S.Y. BSC

RIZVI COLLEGE OF A/S/C

FOUNDATION COURSE -Paper IV (SEM IV)

SYASC - 101   March-2023   230328

Duration:2 1/2 Hrs   Total Marks :75

Note:1. All questions are compulsory.

    2.Figures to the right indicate full marks.

Q.1(A).Explain the following concepts(Any Five) **15 Marks**

a. Citizens' Charters in India

b. Public Services Guarantee Act

c. Polluter Pays Principle

d. Sustainable Development

e. Nanotechnology

f. Information and Communication Technology

g. Soft skills

h. Report Writings

OR

(B) Write a comprehensive note on the Foundation Course(Semester IV) project submitted by you.

Q.2.(A)How are the rights of consumers violated? What are the

provisions of Consumer Protection Act 2019 in India?   **15 Marks**

OR

(B) write a detailed note on Right to Information.

Q.3.(A) Discuss any three environmental approaches to understand ecology? **15 Marks**
OR

(B) what are the different environmental principles?

Q.4.(A) in what way the laser technology is useful? what are its harmful effects ?   **15 Marks**

OR

(B) Discuss the advantages and disadvantages of biotechnology?.

Q.5. (A) Explain the theory of motivation of Abraham Maslow. what steps one can take in smart goal-setting? **15 Marks**

OR

(B) what is meant by time management? What are the benefits and techniques of it?

S4S -106 SYBSc. Semester IV Zoology Paper I   *230410*
Time: 3 Hrs   100 Marks

N.B : 1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw neat and labeled diagrams wherever necessary.

Q1A. Fill in the blanks by choosing the correct options given below   05

a) Who introduced binomial nomenclature for naming species?
(Lamarck, Linnaeus, Darwin)

b) In chromosome translocation, the broken fragment attaches to _____ chromosome.
(homologous, non-homologous, parent)

c) Genetic drift causes significant changes in the gene pool in a _____ population.
(small, medium, large)

d) _____ is a comprehensive report of research
(Thesis, Dissertation , Article in Journal)

e) Most important component of research paper which influences reader to read or skip.
(Title, Keywords, Abstract)

B. Match the columns I and II and rewrite   05

Column I	Column II
a) Germ plasm theory	i) Post-zygotic isolation
b) Mechanical isolation	ii) Weismann
c) Hybrid sterility	iii) Pre-zygotic isolation
d) Mutation theory	iv) additional material
e) Appendices	v) Hugo de Vries

C. State whether True or False   05

a) Paleontology deals with study of fossils.

b) The organisms with two layers are called triploblastic.

c) The selection of infants with medium skull size is an example of stabalizing natural selection.

d) X-chromosome trisomics have been linked to criminal acts of social significance.

e) A monograph is used if the research results have a role in policy making regarding issues.

D. Answer in only one sentence   05

a) Define Petrification

b) Define Impression.

c) What is gene flow?

d) What is research reference?

e) Describe the term Euthanasia

Q 2. **A.** Discuss anatomical evidences in favor of organic evolution.   **10**

OR

A. Describe the theory of Darwinism with examples.

Q2.B. **Explain any two of the following.**   **10**
   a) Weismans germplasm theory.
   b) Evidences of evolution from homologous and vestigial organ
   c) Describe origin of universe
   d) Paleontology

Q3. A. Describe the three patterns of natural selection with examples   **10**

OR

A. Pre-zygotic and post-zygotic isolating mechanisms

Q3. B. Explain any two of the following   **10**
a) Allopatric speciation
b) Chromosomal deletion
c) Aneuploidy involving the sex chromosome
d) Two factors disrupting Hardy-Weinberg equilibrium

Q.4 A. Elaborate on ethics in animal research.   **10**

OR

A. Explain processing of research proposals and grant of permission.

Q.4. B. Explain any two of the following   **10**
a) Research abstract and its types.
b) Techniques of dissemination of data.
c) Review paper writing.
d) Technical report.

Q5. Write short notes on any four of the following   **20**

a) Origin of eukaryotic cell
b) Stages of origin of life.
c) Inbreeding and Inbreeding depression
d) Sympatric speciation
e) Bibliography
f) National biodiversity authority.

SYBSc. Semester IV Zoology Paper II

230412

Time: 3 Hrs   100 Marks

N.B : 1. All questions are compulsory.

2. Figures to the right indicate full marks.

3. Draw neat and labeled diagrams wherever necessary.

Q1A. Fill in the blanks by choosing the correct options given below   05

a) Cell wall is present in _____.

(Plant cell, endosymbiont, eukaryotic cell)

b) The architecture of _____ consists of an intricate network of sheets and tubules.

(Nucleus, ribosomes, endoplasmic reticulum)

c) Any defect in lysosomal enzymes results in storage disease such as _____.

(Diabetes, atherosclerosis, pompe's disease)

d) The _____ is the common type of secondary structure seen in proteins.

(α-helix, β-sheet, β turns)

e) MUFA and PUFA are types of _____ fatty acids.

(unsaturated, saturated, trans)

B. Match the columns I and II and rewrite   05

Column I	Column II
a) Hydrophilic	i) storage batteries of the cell
b) Transfer vesicles	ii) shuttle vesicles
c) Mitochondria	iii) polar
d) Saturated fats	iv) low melting point
e) Unsaturated fats	v) high melting point

C. State whether True or False   05

a) A solution in which there is no flow of water into the cell and vice versa is called an isotonic solution.

b) Pinocytosis is also called cellular eating.

c) Sarcoplasmic reticulum is found in skeletal and cardiac muscles.

d) Quarternary structure of proteins occurs only in proteins with more than one peptide.

e) Glycogen is the storage polysaccharide in plants.

D. Answer in only one sentence   05

a) Define the Desmosomes.

b) Define the Golgi complex.

c) What is mitochondrial matrix?

d) What are disaccharides?

e) Name the fat-soluble vitamins.

Q 2.   A.   Describe the structure of cells?   **10**

OR

A₁.   Describe the junctional complexes in vertebrates.

Q2.B.   Explain any two of the following.   **10**
a)   Active transport
b)   Classification of membrane receptors
c)   Ultrastructure of nuclear pore
d.)   Ultrastructure of nucleus

Q3. A. Describe the general morphology and ultrastructure of Endoplasmic reticulum 10

OR

A.   Explain the ultrastructure and functions of mitochondria.

Q3. B. Explain any two of the following   **10**
a)   Polymorphism in lysosomes
b)   Functions of golgi complex
c)   Types of endoplasmic reticulum
d)   Oxidative phosphorylation

Q.4 A.Discuss the two main secondary structures of proteins   **10**

OR

A.   Write a note on saturated and unsaturated fats. Discuss in detail saturated and unsaturated fats with respect to their melting point and solubility

Q.4. B. Explain any two of the following
a) Glycosidic bond in carbohydrates
b) Tertiary and quaternary structure in proteins
c) Phospholipids
d) Nomenclature of lipids

Q5. Write short notes on any four of the following   **20**
a)   Functions of plasma membrane
b)   Nucleocytoplasmic interactions
c)   Functions of endoplasmic reticulum
d)   Peroxisomes
e)   Biological significance of lipids
f)   Role of cholesterol in plasma membrane

