

240404

S270424

S.Y. B.Sc. SEMESTER – IV EXAMINATION: MARCH / APRIL 2024MATHEMATICS PAPER –I: MULTIVARIABLE CALCULUS – ITime: $2\frac{1}{2}$ Hours

Maximum Marks: 75

NOTE: (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

Qn. (1) Attempt any FOUR questions from the following. ($4 \times 5 = 20$ Marks)

- (a) Show that the limit of a scalar valued function $f: \mathbb{R}^n \rightarrow \mathbb{R}$ at a point $a \in S$ if exists is unique.
- (b) Show that the limit of the function $f(x, y)$ does not exist as $(x, y) \rightarrow (0, 0)$ using path test $y = mx$, where

$$f(x, y) = \begin{cases} \frac{x^4 - y^4}{x^4 + y^4}, & (x, y) \neq (0, 0) \\ 0, & \text{otherwise} \end{cases}$$

- (c) Find the directional derivative of the function $f(x, y, z) = 4xy + xz + zx$ at $(2, 0, -1)$ in the direction of $\vec{u} = 2\vec{i} + 3\vec{j} + \vec{k}$
- (d) Check the convergence of the sequence $x_n = \left(\frac{4n-3}{16n+7}, \frac{14n^2+5}{7n^2+3n+1}, \frac{16n}{8n^2+10} \right)$
- (e) If $u = \log \left[\frac{x^2+y^2}{x+y} \right]$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 1$.

Qn. (2) Attempt any FOUR questions from the following. ($4 \times 5 = 20$ Marks)

- (a) Show that if a scalar field $f: \mathbb{R}^n \rightarrow \mathbb{R}$ is differentiable at a point $a \in \mathbb{R}^n$ then f is continuous at $a \in \mathbb{R}^n$.
- (b) Let $f, g: \mathbb{R}^n \rightarrow \mathbb{R}$ be two scalar fields differentiable at $a \in \mathbb{R}^n$. Show that $f + g$ is differentiable at $a \in \mathbb{R}^n$.
- (c) Find the equation of tangent plane and normal line to the surface $f(x, y, z) = yz - \log(x+z)$ at $(0, 0, 1)$.

- (d) Find the level curve of $f(x, y, z) = 324 - x^2 - y^2 - z^2$ for $C = 0$ and $C = 224$.
- (e) Find the total derivative $\frac{du}{dt}$ where $u = 3\sin x + \cos y$ where $x = t^3, y = t^2$ using Chain rule.

Qn. (3) Attempt any FOUR questions from the following. (4 × 5 = 20 Marks)

- (a) Find the Taylor's polynomial of degree two for the function $f(x, y) = \sin x \sin y$ at $(0,0)$
- (b) Find the linearization of the function $f(x, y, z) = x^3 + 2xy^2 + 3z^3$ at $(2,1,2)$
- (c) Find the Jacobian matrix of the function $f: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ given by
 $f(x, y, z) = (2x + y, 2y + z, 2z + x)$ at $(1,2,1)$.
- (d) Find the points on the ellipse $x^2 + 2y^2 = 1$ where $f(x, y) = xy$ has its extreme values by using Lagrange multiplier method.
- (e) Find the local maxima and local minima for the function

$$f(x, y) = x^2 + xy + y^2 + 3x - 3y + 4$$

Qn. (4) Attempt any THREE questions from the following. (3 × 5 = 15 Marks)

- (a) Show that $\|x + y\| \leq \|x\| + \|y\|$ for all $x, y \in \mathbb{R}^n$.
- (b) Find the iterated limits for the function $f(x, y) = \begin{cases} \frac{x^2 y^2}{x^2 + y^2}, & (x, y) \neq (0,0) \\ 0, & (x, y) = (0,0) \end{cases}$
- (c) State and prove Euler's theorem for function of two variables.
- (d) Find the gradient of $f(x, y, z) = x^3 + 2xyz^2 - 4zy^2$ at the point $(1,2,-3)$.
- (e) If $F(x, y, z) = 3xyz - \cos(x + y + z)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.
- (f) Find the Hessian matrix of $f(x, y) = x^2 + 3xy - y^2$ at $(-1, 6)$.

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SYBSC SEM IV REGULAR MARCH 2024
MATHEMATICS II

MARKS: 75

TIME DURATION: 2 Hrs. 30 Min.

Q.1 Attempt any Four.**(20)**

- (i) Verify whether the map $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined as $T(x, y, z) = (x + y, z, 2x)$ is a linear isomorphism.
- (ii) Verify Rank Nullity Theorem for the Map $T: \mathbb{R}^2 \rightarrow \mathbb{R}^3$ such that $T(x, y) = (2x, 3y, 0)$.
- (iii) If $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ is a linear map defined as $T(x, y, z) = (x, 3y)$, find the dimension of Image of T .
- (iv) Find the Matrix associated with the map $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined as
 $T(x, y, z) = (x, 3y, 4z)$
- (v) State and prove Rank-Nullity Theorem.

Q.2 Attempt any Four.**(20)**

- (i) State and prove Cauchy Schwarz inequality.
- (ii) If V is an inner product space over \mathbb{R} and $x, y \in V$, prove that

$$\|x + y\|^2 + \|x - y\|^2 = 2\|x\|^2 + 2\|y\|^2$$

$$\|x + y\|^2 - \|x - y\|^2 = 4\langle x, y \rangle$$
- (iii) State and prove Pythagoras theorem.
- (iv) Using Gram Schmidt orthogonalization process, find an orthogonal basis for the inner product space whose basis is $\{(1, 1, 1), (0, 1, 1), (0, 0, 1)\}$.
- (v) Let V be a real inner product space and u be a unit vector in V . For any $v \in V$, Prove that,

$$\|v - P_V(u)\| \leq \|v - \alpha u\|, \forall \alpha \in \mathbb{R}.$$

The equality holds if and only if $P_V(u) = \alpha \cdot u$.

Q.3 Attempt any Four.**(20)**

- (i) Find the eigen value and the basis of eigen space of the matrix $\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$.
- (ii) Let V be a vector space and $A: V \rightarrow V$ be a linear map. Let $\lambda \in \mathbb{R}$. Let v_λ be the subset of V of all the eigenvectors of A having λ as eigenvalue. Prove that v_λ is a subspace of V .

- (iii) Let V be a finite dimensional vector space and λ be a scalar. Let $A: V \rightarrow V$ be a linear map. Prove that λ is an eigenvalue of A if and only if $A - \lambda I$ is not invertible.
- (iv) Let V be a vector space and $A: V \rightarrow V$ be a linear map. Prove the set $\{v_1, v_2, \dots, v_m\}$ of the eigenvectors corresponding to the distinct eigen values $\lambda_1, \lambda_2, \dots, \lambda_m$, is linearly independent.
- (v) Verify Cayley Hamilton Theorem for the matrix $\begin{pmatrix} 4 & 3 \\ -2 & 1 \end{pmatrix}$

Q.4 Attempt any Three.

(15)

- i. If V is any finite dimensional real vector space and $T: V \rightarrow V$ is a linear map, prove that, the following three statements are equivalent.
 - a. T is an isomorphism
 - b. $\text{Ker.}T = \{O\}$
 - c. $\text{Im}(T) = V$
- ii. If V and W are any two real vector spaces and $T: V \rightarrow W$ is a linear transformation then prove that
 - a) $\text{Ker.}T$ is a subspace of V ;
 - b) $\text{Im}(T)$ is a subspace of W
- iii. State and prove triangle inequality.
- iv. Find an orthogonal basis of space of solutions of the system $x - y + 2z = 0$.
- v. Let A be a real symmetric matrix and $f(X) = 'XAX$ be the associated quadratic form. Let P be a point on the unit sphere such that $f(P)$ is a maximum for f on the sphere. Prove that P is an eigen value of A .
- (vi) Find the eigen value and the basis of eigen space of the matrix $\begin{pmatrix} 1 & 2 & 2 \\ 1 & 2 & -1 \\ -1 & 1 & 4 \end{pmatrix}$

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S350424

S.Y. B.Sc. SEMESTER – IV EXAMINATION: MARCH / APRIL 2024

MATHEMATICS PAPER –III: NUMERICAL METHODS (ELECTIVE - A)Time: $2\frac{1}{2}$ Hours

Maximum Marks: 75

NOTE: (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

Qn. (1) Attempt any FOUR questions from the following. ($4 \times 5 = 20$ Marks)

- (a) Find a real root of the equation $x^3 - 2x - 5 = 0$ by using Newton – Raphson method up to two approximations. (Choose $x_0 = 2$)
- (b) Find a real root of the equation $x^3 - x - 4 = 0$ by using the method of false position up to two approximations.
- (c) Find a real root of the equation $x^3 + x - 1 = 0$ by using secant method up to two approximations.
- (d) Find a real root of the equation $x = (4 - x)^{1/3}$ by using the fixed point iteration method up to three approximations.
- (e) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{11}$ to 4 significant digits and find its absolute and relative errors.

