

## FACULTY OF ENGINEERING

B.E. 2/4 (E &amp; EE/ECE) I Semester (Main) Examination, December 2010

## ELEMENTS OF MECHANICAL ENGINEERING

Time: 3 Hours]

[Max. Marks: 75

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

## PART – A

(25 Marks)

1. Give the classification of thermodynamic systems with examples.
2. Compare two stroke and four stroke engines.
3. What is Newton's law of cooling?
4. Give the classification of heat exchangers.
5. Define C.O.P and give the units of refrigeration.
6. Explain ammonia-water absorption refrigeration system.
7. What are the different types of gas flames in gas welding?
8. What do you mean by wire drawing process?
9. What is a compound belt drive?
10. What do you mean by reverted gear-trains?

## PART – B

(5×10=50 Marks)

11. a) Define enthalpy. Compare it with internal energy. 4
- b) 30 liters of air expands from an initial pressure of 8 bar and temperature  $850^{\circ}\text{C}$  to a pressure of 1 bar and temperature  $200^{\circ}\text{C}$ . Using reference temperature  $0^{\circ}\text{C}$ , find the change in internal energy, enthalpy and index of expansion during the process. Assume  $C_p = 1.005$  and  $C_v = 0.718$  kJ/kg K. 6
12. a) State the Fouriers law of heat conduction.  
Calculate the rate of heat loss for a red brick wall of length 5 m, height 4 m and thickness 0.25 m. The temperature of the inner surface is  $110^{\circ}\text{C}$  and that of the outer surface is  $40^{\circ}\text{C}$ . The thermal conductivity of red brick,  $k = 0.70$  W/mK. Calculate also the temperature at an interior point of the wall, 20 cm distance from the inner wall. (2+4)
- b) Derive an expression for the LMTD of a parallel flow heat exchanger. 4

13. a) With the help of a block diagram, explain the working of simple vapour compression refrigeration system. Show the cycle on T-S and P-H diagrams. 7
- b) What is heating and humidification process ? Represent it on a psychrometric chart. 3
14. a) Explain the principle of arc welding ? Give the list of equipment required for electric arc welding. 4
- b) Explain the principles of the following machining processes  
 a) turning                      b) drilling                      c) shaping 6
15. a) Explain the four bar chain mechanism with suitable sketches. 5
- b) Derive an expression for the length of belt in open belt drive. 5
16. a) Draw the value timing diagram of a 4-stroke SI engine. 3
- b) A single cylinder, 4 stroke cycle I.C engine was tested and following results were obtained.
- |                                    |                          |
|------------------------------------|--------------------------|
| Mean height of indicator diagram = | 21 mm                    |
| Indicator spring number =          | 27 kN/m <sup>2</sup> /mm |
| Swept volume of cylinder =         | 14 Liters                |
| Speed of engine =                  | 396 rpm                  |
| Effective brake load =             | 77 kg                    |
| Effective brake radius =           | 700 mm                   |
| Fuel consumption =                 | 0.002 kg/sec             |
| Calorific value of fuel =          | 44000 kJ/kg              |
- Determine a) indicated power b) brake power c) mechanical efficiency  
 d) indicated thermal efficiency e) brake thermal efficiency. 7
17. Write short notes on **any four** of the following : 10
- Clausius inequality
  - Critical radius of insulation
  - Thermoelectric refrigeration
  - Forming process
  - Condition for maximum power transmission of flat belt drive.