SYBSc Semester IV
Zoology Paper III (Course X)
Sys-110
230417
Time: 3 hrs
Marks: 100

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

Q. 1 A) Fill in the blanks by choosing the correct option.   (05)

   a) The sperm moves in a fluid medium inside the female genital tract by the _____
       movement of the tail.
       (Undulating, motile, non-undulating)
   b) Formation of a solid ball of cells by blastomere division is called as _____.
       (Blastula, Morula, Gastrula)
   c) The first menstruation begins at puberty and is called _____.
       (Ovulation, menarch, menstrual cycle)
   d) The stratum for away from earth's surface and closer to sun is _____.
       (Stratosphere, mesosphere, thermosphere)
   e) The lowermost hardest layer of solid rocks.
       (E Horizon, B Horizon, R Horizon)

Q. 1 B) Match the column I & II and rewrite   (05)

Column A	Column B
1. Emboly	a) Erectile dysfunction
2. Deuterostome	b) Invagination
3. Impotence	c) Absence of sperm
4. Azoospermia	d) Decibel
5. Noise pollution	e) Enterocoely

Q. 1 C) State whether True or False.   (05)

   a) The animals having true coelom are referred as eucoelomates.
   b) Mesoderm develops into muscles, skeletal and circulatory system.
   c) Non- deciduous placenta is found in *Parameles*.
   d) Inhibin regulates spermatogenesis by regulating FSH production through posterior
       pituitary gland.
   e) E-waste is due to increased use of computer, cellphones etc.

Q. 1 D) Answer in one sentence   (05)

   a) What is dorsal lip of blastopore?
   b) What is somatopleure?
   c) Name the causative agent of chlamydia.
   d) Full form of PCOS.
   e) Define biosphere.

Q. 2 A) Describe morphogenetic movements of cells during gastrulation.   10)

OR

Q. 2 A) Give an account on types of placenta based on histological characteristics. (10)

Q. 2 B) Answer any two from the following   (10)

a) Write a note on allantois
b) Explain in brief the basic structure of sperms
c) Discuss blastocyst
d) Write a note on endogenous yolk sac.

Q.3 A) Describe the female reproductive system and its hormonal regulation.   (10)

OR

Q.3 A) Give a detailed account of infertility related disorders.   (10)

Q. 3 B) Answer any two from the following   (10)

a) What are the genetic causes of female infertility?
b) Write a note on ethical considerations of ART.
c) Explain the role of genital herpes in infertility.
d) Explain in brief impotence.

Q.4 A) Describe the effects of water pollution.   (10)

OR

Q. 4 A) Describe the types and sources of solid waste pollution.   (10)

Q. 4 B) Answer any two from the following   (10)

a) Describe the effects of air pollution
b) Describe the various types of water pollution.
c) Explain the sources of soil pollution.
d) Explain the different means of noise pollution.

Q. 5) Write short notes on any four from the following   (20)

a) Epiboly
b) Emboly
c) IFT
d) PCOS
e) Four components of environment
f) Radioactive pollution

Subject Code: USB401 / Botany: Paper I

[Time: Three Hours]   [Marks: 100]

Please check whether you have got the right question paper.

SYS/12
N.B: 230419

   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. *Erysiphe* belongs to the class _____.
   a) Ascomycetes   b) Basidiomycetesc   c) Plectomycetes   d) Hemiacomycetes

2. *Xylaria* is commonly known as _____
   a) Powdery mildew   b) Rust   c) Blight   d) Dead man's finger

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 alga 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-gametophtye of *Selaginella* is shed from the microsporangium at _____ stage.
   a) 4-celled   b) 8-celled   c) 13-celled   d) 16-celled

8. _____ is the largest order of living gymnosperm.
   a) Cordaitales   b) Ginkgoales   c) Coniferales   d) Gnetales

9. _____ wood is more compact with less parenchyma soft tissue.
   a).Manoxylic   b) Pycnoxylic   c) Polyxylic   d) Pentaxylic

10. *Pinus* is a _____ plant.
   a) monoecious   b) dioecious   c) unisexual   d) asexual

Q.1. B). Answer in one or two sentences   **10 M**

1. Give any two characteristic features of ascomycetes.
2. Give the causal organism and any one symptom of Powdery mildew.
3. What is compression?
4. Mention any two salient features of Psilophyta.
5. Give any two important characteristic features of Gymnosperms.

Q.2. Answer the following questions in brief (any two)   20 M

1. Give an account of general characters of ascomycetes.
2. Describe the asexual reproduction in *Erysiphe*. Adda note on its systematic position
3. What are lichens? Discuss different types of lichens based on thallus structure and support your answer with labelled diagram.
4. Give the causal organism, symptoms, and disease cycle of Late blight of Potato. Add a note on its control measure

Q.3. Answer the following questions in brief (any two)   20 M

1. Discuss the salient features of Lepidophyta and Psilophyta.
2. Describe the external morphology of *Selaginella*. 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. Give a detailed account of classification of class Coniferophyta up to its order.
2. With the help of neat labeled diagram explain internal structure of *Pinus* young stem
3. Discuss the economic importance of Coniferophyta.
4. Describe the external and internal structure of female cone of *Pinus*.

Q.5. Write short notes on: (any four)   20 M

1. Systematic position of *Xylaria*.
2. Schematic diagram for disease cycle of Powdery mildew
3. T.S. of *Selaginella* root
4. T.S. of *Selaginella* stem.
5. R.L.S. of *Pinus* wood.
6. T.L.S. of *Pinus* wood.

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

Paper/ Subject Code: 402/ Botany: Paper II

230420

[Time: Three Hours]   [Marks: 100]

Please check whether you have got the right question paper.

545 114

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) The cambium present within the vascular bundle is called _____.
    (a) abaxial   (b) adaxial   (c) fascicular   d) interfascicular

2) Jute is an example of bast fibre of _____.
    (a) secondary phloem   (b) secondary xylem   (c) vessels   (d) cambium

3) The top and bottom portion of I-girders are known as _____.
    (a) web   (b) flanges   (c) neutral axis   (d) phelloderm

4) Open vascular bundles are present in _____.
    (a) monocot stem   (b) dicot stem   (c) root   (d) rhizome

5) _____is the flowering hormone.
    (a) Florigen   (b) Vernalin   (c) Phytochrome   (d) Florilin

6) _____ enzyme can bring about fermentation extracellularly.
    (a) Succinase   (b) Fumarase   (c) Zymase   (d) Maltase

7) The response of plants to the photoperiod expressed in the form of flowering is called as _____.
    (a) Photosynthesis   (b) Photoperiodism   (c) Vernalization   (d) Respiration

8) _____ are absolutely essential for the normal growth of the plant.
    (a) Rock   (b) Salt   (c) Nutrients   (d) Sulphates

9) In aquatic ecosystem nitrogen compounds are lost by process of _____.
    (a) Sedimentation   (b) Calcification   (c)Oxidation   (d) Reduction

10) The word 'Edaphos' refers to_____.
    (a) Air   (b) Water   (c) Soil   (d) Ecology

Q1.B) Answer in one or two sentences   10

1. Name basic components of Phloem
2. Define photosynthesis
3. What is the role of RUBISCO in photorespiration?
4. What are tyloses?
5. Define ammonification.

