Register No: ……

B.E.DEGREE EXAMINATION APRIL/MAY 2011

Fourth Semester

ELECTRONICS INSTRUMENTATION ENGINEERING

U07EI405: Applied Thermodynamics

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

Answer All Questions:

PART A (10 x 1 = 10 Marks)

1. Your finger sticks to an ice tray just taken from the refrigerator. which factor has more effect on this phenomenon?

   (a) the inside temperature of the freezer, (b) the Humidity of the air

   (c) the heat capacity of both your finger and the tray (d) the thermal conductivity of the tray

2. In a parallel flow gas turbine recuperator, the maximum effectiveness is

   (a)100% (b) 75 % (c) 50% (d) between 25% and 45%

3. Free convection flow depends on all of the following except

   (a) Density (b) Coefficient of Viscosity (c) Gravitational force (d) velocity

4. With rise of temperature , the specific heat of water

   (a) increases (b) decreases (c) First decreases to minimum then increases (d) remains constant

5. A system consisting of more than one phase is called

   (a) isolated system (b) open system (c) non – uniform system (d) heterogeneous system

6. Specific heat of a gas Cp = Cv at

   (a) absolute zero (b) critical temperature (c) triple point (d) all temperatues

7. Non Quasi – static process is

   (a) free expansion of gas

   (b) Expansion of a gas in a cylinder under constant pressure

   (c) Rapid compression of a gas in a cylinder

   (d) Gradual compression of a gas in a cylinder

8. Material for water turbine should have

   (a) high creep ressistance (b) high temperature resistance

   (c) high corrosion resistance (d) low ductitlity

9. Thermal efficiency of a standard otto cycle for a compression ratio 5.5 will be

   (a) 25% (b) 50% (c) 55% (d) 100%

10. For a given set of operating pressure limits of a Rankine cycle the highest efficiency occurs for

(a) Saturated cycle (b) Super heated cycle (c) Reheat cycle (d) Regenrative cycle

PART B (10 x 2 = 20 Marks)

11. What do you mean by PMM2?
12. Explain the term "Lagging" related to boiler.
13. Define mean effective pressure as applied to gas power cycles. How it is related ti indicated power of an I.C Engine.
14. What do you mean by Brake thermal Efficiency?
15. Why diesel engines are more efficient than petrol engines?
16. Why clearance is necessary and what is its effect on the performance of reciprocating compressor?
17. What is meant by free air delivered?
18. What do you mean by Relative Humidity?
19. What do you mean by fin efficiency?
20. State Kirchoff's law of radiation.

PART C (5 x 14 = 70 Marks)

21. a) Three identical finite bodies of constant heat capacity are at temperatures 300K, 300K and 100K. If no work or heat is supplied from outside, what is the highest temperature to which any one of the bodies can be raised by the operation of heat engines or refrigerators?

(OR)

b) The air speed of a turbojet engine in flight is 270m/s. Ambient air temperature is -15®C. Gas temperaature at the outlet of nozzle is 600®C. Correspondig enthalpy values for air and gas are respectively 260KJ/kg and 912KJ/kg. Fuel – air ratio is 0.019. chemical energy of the fule is 44.5MJ/Kg. Owing to incomplete combusion 5% of the chemical energy is not released in the reaction. Heat loss from the engine is 21KJ/kg of air. Calculate the velocity of the exhaust jet.

22. a) An air standard dual cycle has a compression ratio of 16 and compression begins at 1 Bar and 50®C. The maximum pressure is 70Bar. The heat transferred to air at constant

pressure is equal to heat transferred at constant volume. Find the temperature at all points, cycle efficiency and mean effective pressure.

(OR)

b) A gas turbine unit has a pressure ratio 5 and a maximum cycle temperature 900K. The compression takes place in two stages of equal pressure ratio with inter cooling back to initial temperature of 15®C. The isentropic effienciencies of turbine and compressor are 0.86 and 0.89 respectively. Dtermine the efficiency of the unit when it is fitted with a heat exchanger of 70% effectiveness.

23. a) A Rankine cycle operates between pressures of 80bar and 0.1bar. the maximum cycle temperature is 600®C. If the steam turbine and the condensate pump efficiencies are 0.9 and 0.8 respectively, calculate the specific work and thermal efficiency.

(OR)

b) The following data were taken during the test on a boiler for a period of one hour: Steam generated = 5000Kg, Coal burnt = 700Kg, calorific value of coal = 31402KJ/kg. Quality of steam = 0.92. if the boiler pressure is 1.2Mpa and the feed water temperature is 45®C, find the boiler equivalent evaporation and the efficiency.

24. a) A single stage , single acting reciprocating air compressor has a bore of 200mm storke of 250mm and runs at 300 rpm. It receives air at 1.1 Bar and 28®C and delivers it at 9 bar. The law of compression is $PV^{1.35}=C$. detemine the power supplied to compressor and mass of air delivered per minute. Assume η = 80% and η = 85%

(OR)

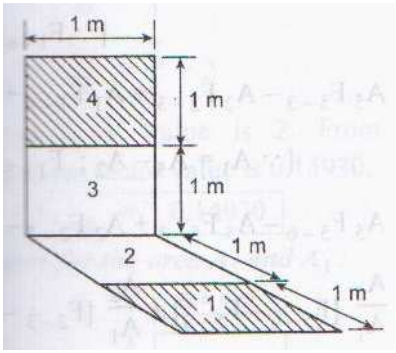
b) A vapour compression refrigeration system uses R40 and has temperature limits of -10®C and 45®C. Dry saturated refrigerant enters the compressor. Temperature after compression is 60®C. Find the COP of the system. Use the following properties :

Saturation Temperature in ®C	Enthalpy KJ/Kg		Entropy KJ/Kg – K	
	Liquid	Vapour	Liquid	Vapour
-10	45.4	460.7	0.183	1.637
45	133	483.6	0.485	1.587

25. a) Air at 20®C flows over a flat plate at 60®C with a free stream velocity of 6m/s . Detremine the value of the average convective heat transfer coefficient upto a length of 1m in the flow direction.

(OR)

b) Determine the view factor (F_{14}) for the figure shown below



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