

U.G. 3rd Semester Examination - 2021

CHEMISTRY

[PROGRAMME]

Skill Enhancement Course (SEC)

Course Code : CHEM-G-SEC-T-1(A)&(B)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer all the questions from selected Option.

OPTION-A

CHEM-G-SEC-T-1

1. Answer any **five** questions: 2×5=10
- Write briefly on sampling.
 - What do you mean by chelation and chelating agents? Cite suitable examples.
 - What do you mean by masking? Illustrate with example.
 - Distinguish between redox and complexometric indicators with suitable examples.

- What do you mean by masking and demasking?
- Define BOD.
- Calculate the silver ion concentration during the titration of 50 ml of 0.05M NaCl with 0.1 M AgNO₃ after the addition of reagent at equivalence point (25 ml). For AgCl, $K_{sp} = 1.82 \times 10^{10}$.

2. Answer any **two** questions: 5×2=10
- What are cation and anion exchangers? Highlight a few applications of ion exchange chromatographic technique. 3+2
 - Analyse the various sources of water contamination and suggest their possible remedy. 5
 - What are stationary and mobile phases in paper chromatography? Discuss the importance of R_f value in paper chromatography. 3+2
 - Write briefly on paper chromatographic separation of a mixture of Fe³⁺ and Al³⁺. 5
3. Answer any **two** questions: 10×2=20
- Discuss the estimation of Calcium and Magnesium ions as Calcium Carbonate *via* complexometric titration. 5+5

- b) Highlight the estimation of K, Ca and Mg in soil samples *via* flame photometry. 10
- c) What do you mean by nutritional value of food stuffs? What are the common adulterants in food samples? Mention the common chemical food preservatives used for food preservation. Do these have any detrimental health effects? Elaborate. Analytically determine the constituents of talcum powder. What are the common deodorants for commercial purposes? 1+2+1+2+3+1
- d) How we can spectrophotometrically determine the presence of iron in dietary tablets? 10

OPTION-B
CHEM-G-SEC-T-1
(IT Skills for Chemist)

1. Answer any **five** questions: 2×5=10
- What do you mean by bits and bytes?
 - Define mean and standard deviation.
 - State the difference between accuracy and precision.
 - Calculate the pH of 0.1 M acetic acid solution if $K_a = 1.8 \times 10^{-5}$.
 - What are ASCII characters?
 - Write the difference between constants and variables.
 - Convert the unit of work into MLT form.
 - Name two graph plotting softwares.
2. Answer any **two** questions: 5×2=10
- Define numerical differentiation. Numerically differentiate $\sin x$ at $\frac{\pi}{3}$ with $h = 0.1$ using forward difference and central difference methods. Which method gives a more accurate result? 2+2+1

b) What do you mean by a function? Plot $y = x$, $y = e^{-x}$ and $y = xe^{-x}$ on a single y vs x graph with proper labels. 1+4

c) Define pH. Calculate the pH of a 10^{-8} M H_2SO_4 solution.

d) What is the binary-bisection method? Explain with an example.

3. Answer any **two** questions: $10 \times 2 = 20$

a) The heat capacity of a material is given by (in cal/g. K)

$$c(T) = 0.132 + 1.56 \times 10^{-4} T + 2.64 \times 10^{-7} T^2.$$

Use trapezoidal method to numerically compute the heat required to raise the temperature of this material from -100 °C to 200 °C. Use 100 °C as the step size.

Also calculate the corresponding heat change by the analytical method. Compare the two (numerical vs analytical) results. 5+3+2

b) If carbon dioxide follows the van der Waals equation, calculate the volume of one mole of carbon dioxide gas at 10 atm and 300 K. Use the ideal gas volume as the initial guess; employ Newton-Raphson method; run two iterations. Given $a = 3.64$ L² atm/mol²; $b = 0.04267$ L/mol. 10

c) Calculate the pH of a 10^{-4} M weak mono-basic acid HA in water. $K_a = 10^{-10}$; $K_w = 10^{-14}$.

Hint: The answer should be less than 7 as the solution is acidic. Use the dissociation equilibrium for HA as well as for water to develop a cubic equation in H^+ concentration, and then solve it. 10