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Reg. No. | | | | | | | | |

VI Semester B.Sc.3./B.Sc.4. Degree Examination, September - 2021

CHEMISTRY (OPTTIONAL)

Paper - I

(Regular/Repeater)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *All questions are compulsory.*
2. *Answer all questions in the same answer book.*
3. *Draw neat diagrams and give equations wherever necessary.*

SECTION - A

1. Answer any **TEN** of the following. **(10×2=20)**

a. What is stepwise constant and overall stability constant of a complex.

b. Mention the factors that affect '10 D_q'.

c. Write the Str. of Zeise's salt.

d. Is $[Fe(CN)_6]^{3-}$ more or less paramagnetic? Give reason.

e. What are epimers and epimerisation.

f. Write the perspective formula of α - D(+) - glucose.

g. Write the D & L - conformers of Alanine.

h. What are terpenes? Give Examples.

i. What type of electronic transistions are involved in

1. CH_3 - Cl

2. $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

j. Give the meaning of intrinsic viscocity.

k. Give the meaning of dielectric constant.

l. Give the principle of Davisson - Germer - experiment.

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SECTION - B

Answer any **FOUR** of the following: **(4×10=40)**

2. Account for the crystal field splitting of d - orbitals in tetrahedral complexes.
3. Discuss 18 - electron rule with respect to Ferrocene and $[Mn(CO)_5]^+$.
4. Give the classification of vitamins and mention the importance of Vitamin A and Vitamin B_6.
5. Explain how the dipolemoment helps in predicting shapes of molecules.
6. Write a note on structure of proteins.
7. Describe the methods of determination of dipole moment by temperature variation method.

SECTION - C

Answer any **TWO** the following. **(2×10=20)**

8. a. Calculate the CFSE for for highspin and d^5 - octahedra complex. Which of them shows John Teller distortion.

   b. What are chelates? Explain the factors affecting chelate - stability.

9. a. Explain crystal field theory and colour of complexes.

   b. Give the synthesis of citral.

10. a. How is Glycyl - Alanine synthesized by Bergmann - method.

    b. Give Killiani's synthesis.

11. a. Give the classification of Polymers.

    b. Illustrate Frank - condon principle for electronic transitions of a diatomic molecule.

12. a. Deduce Einstein photo electric equation.

    b. If an electron in an hydrogen atom jumps from 4^{th} to 2^{nd} - orbit, What will be the wavelength of light emitted? The ground state energy of H - atom is 13.6 eV. If the same transition occurs in slightly ionised helium atom, then what would be the wavelength?

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VI Semester B.Sc.3./B.Sc.4. Degree Examination, September - 2021

CHEMISTRY (OPTIONAL)

Paper - II

(Repeater/Regular 2014-2015 Onwards)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates :

1. *All the questions are compulsory.*
2. *Answer all questions in the same answer book.*
3. *Draw neat labelled diagram and give equation wherever neccesary.*

SECTION - A

Answer any **TEN** of the following. **(10×2=20)**

1. a. What is R_f value? How is it calculated.

b. Give the principle of thermogravimetric analysis.

c. Name the macro and micro nutrients present in the soil.

d. Mention the types of electronic transitions.

e. What are detergents? Give one example.

f. What are antibiotics? Give an example.

g. What is Favorskii rearrangement.

h. What is chemical shift.

i. Mention any two types of electrodes with example.

j. What are photo inhibitors.

k. What is liquid - liquid junction potential.

l. State Grothus - Drapper law.

SECTION - B

Answer any **FOUR** of the following: **(4×5=20)**

2. Give a brief account of coloumn chromatography.

3. Write a note on Orgal diagram.

4. Give the synthesis and one use of chloroquine.

5. Explain cleaning action of soap.

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6. How is pH of a solution is determined by using hydrogen electrode.

7. Explain with suitable example.

   a. Phosphorescence.

   b. Photosensitisation.

SECTION - C

Answer any **FOUR** of the following. **(4×10=40)**

8. a. Give the brief account of paper chromatography.

   b. Using Bray's and Olsen's method how do you determine phosphorus present in the soil.

9. a. Give the mechanism of Beckmann's rearrangement reaction.

   b. Give the synthesis of chloropheniramine maleate (CPM).