Qn. (2) Attempt any FOUR questions from the following. ($4 \times 5 = 20$ Marks)

- (a) Using Lagrange's interpolation formula, find the value of
- $f(5)$
- from the following table.

x	2	3	7	8
$f(x)$	24	35	45	64

- (b) The population of a town in the decennial census was as given below. Find the population for the year 1895 by using Newton's forward difference interpolation formula.

Year (x)	1891	1901	1911	1921	1931
Population (y) (in 1000's)	56	76	91	103	121

- (c) Calculate the area bounded by the curve from the following table using Trapezoidal's rule.

x	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	18	14	10	8	8.5	12	14	15	16

(d) The velocities of a car at intervals of two minutes are given below. Find the distance covered by the car using Simpson's $\left(\frac{1}{3}\right)$ rule.

Time in minutes (x)	0	2	4	6	8	10	12
Velocity in km/hr. (y)	0	27	35	32	23	12	5

(e) Evaluate $I = \int_0^2 \frac{1}{1+x} dx$ using Simpson's $\left(\frac{3}{8}\right)$ rule with $h = 0.25$.

Qn. (3) Attempt any TWO questions from the following. (2 × 10 = 20 Marks)

(a) Solve the following system of equations by LU factorization method.

$$\begin{aligned} 2x + 3y + z &= 6 \\ x + 2y + 3z &= 3 \\ 3x + y + 2z &= 5 \end{aligned}$$

(b) Solve the following system of equations by Gauss – Seidel method up to two iterations.

$$\begin{aligned} 5x + 2y + z &= 9 \\ x + 5y - z &= -22 \\ -2x + 3y + 5z &= 22 \end{aligned}$$

(c) Find the eigenvalue of the following matrix by Jacobi's method

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

Qn. (4) Attempt any THREE questions from the following. (3 × 5 = 15 Marks)

(a) Find the real root of the equation $4x = \cos x + 6$ using fixed point method.

(b) Round-off the following numbers to four significant figures:

48.46235, 0.80029, 0.0032218, 29.235101, 4.36425

(c) Estimate $\log(3.5)$ using Newton's backward interpolation formula from the given table.

x	1.0	2.0	3.0	4.0
logx	0.0	0.69	1.099	1.386

(d) Fit a straight line for the equation $y = 6.71 + 0.38x$ for $x = 0,1,2,3,4,5$.

(e) Find the eigenvalues of the matrix $A = \begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$ using the Rutishauser method.

(f) Solve the following system of equations by Gauss – Seidel method up to two iterations.

$$\begin{aligned} 2x + 5y &= 16 \\ 3x + y &= 11 \end{aligned}$$

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S280424

Subject Code: USB401 / Botany: Paper I
[Time: Three Hours]

[Marks: 100]

Please check whether you have got the right question paper.

N.B:

- i. All questions are compulsory
- ii. Figures to the right indicate full marks
- iii. Draw neat and labeled diagrams whenever necessary

Q 1. A). Choose the correct option from the following and rewrite the sentence 10 M

1. _____ is *Erysiphe*.
a) Insect b) fungus c) Plant d) Bacterium
2. *Xylaria* is a member of _____
a) Ascomycetes b) Basidiomycetes c) Plectomycetes d) deutoromycetes.
3. Late blight of potato is caused by _____.
a) *Erysiphe graminis* b) *Erysiphe polygonii*
c) *Phytophthora infestans* d) *Xylaria hypoxylon*
4. Lichen is the association of an algae and a _____.
a) Bacteria b) Fungus c) Virus d) Protozoa
5. *Selaginella* being _____, produces two types of spores.
a) Homosporous b) Bisporous c) Monosporous d) Heterosporous
6. The endodermis in the older stems of *Selaginella* is referred to as _____.
a) Trabeculae b) Ligule c) Trichoblast d) Elongate
7. The developing micro-gametophyte of *Selaginella* is shed from the microsporangium at _____ stage.
a) 4-celled b) 8-celled c) 13-celled d) 16-celled
8. In *Pinus*, the endosperm is formed _____ fertilization.
a) one day b) one week c) one month d) one year
9. _____ wood is more compact with less parenchyma soft tissue.
a) Manoxylic b) Pycnoxylic c) Polyxylic d) Pentaxylic
10. In *Pinus* seed germination is _____.
a) epigeal b) hypogeal c) vivipary d) none of these

Q.1. B). Answer in one or two sentences

10 M

1. Give any two examples of lichen.
2. Give the causal organism and any one symptom of Powdery mildew.
3. What is ligule?
4. Name the different types of shoots in *pinus*.
5. Give any two salient features of *Coniferophyta*.

Q.2. Answer the following questions in brief (any two)

20 M

1. Give a detailed account of sexual reproduction in Lichen.
2. Describe the asexual reproduction in *Xylaria*. Add a note on its systematic position
3. Explain the life cycle of Erysiphe with the help of schematic diagram.
4. Give the causal organism, symptoms, and disease cycle of Powdery mildew. Add a note on its control measure

Q.3. Answer the following questions in brief (any two)

20 M

1. Give detailed account on the asexual reproduction in *Selaginella*.
2. Describe the external morphology of *Selaginella sporophyte*. Add a note on T.S. of root of the same.
3. With the help of neat and labelled diagrams, explain external and internal structure of leaf of *Selaginella*.
4. What are plant fossils? Explain any three types of fossils studied by you.

Q.4. Answer the following questions in brief (any two)

20 M

1. Enlist the salient feature of Coniferophyta.
2. With the help of neat labeled diagram explain internal structure of *Pinus* young old stem
3. Discuss the economic importance of Coniferophyta.
4. Describe the secondary growth in pinus stem.

Q.5. Write short notes on: (any four)

20 M

1. Systematic position of *Xylaria*.
2. Schematic diagram for disease cycle of Late blight of potato.
3. T.S. of *Selaginella* root
4. Microsporogenesis in *Selaginella*.
5. R.L.S. of *Pinus* wood.
6. Male strobilus of *Cordaites*.

X-----X-----X

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Semester – IV

Botany: Paper II

3 Hours

Marks: 100

- i. N.B.: All questions are compulsory
- ii. Figures to the right indicate full marks
- iii. Draw neat and labeled diagrams whenever necessary

Q.1.A. Choose the correct option from the following and rewrite the sentence **10**

1. A strip of cambium between xylem and phloem.
a) Fascicular b) Intrafascicular c) Interfascicular cambium d) Both a & b
2. These are Balloon-like protusions in the Xylem parenchyma.
a) Tyloses b) Lenticels c) Phellogen d) Phelloderm
3. The support system given to the stem against flexion.
a) Flanges b) Null-line c) Inflexibility d) Sieve cells
4. *Helianthus annus* belongs to which of the family?
a) Poaceae b) Lamiaceae c) Gramineae d) Asteraceae
5. How many total ATPs are formed during Aerobic respiration?
a) 2 b) 36 c) 38 d) 24
6. Inhibition of photosynthesis in C3 plants due to high level of Oxygen is termed as:
a) Chloride effect b) Aerobic respiration c) Anaerobic respiration d) Warburg effect
7. Which of the following is NOT short day plant?
a) *Nicotiana* b) *Xanthium* c) Tomato d) *Dahlia*
8. Who coined the word Ecology combining 2 words *oikos* & *logos*?
a) Odum b) Reiter c) Darwin d) Elton
9. Which of the following is biological nitrogen fixing bacteria ?
a) *Azobacter* b) *Anabaena* c) *Nostoc* d) All of them
10. The term Edaphos refers to:
a) Humus b) soil c) Laterite d) Eluvial layer

Q.1.B. Answer the following in one sentence.

