## **GUJARAT TECHNOLOGICAL UNIVERSITY** BE - SEMESTER-III • EXAMINATION – WINTER 2013

| Subject Code: 132603 Date: 30-11-2013 |   |   |      |
|---------------------------------------|---|---|------|
| Subje<br>Time<br>Instru               | ect Nai<br>e: 02.30<br>ctions:              | me: Thermodynamics of Elastomers & Polymers<br>) pm - 05.00 pm Total Marks: 70  |      |
| instru                                | 1. Att<br>2. Ma<br>3. Fig                   | tempt all questions.<br>The suitable assumptions wherever necessary.<br>gures to the right indicate full marks.   |      |
| Q. 1                                  | Answer the following.                       |   | (14) |
|                                       | (i)<br>(ii)<br>(iii)<br>(iv)<br>(v)<br>(vi) | Define the terms (1) Heat capacity (2) Heat of Reaction.<br>Give difference between state function and path function.<br>Explain the term flame temperature.<br>Give difference between petrol and diesel.<br>Write any two applications of thermodynamics in Rubber Industry.<br>Define the term 'Thermodynamics'. |      |
| 0.2                                   | (vii)                                       | Write any two characteristics of thermodynamic equilibrium.   | (07) |
| Q. 2                                  | (a)   | Derive the expression of CARNOT S THEOREM.  | (07) |
| Q. 2                                  | <b>(b)</b>                                  | State the first law of thermodynamics and give limitations of it.<br>OR   | (07) |
|                                       | <b>(b)</b>                                  | Derive the expression of Maxwell's Thermodynamic Relation.(any three)   | (07) |
| Q. 3                                  | <b>(a)</b>                                  | Derive the expression for Helmholtz function A.   | (07) |
|                                       | <b>(b</b> )                                 | 1 mole of an ideal gas expands isothermally and reversibly from $5 \text{dm}^3$ to $10 \text{dm}^3$ at 300 K. Calculate q, w, $\Delta U$ , $\Delta H$ , $\Delta G$ and $\Delta A$ .   | (07) |
| Q. 3                                  | <b>(a)</b>                                  | Derive the relationship between Cp and Cv for ideal gas.  | (07) |
|                                       | <b>(b)</b>                                  | 1 mole of an ideal gas ( $Cv = 12.471 J K^{-1} mol^{-1}$ ) is heated from 300 K to 600 K. Calculate entropy change when the: (i) volume is kept constant, and (ii) pressure is kept constant.   | (07) |
| Q. 4                                  | <b>(a)</b>                                  | Explain in brief about the concept of ceiling temperature.  | (07) |
|                                       | <b>(b)</b>                                  | Define the term "phase rule" and. Explain in brief about the terms phase and component.   | (07) |
| 04                                    | (9)   | <b>OR</b><br>Write a detailed note on Estimation of heat of polymerization  | (07) |
| ч <b>т</b>                            | ( <b>a</b> )<br>( <b>b</b> )                | Write down the merits and demerits of phase rule  | (07) |
|                                       | (0)   | P.T.O   | (07) |
| Q. 5                                  | <b>(a)</b>                                  | Write down the construction and working principle of bomb calorimeter with diagram.   | (07) |
|                                       | (b)   | Calculate the gross and net calorific value of coal having the following<br>compositions:-<br>Carbon-75%<br>Hydrogen- 15%<br>Sulphur- 2%<br>Nitrogen- 2%  | (07) |

Ash- 6% Latent heat of steam=587cal/g.

## OR

- Q.5 (a) Write down the construction and working principle of Junker's gas calorimeter (07) with diagram.
  - (b) On burning 0.83gm of a solid fuel in a bomb calorimeter, the temperature of (07) 3500gm of water increased from 26.5°C to 29.2°C.water equivalent of calorimeter and latent heat of steam are 385g and 587cal/g respectively. if the fuel contains 0.7% hydrogen ,calculate its gross and net calorific value.