2.   Answer the following questions in brief (any two)   20

a) What are vascular bundles? Give an account of various types of open vascular bundles.
b) Discuss in detail structure of periderm and give functions of same.
c) What is normal secondary growth? Describe in detail T.S of young sunflower stem.
d) What is I-girder? Explain in detail distribution of mechanical tissues in aerial organs of plants.

3.   Answer the following questions in brief (any two)   20

a) Describe different steps involved in EMP Pathway and add not on its Significance
b) Explain mechanism of vernalisation and induction of flowering.
c) Describe the ultrastructure of mitochondria.
d) Explain the mechanism of action for phytochromes in SDPs and LDPs.

4.   Answer the following questions in brief (any two)   20

a) What are biogeochemical cycles? Explain in detail Carbon cycle.
b) What are ecological factors? Explain topographic factors.
c) What do you mean by soil composition? Explain brief account on chemical components.
d) What is community ecology? Give the details of qualitative characters

5.   Write short notes on: (any four)   20

1. Heart wood and sap wood
2. Lenticels
3. Electron transport system
4. Aerobic respiration
5. Quadrats
6. Transect

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

Paper/ Subject Code: USBO403/ Botany: Paper III

[Time: Three Hours]   [Marks: 100]

Please check whether you have got the right question paper.

S45116

230421

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) In a formal garden the imaginary central line is known as _____.
(a) Edges   (b) Focal point   (c) Hedges   (d) Axis

2)   The production, marketing and arranging of flowers and foliage plants is called _____.
(a) Olericulture   b) Floriculture   c) Pomology   d)   Arboriculture

3)   _____ are small areas between the pathway and lawn or walls.
(a) Edges   (b) Lawn   (c) Axis   (d) Hedges

4)   Activated charcoal is used in nutrition media to
(a) Absorb toxic substances   (b) Absorb elements   (c) Absorb moisture   (d) Absorb microbes

5)   Virus eradication can be done using _____ culture.
(a) anther   (b) meristem   (c) root   (d) shoot

6)   Laminar air flow is used for the following reasons except :
(a) For culture growth   (b) Transferring explants   (c) Aseptic transfer (d) Preparing media

7)   The Ti plasmid is found in _____.

(a) *Agrobacterium* (b) Yeast as 2mm plastid   (c) *Azotobacter*   (d) *Rhizobium*

8)   It is defined as the tendency of simultaneous variation between two variables.
(a) Correlation   (b) Multiple relation (c) Relation   (d) Negative relation

9)   Coefficient of correlation can take any value between _____.

(a) 0 to +1   (b) Negative 1 to +1   (c) 1-1000   (d) 0 to -1

10) The nucleic acid sequence database of Gene bank is maintained by _____.

(a) Brookhaven Lab   (b) DDBJ   (c) EMBL   (d) NCBI

B)   Answer in one or two sentences

1. What is landscape garden?
2. What is virus eradication?
3. State any two limitations of Bioinformatics
4. State any two tools for studying protein structure.
5. What is Pomology?

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

a) Define horticulture. State the importance and objectives of horticulture.
b) Briefly describe the edges and give the examples of plants used as edges.
c) Describe water garden and focal point.
d) What is national park? Add a note on Sanjay Gandhi National Park.

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

a) Give an account of laboratory organization for plant tissue culture.
b) What are vectors? Describe in detail about phages as vectors.
c) Describe in detail the technique of gene cloning.
d) What is organ culture? Describe it with reference to embryo culture.

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

a) Write an account on internet and its uses
b) With reference to dedicated tools of retrieving a biological data, explain ENTREZ.
c) What is Chi square? Give characteristics and terms used in the test.
d) Find the coefficient of correlation between the height of mothers and sons from the following data.

Mother's Height	72	70	66	65	69	74	64	68
Son's Height	68	73	68	70	68	71	66	70

5.   Write short notes on: (any four)

i.   Flower Bed
ii. Hedges
iii. DNA ligase
iv. Organogenesis
v.   Types of Correlation
vi   Different types of BLAST

SYS 111

S.Y. B.Sc. SEMESTER – IV EXAMINATION: APRIL 2023

MATHEMATICS PAPER –I: MULTIVARIABLE CALCULUS – I

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) Show that the limit of a scalar valued function $f: \mathbb{R}^n \to \mathbb{R}$ 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 $(x, y) \to (0,0)$ using path test, where

$$f(x,y) = \begin{cases} \dfrac{x^2 - y^2}{x^2 + y^2}, & (x,y) \neq (0,0) \\ 0, & otherwise \end{cases}$$

(c) Find the directional derivative of the function $f(x, y, z) = xy + yz + zx$ at $(1,0,-1)$ in the direction of $(-2,1,0)$.

(d)) Check the convergence of the sequence $x_n = \left(\dfrac{4n-3}{8n+7}, \dfrac{3n^2+5}{4n^2+3n+1}, \dfrac{7n}{6n^2+10} \right)$

(e) If $u = \log\left[\dfrac{x^2+y^2}{x+y}\right]$, prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = 1$.

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

(a) Show that if a scalar field $f: \mathbb{R}^n \to \mathbb{R}$ is differentiable at a point $a \in \mathbb{R}^n$ then f is continuous at $a \in \mathbb{R}^n$.

(b) Let $f, g: \mathbb{R}^n \to \mathbb{R}$ 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 $f(x,y,z) = 144 - x^2 - y^2 - z^2$ for $C = 0, 44$.

(e) Find the total derivative of $u = 2sinxy + cosy$ where $x = t^3, y = t^2$ using Chain rule.

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

(a) Find the Taylor's polynomial of degree two for the function

$f(x,y) = sinx \ siny \ at \ (0,0)$

(b) Find the linearization of the function $f(x,y,z) = 4x^3 + xy^2 + z^3$ at $(1,1,1)$

(c) Find the Jacobian matrix of the function $f: \mathbb{R}^3 \to \mathbb{R}^3$ given by

$f(x,y,z) = (x+y, y+z, z+x) at \ (1,2,1)$.

(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

$$f(x,y) = x^2 + 3xy + 3y^2 - 6x + 3y - 6$$

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

(a) Show that $\|x + y\| \leq \|x\| + \|y\|$ for all $x, y \in \mathbb{R}^n$.

(b) Find the iterated limits for the function $f(x,y) = \begin{cases} \frac{x^2y^2}{x^2+y^2}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$

(c) State and prove Euler's theorem for function of two variables.

(d) Find the gradient of $f(x,y,z) = 2x^3 + 5xyz^2 - 3zy^2$ at the point $(1,2,-3)$.

(e) If $F(x,y,z) = xyz - cos(x+y+z)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

(f) Find the Hessian matrix of $f(x,y) = x^2 + 4xy - y^2$ at $(-1,2)$.

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2

SYBSC SEM IV REGULAR MARCH 2023

SYS 113
MARKS:75

MATHEMATICS II

230420

TIME DURATION: 2 Hrs. 30 Min.

