RIZVI COLLEGE OF A/S/C
FOUNDATION COURSE -Paper III (SEM III)
Nov-2022

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. Minorities in India

b. Child Abuse

C. Disaster Mitigation

d. Earthquake

e. Superstition

f. Cyber crimes

g. Effective Listening

h. VerbalCommunication

OR

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

Q.2.(A) What are the constitutional rights of women in India? How are

they violated by society?   **15 Marks**

OR

(B) How do Scheduled Caste people suffer in the society? Discuss the laws implemented in favour of this vulnerable group.

Q.3.(A) Describe the categories of disasters .How do they affect human life? **15 Marks**
OR

(B) Discuss in detail about National Disaster Management Act 2006 and National Policy on Disaster Management 2009.

Q.4.(A) Write a detailed note on Science.   **15 Marks**

OR

(B) What is technology? State the characteristics and application of technology in modern human living.

Q.5.(A) What are different types of non- verbal communication? Discuss the barriers to effective communication. **15 Marks**

OR

(B) Describe the styles of leadership and advantages of team building.

RIZVI COLLEGE OF ARTS SCIENCE AND COMMERCE
BANDRA WEST MUMBAI
NOVEMBER-2022
CHEMISTRY
(PAPER I) SEM-3

Total – 100 marks

N.B. :

1. All questions are compulsory.
2. Figures to the right side indicate full marks
3. Use of non- programmable calculator is allowed

Q. 1 SELECT THE CORRECT OPTION (ANY 20).   **(20 MARKS)**

1. For a given Potassium chloride solution, transport of Potassium cation is 0.4, then the transport number of chloride anion is _____.
   a) 0.6   b) 0.7   c) -0.4

2. The value of λ of $Al_2(SO_4)_3$ is 858 S cm2 mol-1. If value of λ of $Al+3$ is 189 S cm2 mol-1, then the value of λ of SO4-2 is _____ S cm2 mol-1.
   a) 160   b) -160   c) 1.6

3. Escaping tendency represents the _____ for real gases, and has same dimensions as pressure.
   a)Fugacity   b) Absorption tendency   c) Adsorption tendency

4. Mass, Volume, energy represents _____ properties
   a) Intensive   b) Extensive   c) Both intensive and extensive

5. Partial molal free energy is also known as _____
   a) Chemical potential   b) Physical potential   c) Duhem pressure potential

6. For a non-spontaneous process:
   a) $\Delta G=0$ b) $\Delta G>0$ c) $\Delta G<0$

7. Electrolytic conductance is due to which of the following species.
   a) Electrons   b) Neutrons   c) Ions

8. The disorder or randomness of the system is measured using thermodynamic term known as _____.
   a) Entropy   b) Enthalpy   c) Gibbs Free energy

9. In pure water, the product of concentration of H+ and OH- ions is constant at a given temperature and this is called _____.
   a) Ionic product of water   b) Latent heat of water   c) Latent fusion of water

10. Equivalent conductance of 0.01 N NH_4OH solution is 9.6 S cm-1 at 25° C and conductivity at infinite dilution is 238 S cm-1. Degree of dissociation (α) is _____.
    a)0.04034   b) 0.4034   c) -0.04034

11. Born Haber cycle is very helpful in calculating lattice energy of which compounds. ?
    a) Ionic   b) covalent   c) co ordinate

