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B.E. / B.Tech. DEGREE EXAMINATION, APRIL 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. For the same compression ratio

    (a) thermal efficiency of Otto cycle is greater than that of diesel cycle
    (b) thermal efficiency of Otto cycle is less than that of diesel cycle
    (c) thermal efficiency of Otto cycle is same as that of diesel cycle
    (d) thermal efficiency of Otto cycle cannot be predicted

2. The thermal efficiency of theoretical Otto cycle

    (a) Increases with increase in compression ratio
    (b) Increases with increase in isentropic index γ
    (c) Does not depend upon the pressure ratio
    (d) Follows all of the above

3. Which one of the following power is measured at the engine flywheel

    (a) Brake power   (b) Indicated power
    (c) Friction power   (d) Fuel power

4. Carburettor is used for

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

5. The isentropic expansion of steam through nozzle for the steam initially dry saturated at inlet is approximated by the equation

    (a) $pv = C$ (b) $pv^{1.4} = C$ (c) $pv^{1.3} = C$ (d) $pv^{1.135} = C$

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

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

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 ratio between Refrigerating effect and work done is called as

    (a) Ton of refrigeration   (b) Compression refrigeration
    (c) Coefficient of Performance   (d) Absorption refrigeration

10. Temperature measured by ordinary thermometer is called

    (a) Dry bulb temperature   (b) Wet bulb temperature
    (c) Dew point temperature   (d) Saturation temperature

PART - B (5 x 2 = 10 Marks)

11. Name the various "gas power cycles".

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) Derive the air standard efficiency for Diesel cycle with P-V and T-S diagram.

                                                         (16)

Or

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(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) Explain the construction and working principle of any one of ignition system with neat sketch. (16)

Or

(b) A 4 cylinder two stroke petrol engine develops 30 *kW* at 2500 *r.p.m.* The mean effective pressure on each piston is 8 *bar* and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder of stroke to bore ratio 1.5. Also calculate the fuel consumption of the engine, if the brake thermal efficiency is 28%. The calorific value of the fuel is 43900 *kJ/kg*. (16)

18. (a) Briefly discuss the pressure and velocity compounding in turbines. (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) Develop an expression for the minimum work done by the multistage reciprocating air compressor with perfect intercooling. (16)

Or

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

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20. (a) An office is to be air-conditioned for 50 staffs when the outdoor conditions are 30^0 C DBT and 75% RH if the quantity of air supplied is 0.4 m^3/min/person, find the following.

(i) Capacity of the cooling coil in tons of refrigeration

(ii) Capacity of the heating coil in KW

(iii) Amount of water vapour removed per hour. Assume that required air inlet conditions are 20^0C DBT and 60% RH, air is conditioned first by cooling and dehumidifying and then by heating.

(iv) If the heating coil surface temperature is 25^0C, find the bypass factor. (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)

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