Q.1 Attempt any Four. (20)

(i) Verify whether the map T: $R^3 \rightarrow R^3$ defined as T (x, y, z) = (x + y, z, 2x) is a linear Isomorphism.

(ii) Verify Rank Nullity Theorem for the Map T: $R^2 \rightarrow R^3$ 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: $\mathbb{R}^3 \rightarrow \mathbb{R}^3$ is a linear map 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) Find the angle between the vectors (1,0,0) and (1, -1, 0).

(iii) State and prove Pythagoras theorem.

(iv) Using Gram Schmidt orthogonalization process, find an orthonormal basis for the inner product space whose basis is {(1,0,1), (0,1,1), (1,3,3)}.

(v) Let V be a real inner product space and u be a unit vector in V. For any v ∈ V, Prove that, $\|v - P_V(u)\| \leq \|v - \alpha u\|$, ∀α ∈ R. The equality holds if and only if $P_v(u) = \alpha u$.

Q.3 Attempt any Four. (20)

(i) Find the eigen value and the basis of eigenspace of the matrix $\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$.

(ii) Let V be a vector space and A: V → V be a linear map. Let $\lambda \in \mathbb{R}$. Let v_λ be the sub set 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 → 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 A be an n×n matrix. Prove that a number λ is an eigenvalue of A if and only if λ is a root of characteristic polynomial of A.

(v) Let V be a vector space and A: V → V be a linear map. Prove the set {v₁, v₂, ———, vₘ} of the eigenvectors corresponding to the distinct eigenvalues $\lambda_1, \lambda_2, - - - - -, \lambda_m$, is linearly independent.

Q.4 Attempt any Three.   (15)

(i)   Prove that, the following three statements are equivalent.
        a) T is an isomorphism
        b) Ker.T = {O}
        c) Im(T) = V

(ii)   If V and W are any two real vector spaces and T: V → W is a linear
        transformation then prove that
        a) Ker.T is a subspace of V;
        b) 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 $x - y + z = 0$.

(v)   Let A be a real symmetric matrix and $f(X) = {}^tXAX$ 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 eigenvalue of A.

(vi)   Find the eigen value and the basis of eigenspace of the matrix $\begin{pmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{pmatrix}$

<u>S.Y. B.Sc. SEMESTER – IV EXAMINATION: APRIL, 2023</u>   *230471*

SYS115

<u>MATHEMATICS PAPER –III: NUMERICAL METHODS (ELECTIVE - A)</u>

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 $x = (5 - x)^{1/3}$ by using the fixed point iteration method up to three approximations.

(e) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ 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
$f(x)$	14	25	35	54

(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)	46	66	81	93	101

(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	23	19	14	11	12.5	16	19	20	20

1

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. $(4 \times 5 = 20\ Marks)$

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(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 $x = (5 - x)^{1/3}$ by using the fixed point iteration method up to three approximations.

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

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Population (y) (in 1000's)	46	66	81	93	101

(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	23	19	14	11	12.5	16	19	20	20

(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	22	30	27	18	7	0

(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. ($2 \times 10 = 20\ Marks$)

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

$$2x + 3y + z = 9$$
$$x + 2y + 3z = 6$$
$$3x + y + 2z = 8$$

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

$$10x + 2y + z = 9$$
$$x + 10y - z = -22$$
$$-2x + 3y + 10z = 22$$

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

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

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

(a) Find the root of the equation $2x = cosx + 3$ using fixed point method.

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

38.46235, 0.70029, 0.0022218, 19.235101. 2.36425

(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	0.6931	1.0986	1.3863

(d) Fit a straight line for the equation $y = 8.71 + 0.68x$ for $x = 0,1,2,3,4,5$.

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

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

$$2x + 5y = 16$$
$$3x + y = 11$$

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RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE.
BANDRA WEST, MUMBAI
SYS -102   SEMESTER IV, PAPER-1, APRIL 2023.   23D331

NOTE: All questions are compulsory.   MARKS -100

Figures to the right indicate full marks.   TIME – 3 HOURS

Q 1. A. CHOOSE THE CORRECT OPTION AND REWRITE THE STATEMENT. (ANY10)

1. In a single component system, if degree of freedom is one, maximum number of phases that can coexist is _____
   One, two, three.

2. For water system, the number of phases at the triple point is _____
   One, two, three

3. Identify the salt that cannot be used in salt bridge.
   KCl, Na_2CO_3 , KNO_3

4. $Cd_{(s)} + Cu^{+2} \longrightarrow Cu_{(s)} + Cd^{+2}$
   Cadmium is undergoing reduction,   Copper is undergoing reduction, both Cadmium and copper are undergoing reduction.

5. For two component condensed system, Gibbs rule is given by
   $F=C-1-P$, $F=C+1-P$, $P+F=2$

6. _____ is the hybrid orbitals have tetrahedral geometry.
   sp, sp^2, sp^3

7. Cancer patients are treated with _____ complex of platinum.
   Cis-diammine dichloro, trans-diammine dichloro, cis-diammine trichloro

8. _____ is consider as father of coordination chemistry.
   Werner, Andreas, Fischer

9. _____ is known as wonder metal.
   Platinum, Palladium, Titanium

10. _____ is the fourth most abundant transition elements.
    Manganese, Chromium, Iron

11. Benzoic acid is a _____ carboxylic acid.
    Mono, di, tetra

12. Dieckmann reaction forms a cyclic _____ keto ester.
    Alpha, gamma, beta.

1

13. The IUPAC of propionic acid is _____
    Ethanoic acid , butanedioic acid , propanoic acid.

14. In the HVZ reaction _____ acid is heated with bromine.
    Benzoic, formic, propanoic

15. The nitro group is a _____ directing group
    ortho, meta, para.

B. MATCH THE COLUMNS (ATTEMPT ANY 5)

COLUMN 'A'	COLUMN 'B'
1. Eutectic point	Dicarboxylic acid
2. Oxidation always occurs at	Lead system
3. Reduction always occurs at	Anode
4. dsp^3	Meta directing
5. d^2sp^3	octahedral
6. $-SO_3H$	Cathode
7. terephthalic	trigonal bipyramidal

C. STATE TRUE OR FALSE (ANY 5)

1. In galvanic cell Gibbs free energy of the redox reaction is converted to electrical energy.
2. Sulphur has three triple points.
3. There are five series of transition elements in the periodic table.
4. The valence shell configuration of Chromium is $3d^4 4s^2$.
5. Complexes with coordination number 4, mostly have planar & tetrahedral arrangement.
6. Benzoic acid reacts with an ammonia to form an acetyl compound
7. BSA is an aromatic acid
8. Phosgene is non toxic.

Q 2. ATTEMPT ANY FOUR QUESTIONS [5 MARKS EACH].

A. Represent the complete cell by using the half cell given below. Design a cell from given half cell and identify the anode, cathode for the given half cell and write both the anode, and cathode reaction and the net reaction for the same cell. Calculate the emf generated for the cell represented by you.

