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Question Paper Code: 44704

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Fourth Semester

Mechanical Engineering

14UME404 - THERMAL ENGINEERING

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The thermodynamic cycle working with air as working cycle is known as

   (a) induction stoke (b) compression stoke
   (c) power stoke (d) exhaust stoke

2. Constant volume cycle refers to

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

3. The power developed inside the cylinder is called

   (a) Mechanical efficiency (b) Brake power
   (c) Indicated power (d) Thermal efficiency

4. Carburettor is used for

   (a) S.I. engines (b) Gas engines
   (c) C.I. engines (d) None of the above

5. Increasing the velocity and decreasing the pressure is done by

   (a) Diffuser (b) Turbine (c) Compressor (d) Nozzle

6. De-Laval turbine is an example of

   (a) Impulse turbine (b) Reaction turbine
   (c) Low head turbine (d) Middle head turbine

7. For complete intercooling, the temperature at the inlet and exit of the compressor are

(a) $T_i < T_e$ (b) $T_i > T_e$ (c) $T_i = T_e$ (d) $T_i \neq T_e$

8. In reciprocating air compressor, the method of controlling the quantity of air delivered is done by the

(a) Throttle control (b) Clearance control
(c) Blow off control (d) All the above

9. The C.O.P of an air refrigeration system is_____ a vapour compression system.

(a) More than (b) Lessthan
(c) Equal to (d) No such comparison

10. A sling psychrometer measures temperature of

(a) Dry bulb (b) wet bulb
(c)dew point (d) both dry bulb and wet bulb

PART - B (5 x 2 = 10 Marks)

11. Define air standard efficiency and mean effective pressure.

12. List the methods used to find the friction power.

13. Name the various types of nozzles.

14. What the use is of inter cooler?

15. Define C.O.P of a refrigerator.

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*.

(i) Draw the P-V diagram and calculate the pressures and temperatures at all points of the air standard Otto cycle.

(ii) 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 *kJ/kg* and γ = 1.4. (16)

Or

(b) A four stroke SI engine has the compression ratio of 6 and swept volume of 0.15 m^3. Pressure and temperature at the beginning of compression are 98 kPa and 60°C. Determine the pressure, volume and temperatures at all salient points if heat supplied is 150 kJ/kg. Also find out entropy change, work done, efficiency and mean effective pressure of cycle assuming C_p = 1 kJ/kg·K, C_v = 0.71 kJ/kg·K. Also plot the cycle on T-S diagram. (16)

17. (a) (i) Explain the working of 4 stroke cycle diesel engine with neat sketch. (8)

(ii) Differentiate between SI and CI engines. (8)

Or

(b) Discuss with suitable sketches the following ignition systems

(i) Coil or battery ignition system (8)

(ii) Magneto ignition system (8)

18. (a) Evaluate the throat area, exit area and exit velocity for a steam nozzle to pass a mass flow of 0.2 *kg/s* when inlet conditions are 10 *bar* and 250°*C* and the final pressure is 2 *bar*. Assume expansion is isentropic and that the inlet velocity is negligible. Use $pv^{1.3}$ = constant. (16)

Or

(b) Steam at 10.5 bar and 0.95 bar dryness is expanded through a convergent– divergent nozzle. The pressure of steam leaving the nozzle is 0.85 bar. Find its velocity of steam at throat for max. .Discharge, the throat area and steam discharge if the throat area is 1.2cm^2. Assume the flow is isentropic and there are no friction losses. Take n= 1.135. (16)

19. (a) A single stage double acting air compressor is required to deliver 14 m^3 of air per minute measured at 1.013 *bar* and 15°*C*. The delivery pressure is 7 *bar* and the speed 300 *r.p.m*. Take the clearance volume as 5% of the swept volume with the compression and expansion index of *n* = 1.3. Estimate

(i) swept volume of the cylinder

(ii) delivery pressure

(iii) indicated power (16)

Or

(b) Explain with neat sketch the construction and working roots blower and vane type compressor. (16)

20. (a) Describe the construction and working of Ammonia-water vapour absorption refrigeration system. (16)

Or

(b) In a standard vapour compression refrigeration cycle, operating between an evaporator temperature of – 10°C and a condenser temperature of 40°C, the enthalpy of the refrigerant, Freon-12, at the end of compression is 220 kJ/kg. Show the cycle diagram on T-s plane and calculate: (i) The C.O.P. of the cycle. (ii) The refrigerating capacity and the compressor power assuming a refrigerant flow rate of 1 kg/min. The properties of the Freon-12 are given in the table below.

t(°C)	p(MPa)	h_f (kJ/kg)	h_g (kJ/kg)
-10	0.2191	26.85	183.1
40	0.9607	74.53	203.1

(16)