KUMARAGURU
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Register Number: ………………..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Fourth Semester

MECHANICAL ENGINEERING

MEC111: Thermal Engineering

(Use of Standard thermodynamic tables, Mollier diagram, Psychometric chart and

Refrigerant property tables are permitted)

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Combustion in compression ignition engines
   - a) homogeneous
   - b) heterogeneous
   - c) laminar
   - d) turbulent

2. Ignition lag is
   - a) the time taken by fuel after injection (before top dead center) to reach upto auto-ignition temperature
   - b) time before actual fuel injection and the pump plunger starts to pump fuel
   - c) time corresponding to actual injection and top dead center
   - d) time corresponding to actual ingition and top dead center

3. The efficiency of a diesel cycle will be maximum when
   - a) Speed is high
   - b) Injection pressure is high
   - c) Cylinder is water cooled
   - d) Cut off is zero

4. Presence of moisture in fuel oil would
   - a) keep the burner tips cool
   - b) aid in proper combustion
   - c) cause sputtering, possibly extinguishing flame
   - d) clean the nozzles

5. A nozzle is said to be a convergent nozzle
   - a) when the cross-section of the nozzle increases continuously from entrance to exit
   - b) when the cross-section of the nozzle decreases continuously from entrance to exit
   - c) when the cross-section of the nozzle first decreases from entrance to throat and then increases from its throat to exit
   - d) When the cross section of the nozzle increase continuously throughout the section

6. In a reaction turbine, when steam flows through the fixed blades
   - a) pressure increases while velocity decreases
   - b) pressure and velocity both decreases
   - c) pressure decreases while velocity increases
   - d) pressure and velocity both increases

7. Compression efficiency is compared against
   a) ideal compression
   b) adiabatic compression
   c) isothermal compression.
   d) isentropic compression

8. Pick up the wrong statement
   a) large gas turbines employ axial flow compressors
   b) axial flow compressors are more stable than centrifugal type compressors but not as efficient
   c) axial flow compressors have high capacity and efficiency
   d) axial flow compressors have instability region of operation

9. In a vapour absorption system the function of rectifier is
   a) To seprate ammonia and water
   b) To cool the vapour leaving the analyser
   c) To dissolve ammonia in water
   d) To add energy from external source

10. During air conditioning, whenever two or more streams of moist air are mixed, they follow
    a) Adiabatic process
    b) Isothermal process
    c) Polytrophic process
    d) Isobaric process

PART B (10 x 2 = 20 Marks)

11. What is the function of connecting rod in IC engine?
12. Why are mufflers used in the I.C engines?
13. Efficiency of Otto cycle is 50% and $\gamma = 1.4$, find the compression ratio?
14. Define the term "Specific Fuel Consumption".
15. What is meant by critical pressure ratio of a nozzle?
16. Compare the throttle and nozzle control governing
17. What are the advantages of multi stage compression?
18. Compare the rotary and reciprocating air compressors
19. Name four important properties of a good refrigerant
20. What are the various sources of heat gain of an air-conditioned space?

PART C (5 x 14 = 70 Marks)

21. a) (i) Explain with suitable sketches the working of battery ignition system.   (7)
       (ii) Draw and explain valve and port timing diagram of petrol engine.   (7)

(OR)

    b) (i) Explain the working principle of carburetor.   (7)
       (ii) Explain Forced lubrication system.   (7)

22. a) Derive expressions of efficiency and mean effective pressure in dual combustion cycle.

(OR)

b) The following data to a particular twin cylinder two stroke diesel engine. Bore -15 cm, stroke- 20 cm. speed- 400 rpm, Indicated mean effective pressure - 4 bar, dead weight on the brake drum - 650 N, spring balance reading - 25 N, Diameter of the brake drum 1 m .Fuel consumption 0.075 kg/min and calorific value of the fuel is 44500 kJ/ kg.

Determine

    (i) Indicated Power

    (ii) Brake Power

    (iii) Mechanical efficiency

    (iv) Indicated thermal efficiency

23. a) (i) Derive the expression for maximum discharge through convergent divergent nozzle. (7)

    (ii) Steam at a pressure of 10 bar and 0.9 dry discharge through a nozzle having throat area of 450 mm^2. If the back pressure is 1 bar. Find (i) Final velocity of steam and (ii) Cross sectional area of the nozzle at the exit for maximum discharge. (7)

(OR)

b) In a stage of impulse reaction turbine, steam enters with a speed of 250 m/sec, at an angle of 30° in the direction of blade motion. The mean speed of the blade is 150 m/sec. when the rotor is running at 3000 r.p.m. The blade height is 100 mm. The specific volume of steam at nozzle outlet and blade outlet are 3.5 m^3/kg and 4 m^3/kg respectively. The turbine develops 250 kW. Assuming the combined efficiency of nozzle and blades considered is 90% and carryover coefficient is 0.8 ; find

    (i) The enthalpy drop in each stage

    (ii) Degree of reaction

    (iii) Stage efficiency.

24. a) (i) Derive an expression for volumetric efficiency of a reciprocating compressor. (7)

    (ii) The free air delivery of a single cylinder single stage reciprocating air (7)

compressor is 2.5m^3/min. The ambient air is at STP conditions and delivery pressure is 7 bar. The clearance volume is 5% of the stroke volume and law of compression and expansion is pv$^{1.25}$=C. If L=1.2D and compressor runs at 150 rpm, determine the size of the cylinders.

(OR)

b) List the types of Rotary compressors and explain any two with neat sketches.

25. a) The atmospheric air at 30 °C dry bulb temperature and 75% relative humidity enters a cooling coil at the rate of 200 m^3/min. The coil dew point temperature is 14°C and the bypass factor of the cooling coil is 0.1. Determine (i) Temperature of air leaving the cooling coil. (ii) Capacity of cooling coil in TR (iii) Amount of water vapor removed per minute and (iv) Sensible heat factor.

(OR)

b) Explain the working ammonia – water vapour absorption system with neat sketch.

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