10. a. Explain the PMR spectra of the following organic compound

      i. Acetaldehyde

      ii. Benzene.

   b. Explain hydrogen electrode with neat labelled diagram.

11. a. Discuss the electronic spectra of $[Ti(H_2O)_6]^{3+}$ complex.

   b. Explain the estimation of copper present in the given solution by electrogravimetric method.

12. a. Discuss the construction of calomel electrode.

   b. Explain reversible and irreversible cells.

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VI Semester B.Sc.3/B.Sc.4 Degree Examination, September - 2021

MATHEMATICS (OPTIONAL)

Complex Analysis and Ring Theory

Paper - II

(Regular and Repeaters w.e.f. 2016-17)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates : *1. Question paper has 3 parts. Namely A,B and C.*
2. Answer all parts.

PART - A

Answer any **TEN** of the following. (Two marks each). **(10×2=20)**

1. a. Prove that an analytic function with constant imaginary part is constant.

b. Show that $f(z) = xy + iy$ is continuous but not analytic.

c. Show that $\frac{-y}{x^2+y^2}$ is harmonic.

d. Evaluate $\int_0^{1+i} z^2 dz$.

e. State 'Laurent's theorem'.

f. Define :
i. Pole
ii. Removable singularity.

g. Find the residue of $f(z) = \frac{e^z}{z(z-2)}$ at $z = 0$.

h. Prove that the zeros of an analytic function are isolated.

i. State 'Jordan's Lemma'.

j. Define a ring with unity and give an example of a ring with out unity.

k. Define left and right ideals.

l. Define an 'Integral domain' and give an example.

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PART - B

Answer any **FOUR** of the following (Five marks each). **(4×5=20)**

2. State and prove necessary condition for a function f(z) to be analytic.

3. State and prove 'Cauchy's inequality'.

4. If $u = e^{-x}(x\sin y - y\cos y)$ find f(z) in terms of z by using milne - thomson method.

5. If z = a is a pole of order m of f(z) then prove that

$$\operatorname{Re} s\{f(z):a\} = \lim_{z\to a}\left\{\frac{1}{(m-1)!}\frac{d^{m-1}}{dz^{m-1}}[(z-a)^m f(z)]\right\}$$

6. Prove that $\int_0^{2\pi}\frac{d\theta}{2+\cos\theta} = \frac{2\pi}{\sqrt{3}}$.

7. Show that the set of all 2×2 matrices form a ring w.r.t. matrix addition and matrix multiplication.

PART - C

Answer any **FOUR** of the following (Ten marks Each) **(4×10=40)**

8. a. Prove that an analytic function with constant modulus is constant.

   b. If f(z) is analytic, then prove that $\left[\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4|f'(z)|^2$.

9. a. State and prove 'Liouvelle's theorem.

   b. Let f(z) be analytic in a region R, between two closed contours C_1 and C_2 then

$$\oint_{C_1} f(z)dz = \oint_{C_2} f(z)dz$$

10. a. State and prove 'Taylor's theorem for analytic function f(z).

    b. Expand the function $f(z) = \frac{1}{z^2-3z+2}$ by Laurent's series for

       i. $1<|z|<2$

       ii. $|z|>2$

11. a. State and prove 'Cauchy's Residue theorem.

b. Prove by contour integration that $\int_0^\infty \frac{dx}{(x^2+1)^3} = \frac{3\pi}{16}$.

12. a. A non empty subset S of a ring is a sub ring of R iff

i. $a, b \in S \Rightarrow a - b \in S$

ii. $a, b \in S \Rightarrow ab \in S$

b. Define homomorphism of ring R into R' If $f : R \to R'$ is a homomorphism, then prove that

i. $f(0) - 0'$ where $0'$ is the identity element of R' and

ii. $f(-a) = -f(a)$.

