C09–M–305

3249

BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2013

DME—THIRD SEMESTER EXAMINATION

THERMAL ENGINEERING—I

Time : 3 hours] [*Total Marks* : 80

PART—A

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Give the classification of thermodynamic system. Explain briefly any one of the thermodynamic systems.

2. Derive the relation between the specific heats and gas constant.

3. 0·05 m^3 of air at 1·2 bar is compressed isothermally to a volume of 0·016 m^3. Determine the work done for compression.

4. Derive the expression for entropy for constant pressure process.

5. Define lower calorific value and higher calorific value.

6. What are the various chemicals used in pipettes for absorbing CO_2, O_2 and CO in ORSAT apparatus?

7. An engine working between two temperature limits of 25 °C and 520 °C on Carnot cycle is supplied with 90 kJ of heat per cycle. What is the work done during the cycle?

8. Define dryness fraction of steam and write the formula.

9. Determine the specific enthalpy of wet steam with dryness fraction 0·9 and a pressure of 10 bar.

10. Define coefficient of performance of refrigerator and write the formula.

PART—B

Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. *(a)* State the Clausius statement of 2nd Law of thermodynamics.

(b) 0·2 kg of gas is subjected to change of temperature from 20 °C to 150 °C at constant pressure. Find the heat transfer, change of internal energy and change of enthalpy, if the specific heat at constant pressure is 1·0 kJ/kg-K and the adiabatic index is 1·4.

12. *(a)* 0·24 kg of a gas at a pressure of 100 kPa and a temperature of 25 °C occupies a volume of 0·23 m^3. Calculate the value of gas constant.

(b) A gas engine working on Otto cycle has swept volume of 0 008 m^3 and clearance volume of 0 002 m^3. Find the air standard efficiency if the adiabatic ratio is 1·4.

13. 1·5 kg of air at 8 bar and 35 °C expands adiabatically to a pressure of 2 bar. Determine the *(a)* final volume, *(b)* final temperature, *(c)* work transferred, *(d)* change in internal energy and *(e)* change in enthalpy. For air C_p 1 005 kJ/kg-K and R 0 287 kJ/kg-K.

14. 3 kg of perfect gas is compressed according to law $PV^{1\,1}$ constant and temperature is raised from 16 °C to 150 °C during the compression. Evaluate the change of entropy. Assume R 0 287 kJ/kg-K, C_p 1 005 kJ/kg-K.

15. Explain the working and construction of bomb calorimeter to find HCV with a neat diagram.

16. A Diesel engine has a compression ratio 14 to 1, and the heat supply is cut off at 0·06 stroke. Find the air standard efficiency of the cycle. Assume adiabatic ratio as 1·4.

17. One kg of steam having a pressure of 8·0 bar and dryness fraction 0·85 is expanded to a pressure of 0·34 bar. If the expansion is hyperbolic, determine the quantity of heat which passes through the cylinder walls into the steam.

18. Derive the expression for COP for Bell-Coleman cycle used in air refrigeration system.

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