12. Which of the following ionic crystal is a AB type?
    a) CaF_2 b) NaCl   c) TiO_2

13. Born and Haber are two scientist developed a technique to determine lattice energy of ionic compound are belongs to which country?
    a) Germany   b) Sweden   c) France
14. The geometry and type of hybrid orbital present about the central atom in BF_3 is _____ .
    a) Linear sp   b) Trigonalplanar sp^2 c) Tetrahedral sp^3
15. Atomic orbital has single nucleus and it is called _____ .
    a) Monocentric   b) dicentric   c) Tricentric
16. The amount of energy release per mole at the time of overlapping is termed as _____ .
    a) bonding   b) bond energy   c) bond order
17. Which of the following molecule is paramagnetic?
    a) H_2 b) N_2 c) B_2
18. Nitrogen molecule has Highest bond energy as it has Highest bond order of _____ .
    a) 3   b) 0   c) 2
19. Bonding orbitals are responsible for an _____ in electron density between the nuclei.
    a) increase   b) decrease   c) reduce
20. The molecules containing two atoms of the same element are called as homo nuclear _____ molecules.
    a) Monoatomic   b) diatomic   c) polyatomic
21. The ion formed when the molecule of ethyl alcohol loses a proton is called --------- ion.
    a) phenoxide   b) ethoxide   c) phenyl
22. 2-hexanol is an _____ alcohol.
    a) primary   b) secondary   c) tertiary
23. An example which is not a heterocyclic compound is _____ .
    a) Propylene oxide   b) ethylene oxide   c) Na methoxide
24. One example of an nucleophile is _____
    a) oxonium ion   b) carbanion   c) carbonium ion
25. Hydrogen cyanide reacts with an Grignard reagent followed by acid hydrolysis to form ammonia and _____
    a) ketone   b) aldehyde   c) ester
26. The reaction of a methyl bromide with a strong base involves the formation of _____ transition states.
    a) One   b) Two   c) Three
27. 2-methyl -2-propanol is dehydrated in the presence of conc. Sulphuric acid to form an
    _____
    a) alkane   b) alkyne   c) alkene
28. An epoxide is an _____ membered ring and contains _____ as the hetero atom.
    a)three , nitrogen   b) three ,sulphur   c) three ,oxygen.
29. _____ is a trihydric phenol.
    a) alpha naphtol   b) phloroglucinol   c) quinol
30. Any organolithium compound reacts with solid carbon dioxide followed by acid hydrolysis to form an _____
    a) acid   b) ester   c) aldehyde

Q2. ATTEMPT ANY FOUR QUESTIONS (20 MARKS)

A. Gibbs free energy is related to enthalpy and entropy, write the equation for the above relationship and complete the conclusion table based on the values given.

Sr. No.	Sign of ΔH	Sign of ΔS	Sign of ΔG	Conclusion
1	-ve	-ve	-ve	
2	+ve	-ve	+ve	
3	-ve	-ve	-ve	
4	+ve	+ve	-ve at high temperature	
5	-ve	-ve	+ve at low temperature	

B. Explain the difference between fugacity and activity. Explain mathematical relationship between fugacity and activity. Under what condition fugacity and activity becomes equal.

C. Show that decrease in Gibbs free energy at constant pressure and temperature gives net work.

D. What is Specific conductance and cell constant? Discuss mathematical relationship between the two. Calculate cell constant for 0.5 N solution of a salt surrounding two plates of electrodes, 1.72 cm apart and 4.5 cm2 in area.

E. Explain how Kohlraush law is useful in
   1. Determination of solubility and solubility product of sparingly soluble salt.
   2. Determination of ionic product of water.

F. The $\overset{\infty}{\lambda}$ for CH3COONa, HCl, and NaCl are 91.0, 425.9 and 126.4 S cm2 mol-1, respectively, at 298 K. Calculate $\overset{\infty}{\lambda}$ for CH3COOH.

Q3. ATTEMPT ANY FOUR QUESTIONS (20 MARKS)

A. Discuss the condition for formation of ionic bond.

B. What is lattice energy? Calculate the lattice energy of NaI crystal from the following data.
   Heat of sublimation of sodium   = 108.7 KJ/mol.
   Heat of dissociation of Iodine   = 106.6KJ/mol.
   Ionisation potential of sodium   = 493.7 KJ/mol
   Electron affinity of Iodine   = -305. 9KJ/mol
   Heat of Formation of NaI   = -287.6 KJ/mol

C. Define Hybrid orbitals. Explain the formation of sp^2 hybrid orbitals & hybridization.

D. Distinguish between Sigma molecular Orbitals & Pi molecular Orbitals.

E. Explain Molecular Orbitals diagrams for Li_2 & Be_2 molecules.

F. Define Bond order. Explain Molecular Orbitals Diagram for O_2 molecules.

Q4. ATTEMPT ANY FOUR QUESTIONS (20 MARKS)

A. Draw a neat labelled energy profile diagram which represents the action of KOH on methyl bromide.

B. What is cine substitution? Explain by taking o-chloro toluene as an example. Write the relevant mechanism for the same

C. Carry out the following conversions:
   a) ethyl magnesium bromide to butan-2-ol
   b) phenyl magnesium iodide to benzoic acid.
   c) cyclohexanone to 1-methyl cyclohexanol.