10

1. Phellogen
2. Endarch.
3. Phytochromes.
4. Cryptophytes.
5. Humification?

Q.2. Answer any two of the following.

20

1. With the help of cellular & labelled diagrams explain secondary growth in dicot stem.
2. Give a detailed account on Sclerenchyma and its various types.
3. Describe various types of vascular bundles.
4. Explain inextensibility and incompressibility in detail with the help of suitable diagrams.

Q.3. Answer any two of the following.

1. Elaborate the EMP pathway (glycolysis) and its significances.
2. Synthesis of ATP & transport of electrons, protons and electrons is controlled by some enzyme complexes. Explain all enzyme complexes to describe mechanism of ETC.
3. What is Photoperiodism and its significance? Differentiate between short & long day plants.
4. Explain the Physico-chemical properties of Phytochrome and its role in flowering of SDPS & LDPS

Q.4. Answer any two of the following.

20

- 1) What is nitrogen cycle. Discuss various steps involved in it.
2. What is soil profile? Explain with the help,of diagram.
- 3 Explain Pedogenesis and factors affecting soil formation.
4. Discuss various Growth forms classified by C. Raunkier

Q.5. Write short notes on any four.

20

1. Sap wood and heart wood
2. Shearing stress.
3. Vernalization.
4. Photorespiration.
5. Stratification.
6. Physiognomy.

N.B.: All questions are compulsory

Figures to the right indicate full marks

Draw neat and labeled diagrams whenever necessary

Q.1.A. Choose the correct option from the following and rewrite the sentence

10

1. The study of fruit production and marketing is called.
 - a) Pomology b) Horticulture c) Floriculture d) Agriculture

2. Small heighted border demarking one garden feature from another
 - a) Hedges b) Edges c) Fence d) Both a & b

3. Which of the following is an Avenue tree?
 - a) Michelia champaca b) Nymphaea lotus c) Petunia violacea d) Ficus religiosa

4. Lawn grass Cynadon dactylon belongs to the family
 - a) Lythraceae b) Graminae c) Rubiaceae d) Aracaceae

5. It is the genetic potential of a plant cell to produce entire plant.
 - a) Totipotency b) pluriopotency c) both a and b d) none of these

6. Which of the following is a hybrid vector?
 - a) Plasmid b) Cosmid c) Bacteriophage d) M13 phage

7. The associated database not included in the Entrez are
 - a) CDD b) GSS c) MesH d) NCBI

8. A tentative and formal prediction about relationship between two or more variable is
 - a) Null hypothesis b) Hypothesis c) Degree of freedom d) Alternative hypothesis

9. When both the variables are directly proportional to each other than the correlation is
 - a) Perfect positive b) partially positive c) partially negative d) perfect negative

10. The enzyme which breaks phosphodiester bond
 - a) Ligase b) Polymerase c) kinase d) Nuclease

Q.1.B. Answer the following in one sentence.

10

1. Floriculture.
2. Informal garden.
3. Organ culture.
4. Cloning vector.
5. Information technology.

Q.2. Answer any two of the following.

20

1. What is formal garden? Explain the different features of formal garden.
2. Describe in detail flora and fauna of Sanjay Gandhi National park.
3. Explain in detail about Lambda phage vector.
4. Find the coefficient of correlation between the height (inches) of fathers and sons from the following data:

Height of fathers(X)	65	66	67	68	69	70	71
Height of sons(Y)	67	68	66	69	72	72	69

Q.3. Answer any two of the following.

20

1. Mention the role of botanical garden in conservation of biodiversity. Explain its designing and Significance.
2. Discuss the steps involved in gene cloning.
3. What is anther and pollen culture. Discuss the importance and advantages of pollen and anther culture.
4. Explain CHI square test with its characteristics and terms used in testing CHI square test.

Q.4. Answer any two of the following.

20

- 1) Give a brief information about jijamata udyan.
2. Describe the factors affecting organogenesis and importance of organogenesis.
3. Define bioinformatics. Explain the different tools used in bioinformatics.
4. In an experiment, an experimenter obtained 142 red mesocarp with black seeds, and 49 red mesocarp with brown seed, 41 pink mesocarp with black seed and 8 pink mesocarp with brown seeds. Do the results, obtained under field conditions support the theoretical statement, the ratio of fruits should be 9 red mesocarp with black seeds: 3 red mesocarp with brown seeds: 3 pink mesocarp with black seeds: 1 pink mesocarp with brown seeds?

Q.5. Write short notes on any four.

20

1. Water garden.
2. Hedges.
3. DNA Polymerase.
4. YAC.
5. BLAST
6. Bioinformatics programs in India.

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S170424

Time : 3 Hrs

Total Marks : 100

- N.B :
1. All questions are compulsory
 2. All questions carry equal marks
 3. Draw neat and labelled diagram wherever necessary

Q.1 A) Fill in the blanks by choosing the correct options given below.

05

- a. _____ was absent in primitive atmosphere of earth.
(Hydrogen, Oxygen, Nitrogen)
- b. Charles Darwin theory
(Natural selection, Mutation, Modern synthetic)
- c. Declining white peppered moth population after industrialization is an example of _____ selection.
(Directional , stabilizing, disruptive)
- d. Inversion involved chromatid does not include the centromere is called as _____.
(Paracentric inversion, acentric inversion, pericentric inversion)
- e. Wild life (Protection) Act, was enacted in the year _____.
(1972, 1982, 1992)

Q.1B) Match the columns I and II and rewrite

05

Column I	Column II
a) Weismann	1) Trisomy
b) Appendix	2) Cross between goat and sheep
c) Hybrid inviability	3) Alexander Fleming
d) $2n+1$	4) Vestigial organ
e) Discovery of Penicillin	5) Germplasm theory

Q.1 C) State whether the given statement is true or false.

05

- a. The organism with two layers are called triploblastic.
- b. Linnaeus introduced binomial nomenclature for naming species.
- c. Micro-evolution refers to changes in gene frequency within population
- d. ICAR stands for Indian Council Of Animal Research.
- e. A good introduction in research paper should be unipartite.

Q.1 D) Define the following.

05

- a. Impression
- b. Homologous organs
- c. Exaptation
- d. UGC
- e. Zoonosis

Q.2 A) Describe chemical evolution with Miller-Urey experiment. 10

OR

A) Neutral theory of molecular evolution.

Q.2 B) Explain any two from the following. 10

- a. Mutation theory .
- b. Facts and deductions of Darwinism.
- c. Palaeontology
- d. Variations and heredity.

Q.3 A) Explain Hardy-Weinberg law with one example. 10

OR

A) Explain genetic variation.

Q.3 B) Explain any two from the following. 10

- a. Inbreeding depression
- b. Migration
- c. Negative assortative mating
- d. Biological assertive mating

Q.4A) Explain the steps involved in scientific method. 10

OR

A) Explain the role of computers in research.

B) Explain any two from the following. 10

- a. Structure and components of a research report.
- b. Functions of National Biodiversity Authority
- c. Describe the process of approval for conduction research in protected areas.
- d. Review paper writing.

Q.5 Write short notes on any four. 20

- a. Neo- Darwinism.
- b. Evidences from physiology.
- c. Balanced polymorphism
- d. Adaptive radiation
- e. Difference between research methods and research methodology.
- f. Constitution of Institutional Animal Ethics Committee.

240330

S200424

SYBSc. ZOOLOGY SEMESTER IV PAPER II (COURSE IX)

Time : 3 Hrs

Total Marks : 100

- N.B :**
1. All questions are compulsory
 2. All questions carry equal marks
 3. Draw neat and labelled diagram wherever necessary

Q.1 A) Fill in the blanks by choosing the correct options given below.

05

- Ingestion of solid food by plasma membrane is called _____
(Endocytosis, Pinocytosis, Phagocytosis)
- Which is not an example of active transport
(Exocytosis, Endocytosis, Facilitated diffusion)
- Cisternae is part of _____
(Nucleus, Lysosomes, Golgi complex)
- _____ is an uncharged polar hydroxy amino acid
(Serine, Histidine, Lysine)
- In glycogen glucose units joined by _____ glycosidic linkage.
($\alpha 1 \rightarrow 6, \beta 1 \rightarrow 4, \beta 1 \rightarrow 6, \alpha 1 \rightarrow 4$)

Q.1B) Match the columns I and II and rewrite

05

Column I	Column II
a) Microtubules	1) Polar
b) Hydrophilic	2) Contain 13 protofilaments
c) ATP	3) Golgi complex
d) Protein sorting and secretion	4) Anomers
e) Non mirror image	5) Chemiosmosis

Q.1 C) State whether the given statement is true or false.

