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Fifth Semester B.E. Degree Examination, Dec.2015/Jan.2016

Basic Thermodynamics

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. What is thermodynamics? Mention the scope and applications of thermodynamics. (08 Marks)
- b. Differentiate between
 - i) Macroscopic and Microscopic thermodynamics ii) System and Control Volume (08 Marks)
- c. Find the force in kN, acting on a body of mass 120Kg moving with an acceleration of 10m/s^2 . (04 Marks)
- 2 a. Explain about the similarities between heat and work. (04 Marks)
- b. A cylinder contains 1Kg of fluid at an initial pressure of 20bar. The fluid is allowed to expand reversibly behind a piston until the volume is doubled. The fluid is then cooled reversibly at constant pressure until the piston regains its original position, heat is then supplied reversibly with the piston firmly locked in this position until the pressure rises to the original value of 20 bar. Calculate the net work done by the fluid for an initial volume of 0.05m^3 . (10 Marks)
- c. With examples explain about the work done at the boundary of a system. (06 Marks)
- 3 a. Explain Joules experiment. Derive an expression for mechanical equivalent of heat. (07 Marks)
- b. Prove that energy is a property of a system. (06 Marks)
- c. Derive an expression for first law of thermodynamics to control volume. (07 Marks)
- 4 a. In a steam power plant, the work output of the turbine is 100kJ while heat supplied at the boiler is 300kJ. Given that, during the same period, work input to the pump is 0.5kJ. Find the heat rejected at the condenser and the thermal efficiency of the plant. (05 Marks)
- b. What are heat engines? Write a note on Direct, and Reversed heat engines. (05 Marks)
- c. Brief about Kelvin-Planck and Clausius statements of second law of thermodynamics. Explain about the equivalence of the statement. (10 Marks)

PART – B

- 5 a. State and prove Clausius inequality and its application to a reversible cycle. (08 Marks)
- b. 5Kg of ice at -10°C is mixed with 20Kg water at 80°C in an insulated vessel. i) What is the temperature of the mixture when equilibrium is established between ice and water? Find the change in entropy during this process for ii) Ice, iii) Water and iv) The universe. Assume specific heat of ice = 2.1 kJ/Kg K and latent heat is 330 kJ/Kg . (12 Marks)
- 6 a. With the help of P – V diagram explain about the triple point and critical point of water system. (10 Marks)
- b. A rigid vessel contains 1.5Kg wet steam at a certain pressure. If 8% of this mass is liquid find the dryness fraction of the mixture. (05 Marks)
- c. A boiler is generating steam at a pressure of 10bars. The quality of steam is 0.85. Find the ratio of the mass of saturated liquid to saturated steam in the steam supplied by the boiler. (05 Marks)
- 7 a. Write a short note on Maxwell relations and Clausius Claypeyron's equation. (06 Marks)
- b. Discuss about universal and particular gas constants. (04 Marks)
- c. Explain briefly about i) Reversible constant pressure process and ii) Reversible hyperbolic process. (10 Marks)
- 8 a. State and derive i) Dalton's law of additive pressures, and ii) Amagat's law of additive volumes. (10 Marks)
- b. Explain briefly about the following properties of gaseous mixture i) Apparent molar mass and gas constant ii) Specific properties. (10 Marks)

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