D. Draw structure of the following:
   a) 2-chloro-2-butanol
   b) resorcinol.
   c) 2,3 dichloro epoxy ethane
   d) any one aliphatic Grignard reagent.
   e) 2-amino-1-naphtol.

E. Convert ethene into ethyl alcohol. What is the action of the following on ethyl alcohol.
   a) thionyl chloride
   b) ethanoic acid

F. Write reactions to show the following conversions:
   a) benzene sulphonic acid to phenol
   b) iso-propyl benzene to phenol

Q5. ATTEMPT ANY FOUR QUESTIONS (20 MARKS)

A. Explain the following terms
   1. Ionic product of water
   2. Transport number
   3. Solubility
   4. Solubility product
   5. Degree of ionisation

B. Derive Gibbs Duhem equation.

C. Define homonuclear diatomic molecules. Discuss the covalent bond formation in Li_2 molecule & O_2 molecules.

D. Define radius ratio. Give the application of Born-Haber cycle.

E. What are epoxides? Draw the structure of epoxy ethane. How is epoxy ethane converted into the following:
   a) glycol
   b) 2- amino ethanol

F. Write a note on ' dehydration of alcohols'

RIZVI COLLEGE OF ARTS, SCIENCE AND COMMERCE
BANDRA WEST , MUMBAI
NOVEMBER-2022
CHEMISTRY
(PAPER II) SEM-3

N.B. :   Total – 100 marks

1. All questions are compulsory.
2. Figures to the right side indicate full marks
3. Use of non- programmable calculator is allowed
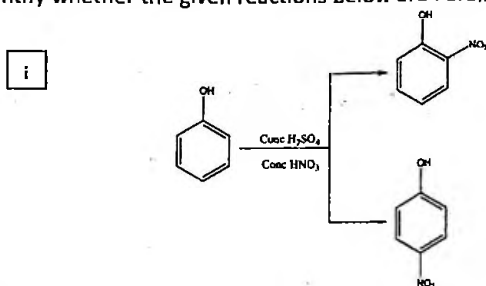
Q1 SELECT THE CORRECT OPTION (ANY 20).   **20 Marks**

1. In collision theory the molecules are considered as
    a) Rigid and hard sphere   b) Non-rigid and soft sphere c) Non-rigid and hard sphere
2. Unimolecular reaction can be explained by _____collision theory.
    a) Lindemann's   b) Arrhenius   c) Vant Hoff's
3. The additional energy required by the reactant molecule to form activated complex compound is called_____.
    a) Activation energy   b) Threshold energy   c) Potential energy
4. In collision theory the molecules must overcome _____ and _____ barrier.
    a) Speed and Velocity   b) Time and Distance   c) Energy , Orientation
5. The failure of collision theory is due to not taken into consideration _____ & _____ energy of the reacting molecules.
    a) Kinetic and potential energy   b) Rotational and Vibrational energy   c) Potential and Vibrational energy
6. The concentration of a solute in two immiscible liquids is C_1 and C_2 then according to distribution law we get _____.
    a) $C_1+C_2=K$ b) $C_1/C_2=K$ c) $C_1-C_2=K$
7. A solution is prepared by using two liquids A and B. If the mole fraction of liquid A is 0.479 then mole fraction of liquid B is _____.
    a) 0.521   b) 0.479   c) zero
8. Water and Ethanol are _____ liquids.
    a) Completely immiscible   b) Completely miscible   c) Partially miscible
9. The characteristic of ideal solution is _____.
    a) It should obey Raoults law under all condition. b) It should not obey Raoults law under all condition.   c) It should obey Raoults law only at very high temperature.
10. When ΔV and ΔH is positive, then it shows _____ Raoults deviation
    a) Negative   b) Positive   c) Zero

11. In Tetraborane molecule, the total number of valance electrons available for bonding are _____.

    a) 20   b) 22   c)18

12 _____ are called as nidoboranes.

