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G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.



## UG DEGREE END SEMESTER EXAMINATIONS - NOVEMBER 2025.

(For those admitted in June 2021 and later)

## PROGRAMME AND BRANCH: B.Sc., CHEMISTRY

| SEM | CATEGORY | COMPONENT | COURSE CODE | COURSE TITLE          |
|-----|----------|-----------|-------------|-----------------------|
| IV  | PART-III | CORE      | U21CH407    | PHYSICAL CHEMISTRY-II |

Date &amp; Session: 07.11.2025/AN

Time: 3 hours

Maximum: 75 Marks

| Course Outcome | Bloom's K-level | Q. No. | <b>SECTION – A (10 X 1 = 10 Marks)</b><br><b>Answer ALL Questions.</b>                                                                                                                                               |
|----------------|-----------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1            | K1              | 1.     | Which one of the following is an extensive property?<br>a) mass                      b) viscosity                      c) refractive index                      d) heat capacity                                     |
| CO1            | K2              | 2.     | The inversion temperature $T_i =$<br>a) $3a/Rb$ b) $2a/Rb$ c) $4a/3b$ d) $2a/\pi b$                                                                                                                                  |
| CO2            | K1              | 3.     | HS H <sup>o</sup> 21.Tb is known as _____.<br>a) Entrophy rule                      b) Trouton's rule<br>c) both a and b                      d) state function                                                      |
| CO2            | K2              | 4.     | In an isothermal process _____ is constant.<br>a) T                      b) V                      c) P                      d) both b and c                                                                         |
| CO3            | K1              | 5.     | According to law of mass action, the rate of a chemical reaction is proportional to _____.<br>a) active reagent    b) active mass    c) concentration                      d) pressure                               |
| CO3            | K2              | 6.     | In heterogeneous equilibrium the reactants and products are in<br>a) same phase    b) liquid phase    c) solid phase                      d) different phase                                                         |
| CO4            | K1              | 7.     | The amount of NaOH used for the preparation of 1 litre of 0.1N solution is _____.<br>a) 40g                      b) 20g                      c) 4g                      d) 2g                                        |
| CO4            | K2              | 8.     | Nicotine in water system has _____.<br>a) upper CST                      b) lower CST    c) both a and b                      d) distillation                                                                        |
| CO5            | K1              | 9.     | Which one of the following is a strong electrolyte _____.<br>a) NaCl                      b) NH <sub>4</sub> OH                      c) CH <sub>3</sub> COOH                      d) Na <sub>2</sub> CO <sub>3</sub> |
| CO5            | K2              | 10.    | The pH of pure water is _____.<br>a) 7.8                      b) 7.0                      c) 14                      d) 13                                                                                           |
| Course Outcome | Bloom's K-level | Q. No. | <b>SECTION – B (5 X 5 = 25 Marks)</b><br><b>Answer ALL Questions choosing either (a) or (b)</b>                                                                                                                      |
| CO1            | K3              | 11a.   | Illustrate intensive and extensive properties with examples.                                                                                                                                                         |
|                |                 |        | (OR)                                                                                                                                                                                                                 |
| CO1            | K3              | 11b.   | Interpret the relation between $C_p$ and $C_v$ .                                                                                                                                                                     |

|     |    |      |                                                                                                                                 |
|-----|----|------|---------------------------------------------------------------------------------------------------------------------------------|
| CO2 | K3 | 12a. | Interpret the physical significance of entropy in terms of molecular disorder and energy dispersal.<br><b>(OR)</b>              |
| CO2 | K3 | 12b. | Define entropy. Explain why entropy is considered a state function.                                                             |
| CO3 | K4 | 13a. | Analyze the key differences between reversible and irreversible reactions.<br><b>(OR)</b>                                       |
| CO3 | K4 | 13b. | Compare homogeneous and heterogeneous equilibria using the law of mass action.                                                  |
| CO4 | K4 | 14a. | Distinguish between ideal and non-ideal solutions using Raoult's law.<br><b>(OR)</b>                                            |
| CO4 | K4 | 14b. | Differentiate between nematic, smectic, and cholesteric liquid crystals based on molecular arrangement and physical properties. |
| CO5 | K5 | 15a. | Critically assess the use of Kohlrausch's law in calculating the equivalent conductance of weak electrolytes.<br><b>(OR)</b>    |
| CO5 | K5 | 15b. | Evaluate the limitations of Debye-Hückel-Onsager theory.                                                                        |

| Course Outcome | Bloom's K-level | Q. No. | <b>SECTION – C (5 X 8 = 40 Marks)</b><br><b>Answer <u>ALL</u> Questions choosing either (a) or (b)</b>                 |
|----------------|-----------------|--------|------------------------------------------------------------------------------------------------------------------------|
| CO1            | K3              | 16a.   | State the first law of thermodynamics and apply it to derive the expression for internal energy change.<br><b>(OR)</b> |
| CO1            | K3              | 16b.   | Derive the expression for the Joule-Thomson coefficient in terms of thermodynamic properties.                          |
| CO2            | K4              | 17a.   | Differentiate between spontaneous and non-spontaneous processes.<br><b>(OR)</b>                                        |
| CO2            | K4              | 17b.   | For an ideal gas, analyze how entropy changes with temperature and volume.                                             |
| CO3            | K4              | 18a.   | Using Le-Chatelier's principle, analyze the effect of increasing pressure on a gaseous equilibrium.<br><b>(OR)</b>     |
| CO3            | K4              | 18b.   | Compare the application of Le-Chatelier's principle to homogeneous and heterogeneous equilibria.                       |
| CO4            | K5              | 19a.   | Evaluate how temperature control can influence solubility and phase separation in lower CST systems.<br><b>(OR)</b>    |
| CO4            | K5              | 19b.   | Critically evaluate Raoult's law's assumptions in concentrated or non-ideal solutions?                                 |
| CO5            | K5              | 20a.   | Evaluate the relationship between ionic mobility and viscosity of the solvent using Walden's rule.<br><b>(OR)</b>      |
| CO5            | K5              | 20b.   | Evaluate the relative merits and limitations of Hittorf's method.                                                      |