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VI Semester B.Sc.3/B.Sc.4 Degree Examination, September - 2021

MATHEMATICS (OPTIONAL)

Topology and Laplace Transforms

Paper - III

(Regular and Repeaters w.e.f. 2016-17)

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates : *Answer ALL parts.*

PART - A

1. Answer any **TEN** of the following. **(10×2=20)**

a. If $X=\{1,2,3,4\}$ and $T=\{X,\phi,\{2\},\{3\},\{2,3\}\}$. Then prove that T is a topology on X.

b. In a real space (R,U), prove that every closed interval is a closed set.

c. Define

i. Cluster point

ii. Derived set.

d. Prove that subspace of indiscrete space is indiscrete.

e. Prove that every T_2 - space is a T_1 - space.

f. Show that $L[\cos at]=\frac{s}{s^2+a^2}$.

g. Find the inverse Laplace transform of $\frac{(1+2s)^2}{s^4}$.

h. Evaluate $L(t^2\cos 2t)$.

i. Evaluate $L^{-1}\left[\frac{s}{(s+4)^2}\right]$.

j. Prove that $L[H(\in -a)]=\frac{e^{-as}}{s}$.

[P.T.O.

k. Define convolution of two functions f(t) and g(t).

l. Write the working rule to solve the linear differential equations by Laplace transform.

PART - B

Answer any **FOUR** of the following. **(4×5=20)**

2. If (X,T) is a topological space and A,B are two subsets of X, then prove that

   i. $A \subset B \Rightarrow d(A) \subset d(B)$

   ii. $d(A \cup B) \Rightarrow d(A) \cup d(B)$.

3. Define T_1 and T_2 - spaces. Prove that property being a T_2 - space is hereditary property.

4. If L[f(t)] = F(s), then prove that

   i. $L[f'(t)] = SF(s) - f(0)$.

   ii. $L[f''(t)] = S^2F(s) - sf(0) - f'(0)$.

5. Find the Laplace transform of

   i. $e^{2t}(2t^2 - 3t + 4)$

   ii. $t^2 \sin t$

6. Find the inverse Laplace transform of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 8s}$.

7. Express the function $f(t) = \begin{cases} 6, & 0 < t < 4 \\ 2t + 1, & t > 4 \end{cases}$. interms of unit step function and find its Laplace transform.

PART - C

Answer any **FOUR** of the following. **(4×10=40)**

8. a. In a topological space (X,T), if $A, B \subset X$, then prove that

      i. $A \subset B$ then $\overline{A} \subset \overline{B}$

      ii. $\overline{A \cap B} \subset \overline{A} \cap \overline{B}$

   b. If (X,T) is a topological space, prove that

      i. Every intersection of closed set is a closed set.

      ii. Every finite union of closed set is a closed set.

9. a. Define

   i. Interior.

   ii. Exterior

   iii. Boundary of a subset A of X in the topological space (X,T). Prove that $\partial(A) = \overline{A} \cap \overline{A'}$.

   b. If X = {a,b,c} and $T = \{X, \phi, \{a\}, \{b\}, \{a,b\}, \{a,c\}\}$, then prove that $B = \{\phi, \{a\}, \{b\}, \{a,c\}\}$ is a base for topology.

10. a. State and Prove First Shifting Property.

   b. Find L[f(t)]

   i. Cosh4t. sin3t

   ii. 6^t.

11. a. If L[f(t)] = F(S), then prove that $L\left[\frac{f(t)}{t}\right] = \int_s^\infty F(s).ds$.

   b. Verify convolution theorem for f(t) = t, g(t) = e^{2t}.

12. a. If f(t) is a periodic function of period T>0, Then prove that $L[f(t)] = \frac{1}{1-e^{-ST}} \int_0^T e^{-ST}.f(t).dt$.

   b. Solve $\frac{d^2y}{dt^2} + 2.\frac{dy}{dt} + 5y = e^{-5t}.\sin t$, given that y(0) = 0, $y'(0) = 1$.

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VI Semester B.Sc.4/B.Sc.3 Degree Examination, September - 2021

PHYSICS (OPTIONAL)

(Regular&Repeaters)

Paper - I

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

1) *Calculators may be allowed for solving problems.*
2) *Write intermediate steps.*
3) *Give physical meaning for symbols and notations.*

PART - I

1. Answer any **TEN** questions. **(10×2=20)**

a) What is Primitive cell?

b) Define specific heat of solids.

c) What is intrinsic semiconductor?

d) Define transition temperature.

e) What are the magic numbers?

f) Mention Geiger-Nuttal law.

g) What is renewable energy source?

h) What is Zenith angle?

i) What is hexadecimal number?

j) Mention the types of liquid crystals.

k) X-rays of wavelength 2A° make a glancing angle of 30° in the second order, when diffracted from Nacl crystal. Find the lattice constant of Nacl.

l) Convert $(1011)_2$ binary to decimal number.