    a) B_nH_{n+4} b) B_nH_{n+6} c)B_nH_{n+2}

13. Thallium forms a large number of more stable compounds in the ____ state.

    a) Divalent   b) Univalent   c)Trivalent

14. In the group 14 , which of these element is found to be very rare?

    a) Germanium   b) Silicon   c)Tin

15. Argyrodite is a mineral is found mostly in _____ .

    a) South Africa   b) Brazil   c)Germany

16. Silicon and Germanium are used as _____ .

    a) Conductors   b) Semiconductors   c)Insulators

17. In Nitrogen family, Bismuth is _____.

    a) Non metal   b) Metalloid   c)Metal

18. Nitric oxide is prepared on a large scale by Oswald process using which catalyst?

    a) Nickel   b) Platinium   c)Scandium

19. Colour of the dinitrogen pentaoxide compound is _____.

    a) Blue   b) Green   c) Colourless

20. Who discovered the zone refining technique for purification of materials?

    a) W. G. Pfann   b) Haber   c)Arrhenius

21. Aldehydes and ketones are _____ compounds.

    a) Hydroxyl   b) amide   c) carbonyl

22. _____ is an example of a reactive methylene compound.

    a) Acetone   b) diethyl malonate   c) succinic acid

23. The MF of formalin is _____

    a) CH_3O b) CH_2O c) CHO_2

24. The Gattermann reaction involves the formation of an aldehyde by using _____

    a) NO   b) KCN   c) HCN.

25. _____ reactionis used to prepare ketones.

    a) Mannich   b)freidel craft   c) gattermann.

26. Methanal undergoes the reduction reaction to form _____

    a) Methanol   b) ethanol   c) 1-propanol.

27. An _____ is the dialkoxy derivative of an aldehyde.

    a) Ketal   b) acetal   c) metal.

28 . The IUPAC of acetone is _____

    a) Propan-2-one   b) propen-2-one   c) butan-2-one.

29. The $CH_2=CH-$ group is called the _____ group.

    a) Allyl   b) ethyl   c) vinyl

30. Acetone is reduced to form _____ alcohol
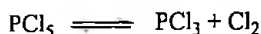
    a) Primary   b)tertiary   c) secondary

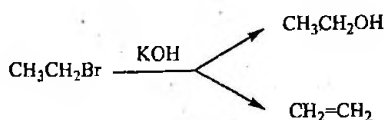**Q2**   **ATTEMPT ANY FOUR QUESTIONS**   **20 Marks**

A   Explain the Lindemann's unimolecular theory of reaction rates

B   What is ideal and non ideal solution? Give examples.

C   Explain the difference between positive and negative deviation from Raoults law.

D   Write any two advantages and limitation of collision theory.

E   Explain upper consolute temperature and lower consolute temperature with example.

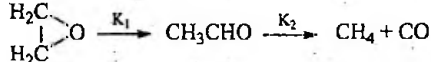F.   Identify whether the given reactions below are Parallel, reversible and Consecutive in nature.

i

ii

$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

iii)

$$CH_3CH_2Br \xrightarrow{KOH} \begin{matrix} CH_3CH_2OH \\ CH_2=CH_2 \end{matrix}$$

iv)

$$CO + NO_2 \underset{K_2}{\overset{K_1}{\rightleftharpoons}} CO_2 + NO$$

v)

$$H_2C{\overset{H_2C}{\underset{H_2C}{\diagup}}}O \xrightarrow{K_1} CH_3CHO \xrightarrow{K_2} CH_4 + CO$$

Q3   **ATTEMPT ANY FOUR QUESTIONS**   **20 Marks**

A.   Give the electronic configuration of the elements of boron family.

B.   Give the preparation and uses of Borax.

C.   Write short notes on oxidation state of the silicon group family.

D.   Discuss the Czochralski is pulling technique for the preparation of a single crystal of Germanium and silicon.

E.   Give electronic configuration of elements Nitrogen and on this basis discuss their general properties.

F.   Explain the synthesis of Ammonia by Haber-Bosch process with schematic diagram.

Q4   **ATTEMPT ANY FOUR QUESTIONS**   **20 Marks**

A. Draw structure of the following:
   1. Butanal 2. 3-bromo pentanal 3. Cyclohexane carbaldehyde.
   4. allyl aldehyde 5. p -methyl benzaldehyde.

B. Convert acetoacetic ester to
   1. 2-pentanone   2. Butan-2-one

C. 1. An aromatic hydrocarbon reacts with benzoyl chloride in the presence of a
      lewis acid. Name the reaction and the products formed
   2. What is the action of hydrazine on acetophenone

D. Give two applications and the mechanism of knoevenagel reaction

E. How will you convert:
   1. benzene to benzaldehyde
   2. benzene to methyl phenyl ketone
   3. propyne to acetone

F. 1. What is keto enol tautomerism? Explain by taking 2-propanone as an example.
   2. What is the action of HCN on benzaldehyde.

