Register Number……

B.E. DEGREE EXAMINATIONS: APRIL / MAY 2010

Fourth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U07ME406: Applied Thermodynamics

(Use of standard steam tables, refrigeration tables and heat transfer data book are permitted)

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

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. A Non flow process applied to

A. Open System B. Closed System C. An isolated system D. Both open and closed system

2. $[COP]_{HP}$ =

A. $[COP]_{Ref} - 1$ B. $[COP]_{Ref}$ C. $[COP]_{Ref} + 1$ D.1 - $[COP]_{Ref}$

3. The air standard Otto cycle consists of

A. Two Constant Volume and two Constant Pressure processes

B. Two Constant Pressure and two Adiabatic processes

C. Two Constant Volume and two Isentropic processes

D. Two Constant Pressure and two Isentropic processes

4. For a gas turbine the pressure ratio may be in the range

A. 2 to 3 B. 3 to 5 C. 16 to 18 D. 18 to 22

5. The ratio between the mass of actual dry steam to the mass of steam containing it is known as

A. Hidden heat B. Sensible heat C. Dryness fraction D. Mass fraction

6. For Parson's reaction steam turbine, degree of reaction is

A. 75% B. 50% C. 100% D. 60%

7. In a two-stage compressor efficiency will be maximum when

A. $p_2 = p1 \times p_3$ B. $p_2 = p1 - p_3$ C. $p_2 = \sqrt{p1p3}$ D. $p_2 = p1 + p_3$

8. One tonne of refrigeration is

A. 2 kW B. 3kW C. 3.54 kW D. 4 kW

9. The unit of Thermal Conductivity is

A. W/m^2K B. W/m K C. W/K D. W/m^2

10. Reynolds Number is given by

A. VD/K B. Vx/k C. VD/υ D. Vυ/X

PART B (10 x 2 = 20 Marks)

11. What do you mean by SFEE?
12. Draw the pv diagram of Carnot cycle and indicate the different processes.
13. Define Compression ratio.
14. State the applications of Gas turbines.
15. Enumerate the differences between boiler mountings and accessories.
16. State the different methods of governing of steam turbines.
17. What do you mean by intercooling?
18. Define the refrigeration.
19. State Fourier's law of conduction.
20. What do you mean by black body?

PART C (5 x 14 = 70 Marks)

21. (a) (i) A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is – 340kJ. The system completes 200 cycles per min. Complete the following table showing for each item, and compute the neat rate of work output in kW. (10)

Process	Q(kJ/min)	W(kJ/min)	ΔE(kJ/min)
1-2	0	4340	---
2-3	42000	0	---
3-4	-4200	---	-73200
4-1	---	---	---

(ii) Give the following statements of second law of thermodynamics

(1) Clausius statement (2) Kelvin-Planck statement (4)

(OR)

(b) (i) 300kJ/s of heat is supplied at a constant fixed temperature of 290°C to a heat engine. The heat rejection takes place at 8.5°C. The following results were obtained.

(1) 215 kJ/s are rejected

(2) 150 kJ/s are rejected

(3) 75 kJ/s are rejected.

Classify which of the result report a reversible cycle or irreversible cycle or impossible results. (7)

(ii) Explain briefly about "Principle of increase of entropy". (7)

22. (a) (i) Compare four stroke and two stroke engines. (7)

(ii) Draw the p-v diagram of Diesel cycle and explain the various processes. (7)

(OR)

(b) (i) Air enters the compressor of a gas turbine power plant operating on Brayton cycle at 101.325 kPa, 27°C. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume $W_T = 2.5\ W_C$, where W_T and W_C are the turbine and the compressor work respectively. Take $\gamma = 1.4$. (7)

(ii) Discuss briefly the methods employed for improvement of thermal efficiency of open cycle turbine. (7)

23. (a) (i) A vessel having a capacity of $0.05m^3$ contains a mixture of saturated water and saturated steam at a temperature of 245°C. The mass of the liquid present is 10 kg. Find the following:

(1) The pressure (2) The mass

(3) The specific volume (4) The specific enthalpy

(5) The specific entropy (6) The specific internal energy

(OR)

(b) With the help of neat sketch, explain the functions of each component and working principle of a steam power plant.

24. (a) (i) An air compressor takes in air at 1 bar and 20°C and compresses it according to the law $pv^{1.2}$ = constant. It is delivered to a receiver at a constant pressure of 10 bar. Take R= 0.287 kJ/kg K. Determine:

1. Temperature at the end of compression
2. Work done during compression per kg of air. (7)

(ii) Explain briefly the working principle centrifugal compressor with neat sketch. (7)

(OR)

(b) Describe a simple vapour compression cycle with a neat diagram and explain the processes by using p-h & T-s diagrams.

25. (a) A wall is constructed of four layers. The first layer consists of masonry brick 20cm thick of thermal conductivity 0.66W/mK, the second layer consists of 3cm mortar of thermal conductivity 0.6W/mK, the third layer consists of 8cm thick limestone of thermal conductivity 0.58W/mK and the outer layer consists of 1.2cm thick plaster of thermal conductivity 0.6W/mK. The heat transfer coefficient on the interior and exterior of the wall are 5.6W/m^2K and 11W/m^2K respectively. The interior room temperature is 22^0C and outside room temperature is -5^0C. Calculate (i) Overall heat transfer coefficient (ii) Overall thermal resistance (iii) Rate of heat transfer (iv) Temperature at the junction between the mortar and limestone

(OR)

(b) (i) Explain briefly about the following.

1. Difference between Free and Forced Convection (7)
2. Chip cooling (7)

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