| BME-052 |

DIPLOMA IN MECHANICAL ENGINEERING (DME) / ADVANCED LEVEL CERTIFICATE COURSE IN MECHANICAL ENGINEERING (DMEVI / ACMEVI)

Term-End Examination

June, 2018

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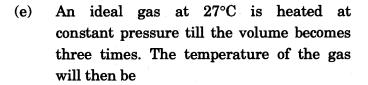## BME-052 : BASICS OF THERMAL ENGINEERING

Time : 2 hours *Maximum Marks : 70*

Note : All questions carry equal marks. Use of scientific calculator is permitted. Use of Steam tables and Mollier diagram is permitted. All questions are compulsory.

1. Choose the correct answer from the given *four* alternatives. *7×2=14*

   (a) Zeroth law of thermodynamics states that
      (i) two thermodynamic systems are always in thermal equilibrium with each other.
      (ii) if two systems are in thermal equilibrium, then the third system will also be in thermal equilibrium.
      (iii) two systems not in thermal equilibrium with a third system are also not in thermal equilibrium with each other.
      (iv) when two systems are in thermal equilibrium with a third system, they are in thermal equilibrium with each other.

(b) The draught produced by a chimney of given height at given outside temperature

   (i) decreases if the chimney gas temperature increases

   (ii) increases if the chimney gas temperature increases

   (iii) remains same irrespective of chimney gas temperature

   (iv) may increase or decrease

(c) In a shell and tube surface condenser

   (i) steam and cooling water mix to give the condensate

   (ii) cooling water passes through the tubes and steam surrounds them

   (iii) steam passes through the cooling tubes and cooling water surrounds them

   (iv) all of the above, varying with the situation

(d) In a regenerative surface condenser

   (i) there is one pump to remove air and condensate

   (ii) there are two pumps to remove air and condensate

   (iii) there are three pumps to remove air, vapour and condensate

   (iv) there is no pump, the condensate gets removed by gravity

(e) An ideal gas at 27°C is heated at constant pressure till the volume becomes three times. The temperature of the gas will then be

   (i)   81°C

   (ii) 900°C

   (iii) 627°C

   (iv) 927°C

(f) The work done by a closed system will increase when the value of the polytropic index n

   (i)   increases

   (ii) decreases

   (iii) first decreases and then decreases

   (iv) first increases and then decreases

(g) The work done by an ideal gas undergoing polytropic expansion from state 1 to state 2 is

   (i) $\dfrac{n(p_1v_1 - p_2v_2)}{n-1}$

   (ii) $\dfrac{p_2v_2 - p_1v_1}{n-1}$

   (iii) $\dfrac{p_1v_1 - p_2v_2}{n-1}$

   (iv) $\dfrac{p_1v_1 - p_2v_2}{\gamma-1}$

2. Answer any *two* of the following :   *2×7=14*

  (a)   What is meant by thermodynamic equilibrium ? Explain thermodynamic properties.

  (b)   In a cyclic process, heat transfers are + 14·7 kJ, − 25·2 kJ, − 3·56 kJ, and + 31·5 kJ. What is the net work for this cyclic process ?

  (c)   Explain the Clausius' statement of the second law of thermodynamics.

3. Answer any *two* of the following :   *2×7=14*

  (a)   Discuss "Triple point of water", and show it on P − T diagram.

  (b)   Define the following terms :
     (i)   Latent heat of vaporisation, and
     (ii)   Dryness fraction of steam

  (c)   State how the boilers are classified. Sketch and describe a Cochran boiler.

4. Answer any *two* of the following :   *2×7=14*

  (a)   Explain why the Rankine cycle rather than Carnot cycle is used as a standard of reference for the performance of steam plants.

  (b)   What are the advantages of reheat cycle over Rankine cycle ?

  (c)   What do you mean by a steam condenser ? Explain its function.

5. Answer any *two* of the following :   *2×7=14*

    (a)   Differentiate between thermal conductivity and thermal diffusivity.

    (b)   What do you understand by the terms, "convective heat transfer coefficient" and "overall heat transfer coefficient" ?

    (c)   Describe the basic photovoltaic cell (solar cell). Sketch and explain its working.

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