Code No: 53017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, May/June - 2015
THERMODYNAMICS
(Common to ME, AE, AME)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1. A gas undergoes two processes that are in series. The first process is an expansion that is carried out according to the law PV = constant and the second process is a Constant pressure process that returns the gas to the initial volume of the first process. The start of the first process is at 400 k Pa and 0.025 m^3 with the expansion to 200 k Pa. Sketch the process on a P-V diagram, and determine the work of the combined process. [15]

2.a) State the conditions for a process to be reversible.
b) A mass of gas is compressed in a quasi-static process form 75 kPa, 0.1 m^3 to 0.45 Mpa, 0.03m^3. Assuming that the pressure and volume are related by $pv^n = c$, find net work done by gas system. [7+8]

3.a) State the Kelvin-Plank and Clausius statements of the second law of thermodynamics and establish equivalence between them.
b) Determine the power required to run a refrigerator that transfers 2000 kJ/min of heat from a cooled space at 0^0C to the surrounding atmosphere at 27^0C. The refrigerator operates on reversed Carnot cycle. [7+8]

4.a) Describe the process of formation of steam and give its graphical representation
b) Steam enters an engine at a pressure 10 bar absolute and 2500C. It is exhausted at 0.2 bar. The steam at exhaust is 0.9 dry. Find:
i) Drop in enthalpy
ii) Change in enthalpy. [7+8]

5.a) Write down the Vander Waals equation of state. How does it differ from the ideal gas equation of state?
b) A gas occupies 0.034 m3 at 600 k Pa and 85°C. It is expanded in the non-flow process according to the law $pv^{1.2} = c$ to a pressure of 60 k Pa after which it is heated at constant pressure back to its original temperature. Sketch the process on the p-v and T-s diagrams, and calculate for the whole process the work done, the heat transferred. Take C_p = 1.047 and C_v = 0.775 kJ/kg-K for the gas. [6+9]

6. A mixture of ideal gases consists of 3 kg of Nitrogen and 5 kg of carbon dioxide at a pressure of 4 bar and temperature of 25^0C. Find:
a) Mole fraction of each constituent
b) Equivalent molecular weight of the mixture
c) Equivalent gas constant of the mixture
d) Partial pressure and partial volumes
e) Volume and density of the mixture
f) C_p and C_v of the mixture. [15]

7.a) Draw p-v and T-s plots of Ericcson cycle and explain various processes constituting the cycle.

b) Derive the expressions for efficiency and mean effective pressure of Ericcson cycle. [7+8]

8. Explain ideal vapour compression refrigeration cycle with neat sketches of lay out, T-s and p-h diagrams and derive the expression for COP. [15]

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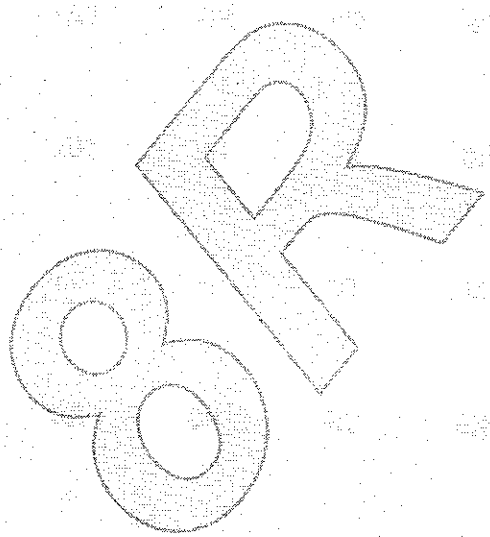

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