[P.T.O.

PART - II

Answer any **FOUR** questions. **(4×5=20)**

2. Mention Bravais lattices in two dimensions.
3. Mention the advantages of renewable energy sources.
4. Explain the construction and theory of linear accelerator.
5. The electrical and thermal conductivity of silver at 303 K are 6.2×10^7 SI unit and 425 SI unit respectively calculate Lorentz number.
6. Calculate the frequency of Oscillating potential applied to a cyclotron, so as to accelerate deutron using a magnetic field of 2.5 Tesla

   Mass of deutron = 3.34×10^{-27} kg

   Charge of electron = 1.6×10^{-19} c
7. Prove the Boolean identity

   $(A+B)(A+C) = A+BC$

PART - III

Answer any **FOUR** of the following questions. **(4×10=40)**

8. Give Einstein's theory of specific heat of Solids, What are its limitations. **(8+2)**
9. Derive an expression for electrical and thermal conductivity on the basis of free electron theory. **(5+5)**
10. Describe the construction and working of G M counter.
11. Write a note on conventional energy sources.
12. State and prove Demorgan's first law and second law. **(5+5)**

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VI Semester B.Sc.4/B.Sc.3 Degree Examination, September - 2021

PHYSICS (OPTIONAL)

(Regular&Repeater)

Paper - II

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

1) *Use Calculators for calculations.*
2) *Write intermediate steps.*
3) *Give physical meaning for symbols and notations.*

PART - I

1. Answer any **TEN** questions. **(10×2=20)**

a) Define inverse Fourier transform.

b) State Parseval's identity of Fourier transform.

c) What is photodiode? Draw its circuit symbol.

d) Mention various losses in Optical fiber.

e) What is Skip distance?

f) What is demodulation?

g) What is Flow Chart?

h) What is break statement? Where it is used?

i) Find the Laplace transform of e^{at}.

j) What is differential amplifier?

k) In an optical fiber, refractive index of cladding lay is 1.4355 and refractive index of core is 1.4500.1 the numerical aperture.

l) Calculate the modulation factor for AM wav if $V_{max} = 4v$ and $V_{max} = 2v$.

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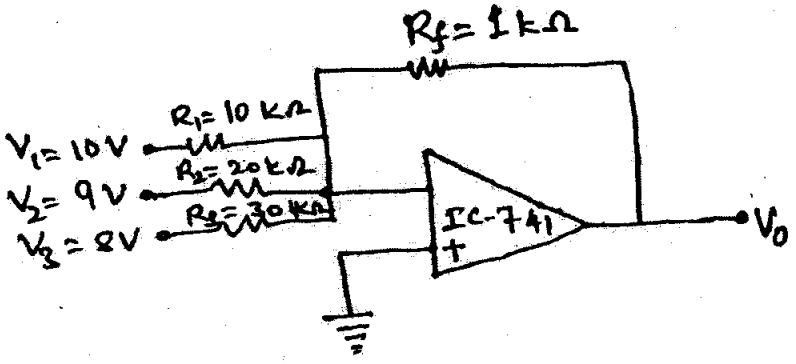
PART - II

Answer any **FOUR** of the following. **(4×5=20)**

2. Distinguish between step index and graded index fit.
3. Explain Space Wave propagation.
4. With neat circuit diagram, explain the working IC - 555 as rectangular wave generator.
5. Find the Laplace transform of $f(t) = e^{at} \sinh bt$.
6. Write a C-program to find the sum of 'n' na numbers.
7. For the summing amplifier having Op-Amp shown calculate the output voltage V_0.



PART - III

Answer any **FOUR** of the following. **(4×10=40)**

8. a) Derive an expression for Fourier transform of derivative $\left[\frac{d^n f}{dt^n}\right]$

   b) Establish relation between Laplace and Fourier transform.

9. Define acceptance angle and numerical aperture. Obtain an expression for numerical aperture of a optical fiber.
10. What is frequency modulation? Derive an expression for frequency modulation.
11. a) Explain basic data types used in C-language.

    b) Write a C-program to convert the temperature degree celsius to Fahrenheit using the relation $F = 32 + \frac{9}{5}C$

12. What is multivibrator? Mention any two uses of multivibrator. Explain the working of monostable multibrator with neat diagram.