# Model Question Paper-1/2 with effect from 2022-23 (CBCS Scheme)

USN | | | | | | | | | | |

## Fourth Semester B.E. Degree Examination

## Biochemical Thermodynamics

**TIME: 03 Hours** **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02.
03.

| | | Module -1 | *Bloom's Taxonomy Level | Marks |
|---|---|---|---|---|
| Q. 01 | a | Define First law , Zeroth law , Second law of Thermodynamics. . | L1 | 10 |
| | b | Explain with suitable examples : i) Intensive and Extensive property ii) Closed and Open system iii) Reversible and Irreversible processes iv) Heat engine and Heat pump | L2 | 10 |
| | | | | |
| | | OR | | |
| Q. 02 | a | Derive First law of Thermodynamics for Flow process. | L2 | 10 |
| | b | Explain P – V diagram of Carnot cycle and explain Carnot principle. | L2 | 10 |
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| | | **Module-2** | | |
| Q. 03 | a | Explain PVT behaviour or pure fluids. | L2 | 10 |
| | b | Derive the equation to calculate the workdone in an adiabatic process from fundamental | L3 | 10 |
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| | | OR | | |
| Q. 04 | a | Explain any 2 equations of state for real gases | L2 | 10 |
| | b | Using Hess's law, calculate the heat of formation of methane gas from the following heat of combustion data.<br>i) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(\ell)$ ; $\Delta H^0_{298} = -890.94$ kJ<br>ii) $C(s) + O_2(g) \rightarrow CO_2(g)$ ; $\Delta H^0_{298} = -393.78$kJ.<br>$H_2(g) + ½\ O_2(g) \rightarrow H_2O(\ell)$ ; $\Delta H^0_{298} = -286.03$ kJ. | L3 | 10 |
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| | | **Module-3** | | |
| Q. 05 | a | Differentiate between Reference properties , Energy properties and Derived properties. | L2 | 10 |
| | b | | L3 | 10 |

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| | | Prove that Cp – Cv = R | | |
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| | | OR | | |
| Q. 06 | a | . Define Fugacity and Fugacity co-efficient. Give the expression for effect of temperature and pressure on fugacity. | L1 | 10 |
| | b | Derive an expression for the fugacity co-efficient of a gas obeying the equation of state P(V-b) = RT and estimate the fugacity of ammonia at 10 bar and 298 K , given that b = $3.707 \times 10^{-5}$ $m^3$/mol. | L3 | 10 |
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| | | **Module-4** | | |
| Q. 07 | a | Derive Gibb's Duhem equation | L3 | 10 |
| | b | Define Chemical potential. Explain the effect of temperature and pressure on chemical potential. | L1 | 10 |
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| | | OR | | |
| Q. 08 | a | Explain : i) Lewis Randall rule ii) Raoult's law iii) Henry's law iv) Azeotropes | L2 | 10 |
| | b | Explain Consistency test for VLE data using slope of $\ell_n$ v curves. | | 10 |
| | | | | |
| | | **Module-5** | | |
| Q. 09 | a | Discuss Heterogeneou reaction equilibrium for i) Reaction in solution ii) Equilibrium involving pure solids and liquids. | L2 | 10 |
| | b | Explain Le Chatelier's principle. | | 10 |
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| | | OR | | |
| Q. 10 | a | A gas mixture containing 3 mol $CO_2$ , 5 mol $H_2$ and 1 mol $H_2O$ is undergoing the following reactions. $CO_2 + 3H_2 \rightarrow CH_3OH + H_2O$ $CO_2 + H_2 \rightarrow CO + H_2O$ Develop expressions for the mole fractions of the species in terms of the extent of reaction | L3 | 10 |
| | b | Show that $\Delta g^0 = - RT \ell n K$. | L3 | 10 |
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*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.