

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), November 2018

B. Tech in Mechanical Engineering, Semester III

Roll No.....

COURSE CODE: ME 301

Time: 3 hours

Max. Marks:80

COURSE TITLE : Engineering Thermodynamics

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Assume suitable data wherever required and mention it clearly.
 3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
 4. Use of steam table is permitted.
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Q.1 Objective type multiple choice questions

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- i. Properties are:
 - a. Path function
 - b. State function
 - c. State and path function
 - d. None of the above
- ii. Heat transfer is:
 - a. Path function
 - b. State function
 - c. State and path function
 - d. All of the above
- iii. Macroscopic approach studies thermodynamic behavior of the system :
 - a. Molecular level
 - b. Outer boundary level
 - c. Center of the system
 - d. All of the above
- iv. The constants of Vander Waal's equation of state are calculated using:
 - a. Pressure and volume of the gas
 - b. Temperature and volume of the gas
 - c. Pressure, temperature and volume of the gas
 - d. None of the above
- v. Internal energy can be measured by
 - a. Thermometer
 - b. Pressure gauge
 - c. All of the above
 - d. None of the above

- vi Zeroth law of Thermodynamics is law of:
 - a. Equilibrium
 - b. Non equilibrium
 - c. Reaction
 - d. Reaction and equilibrium
- vii Unit of Universal gas constant is:
 - a. kJ/kg
 - b. kJ/kg - K
 - c. kJ/K
 - d. None of the above
- viii Can the enthalpy of pure substance at any state be determined by using:
 - a. Internal Energy and Pressure
 - b. Internal Energy and Temperature
 - c. Internal Energy, Pressure and Volume
 - d. None of the above
- ix Work is :
 - a. Low grade energy
 - b. High grade energy
 - c. Not an Energy
 - d. None of the above
- x Quality of steam has significance in:
 - a. Subcooled region
 - b. Super heat region
 - c. Saturated region
 - d. None of the above

Q.2 10

- a. Most of the energy generated in the engine of a car is rejected to the air by the radiator through the circulating water. Should the radiator be analyzed as a closed system? Explain.
- b. A person is cooking vegetable soup for his family in a pan which is:
 - a. Uncovered
 - b. Covered with a light lid
 - c. Covered with heavy lid
 For which case the cooking time will be highest and why ?

Q.3 10

- a. Cyclic relation
- b. Reciprocating relation at constant P

- Q.4 A 0.1 m³ tank contains steam initially at 500 kPa and 200°C. The steam is now allowed to cool until its temperature drops to 50°C. Determine the amount of heat transfer during the process and final temperature of the tank. 10

OR

- Q.4 A piston cylinder device contains 25 gm of saturated water which is maintained at a constant pressure of 300 kPa. A resistance heater within the cylinder is turned on and passes a current of 0.2 A for 5 minutes from 10 V source. At the same time, a heat loss of 3.7 kJ occurs. 10
- Show that for a closed system the boundary work W and the change in internal energy U in first law relation can be combined in to one term H , for a constant temperature process.

- Q.5 a. A Carnot engine is operating with steam receives 500 kJ heat per cycle from a high temperature source of 600°C and rejects heat to a low temperature sink at 30°. Determine: 20
- a. Thermal efficiency of Carnot engine
 - b. Amount of heat rejected per cycle
- What happens if we use air in place of steam? Calculate using air as working fluid
- a. Thermal efficiency
 - b. Heat rejected to the sink

OR

- Q.5 a. Calculate the enthalpy of vaporization of steam at 150°C using Clapeyron equation. 20
- b. Estimate the saturation pressure of water at 50°C
- Q.6 Steam flows steadily through an adiabatic turbine. The inlet conditions of the steam are 10 MPa, 450°C and 80 m/s and the exit conditions are 10 kPa, 92% quality and 50 m/s. The mass flow rate of steam is 12 kg/s. Determine: 20
- a. The change in Kinetic energy
 - b. The power output
 - c. The turbine inlet area.