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**Reg. No. :**

**Question Paper Code: 44074**

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

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) *Ti < Te*  (b) *Ti > Te*  (c) *Ti = Te* (d) *Ti ≠ Te*

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. Temperature measured by ordinary thermometer is called

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

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. Identify the important properties of a good refrigerant.

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

(b) 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 *Cv =* 0.72 *kJ/kg* and *γ =* 1.4. (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) 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) (i) Differentiate between impulse turbine and reaction turbine. (8)

(ii) Describe briefly the various methods of steam turbine governing. (8)

Or

(b) Briefly discuss the pressure and velocity compounding in turbines. (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)

20. (a) 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.

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| --- | --- | --- | --- |
| t(°C) | p(MPa) | hf (kJ/kg) | hg (kJ/kg) |
| -10 | 0.2191 | 26.85 | 183.1 |
| 40 | 0.9607 | 74.53 | 203.1 |

(16)

Or

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