05

- Mitochondria are the power house of cell.
- Golgi complex is found in the cytoplasm.
- Endoplasmic reticulum is continuous with outer membrane of nuclear envelope
- Mitochondria are storage batteries of the cell
- The average mass of amino acid is 210 Da.

Q.1 D) Define the following.

05

- Plasma membrane
- Lysosomes
- Residual bodies
- Mutarotation
- Peptide bond

Q.2 A) Describe fluid mosaic model of plasma membrane.

10

OR

A) Describe facilitated diffusion.

Q.2 B) Explain any two from the following.

10

- a. Difference between prokaryotes and eukaryotes .
- b. Passive transport
- c. Osmosis
- d. Nucleolus

Q.3 A) Give an account of ultra-structure of Golgi complex

10

OR

A) Explain respiratory chain and oxidative phosphorylation

Q.3 B) Explain any two from the following.

10

- a. Significance of endoplasmic reticulum .
- b. Functions of lysosomes
- c. Significance of Golgi complex
- d. Morphology of mitochondria

Q.4A) Classify amino acids on the basis of polarity.

10

OR

A) Explain polysaccharides with example.

B) Explain any two from the following.

10

- a. Ester linkage
- b. D -L stereoisomers
- c. Biological and clinical significance of lipids
- d. Collagen

Q.5 Write short notes on any four.

20

- a. Ultra-structure of micro-villi
- b. Scope of cell biology.
- c. Origin and occurrence of lysosomes.
- d. Ultra-structure of endoplasmic reticulum
- e. Steroid
- f. Fructose

240403

S240624

SYBSc. ZOOLOGY SEMESTER IV PAPER III (COURSE X)

Time : 3 Hrs

Total Marks : 100

- N.B :**
1. All questions are compulsory
 2. All questions carry equal marks
 3. Draw neat and labelled diagram wherever necessary

Q.1 A) Fill in the blanks by choosing the correct options given below.

05

- a. Size of *Amphioxus* sperm is _____ mm.
(0.018, 1.25, 2.25)
- b. _____ extraembryonic membrane helps in gas exchange
(amnion, chorion, yolk sac)
- c. The first menstruation begins at puberty and is called _____.
(Ovulation, Menarche, Menstrual cycle)
- d. Abence of sperm in semen is called as.....
(Oligospermia, Azoospermia, Teratozoopermia)
- e. 'A' horizon of soil consists of _____.
(Fertilizers,iron, humus)

Q.1B) Match the columns I and II and rewrite

05

Column I	Column II
a) Yolkless egg	1) Gastrula
b) Archenteron	2) Klinefelter syndrome
f) Hydrosphere	3) 50 dB(A)
g) Primary hypogonadism	4) Oceans
c) Silence zone	5) Mammals

Q.1 C) State whether the given statement is true or false.

05

- a. The amnion is connected to the embryo at ventral stalk called as somatic umbilicus.
- b. The lower layer of bird gastrula is called as epiblast.
- c. Interstitial cell stimulating hormone is also know as LH hormone.
- d. Smaller growths within the uterus called fibroid.
- e. Biogas is very safe for the environment

Q.1 D) Define the following.

05

- a. Exogenous yolk sac
- b. Amniotic
- c. Eutrophication
- d. Ovulatory phase.
- e. Agricultural solid waste

Q.2 A) Explain blastula and its types.

OR

A) Gastrulation in birds and mammals.

Q.2 B) Explain any two from the following.

10

- a. Cocloblastula
- b. Germ layers
- c. Spiral cleavage
- d. Mosaic egg

Q.3 A) What is the contraception. Explain the different methods of artificial contraception.

10

OR

A) Give an account of intracytoplasmic sperm injection (ICSI)

Q.3 B) Explain any two from the following.

10

- a. Syphilis .
- b. Intra- fallopian transfer
- c. Endocrine disruption in infertility
- d. Abortion

Q.4A) Describe the types and sources of soil pollution.

10

OR

Q.4A) Explain climate change and global warming.

B) Explain any two from the following.

10

- a. Types of pollutant that cause air pollution
- b. Various sources of water pollution
- c. Control measures of solid waste pollution
- d. Various means of noise pollution

Q.5 Write short notes on any four.

20

- a. Amnion
- b. Coelom
- c. Hormonal methods of contraception
- d. Primary ovarian failure.
- e. Hazards of radioactive pollution
- f. Effects of air pollution

240328

Revised Course

5160429

RIZVI COLLEGE OF ARTS, SCIENCE & COMMERCE
SYBSc (PHYSICS) SEM IV - REGULAR
PAPER - I (USPH401)

Time : 2 ½ hrs.

Marks : 75 M

INSTRUCTIONS:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of simple non-programmable calculator is allowed.
4. Draw a diagram wherever necessary.

Q. 1 A) Attempt any TWO of the following. (20)

1. Explain Fresnel's diffraction at a straight edge. Show that the distance between the successive maxima decreases.
2. Obtain the intensity variation distribution for Fraunhofer's diffraction at a single slit. Draw suitable waveform.
3. Define polarisation. Give the phenomenon of double refraction and Huygen's theory to support double refraction.
4. Explain the construction and working of Half-Wave plate.

Q. 2. A) Attempt any TWO of the following. (20)

1. With the help of a neat diagram explain construction and working of Michelson Interferometer. Give its adjustments.
2. How will you determine the wavelength of a monochromatic light using Michelson's Interferometer.
3. Deduce an expression for R.P. of a telescope. Comment on the results.
4. Show that the R.P of a prism is independent of refracting angle (A) of a prism.

Q. 3. A) Attempt any TWO of the following. (20)

1. Draw the pin diagram of 8085 microprocessor.
2. Explain the control signal and status signal in 8085 microprocessor.
3. Explain RAR, RAL instructions with suitable example.
4. What is addressing modes? Describe the different addressing modes.

Q.4. A) Attempt any THREE of the following. (15)

1. Give a simple theory of plane diffraction grating.
2. Define polarisation. Explain the polarisation by selective absorption.

3. Michelson interferometer is illuminated by a light of 5890 A.U and 5896 A.U. Find the distance through which a mirror is to move to get circular fringes.
 4. Explain the Rayleigh's criterion of resolving power.
 5. What is arithmetic group in 8085 microprocessor? Explain any two instructions of this group with a suitable example.
 6. Explain address and data bus in 8085 microprocessor.
-

240328

Old Centre

S160424

RIZVI COLLEGE OF ARTS, SCIENCE & COMMERCE
SYBSc (PHYSICS) SEM IV
A.T.K.T
PAPER – I (USPH401)

Time : 3 hrs.

Marks : 100 M

INSTRUCTIONS:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of simple non-programmable calculator is allowed.
4. Draw a diagram wherever necessary.

Q. 1 A) Attempt any two of the following. (20)

1. Show that the area of Fresnel's half-period zones are equal. Draw a suitable diagram.
2. Obtain positions of secondary maxima on the basis of Fraunhofer diffraction at a single slit.
3. How will you determine the radius of a thin wire using Fresnel's diffraction.
4. Give the necessary theory of Fraunhofer diffraction at double slit..

B) Attempt any ONE (05)

1. A slit of width 'a' is illuminated by white light. The first minimum for red colour ($\lambda = 6500 \text{ \AA}$) falls at 30° , find the 'a'.
2. A fabric with 600 threads/cm is illuminated with 6000 \AA . Find the angle between central image and the first order diffraction image.

Q. 2. A) Attempt any two of the following. (20)

1. What is polarisation? Explain the polarisation by i) selective absorption ii) scattering.
2. Explain the construction and working of Quarter wave plate.
3. State and explain the Law of Malus. Derive necessary relation.
4. Show that the linearly polarized light is a special case of a circular polarized light..

B) Attempt any ONE. (05)

1. For a certain glass if the angle of polarisation is 60° , find the R.I of a glass
2. A light of 5000 \AA falls on a quarter wave plate. Find the least thickness for which the E-rays and o-rays are polarized. [$\mu_o = 1.5422$ and $\mu_E = 1.5533$]

Q.3 A) Attempt any two of the following. (20)

1. Explain the construction and working of JK-MASTER-SLAVE flip-flop.
2. With the help of a diagram, waveform and truth-table the 8421-decade counter.
3. What are shift-registers? Explain it's different types.

