Reg. No. :

Question Paper Code: 50744

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Mechanical Engineering

15UME404 - THERMAL ENGINEERING

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Otto cycle is also known as

    (a) Constant Pressure cycle   (b) Constant Temperature cycle
    (c) Constant Volume cycle   (d) Constant Enthalpy cycle

2. The pressure ratio of Brayton cycle is 6 and $\gamma=1.4$, then the efficiency of the Brayton cycle is

    (a) 400%   (b) 40%   (c) 4%   (d) 0%

3. In Internal combustion engine, which part converts the reciprocating motion of the piston into the rotary motion

    (a) Piston rings   (b) Flywheel   (c) Crank shaft   (d) Cylinder

4. Fuel injector is used in

    (a) CI engines   (b) SI engines   (c) Gas engines   (d) Steam engines

5. Critical pressure ration for superheated steam is

    (a) 0.564   (b) 0.654   (c) 0.456   (d) 0.546

6. Steam turbines are not governed by

    (a) Throttle governing   (b) Nozzle control governing
    (c) By-pass governing   (d) Morse test method

7. The ratio of free air delivered to the displacement of the compressor is known as

    (a) Isothermal efficiency   (b) Adiabatic efficiency

    (c) Volumetric efficiency   (d) Isentropic efficiency

8. The use of intercooler in multistage air compressors is

    (a) To increase the performance of air compressor

    (b) To increase the speed of air compressor

    (c) To increase the volume of air compressor

    (d) To increase the temperature of air compressor

9. Presently, the refrigerant used in domestic refrigerators is

    (a) R134a   (b) NH_3 (c) Water   (d) Air

10. The ratio of room sensible heat to the sum of room sensible heat and room latent heat is called

    (a) GSHF   (b) ESHF   (c) RSHF   (d) Relative humidity

PART - B (5 x 2 = 10 Marks)

11. Plot the p-v diagram of dual cycle enegine and indicate the various thermodynamics processes.

12. Why cooling system is provide in internal combustion engines?

13. Differentiate impulse and recation turbines.

14. State the advantages of multi-stage air comprssion.

15. How air-conditioning systems are classified?

PART - C (5 x 16 = 80 Marks)

16. (a) Derive an expression for air standard efficiency and mean effective pressure of the Otto cycle. Indicate the various processes involved in Otto cycle through the p-v and T-S diagrams. (16)

Or

    (b) In an air standard Diesel cycle, the compression ratio is 16, and at the beginning of isentropic compression, the temperature is 15°C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of the constant pressure process is 1480°C. Calculate (i) the cut-off ratio, (ii) the heat supplied per kg of air, (iii) the cycle efficiency, and (iv) the mean effective pressure. (16)

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17. (a) With help of neat diagram, explain the construction and working principle of battery coil ignition system. (16)

Or

(b) (i) Explain the working of simple carburetor with suitable diagram. (6)

(ii) Describe the working of splash lubrication system with neat sketch used in IC engines. (10)

18. (a) (i) What is a supersaturated flow in steam nozzles and list out its effects. (6)

(ii) A convergent-divergent nozzle is to be designed in which steam initially at 14 bar and 80°C of superheat is to be expanded down to a back pressure of 1.05 bar. Determine the necessary throat and exit diameters of the nozzle for a steam discharge of 500 kg/hr, assuming that the expansion is in thermal equilibrium throughout and friction reheat amounting to be 12% of the isentropic enthalpy drop to be effective in the divergent part of the nozzle. (10)

Or

(b) Why compounding is necessary in steam turbines? With help of neat sketch explain the operation of (i) Velocity compounding (ii) Pressure velocity compounding. (16)

19. (a) A single stage reciprocating air compressor has a swept volume of 2000cm^3 and runs at 800 rpm. It operates on a pressure ratio 8, with a clearance of 5% of the swept volume. Assume NTP room conditions and at inlet (P=101.3kPa, T= 15°C), and Polytropic compression and expansion with n= 1.25. Calculate (i) Indicated power, (ii) Volumetric efficiency (iii) Mass flow rate (iv) Free Air Delivered (v) Isothermal efficiency (vi) The actual power required to drive the compressor if mechanical efficiency is 0.85. (16)

Or

(b) Describe the working of multistage air compressor with inter cooling. Also explain the thermodynamic processes using p-v diagram. (16)

20. (a) With help of neat sketch, explain the construction and working principle of vapour compression refrigeration system. (16)

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(b) Discuss the working of the following with neat diagram:

    (i)   Winter air-conditioning system (8)

    (ii) Summer air-conditioning system (8)

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