1. $E°Ag^{+1}|Ag_{(s)}=0.799$ V
   $E°Cu^{+2}|Cu_{(s)} = 0.337$ V

2. $E°Cd^{+2}|Cd_{(s)}=-0.403$ V
   $E°Zn^{+2}|Zn_{(s)} = -0.763$ V

B. Explain the following
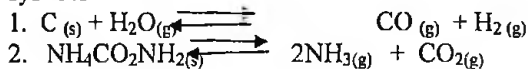   1. Degree of freedom
   2. Phase and components of a system

C. Calculate the pH of solution from the following data.
   SCE|H$^+$, Quinhydrone|Pt
   At 25°C Ecell =0.1 V, E SCE = 0.242 V and EQH= 0.699 V .
   For the above cell, write the net cell reaction.

D. Calculate the no. of phase, no. of components, and degree of freedom in the following systems.
   1. $C_{(s)} + H_2O_{(g)} \rightleftharpoons \quad CO_{(g)} + H_{2\,(g)}$
   2. $NH_4CO_2NH_{2(s)} \longrightarrow 2NH_{3(g)} + CO_{2(g)}$

E. Derive Clapeyron-Clausius equation.

F. Explain the given gas concentration cell with respect to anode, cathode and net cell reaction.
   Pt, $Cl_{2(g)}$ | $HCl_{(aq)}$ |$Cl_{2(g)}$, Pt
   $P_1 \qquad \qquad P_2$
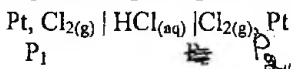
Q 3. ATTEMPT ANY FOUR QUESTIONS [5 MARKS EACH].

A. Name the elements of third transition series and give their electronic configuration.
B. What are transition elements? Explain its properties.
C. Explain properties of oxides of vanadium.
D. Define   i) double salt   ii) complex salt   iii) coordination compound   iv) complex ion
   v) ligand
E. Give IUPAC name of the following coordination compound. i) $[Co(NH_3)_6]Cl_3$ ii) $Ag(NH_3)_2]Cl$
   iii) $[CoCl(NH_3)_5]^{2+}$ iv) $[CoH_2O(NH_3)_5]I_3$ v) $K4[Fe(CN)_2)_6]$
F. Write notes on Werners coordination theory.
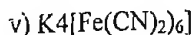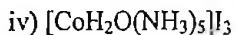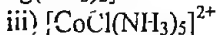
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Q 4. ATTEMPT ANY FOUR QUESTIONS [5 MARKS EACH]. ·

A. Explain the acidic character of carboxylic acids. Why is o-hydroxy benzoic acid stronger than benzoic acid.

B. Write mechanism of conversion of:
1. acid halide to an amide
2. acid halide to an anhydride

C. How is benzoic acid prepared from the following:
1. toluene   2. grignard reagent   3. Cyanobenzene

D. What is the action of the following reagents on benzoic acid:
1. sodium carbonate   2. PCl_5 3. ammonia/ heat

E. What is sulphonation. Write its mechanism

F. Draw the structure of the following:
1. methanoic acid   2. fumaric acid   3. malonic acid.
4. naphthalene-1-sulphonic acid   5. o-xylene
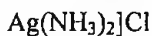
Q 5. ATTEMPT ANY FOUR QUESTIONS [5 MARKS EACH].

A. Construct a galvanic cell for each of the following redox reaction.

1. $Cd_{(s)} + Cu^{+2}{}_{(aq)} \longrightarrow Cu_{(s)} + Cd^{+2}{}_{(aq)}$

2. $2Ag^{+1}{}_{(aq)} + Zn_{(s)} \longrightarrow Zn^{+2}{}_{(aq)} + 2Ag_{(s)}$
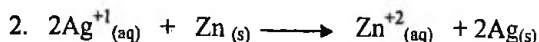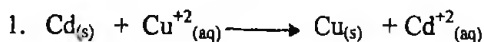
B. Discuss the application of the phase rule to Water system. Explain the maximum number of phases that can coexist in the water system.

C. What is sp^3 hybridization? Explain molecular geometry and magnetic property of $[NiCl_4]^{-2}$.

D. Write notes on industrial application and biological application of coordination compound.

E. Two esters having alpha H atoms self-condense in the presence of NaOH. Name and write the reaction. Write the mechanism involved.

F. Write reactions for the following and name the products formed:
1. Reaction of ethanol with benzoic acid.
2. Reaction of NaOH with BSA.
3. Desulphonation

RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE.
BANDRA WEST, MUMBAI
SEMESTER IV, PAPER-2, APRIL 2023.

MARKS -100
TIME – 3 HOURS

NOTE: All questions are compulsory.
Figures to the right indicate full marks.

Q1:   A) Select the correct option and rewrite the statement.(ANY 10)   10 Marks

1. Bragg`s equation is given as _____.
    ($2d=sin\Theta.n\lambda$, $2dsin\Theta=n\lambda$, $sin\Theta=n\lambda.2d$)

2. Face centered cubic crystal has
    (three atoms, four atoms, five atoms)

3. The size of nanoparticles is in the range
    (1 -100 cm, 1-100 m, 1-100 nm)

4. Bravais lattices are only
    (14, 13 , 11)

5. Enzymes catalyst are complex
    (Carbohydrates, lips, proteins)

6. H_3PO_3 is called as _____.
    (Phosphorus acid , phosphoric acid, hypophosphorus acid)

7. $H_2S_7O_6$ is called as _____.
    (Thioric acid, Thiosulphuric acid, Peridisulphuric acid)

8. _____is the following constituent percentage is high in the atmosphere.
    (Nitrogen, oxygen, carbon dioxide)

9. _____oxides of nitrogen mainly cause air pollution.
    (NO, NO_2 N_2O)

10. According to Bronsted and Lowry acid base, behaviours of water can be
    expressed by _____ species.
    (Two, three, four)

11. _____ contains Sulphur as the hetero atom
    (thiopene , furan , urea)

12. Tertiary amines always contain the _____ atom
    (Sulphur , oxygen , nitrogen)

13. The acid used to prepare diazonium salts is _____
(nitric , nitrous , HCl)

14. _____ is prepared by using the Paal-Knorr synthesis.
(benzene , pyrrole , pyridene-N-oxide)

15. An aliphatic amine is reacted with _____ to prepare methyl isocyanate.
(Trichloro methane , tetrachloro methane , thiopene)

Q2 B MATCH THE COLUMNS   (ANY 5 OUT OF 7)   5 Marks

Column A	Column B
1. Catalyst deactivators	Oxygen atom 3.
2. Cubic crystal	Latimer equation 6
3. Rhombohedral	Retard rate of chemical 1 reaction
4. -NH-	a=b=c & α=β=γ 2.
5. Furan	a=b=c & α=β=γ≠ 90 3
6. Hydration energy	chloride ion 7
7. Non basic anion	Sec. amine 4

C: State whether the following are true or false(any 5 out of 8)   5 Marks

1. The reduction of any nitrile results in the formation of an amide. F

2. Piperidine is an aromatic compound. F

3. Diazonium salts are synthesized at RT. F

4. Catalyst alters the rate of reaction by decreasing the activation energy of the system. T

5. A crystalline solid has definite geometrical shape. T

6. The cations with additional atoms along with the metal cation are called polyatomic T
   cations. T

7. Basicity of an ion increases strongly with negative charge. T

2

Q2: Attempt any 4 questions (5mks each)   20 Marks

A] What is crystallography? Explain the laws of crystallography with suitable examples.