4. What is difference between latch and flip-flop.? Explain SR-LATCH.

B) Attempt any ONE.

(05)

1. Convert the following binary numbers into octal and hexadecimal.

a) 11011011.10101 b) 10111001.11101

2. Perform the following subtraction using 2's complement method.

a) 1010110 b) 110101

- 1100011 - 101111

Q.4 Attempt any FIVE of the following.

(25)

1. Distinguish between fresnel's and Fraunhofer's diffraction.
 2. Explain the intensity distribution inside the geometrical shadow , if a diffraction Is due to straight edge.
 3. In case of a Fraunhofer's diffraction derive an equation for the width of a Central maxima.
 4. Give Huygen's theory of double refraction.
 5. The angle between the pass axis of polarizer and analyser is 45° , calculate the % of polarization light passing through analyser.
 6. Derive an expression for Brewster's law.
 7. Explain HALF-ADDER. Draw it's symbol and write it's truth-table.
 8. Write a note on contact bounce elimination switch.
 9. Explain synchronous MOD-5 counter.
-

240330

VIA COURSE

S190424

Rizvi College of Arts, Science & Commerce

Off. Carter Road, Bandra (West), Mumbai-400050

S.Y.B.Sc. (Physics) ATKT: 2023-2024

Semester-IV Paper-II (Quantum Mechanics)

Time: 3 Hours

Max. Marks: 100

NOTE:

1. All questions are **compulsory**.
2. All questions carry equal marks.
3. Figures to the right indicate full marks.
4. Use of non-programmable scientific calculator is allowed.

Given: mass of electron 'm' = 9.1×10^{-31} kg

Plank's constant $\hbar = 1.05 \times 10^{-34}$ J-sec

$1eV = 1.6 \times 10^{-19}$ J

Q.1 A) Attempt any TWO of the followings: (20)

- i) What are operators? What is their role in wave mechanics? Write down the Operators for energy and momentum and show how Schrödinger time-dependent form of wave equation may be deduced from these operators.
- ii) The wave function for the motion of the particle in the region $0 < x < L$ is given by

$$\Psi_n(x) = A \sin \frac{n\pi x}{L}$$

Obtain the normalized wave-function. Using this normalized wave function obtain the expectation value of position of the particle in the region $0 < x < L$.

- iii) Derive time-independent form of Schrödinger Wave equation in one dimension. Hence also express it in three dimensional form.

- iv) What is an eigen value equation? Explain what is meant by eigen function

and eigen value. Show that $\psi(x) = e^{-\frac{x^2}{2}}$ is an eigen function of the operator

$\left(\frac{\partial^2}{\partial x^2} - x^2\right)$ with an eigen value equal to -1 .

B) Attempt any ONE of the followings: (05)

- i) Show that the probability current density for a free particle is equal to the product of its probability density and its speed.
- ii) Explain why the expectation values involving operator can be expressed only in given form

$$\langle P \rangle = \int_{-\infty}^{+\infty} \psi^* \hat{P} \psi$$

Q.2 A) Attempt any TWO of the followings: (20)

- i) Consider an electron of energy E incident on the step potential defined by

$$V(x) = \begin{cases} 0 & ; x < 0 \\ V_0 & ; x \geq 0 \end{cases}$$

Show that the particle can penetrate into the second region even if its energy is less than V_0 .

- ii) A particle is confined to move in one-dimensional infinitely deep potential well whose potential is described by

$$V(x) = \begin{cases} 0 & \text{for } x > 0 \text{ and } x < L \\ \infty & \text{for } x \leq 0 \text{ and } x \geq L \end{cases}$$

Set up Schrodinger's equation and solve it. Hence show that the energy of the particle is given by

$$E_n = \left(\frac{\pi^2 \hbar^2}{2mL^2} \right) n^2$$

where m is the mass of the particle and $n = 1, 2, 3, 4, \dots$

- iii) A particle is confined to a three dimensional box with sides L_x, L_y, L_z by impenetrable walls. Set up the Schrödinger time-independent wave equation for the particle and obtain its solution. Hence show that the normalized wave function for the particle inside the box is given by

$$\psi_{n_x n_y n_z}(x, y, z) = \sqrt{\frac{8}{L_x L_y L_z}} \sin \frac{n_x \pi x}{L_x} \sin \frac{n_y \pi y}{L_y} \sin \frac{n_z \pi z}{L_z}$$

- iv) Define free particle? Set up Schrodinger's equation for a free particle. Solve the equation to obtain the wave function. Discuss the condition of normalization of a free particle. (05)

B) Attempt any ONE of the followings:

- i) A particle of kinetic energy $E = 8\text{eV}$ is incident on a potential step of height $V_0 = 4\text{eV}$. Calculate the transmission coefficient T .
 ii) Show that the energy state, $E = \frac{38\pi^2 \hbar^2}{2mL^2}$ of a particle in a cubical box is 9-fold.

Q.3 A) Attempt any TWO of the followings: (25)

- i) Write (do not derive) down the expression for the transmission coefficient T and reflection coefficient R for the rectangular potential barrier of finite height V_0 and finite width a for the case $E > V_0$. Hence show that
 a) when $E \rightarrow V_0$, the transmission coefficient T is given by

$$T = \frac{1}{1 + \frac{mV_0 a^2}{2\hbar^2}}$$

- b) when $T \rightarrow 1$, the width of the potential barrier is an integral multiple of half wavelength.

- ii) State correspondence principle. Show how quantum and classical probabilities of a one-dimensional oscillator leads to correspondence principle.
 iii) The Hermite's differential equation for the one dimensional harmonic oscillator is given by

$$\frac{d^2 H}{d\xi^2} - 2\xi \frac{dH}{d\xi} + (\epsilon - 1)H = 0$$

Solve the above differential equation by the method of Frobenius/power series to obtain the eigenvalues of the harmonic oscillator.

- iv) Define Tunneling effect. Derive an expression of the approximate transmission coefficient of a potential barrier of height V_0 and width a .

B) Attempt any ONE of the followings: (05)

- i) Write down some applications of tunneling effect in modern physics.
 ii) A particle of mass $2mg$ is attached to a spring of spring constant $2 \times 10^{-3} \text{N/m}$. Calculate its zero point energy in eV .

Q.4 A) Attempt any TWO of the followings: (25)

- i) Why the given eigen function cannot be solution of Schrodinger's equation for all values of x ?

a) $\psi(x) = \begin{cases} A \cos kx \\ B \sin kx \end{cases}$ and b) $\psi(x) = A \frac{e^{-kx}}{x}$

- ii) Prove that $\left(\frac{\partial}{\partial x} + \alpha x \right) \left(\frac{\partial}{\partial x} - \alpha x \right) = \frac{\partial^2}{\partial x^2} - \alpha^2 x^2 - \alpha$ [where α is constant]

- iii) Verify that the function $f(x - ct)$ satisfies the wave equation.
 iv) The wave function for the particle inside the box given as

$$\psi_{n_x n_y n_z}(x, y, z) = D \sin \frac{n_x \pi x}{L_x} \sin \frac{n_y \pi y}{L_y} \sin \frac{n_z \pi z}{L_z} \quad \text{for} \quad \begin{cases} 0 < x < L_x \\ 0 < y < L_y \\ 0 < z < L_z \end{cases}$$

and $\psi_{n_x n_y n_z}(x, y, z) = 0$ for $\begin{cases} 0 \geq x \geq L_x \\ 0 \geq y \geq L_y \\ 0 \geq z \geq L_z \end{cases}$

Find the value of D using normalization condition.

- v) Calculate the values of momentum in one-dimensional box of length $2A^0$ for $n = 1$ and $n = 2$.
 vi) Consider a particle which is confined in a one-dimensional box within the region $0 \leq x \leq L$ and whose normalized eigen function is

$$\Psi(x) = \sqrt{\frac{2}{L}} \sin \frac{\pi x}{L}$$

Find $V(x)$.

