Code No. 5349

FACULTY OF ENGINEERING

B.E. 2/4 (Automobile Engg.) II – Semester **(Supplementary)** Examination, January 2012

Subject : **Thermal Engineering**

Time : 3 Hours Max. Marks: 75

Note: Answer **all** questions of Part – A. Answer any **five** questions from Part-B.

PART – A (25 Marks)

1. Define quasi static process. (3)
2. Distinguish intensive property from extensive property with suitable examples. (2)
3. Define the statements of second law of thermodynamics. (3)
4. Prove that $COP_{HP} = 1 + COP_R$. (2)
5. Distinguish between nozzle and diffuser. (3)
6. Sketch Rankine cycle on T – S diagram. (2)
7. Define the following :
   (a) Ton of refrigeration (b) COP (c) Refrigeration effect (3)
8. Discuss the effects of clearance volume. (2)
9. State Newton's law of cooling. Write the S.I. units of all the terms. (3)
10. Define Wien's displacement law. (2)

PART – B (5x10=50 Marks)

11.(a) Explain the working principle of Ideal Gas thermometer (constant volume type) with a neat sketch.

(b) 90 kJ of heat is applied to system at constant volume. The system rejects 95 kJ of heat at constant pressure and 18 kJ of work is done on it. The system is brought to the original state by adiabatic process. Determine adiabatic work, the values of internal energy at all end status, if initial value is 105 kJ.

12.(a) Explain the PMM II and also discuss why such a machine cannot be constructed in practice.

(b) Prove that entropy is a point function.

13.(a) Two reversible heat engines operate in a series between two end temperatures 600° K and 300° K via an intermediate thermal reservoir. Both develop same power. Determine the temperature of the intermediate thermal energy reservoir.

(b) Sketch the T – S diagram of a Carnot cycle.

14.(a) With the help of a neat sketch explain the working princple of a regenerative Brayton cycle and also derive the equation for thermal efficiency, sketch the cycle on T – S diagram.

(b) Air is escaping through a nozzle attached to a large reservoir with an inside temperature 127°C to atmosphere at 27°C. What is the velocity of air at the exit of nozzle?

15. Compare the power required to compress 10 m^3 / min of free air from 1 bar and 20°C to 7 bar when the compression
   (a) single stage (b) two stage (c) three stage compressor

   The compression index is 1.2 and the inter cooling is perfect.

16.(a) Derive an expression for the LMTD of a counter flow heat exchanger.

(b) What is the Stefan Boltzman's law

17. Write short notes on the following :
   (a) Define free and forced convection with examples.