Enrolment No./Seat No_____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2024**

**Subject Code:3132604 Date:29-11-2024**

**Subject Name: Rubber Physics & its thermodynamics**

**Time:10:30 AM TO 01:00 PM Total Marks:70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | **MARKS** |
|---|---|---|---|
| **Q.1** | **(a)** | State Zero and First law of Thermodynamics. | **03** |
| | **(b)** | Derive the formula for work done (W) in reversible isothermal process involving ideal gas. | **04** |
| | **(c)** | Describe in detail "Entropy". Relate entropy with disorder, unavailable energy and probability. | **07** |
| **Q.2** | **(a)** | Derive the Expression for relation between pressure –volume and work. | **03** |
| | **(b)** | The free energy change ($\Delta G$) accompanying a given process is -85.77 kj at $25^0$c and -83.68 at $35^0$c. Calculate the change in enthalpy ($\Delta H$) for the process at $30^0$c. | **04** |
| | **(c)** | Define the following terms: State of system, State and Path functions, and Isochoric, Isobaric and Isentropic process. | **07** |
| | | **OR** | |
| | **(c)** | Prove that: $PV\gamma$ = constant for adiabatic process. | **07** |
| **Q.3** | **(a)** | Explain the effect of cross linking on solubility. | **03** |
| | **(b)** | Give difference between Extensive properties & Intensive Properties. | **04** |
| | **(c)** | Short note on Thermodynamic investigation of polymer-polymer systems for three component systems. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain in brief about the concept of ceiling temperature. | **03** |
| | **(b)** | Write the difference between homogeneous process & Heterogeneous process. | **04** |
| | **(c)** | Explain in detail about enthalpy of mixing of two polymers & free energy of mixing of polymers for binary polymer-polymer systems. | **07** |
| **Q.4** | **(a)** | With suitable example, explain the concept of functionality. | **03** |
| | **(b)** | Explain the termination stage associated with free-radical polymerization. | **04** |
| | **(c)** | Discuss mechanism of emulsion polymerization technique. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Write in brief on 'bulk modulus' | **03** |
| | **(b)** | Explain the types of molecular motion observed in rubber. | **04** |
| | **(c)** | Discuss the characteristic properties of rubber. | **07** |
| **Q.5** | **(a)** | Write in brief on Poisson's ratio. | **03** |
| | **(b)** | Explain the theory of shape factor. | **04** |
| | **(c)** | Discuss the conditions which are necessary for rubber like elasticity in polymer. | **07** |
| | | **OR** | |
| **Q.5** | **(a)** | Explain the term refractive index with respect to polymer. | **03** |
| | **(b)** | Summarize the laws of friction with respect to rubber. | **04** |
| | **(c)** | Discuss the characteristic features of sinusoidal vibrations. | **07** |

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