bar and 50°C. If the maximum pressure is limited to 25 bar, find the following: (i) The air standard efficiency of the cycle. (ii) The mean effective pressure for the cycle.   CO2- App   (16)

Or

   (b) An engine with 200 mm cylinder diameter and 300 mm stroke works on theoretical diesel cycle. The initial pressure and temperature of air used are 1 bar and 27° C. The cut-off is 8% stroke. Determine: (i) Pressures and Temperatures at all salient points (ii) Theoretical air standard efficiency (iii) Mean effective pressure (iv) 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.   CO2- App   (16)

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17. (a) Explain the working of Simple carburetor with neat sketch   CO1- U   (16)

Or

(b) Explain about full pressure lubrication system in I.C Engine.   CO1- U   (16)

18. (a) Dry saturated steam enters a steam nozzle at a pressure of 12   CO3- App   (16)
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.

Or

(b) Steam at 20 bar and 250°C enter a group of convergent –   CO3- App   (16)
divergent nozzles. The backup pressure of nozzle is 0.07 bar.
Neglect the losses in the convergent part. Assume a loss of
10% of enthalpy drop available in the divergent part. Find the
number of the nozzles required to discharge 13.6 kg/s. the
throat area of each nozzles is 3.97cm^2. Also determine the the
area of exits of each nozzle.

19. (a) Derive the work done by a two stage reciprocating air   CO6- App   (16)
compressor with intercooler and derive the condition for
minimum work input and the expression for minimum work
required for stage reciprocating compressor?

Or

(b) A single acting reciprocating air compressor has cylinder   CO6- App   (16)
diameter and stroke of 200mm and 250 mm respectively. The
compressor sucks air at 1.1bar and 28^0 C and delivers at 9bar
while running at 300 rpm. Find (i) Indicated power of the
compressor (ii) Mass of air delivered by the compressor per
min. The compression follows the law $PV^{1.35} = C$. assume n
$_{vol =80\%, and}$ n_{mech} =85%..

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20. (a) An airplane using 20 TR bootstrap air refrigeration system has CO5- App (16) ambient conditions of 0.9 bar and 15°C. Ram air pressure after isentropic compression is 1.1 bar. Main compressor exit pressure is 3.5 bar, and exit pressure of secondary compressor is 4.5 bar. The carbine is required to be maintained at 1 bar and 25°C. Isentropic efficiency of each compressor is 85% and that of cooling turbine is 90%. The effectiveness of both heat ex-changers is 60%. Find(i) Mass flow rate of air passing through the carbine (ii) Power required, (iii) COP of the system. Assume Cp=1.01 kJ/kg K.

Or

(b) Explain With a neat sketch, explain vapour compression CO5- App (16) refrigeration system.

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