B] Calculate the Miller indices for the following intercepts on the crystallographic axis
(Weiss indices)

i)   1/2, 1, 2   4 : 2 : 1
ii)   1,∞,∞   1 : 0 : 0
iii)   1,1,∞   1 : 1 : 0
iv)   4,3,3   3 : 4 : 4
v)   5/2, 3, 5/2   6 : 5 : 6

C] What are catalyst? Explain any four characteristic features of catalyst.

D] What are X rays? How are they produced? How are X rays used to determine the
interplanar distance in cubic crystals?

E] What are nanocatalyst? Explain the various application of nanocatalyst.

F] Catalyst remain unchanged at the end of chemical reaction but are able to alter the
rate of chemical reaction - Explain.

Q3: Attempt any 4 questions (5mks each)   20 Marks

A. Explain hydrolysis of cations with its pk_a equation.

B. Explain the classification of cations on the basis of acidity category.

C. Define oxo anions and explain its classification.

D. Explain physical properties of nitrous oxide and nitrogen dioxide.

E. Explain physical properties and uses of nitric acid.

F. Discuss the predominance diagrams for anions & protonated anions.

3

Q4: Attempt any 4 questions (5mks each)   20 Marks

A. How is furan prepared from butanedial. Explain the ring opening reaction of furan and name the product formed.

B. Draw the structure of the following :

1.Pyridene -3-sulphonic acid   2. Monomethylaniline   3. Pyrrolidene

4.Benzene diazonium chloride   5. 2-nitro thiopene

C. How does aniline react with acetic anhydride and acetyl chloride.Name the products so formed.

D. Convert the following:

1. urea to hydrazine

2. thiopene to 2-acetyl thiopene

3. succinaldehyde to pyrrole

E. What are azo coupling reactions. Write one synthesis of an azo dye.

F. Explain the following reactions:

1. VilsmeyerHaack reaction of thiopene

2. Reaction of furan with cyclohexene.

3. Nitration reaction of pyrrole.

Q5: Attempt any 4 questions (5mks each)   20 Marks

A. What are Enzyme catalyst? Explain the effect of enzyme catalyst on following

a) pH

b) Temperature.

B. The angle Θ of reflection for the first order diffraction pattern from (110) plane of a cubic crystal   is 9.5°. If the wavelength λ of the X ray used is 2×10^{-10} m. Calculate the length of the edge of the unit cell.

C. Explain environmental aspects of phosphate in detail.

D. Explain acid rain. Discuss physical properties of nitric oxide.

E. a) Give any two methods by which aniline is prepared.

b)Why is aniline basic in nature.

F. Write the N- alkylation reactions of aniline and name the products formed

RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE

BANDRA (W)

SYS-104

S4B56

(APRIL-2023) (REGULAR/ATKT)   230406

Time:3 hours   **S.Y.B.Sc. PAPER-III SEMESTER -IV**   Marks:100

N.B.: 1. All questions are compulsory.

2. Figures to the right side indicate full marks

Q.1 (A).   Choose the correct option. (Attempt any 10)   (10mks)

1. In TLC stationary phase is a _____ __.

    (a) solid   (b) liquid   (c) both solid and liquid

2. in ascending chromatographic development, the mobile phase rises

    due to _____.

    (a) partition of liquid (b) adsorption of liquid   (c) capillary action

3. In paper chromatography, the stationary phase is _____.

    (a) solid   (b) liquid   (c) solid and liquid

4. Electrophoretic separation can be performed for _____.

    (a) charged substance   (b) uncharged substance

    (c) both charged and uncharged substance

5. TLC separation based on _____.

    (a) adsorption   (b) partition   (c) absorption

6. A _____ is that electrode whose potential known and remains

    constant.

    (a) the reference electrode   (b) indicator electrode   (c) pH electrode

7. An_____ is that electrode whose potential changes during the

    course of titration.

    (a) the reference electrode   (b) indicator electrode

    (c) structural colonel electrode

8. I combined glass electrode, the reference electrode used is _____.

    (a) standard hydrogen electrode   (b) set calomel electrode

    (c) quinhydrone electrode

1

9. The unit of conductance is _____.

    (a) cm^{-1} (b) Siemen (c) cm^2

10. In conduct metric titration _____ of solution changes during the course of titration.

    (a) pH (b) conductance (c) concentration

11. The overall shape of the normal error represents _____ of given set of measurement.

    (a) uncertainty (b) accuracy (c) precision

12. Null hypothesis is often used as _____.

    (a) test of repeat bling (b) test of significance

    (c) test of uncertainty

13. For very large number of measurements, absolute devotion is given as _____.

    (a) $\pm Zs$ (b) $\pm ts$ (c) $\pm \mu s$

14. A strong positive linear relationship indicates value of r = _____.

    (a) -1 (b) 0 (c) +1

15. The most frequently obtained observation from the given set is known as _____.

    (a) mode (b) median (c) deviation

(B) . Match the following: (Attempt any 5)   (5mks)

	A	B
1.	Thin layer chromatography	Random error
2.	Solvent extraction	Measure of central tendency
3.	Electrophoresis	Siemen
4.	Glass electrode	Reference electrode
5.	Unit of conductance	Separation by adsorption
6.	Saturated calomel electrode	Two immiscible liquid
7.	Indeterminate error	Separation of proteins
8.	Median	Ion selective electrode

(C) . State True or False (Attempt any 5)   (5mks)

1.In TLC, the stationary phase is filled in a column.
2.Rf value is Independent of solvent system.
3. Potentiometric titration method is applicable only aqueous solution.
4. The saturated calomel electrode is known as indicator electrode.
5. Accuracy of the measurement is described in terms of absolute error.
6. Mode is a measure of dispersion of the data.
7. Coefficient of variance is RSD expressed percentage.

Q.2. Attempt any four questions.   (5mks each)
A. What are the principle of paper chromatography?
B. Given the applications of thin layer chromatography.
C. What are the different types of distillations?
D. What is electrophoresis? How is it carried out?
E. What is Batch extraction? Explain.
F. Distribution ratio of iodine between water and carbon tetra chloride is 0.0125.   100cm³ of water containing 20mg of iodine is to be extracted in carbon tetrachloride. How much carbon tetra chloride should be used if 1mg of iodine is to remain in the acquis layer?

Q.3. Attempt any four questions.   (5mks each)
A. Explain principle of pH meter.
B. Explain Merits and Demerits of glass electrode.
C. With neat and labelled diagram explain construction of calomel electrode.
D. Discuss the determination of equivalence point from the following curves.
    a) E/V vs V   b) ΔE/ΔV vs. V
E. Discuss the pH metric titration curves obtained when a strong acid is neutralized by a strong base.
F. Explain basic principle of conductometric titration.

Q.4. Attempt any four questions.   (5mks each)
A. What is meant by indeterminate errors? How they arise?
B. Calculate the mean, median and mode for the following sets of values: 18:30,
        18:28, 18:32, 18:27, 18:28.
C. The hardness of water samples were determined with the following results.

