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BIME-023

DIPLOMA – VIEP– MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

00672

December, 2017

BIME-023 : ENGINEERING THERMODYNAMICS

Time : 2 hours *Maximum Marks : 70*

Note : *All questions are* ***compulsory****. Use of steam table is permitted. Use of calculator is permitted.*

1. Choose the correct answer. *7×2=14*

(a) A definite area or space where some thermodynamic process takes place is known as

(i) Thermodynamic system

(ii) Thermodynamic cycle

(iii) Thermodynamic process

(iv) None of these

(b) With the increase in pressure

(i) Enthalpy of evaporation increases

(ii) Enthalpy of evaporation decreases

(iii) There is no effect on the enthalpy of evaporation

(iv) None of the above

(c) Which of the following is ***not*** a property of the system ?

(i) Internal energy

(ii) Entropy

(iii) Enthalpy

(iv) Heat

(d) For a reversible adiabatic process, the change in entropy is

(i) Zero

(ii) Unity

(iii) Infinity

(iv) None of these

(e) The property of a working substance which increases or decreases as the heat is supplied or removed in a reversible manner is known as

(i) Internal energy

(ii) Enthalpy

(iii) Entropy

(iv) Work done

(f) The Helmholtz function is expressed as

(i) $(u - Ts)$

(ii) $(h - Ts)$

(iii) $(u + pV)$

(iv) $(u + Vdp)$

(g) Rankine cycle efficiency of a good steam power plant may be in the range of

(i) 15 to 20%

(ii) 35 to 45%

(iii) 70 to 80%

(iv) 90 to 95%

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

(a) Define thermodynamic equilibrium of a system and state its importance. What are the conditions required for a system to be in thermodynamic equilibrium ? Describe in brief.

(b) An engine cylinder has a piston area 0·12 m^2 and contains gas at a pressure of 11·5 bar. The gas expands according to a process which is isothermal. The final pressure is 1·5 bar. Calculate the work done by the gas on the piston if the stroke is 0·30 m.

(c) A steam turbine operating under steady flow conditions receives 3600 kg of steam per hour. The steam enters the turbine at a velocity of 80 m/s, an elevation of 10 m and specific enthalpy of 3276 kJ/kg. It leaves the turbine at a velocity of 150 m/s, an elevation of 3 m and a specific enthalpy of 2465 kJ/kg. Heat losses are 3600 kJ/hour. Estimate power output of the turbine.

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

(a) Show that the efficiency of a reversible engine operating between two given constant temperatures is the maximum.

(b) Establish the inequality of Clausius.

(c) A reversed Carnot engine is used for heating a building. It supplies 210000 kJ/hour to the building at 20°C. The outside air is at – 5°C. Find the heat taken from the outside air per hour and the power input.

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

(a) Describe the process of formation of steam and give its graphical representation also.

(b) Determine the amount of heat, which would be supplied to 1 kg of steam at 25°C to convert it into steam at 5 bar and 0·9 dry.

(c) 3 kg of an ideal gas is compressed adiabatically from pressure 100 kPa and temperature 25°C to a final pressure of 600 kPa. Find the work done, heat transfer and change in internal energy.

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

(a) Discuss the effect of superheat and inlet pressure on the performance of Rankine cycle with the help of a T-s diagram.

(b) Discuss the Rankine cycle with the help of p-V, T-s and h-s diagrams and also derive the expression for its efficiency.

(c) In a steam power plant, steam supplied to the turbine at 20 bar, 360°C is expanded to 0·08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Determine the cycle efficiency.