- vii) Calculate the zero-point energy in eV of a harmonic oscillator of frequency $2 \times 10^{15} \text{ Hz}$.
 viii) Show that the ground state eigen function of the one-dimensional harmonic oscillator

$$\Psi_0(x) = \left(\frac{\alpha^2}{\pi} \right)^{1/4} e^{-\alpha^2 x^2 / 2}$$

is normalized. Use: $\int_{-\infty}^{+\infty} e^{-a^2 x^2} dx = \frac{\sqrt{\pi}}{a}$

- ix) Electrons of energy 5.0 eV are incident on a barrier 3.0 eV high and $1A^0$ wide. Calculate the transmission coefficient T.

***** END *****

240330

Revised Course

5190424

RIZVI COLLEGE OF ARTS, SCIENCE & COMMERCE
S.Y.B.Sc. (PHYSICS) SEM IV REG & ATKT
PAPER – II (USPH402)

Time : 2.30 hrs.

Marks : 75 M

INSTRUCTIONS:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of simple non-programmable calculator is allowed.
4. Draw a diagram wherever necessary.

Q. 1 Attempt any **TWO** of the following. (20)

1. Explain the line integral (Path Integral) of a vector function.
2. State and explain the fundamental theorem for divergence with suitable example.
3. What are spherical polar co-ordinate system and obtain relation between spherical polar co-ordinate system and Cartesian co-ordinate system.
4. In case of cylindrical polar co-ordinate system define unit vectors in-terms of $\hat{i}, \hat{j}, \hat{k}$ vectors. Derive necessary equation for displacement vector, Volume element and Position vector (\vec{r}).

Q. 2. Attempt any **TWO** of the following. (20)

1. State and explain Coulomb's law in electrostatics.
2. Obtain Poisson's and Laplace's equations in electrostatics. Obtain solution of Laplace's equation in three dimensions.
3. State and explain Second uniqueness theorem in electrostatics with suitable example.
4. Write, comments on electrostatic potential. Show that superposition of the potentials follows immediately from the superposition of the field.

Q. 3 Attempt any **TWO** of the following. (20)

1. What are steady currents? Obtain an expression due to infinitely long straight conductors.
2. Obtain Divergence of magnetic field using vector method.
3. What are Surface and volume bound currents? Obtain expression for the magnetic vector potential. Prove that magnetic vector potential is due to vector sum of bound currents densities.
4. Analyse differently the interpretation of bound currents in a uniform magnetization.

Q. 4 Attempt any **Three** of the following. (15)

1. Find the volume of a sphere of radius R, using spherical polar co-ordinate system.
2. Prove that Cylindrical co-ordinate system is orthogonal.
3. Consider a potential (V) = $5x^2 y^3 z^2$ at a given point (1,1,1), then find the potential at P. Verify whether potential satisfies Laplace's equation or not.
4. Find whether the given equation satisfies the Poisson's equation or not. $V = x^2 + y^2 - 2z^2$
5. Enlist difference between electrostatics and magneto statics.
6. Show that the divergence of the bound current density is zero.

*****THE END*****

240403

old course

S 230424

RIZVI COLLEGE OF ARTS, SCIENCE & COMMERCE
SYBSc (PHYSICS) SEM IV - ATKT
PAPER – III (USPH403)

Time : 3 hrs.

Marks : 100 M

INSTRUCTIONS:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of simple non-programmable calculator is allowed.
4. Draw a diagram wherever necessary.

Q. 1 A) Attempt any two of the following. (20)

- 1) Write and explain geomagnetic elements and their units.
- 2) Explain in short internal structure of Earth with neat diagram.
- 3) Write all types of plate boundaries and explain each in short with neat diagram.
- 4) Write note on Delta sediments.

B) Attempt any ONE (05)

- 1) Discuss any two method of determination of age of earth.
- 2) What is Landslide? Write its mechanism.

Q. 2. A) Attempt any two of the following. (20)

- 1) Explain the function of Accumulator, Program counter, stack pointer in 8085 microprocessor.
- 2) Explain the five flags in 8085 microprocessor.
- 3) What is addressing modes? Describe the different addressing modes.
- 4) What is data transfer group? Explain any three instructions of this group with a suitable example.

B) Attempt any ONE. (05)

- 1) Explain the instructions JNC & JZ address.
- 2) Write note on address and data bus of 8085 microprocessor.

Q.3 A) Attempt any two of the following. (20)

- 1) Explain Electrical Noise. Explain various types of Noise.
- 2) What is the need of Modulation? Explain Amplitude modulation and modulation index in case of AM.
- 3) Derive an expression for the frequency spectrum of frequency modulation. Draw necessary graph to support your answer.
- 4) Explain the concept of PAM, PPM, PWM, PCM.

B) Attempt any ONE.

(05)

- 1) In FM system the audio frequency is 1 KHz and audio voltage is 2 V, the deviation is 4 KHz. If the AF voltage is now increased to 8 V and its frequency is dropped to 500 Hz then find the modulation index in each case.
- 2) Determine noise figure for an equivalent noise temperature of 75 k.

Q. 4. Attempt any FIVE of the following.

(25)

- 1) List and Explain three major seismic belts of the world.
 - 2) Write a short note on causes of climate change.
 - 3) Distinguish between Machine language and assembly language.
 - 4) Explain the register array in 8085 microprocessor.
 - 5) Explain tuned radio frequency receiver in case of AM demodulation.
 - 6) Distinguish between AM and FM.
 - 7) Explain (1) Simplex mode of communication, (2) Duplex mode of communication.
 - 8) For a non-ideal amplifier, determine (a) input S/N ratio (dB), (b) output S/N ratio (dB), (c) Noise factor, (d) Noise figure.
-

240403

5230424

RIZVI COLLEGE OF ARTS, SCIENCE & COMMERCE
S.Y.B.Sc. (PHYSICS) SEM IV REG & ATKT
PAPER – III (USPH403)

Time : 2.30 hrs.

Marks : 75 M

INSTRUCTIONS:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of simple non-programmable calculator is allowed.
4. Draw a diagram wherever necessary.

Q. 1 Attempt any **TWO** of the following. (20)

1. Derive time-independent form of Schrödinger Wave equation in one dimension. Hence also express it in three dimensional form.
2. The wave function for the motion of the particle in the region $0 < x < L$ is given by

$$\Psi_n(x) = A \sin \frac{n\pi x}{L}$$

- (a) Obtain the normalized wave-function and write down the eigenstate wave function.
- (b) Using this normalized wave function obtain the expectation value of position of the particle in the region $0 < x < L$.

3. State and explain the basic postulate of quantum mechanics.
4. Derive the equation of continuity in quantum mechanics.

Q. 2. Attempt any **TWO** of the following. (20)

1. For step potential whose potential is described by

$$V(x) = \begin{cases} 0 & ; -\infty \leq x < 0 \quad \text{Region - I} \\ V_0 & ; 0 \leq x \leq +\infty \quad \text{Region - II} \end{cases}$$

A beam of electrons, each of mass m and energy E is incident on a step potential from left to right. For $E < V_0$, show that the reflection coefficient is one and transmission coefficient is zero.

2. A particle is confined to one dimensional infinite rectangular potential well described by

$$V(x) = \begin{cases} 0 & ; x > 0 \quad x < L \\ \infty & ; x \leq 0 \quad x \geq L \end{cases}$$

Write down the Schrodinger's wave equation and solve it to obtain normalized eigen function.

3. A particle is confined to a three dimensional box with sides L_x, L_y, L_z by impenetrable walls. Set up the Schrödinger time-independent wave equation for the particle and obtain its solution. Hence show that the eigen values of the energy of the particle is

$$E_{n_x n_y n_z} = \frac{\pi^2 \hbar^2}{2m} \left[\frac{n_x^2}{L_x^2} + \frac{n_y^2}{L_y^2} + \frac{n_z^2}{L_z^2} \right]$$

4. What is free particle? Set up Schrodinger's equation for a free particle. Solve the equation to obtain the wave function. Discuss the condition of normalization of a free particle.

Q. 3 Attempt any **TWO** of the following. (20)

1. A beam of electrons, each of energy E , is incident on a one-dimensional rectangular potential barrier of width 'a' and height V_0 . The potential is described by

$$V(x) = \begin{cases} 0 & ; -\infty < x < 0 \\ V_0 & ; 0 \leq x \leq a \\ 0 & ; a \leq x < \infty \end{cases}$$

For the case $E > V_0$, Set up the Schrödinger time-independent wave equation for the particle and solve it to obtain the transmission coefficient T.