Trial	ppm
1	2.40
2	2.55
3	2.50
4	2.54
5	2.47

        Calculate the standard deviation, varience and coefficient of variation for the set of Observation.
D. Describe the Gaussian Distribution Curve.

3

E. Four replicate measurements for determination of fluoride in a well water gives the following results 0.89, 0.86, 0.87, and 0.96 ppm fluoride calculate the 95% confidence limit for mean if

    I.   no additional information about the precision of method is known and

    ii.   a large number of previous experiments have given $6=0.05$ ppm fluoride. $(t=3.18)$

F. Explain: a) 2.5d rule   b) 4.0d rule

Q.5. Attempt any four questions.   (5mks each)

  A. Explain i) Ascending ii) Descending iii) Two dimensional iv) Radial chromatographic technique used in paper chromatography.

  B. Explain condition of solvent extraction.

  C. Give the application of potentiometric titration.

  D. Discuss the conduct metric titration curve obtained in the following neutralisation.

    a) Strong Acid against Strong Base

    b) Strong Base against Weak Acid

E. Following are the results of percentage of gold obtained from analysis of same sample from the data given in two sets verify whether two standard deviation are same or difference.

Set 1	15.72	15.68	15.76
Set 2	15.62	15.80	15.67

F. For the data in the following table, derive on equation of the type y=m x +c by the method of least squares.

x	1	2	3	4	5	6	7
y	1.4	2.1	2.6	3.2	3.4	3.9	4.5

4

RIZVICOLLEGE OF ARTS, SCIENCE & COMMERCE.

S.Y.BSC. PHYSICS- 1 RERGULAR

SEM-IV, SET-I, MARCH-2023.

545 -105

TIME: 3HRS,

23 04/0

M: 100

Q.1. A) MCQ .   12

1. If the width of aperture is ………… with respect to wavelength diffraction occurs.

a) less than wavelength   b) greater than wavelength

c) comparable to wavelength   d) negligible

2. If a slit of width "a" illuminated by a white light. For red colour (λ = 6000 A.u.) , for first order at 30° , what is "a"…………..

a) 1.3 micron   b) 13 micromm   c) 130 cm   d) 1.3 nm.

3. An optically active compound………………of polarized light.

a) rotates the plane b) shifts the phase c) changes velocity d) alters frequency.

4. ……………….. Law gives R.I. of a medium.

a) Brewster's   b) Malus's   c) Stock's   d) Huygen's

5. Indicate which of the following binary addition is correct?

a) 10101 + 1111 = 111101   b) 1010 + 1101 = 1111

c) 1010 + 1001 = 1111   d) 1010 + 1110 = 11000

6. The race around condition occurs in JK FF is ,…….

a) J = 1 , K = 1   b) J = 0 , K= 0

c) J = 0 , K = 1   d) J = 1 , K = 0

B) Fill in the blanks.   05

1. For constructive interference o.p.d. is……………….

2. Fraunhofer diffraction is due to ……..wavefront.

3. …………ray do not obey snell's law.

4……………….for negative crystal.

5. The number of nibbles which make up one byte is _____.

1

C) Answer in one line.   03

   1. What is diffraction?

   2. Define polarization.

   3. What is the limitation of Full Adder circuit?

Q.2.A) Answer any TWO of the following.   16

   1. Show that the area of FHPZ is nearly equal.

   2. Discuss the diffraction of light due to a thin wire. How will you determine the
      Radius of a wire?

   3. Explain the Fraunhofer's diffraction at a single slit. Derive an expression for the
      width of a central maxima.

   4. Give an elementary theory of a plane transmission grating. Derive an equation
      For a grating law.

   B) Attempt any ONE.   04

   1. A narrow slit is illuminated by a light placed at a distance of 0.1 m from a
      Straight edge. I f the distance between the 1 st & 2 nd dark band is 0.7786 X 10^{-3}
      Find λ, if the screen is at a 0.5m away from the edge.

   2. A fabric with 600 threads/cm is illuminated by a light of 6000 A.U. Find the
      Angle between the central image of a light and it's first order diffraction image.

Q 3. A) Attempt any TWO   16

   1. State & explain the MALU'S law.
   2. Give Huygen's theory of double refraction.
   3. Show that the elliptically & circularly polarized light are the special cases of a
      Linearly polarized light.
   4. Give the mathematical analysis of the superposition of two linearly polarized
      Waves at right angles to each-other.

   B) Attempt any ONE.   04

   1. What is the thickness of a Quarter-wave plate, if a light of 5893 A.U. passes

Through it. $[\mu_E = 1.55, \mu_O = 1.54]$

2. The angle between the pass axis of polarisor & analyser is $45°$. Find the % of Polarization of light passing through the analyser.

Q. 4 A) Attempt any Two of the following.   16

1. Explain with neat circuit diagram the working of the half adder with truth table.

2. What do you mean by binary arithmetic? Explain binary multiplication, binary division with at least two examples each.

3. Explain with circuit diagram the construction and working of Master Slave JK flip flop.

4. Explain with circuit diagram the working of Serial in and Serial out Shift Register.

Q. 4 B) Attempt any One of the following.   04

1. Convert the following binary numbers into hexadecimal.

$(101110.101001)_2$ and $(10101100.11)_2$

2. Solve the following. $(1100110)_2 + (111001100.110)_2 + (110011.11)_2$

Q. 5 Attempt any four of the following.   20

1. State the Brewster's law. Draw a suitable diagram.

2. Distinguish between INTERFERENCE & DIFFRACTION pattern.

3. Explain polarization by selective absorption.

4. How will you produce a circularly polarized light.?

5. Distinguish between Latch and FF.

6. Write a short note on number systems.

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545 /07

230412

Time: 3 Hrs

M. Marks: 100

Note: 1. All questions are compulsory.

2. Figure to the right indicates full marks.

3. Use of non-programmable calculator is allowed.

4. Symbols have their usual meanings.

Q.1 A Chose correct alternative among the four and rewrite the statement. (12)

1. A well behaved wave function which represents a particle must
   (a) be finite
   (b) be infinite
   (c) not exist
   (a) none of these

2. Which of the following wave function represent a free particle?
   (a) $A \sin(kx - \omega t)$ (b) $A \cos(kx - \omega t)$
   (c) $A e^{i(kx-\omega t)}$ (d) $A e^{-(kx-\omega t)}$

3. The transmission coefficient (T) and reflection coefficient (R) obey which of the following?
   a) R+T=1   b) R-T=1
   c) R=T   d) R=2T

4. The energy of a particle in the nth quantum state in a one-dimensional box is proportional to ___
   a) n b) n^2
   c) $\frac{1}{n}$ d) $\frac{1}{n^2}$

5. The energy levels of the one-dimensional harmonic oscillator are _____.
   (a) continuous   (b) equally spaced
   (c) 2-fold degenerate   (d) 3-fold degenerate

6. Diatomic molecule is an example of _____
   (a) damped oscillator   (b) forced oscillator
   (c) harmonic oscillator   (d) linear oscillator

Q.1 B Answer the following questions in one statement. (03)

1. What is wave function?

2. What is orthonormal wave function?

3. What is Ramsur-Townsend effect?

Q.1 C Fill in the blanks. (05)

1. $|\psi|^2 =$ _____

2. The probability of finding the particle in classically forbidden region is called _____ .

3. When a particle is not subjected to any external force, so that it moves in a region of constant potential. Such particle is said to be _____.