2. The Hermite's differential equation for the one dimensional harmonic oscillator is

given by

$$\frac{d^2 H}{d\xi^2} - 2\xi \frac{dH}{d\xi} + (\epsilon - 1)H = 0$$

Solve the above differential equation by the method of Frobenius/power series to obtain the eigenvalues of the harmonic oscillator.

3. State correspondence principle. Show how quantum and classical probabilities of a one-dimensional oscillator leads to correspondence principle.
4. Discuss in detail the theory of alpha particle decay from radioactive nucleus.

Q. 4 Attempt any **THREE** of the following. (15)

1. Given that one dimensional wave function $\psi = \sqrt{a}e^{-ax}$. Show that the probability of finding the particle between $x = \frac{1}{a}$ and $x = \frac{2}{a}$ is $\frac{e^{-2} - e^{-4}}{2}$.
2. Prove that $\left(\frac{\partial}{\partial x} + x\right)\left(\frac{\partial}{\partial x} - x\right) = \frac{\partial^2}{\partial x^2} - x^2 - 1$
3. Find the lowest energy of an electron confined in a infinitely high potential box of length 1\AA .

Given: mass of electron 'm' = $9.1 \times 10^{-31}\text{kg}$

$$\hbar = 1.05 \times 10^{-34}\text{J-sec}$$

4. For a particle in a one dimension box, show that the fractional difference in the energy between adjacent energy level is given by

$$\frac{\Delta E_n}{E_n} = \frac{2n+1}{n^2}$$

5. A particle of mass $2mg$ is attached to a spring of spring constant $2 \times 10^{-3}\text{N/m}$. Calculate its zero point energy in eV .
6. Electrons of energy $5.0eV$ are incident on a barrier $3.0eV$ high and 1\AA wide. Calculate the reflection coefficient \mathcal{R} .

*****THE END*****

- N.B.: (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.
 (3) Use of log table/ non-programmable calculator is allowed.

Q1 A Multiple choice question (any 5 out of 7)

5M

- 1 Oxidation and Reduction always occurs at _____ and _____ electrode respectively.
 a) Cathode and Anode b) Anode and Cathode. c) Cathode and Cathode only.
- 2 Chemical energy is converted into electrical energy in devices called _____ cells.
 a) Galvanic b) Concentration c) Electrolytic
- 3 At triple point of water the degree of freedom is _____.
 a) one b) two c) zero
- 4 The number of components present in the system below is

$$N_2O_2(g) \rightleftharpoons 2NO_2(g)$$
 a) one b) two c) zero
- 5 Using a quinhydrone electrode, at 298 K, pH is given by the expression.
 a) $(E_{cell} - 0.699)/0.699$ b) $(0.457 - E_{cell})/0.0592$ c) $(E_{cell} - 0.457)/0.0592$
- 6 _____ is a non-homogeneous system.
 a) Salt solution b) Sugar Solution c) Saturated solution of NaCl
- 7 In a single-component condensed system, if degree of freedom is zero, maximum number of phases that can co-exist _____.
 a) one b) two c) three

Q1 B Match the columns (any 5 out of 7)

5M

- | | |
|--------------|---------------------|
| 1 Scandium | a) Bond order= 4.9 |
| 2 Molybdenum | b) Monodentate |
| 3 Co^{2+} | c) Bond order= 3.7 |
| 4 Co^{3+} | d) $[Ar] 3d^1 4s^2$ |
| 5 EDTA | e) $[Kr] 4d^5 5s^1$ |
| 6 En | f) Hexadentate |
| 7 Aqua | g) Bidentate |

Q1 C True or False (any 5 out of 7)

5M

- 1 Benzoic acid is an aliphatic acid and forms an amide when heated with ammonia.
- 2 The IUPAC of propionic acid is propanoic acid.
- 3 In the HVZ reaction the beta halogenation of acids takes place.
- 4 The nitro group is a p- directing group.
- 5 Benzoic acid reacts with 2 moles of sodium hydroxide.
- 6 BSA is an aromatic acid and undergoes de-sulphonation to form toluene.
- 7 Carbonyl chloride is non-toxic.

Q2 Attempt any 4 **20M**

- A** Calculate ΔG° for the reaction: $Zn_{(s)} + Cu^{2+}_{(aq)} \rightleftharpoons Zn^{2+}_{(aq)} + Cu_{(s)}$
Given: $E^\circ Zn^{2+}/Zn = -0.76\text{ V}$ and $E^\circ Cu^{2+}/Cu = +0.34\text{ V}$ and $R = 8.314\text{ JK}^{-1}\text{ mol}^{-1}$, $F = 96500\text{ C mol}^{-1}$
- B** Calculate e.m.f. of the following cell: $Zn_{(s)}/Zn^{2+}(0.1\text{ M}) \parallel (0.01\text{ M}) Ag^+/Ag_{(s)}$
Given: $E^\circ Zn^{2+}/Zn = -0.76\text{ V}$, $E^\circ Ag^+/Ag = +0.80\text{ V}$.
- C** What is liquid junction potential? How it is eliminated? Explain the construction, principle and working of salt bridge.
- D** Discuss the application of phase rule to water system.
- E** Calculate Degrees of freedom (F) for the following system.
- a) $ice \rightleftharpoons Water \rightleftharpoons Vapour$
- b) $CaCO_3 \rightleftharpoons CaO + CO_2$
- F** The vapour pressure of pure ethanol at 0° C and at 60° C are respectively 0.016 and 0.470 bar. Calculate Molar enthalpy of vapourisation.

Q3 Attempt any 4 **20M**

- A** What are d-block elements? Give name and electronic configurations of 3d series.
- B** Calculate magnetic moment for the following configurations
 i) d^1 ii) d^2 iii) d^6 iv) d^8 v) d^{10}
- C** a) How are the following salts detected qualitatively **3M**
 i) Mn ii) Co iii) Ni
- b) Discuss Diamagnetism **2M**
- D** Define Isomerism. Explain structural isomerism in detail.
- E** Distinguish between double salt and complex salt.
- F** a) Name the following complexes **3M**
 i) $K_2[Ni(CN)_4]$ ii) $K_4[Fe(CN)_6]$ iii) $[CoCl_2(en)_2]Cl$
- b) Find the oxidation state of the following complexes **2M**
 i) $[Fe(H_2O)_6]Cl_2$ ii) $[Cr(CO)_6]$

Q4 Attempt any 4 **20M**

- A** Synthesise benzoic acid from : i) primary alcohol ii) Dry ice.
- B** Write mechanism of conversion of:
 i) acid halide to an amide ii) Acid halide to anhydride.
- C** What is the action of the following reagents on benzoic acid:
 i) sodium carbonate ii) Thionyl chloride iii) $CaO/heat$
- D** What is sulphonation. Write the sulphonation reactions of naphthalene and toluene. Name the products formed.
- E** Draw the structure of the following:
 i) butanoic acid. ii) Benzene-1,3 disulphonic acid. iii) phthalic acid. iv) naphthalene-2-sulphonic acid. v) p-toluene sulphonyl bromide.
- F** Convert: i) any one acid to an anhydride
 ii) Acid to an acid chloride using PCl_3
 iii) propanoic acid to α -bromo propanoic acid.

- Q2 Attempt any 4 20M**
- A Explain with diagram production of X rays using Coolidge tube. Why target anode electrode needs to be cooled during production of X rays.?
- B Explain how Bragg's equation is used to determine inter-planar distance in the crystal.
- C What is crystallography? Explain any four properties exhibited by crystalline solids.
- D How does a catalyst accelerate a reaction? Explain your answer using Arrhenius theory with suitable example and energy profile diagram.
- E What are enzyme catalysts? Using Michaelis-Menten equation law show that when substrate concentration is low the reaction follows first order kinetics and when substrate concentration is high it follows zero order kinetics.
- F Explain the theory of heterogeneous catalysis with suitable examples.
- Q3 Attempt any 4 20M**
- A Give Properties and Uses of Nitric acid
- B Write a note on Photochemical smog
- C i) Give the sources of NO_x and SO_x 3M
ii) Give uses of Phosphoric acid 2M
- D On the basis of pK_a value, give classification of monoatomic cation.
- E Explain the hydrolysis of anion using the following equation:

$$\text{S}^{2-} + \text{H}_2\text{O} \longrightarrow [\text{HS}]^- + \text{OH}^-$$
- F Explain hydration of anion. What are the factors which affect the basicity of monoatomic anion?
- Q4 Attempt any 4 20M**
- A i) How is thiophene prepared from succinaldehyde.
ii) Draw the resonance structures of thiophene.
- B Draw the structure of the following :
i) N-ethyl aniline ii) Biphenyl iii) p-Methyl benzoic acid.
iv) Any one diazotized salt v) α -picoline.
- C i) Prepare a quaternary ammonium salt from methyl amine.
ii) Why does the N atom possess a positive charge.
- D Convert the following:
i) Aniline to 1,3,5-tribromo benzene.
ii) Thiophene to 2-acetyl thiophene.
- E i) How is aminobenzene prepared.
ii) Convert aniline to iodobenzene.
- F Explain the following reactions:
i) carbylamine test ii) Diels Alder reaction of furan

- N.B.: (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.
 (3) Use of log table/ non-programmable calculator is allowed.