4. When force field acting on a particle is zero everywhere except in a limited region, it is known as _____.

5. α-particle emission from radioactive elements is an example of _____.

1

Q.2 A Attempt any TWO of the following.

1. 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.

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

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

4. State and explain the basic postulate of quantum mechanics.

Q.2 B) Attempt any ONE of the following. (04)

1. Show that the probability current density for a free particle is equal to the product of its probability density and its speed.

2. The function $f(x) = 3x^2 - 1$, is an eigenfunction of the operator

$$\hat{O} = -(1 - x^2)\frac{d^2}{dx^2} + 2x\frac{d}{dx}$$

   Find the eigenvalue corresponding to the given eigenfunction.

Q. 3. A) Attempt any TWO of the following. (16)

1. For step potential whose potential is described by

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

A beam of electrons, each of mass m and energy E is incident on a step potential from left to right. For $E > V_0$, obtain the expression for the coefficient of reflection.

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

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

Obtain the wave equation for the particle and its solution. 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 $n = 1,2,3,4, - - - - -$

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 solutio 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. Consider a particle in a finite potential well given by

$$V(x) = \begin{cases} V_0 & ; \quad -a \le x \le a \\ \infty & ; \; x > a \; and \; x < -a \end{cases}$$

Set up the Schrödinger's equation in different regions and solve it. Hence obtain the expression for the allowed energies for the first group.

Q. 3 B) Attempt any ONE of the following. (04)

1. Explain the concept of free particle.
2. A particle of kinetic energy $E = 9eV$ is incident on a potential step of height $V_0 = 4eV$. Calculate the transmission coefficient T.

Q.4. A. Attempt any TWO of the following. (16)

1. A particle of mass m and energy $E > V_0$ travelling along x-axis has a potential barrier described by

$$V(x) = \begin{cases} 0 & for \ x < 0 \\ V_0 & for \ 0 \leq x \leq a \\ 0 & for \ x > a \end{cases}$$

Write down the time-independent Schrodinger wave equation for the motion of particles, solve it and derive the expression for the reflection coefficient of the particle.

2. Derive an expression of the approximate transmission coefficient of a potential barrier of height V_0 and width a.

3. Write down the time-independent Schrodinger wave equation for S.H.O. in one-dimension and hence obtain the simplified form of Schrodinger wave equation for the oscillator.

4. State correspondence principle. Show how quantum and classical probabilities of a one-dimensional oscillator leads to correspondence principle.

B Attempt any ONE of the following. (04)

1. Write (do not derive) down the expression for the transmission coefficient T for the rectangular potential barrier for the case E<V_0. Hence show that the transmission coefficient T is given by

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

2. Electrons of energy $5.0eV$ are incident on a barrier $3.0eV$ high and $1A°$ wide. Calculate the transmission coefficient T.

Q.5 Attempt any FOUR of the following. (20)

1. Prove that $\frac{\partial x^n}{\partial x} - x^n \frac{\partial}{\partial x} = nx^{n-1}$

2. 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 $\frac{e^{-2}-e^{-4}}{2}$.

3. Draw the energy-level diagram and wave form for the wave functions of a particle confined in a one-dimensional box for the first three values of principle quantum number n.

4. Show that the energy state, $E = \frac{26\pi^2 h^2}{2mL^2}$ of a particle in a cubical box is 6-fold.

5. Calculate the zero point energy of a harmonic oscillator of frequency 2×10^{15} Hz. Given: $h = 6.63 \times 10^{-34}$ J-s.

6. What is tunnelling effect? Write down the application of tunnelling effect.

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RIZVI COLLEGE OF ARTS, SC. & COM.
S.Y.B.Sc (Physics)   SEM - IV
Paper-III (USPH403)

$545-109$

Time : 3 Hrs

230417
marks : 100

Note : 1.All questions are compulsory.

2. Figure to the right indicates full marks.

3. Use of non-programmable calculator is allowed.

4. Symbols have their usual meanings.

Q.1 A) Chose correct alternative among the four and rewrite the statement.   (12)

1) An famous impact of crater at _____ in buldhana district of Maharashtra.

   a) Nandura   b) Lonar
   c) Khamgaon   d) Mehkar

2) _____ is an major antiferromagnetic mineral. but can carry weak ferrimagnetism.
   a) Ulvospinel   b) Pyrrhotite
   c) Hematite   d) Geothite

3) Opcode of LXI is _____.
   a) 11   b) 21
   c) 31   d) 41

4) Status signal is _____.
   b) Read, Write   b) Hold, HLDA
   d) So, S1   d) Reset

5) The communication medium causes the signal to be _____.
   a) Amplified   b) modulated
   c) Attenuated   d) interfered

6) For an ideal AM, m is _____
   b) 0   b) 1
   C) > 1   d) < 1

Q.1 B) Answer the following questions in one statement.   (3)

1) What is Palaeomagnetism?
2) What is Earthquake.
3) What is demodulation?

1

Q.1 C) Fill in the blanks. (5)

1) The excess amount of phosphorus is known as _____.
2) The concept that the lithosphere floats on the asthenosphere is called _____.
3) 8085 microprocessor have _____ total instructions.
4) _____ network connections can be used to set the frequency of internal clock generator.
5) During FM, carrier _____ remains constant.

Q.2 A) Attempt any TWO of the following. (16)

1) Explain Alfred Wegener theory on continental drift.
2) Write and explain geomagnetic elements and their units.
3) Explain plate tectonic with neat diagram.
4) Write note on Playa sediments.

Q.2 B) Attempt any ONE of the following. (04)

1) What is Tsunami? Give any suitable example of Tsunami.
2) What is Landslide? Write it their mechanism.

Q.3 A) Attempt any TWO of the following. (16)

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.3 B) Attempt any ONE of the following. (04)

1) Explain the instructions JPO & JP address.
2) Which are interrupt signal of 8085 microprocessor and explain it.

Q.4 A) Attempt any TWO of the following. (16)

1) Explain different blocks of electronic communication system.
2) What is S to N ratio, noise factor, noise figure in case of electrical noise.
3) Explain the concept of modulation and need of modulation.
4) Explain in detail the functioning of pulse code modulation (PCM).

Q.4 B) Attempt any ONE of the following. (04)

1) Determine the corresponding wavelength range for the following; ELF (30 Hz to 300 Hz) and SHF (3 GHz to 30 GHz).
2) Calculate the modulation index in AM, if Vmax = 7.5 V and Vmin = 7 V.

Q.5 A) Attempt any **FOUR** of the following.

1) Write a short note on floods.

2) Write a short note on causes of climate change.

3) What is arithmetic group in 8085 microprocessor? Explain any two instructions of this group with a suitable example.

4) Explain address and data bus in 8085 microprocessor.

5) Distinguish between AM and FM

6) Write a short note on PPM.

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