Q1 A Multiple choice question (any 5 out of 7)**5M**

- 1 In Bragg's equation θ represents the angle of _____ of X-rays.
 a) incidence b) reflection c) diffraction
- 2 X-ray crystallography uses _____ characteristic of light.
 a) Polarization b) Interference c) Diffraction
- 3 In coolidge tube cathode is made of _____ .
 a) Tungsten b) Silver c) Gold
- 4 A crystalline solid has _____
 a) Definite geometrical shape b) Sharp edges c) both a and b
- 5 Inhibitors are called as _____ catalyst.
 a) Neutral b) Positive c) Negative
- 6 Catalyst is _____.
 a) A substance that speeds up a chemical reaction without being consumed
 b) A product formed in a chemical reaction
 c) A type of acid used in industrial processes
- 7 Enzymes are _____.
 a) lipids b) carbohydrates c) proteins

Q1 B Match the columns (any 5 out of 7)**5M**

- | | | | |
|---|------------------------------|----|-----------------------------|
| 1 | $pK_a \approx 14$ | a) | Acid rain |
| 2 | $pK_a = 1$ to 6 | b) | King of Chemicals |
| 3 | $pK_a < (-4)$ | c) | Very strongly acidic cation |
| 4 | H_2SO_4 | d) | Photochemical smog |
| 5 | PAN | e) | Non acidic cation |
| 6 | Decolourisation of Taj Mahal | f) | Phosphates |
| 7 | Eutrophication | g) | Feebly acidic cation |
| | | h) | Moderately acidic cation |

Q1 C True or False (any 5 out of 7)**5M**

- 1 Amines always contain the N atom.
- 2 Diazotisation is a reaction involving esters.
- 3 Formalin is used to prepare pyridine.
- 4 Nitrogen contains two lone pair and both are nonbonding electrons.
- 5 Thiophene exhibits aromaticity.
- 6 Furan undergoes bromination at 3rd position.
- 7 A diazotized salt contains a positive charged O

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RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE

S.Y.B.Sc. CHOICE BASED (Regular 2023-24) SEMESTER-IV CHEMISTRY: PAPER III

(Time: 2½ Hours)

Total Marks: 75

- N.B.: (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.
 (3) Use of log table/ non-programmable calculator is allowed.

Q1A Multiple choice question (any 5 out of 7) 5M

- 1 In TLC , the stationary phase is
 a) solid b) liquid c) Gas
- 2 is the formation of a solid from a solution
 a) precipitation b) centrifugation c) filtration
- 3 Iodine chamber is used for.....
 a) detection in TLC b) detection in paper chromatography c) determination in TLC
- 4 is mechanical method of separation.
 a) filtration b) precipitation c) solubility
- 5 R_f stands for
 a) retardation factor b) report factor c) reference factor
- 6 distillation is used to separate two or more miscible liquids with different boiling point.
 a) fractional b) azeotropic c) vaccum
- 7 technique is used to separate charged macromolecules like proteins, enzymes, hormones.
 a) filtration b) electrophoresis c) solvent extraction

Q1B Match the columns (any 5 out of 7) 5M

- | | | | |
|---|-----------------------------|----|-------------------------------------|
| 1 | Reference electrode | a) | Glass electrode |
| 2 | Conductometry | b) | Conductivity cell |
| 3 | Saturated KCl solution | c) | V shaped |
| 4 | Platinum electrode | d) | Pt electrode |
| 5 | Indicator electrode | e) | Salt bridge |
| 6 | Strong acid v/s strong base | f) | Measure the conductance of solution |
| 7 | Redox titration | g) | Calomel electrode |

Q1C True or False (any 5 out of 7) 5M

- 1 The overall shape of normal error curve is measure of precision of the measurement.
- 2 .When the number of measurements are more than 30 then practically \bar{x} and s are identical.
- 3 Q test is not used for rejection of data.
- 4 Null hypothesis is used for rejection of doubtful value from the set of measurements.
- 5 If F_{cal} is less than F_{tab} then two standard deviation are significantly identical.
- 6 Student t method is used to develop confidence interval.
- 7 For a very large number of measurement, absolute deviation is given as $\pm ts$.

RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE

S.Y.B.Sc. CHOICE BASED (Regular 2023-24) SEMESTER-IV CHEMISTRY: PAPER III

Q2 Attempt any 4

20M

- A Explain different methods of development of chromatogram in paper chromatography.
- B Give the principle of electrophoresis. How it is carried out?
- C What is Nernst' Distribution Law?
500 cm³ of water contains 100 mg of an acid. It is shaken with 50 cm³ of an organic solvent. At equilibrium it is observed that 20 mg of the acid remains unextracted. Calculate the distribution ratio of the acid between water and the organic solvent.
- D Give a brief note on thin layer chromatography.
- E Describe batch extraction and continuous extraction in solvent extraction.
- F Give a brief note on types of separation methods based on volatility.

Q3 Attempt any 4

20M

- A Give a brief note on conductance cell.
- B Give application of pH metry in biological and envirmetal analysis.
- C Explain briefly role of refrence electrode and indicator electrode in potentiometric titration.
- D What are merits and demerits of the glass electrode used in pH metry
- E Explain different type of conductometric titration with neat diagram.
- F What are advantages and limitation of potentiometric titration.

Q4 Attempt any 4

20M

- A Explain i) 2.5d rule ii) 4d rule used in rejection of data.
- B .write a brief note on null hypothesis.
- C Five replicate measurement for the determination of gold in a sample of gold gave the following results.
15.61, 15.52, 15.63, 15.68 and 15.64% gold.
Calculate the 95% confidence limits for the mean if: (i) no additional. information about the precision of the method is known and (ii) a large number of measurements have given $\sigma = 0.02$.
($t=2.78$ for 95% confidence limit) ($z = 1.96$ for 95% confidence limit)
- D Describe Gaussain distribution curve with its salient features .
- E What is the significance of F - test.
- F In the analysis of sulphur content of a sample, the following values were reported. Sulphur content (per cent): 0.47, 0.48, 0.47 and 0.50. Find whether the value of 0.50 can be retained on the basis of the Q-test.(given : $Q_{tab} = 0.76$)

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ASC 390424

Rizvi College of A/S/C
Foundation Course – Paper IV (SEM IV)
March 2024

Time: 02 1/2hr

Marks:75

Note:

All question are compulsory.

Figures to the right indicate full Marks

Q1 (A). Explain the following concepts (Any Five) 15Marks

- a. Violations of consumer Rights.
- b. Consumer Courts.
- c. Anthropocentrism.
- d. Polluter pays principle.
- e. Laser Technology.
- f. Genetic engineering.
- g. Time Management
- h. Motivation.

OR

Q1 (B) Write a Comprehensive note on the Semester IV Foundation course project submitted by you.

Q2 (A) Examine RTI as an attempt to promote transparency and accountability among public authorities. 15Marks

OR

Q2 (B) Illustrate on Public interest Litigation.

Q3 (A) Write a detailed note on Eco-Feminism. 15Marks

OR

Q3 (B) Examine the Sustainable Development Goals 2015-2030.

Q4 (A) What is ICT? Examine the significance & Applications of IT. 15Marks

OR

Q4 (B) Highlight the uses/Applications of Laser Technology.

Q5 (A) Define the team Goal. Explain various steps of Goal setting. 15Marks

OR

Q5 (B) Discuss various effective strategies for Time Management.