Q5   **WRITE SHORT NOTES- ATTEMPT ANY FOUR QUESTIONS**   **20 Marks**

A.   What is Nernst distribution law? Explain its application.
B.   Explain Arrhenius theory of reaction rate with the help of energy diagram.
C.   Give the preparation, properties & structure of Nitrous Oxide.
D.   Explain the preparation & structure of $SiCl_4$.
E.   Draw the structure for the following :
      1. 2-chloropentan-3-one
      2. Ethane dial
      3. Benzophenone
      4. 4- methyl acetophenone
      5. Butane-2,3-dione.
F. 1. What are reactive methylene compounds? Draw the structure of any
      two reactive methylene compounds and name them.
   2. What is the action of methyl magnesium iodide on ethyl methyl ketone.

4

Rizvi college of Arts, Commerce and Science

Subject- Chemistry Paper III, November 2022

Semester-III Time- 3 hour. Total marks- 100

NB: 1) All the questions are compulsory.

2) Figures on the right-hand side indicate full marks.

Q.1 Choose correct option for the following questions (Any 20)   **20 Mark**

1   In High performance liquid chromatography.......is mobile phase.

a) Inert gas   b) Polar solvents   c) non-polar solvents   d) Standard solution

2   The ratio of two calibration sensitive is-------

a) selectivity denominator b) selectivity numerator c) selectivity coefficient d) All of above

3   In partial analysis---- component of sample is determined.

a) one b) two c) Three d) Infinite

4   ----- and --- are types of determinate error.

a) Constant and incorrect b) constant and proportionate c) constant and inverse d) constant and fractional

5   -----types of error arise due to unknown uncertainties in measurements.

a) Determinate b) Indeterminate c) Relative d) Absolute

6   ----- is useful for comparison between uncertainty of two different measurements of absolute magnitude.

a) Standard deviation b) Relative standard deviation c) mean d) Median

7   Impurities in the sample can be detected by----- analysis.

a) Complete Analysis b) Trace analysis c) Partial analysis d) Proximate analysis

8   The error arises due to unknown uncertainties in measurement is-----

a) Determinate error b) Indeterminate error c) Relative error d) Absolute error

9   The term Variance mathematically represented as------

a) $S^2 = \sum_{i=1}^{N} X_i - \overline{X}$ b) $S^2 = \overline{X} - X$ c) $S^2 = \sum_{i=1}^{N} \overline{X} - X^2$ d) $S^2 = \sum_{i=1}^{N} X_i - N$

10   The most frequent observation among 'N' observation is known as-----

a) Mean b) Mode c) median d) error

11   The substance which indicates completion of reaction in titration by colour change is known as-----

a) Indicator b) Reflector c) Initiator d) promotor

12   ------is a good example of metal ion indicator.

a) Eriochrome Black T b) Methyl orange c) Methyl blue d) All of above

13   A solution whose concentration is exactly known is known as-----

a) Standard solution b) Hygroscopic solution c) Measured solution d) Anhydrous solution

14   The unit of molarity is----

a)   m mol/Kg b) m mol/mL c) $Litre^{-1}$ d) All of above

15   The value of ionic product K_w of water is close to-----

a) 1×10^{-10} b)1×10^{-14} c)1×10^{-9} d)1×10^{-6}

16   Which condition is suitable for formation of precipitation

a) Ionic product > Solubility product b) Ionic product = Solubility product c) Ionic product< Solubility product d) None

17   In Homogenous nucleation process----- degree of supersaturation occur.

a) High b) Low c) Medium d) Small

18   In colloidal state size of particle ranges from ------

a) $1\ nm\ to\ 10^{3}\ nm$ b) $1\ m\ to 10^{-9}\ m$ c) $1\ nm\ to 1\ cm$ d) $1\ m\ to\ 100\ cm$

19   Drying of substance takes place at ---- temperature.

a) 110 K b)500 K c) 1000 K d) 2500K

20   Ignition of substance generally takes place at ----- temperature.

a) 500 K to 1500 K b) 1000 K to 2000 K c) 100 K to 200 K d) 450 K to 700 K

21   The electrons which are not involved in the bonding between atoms in molecules are----

a) p-electrons b) n-electrons c) Neutrons d) positrons

22   The unit of radiant power is-----

a) $Jm^{-2}s^{-1}$ b) $Jm^{-1}s^{-2}$ c) $Jm^{-3}s^{2}$ d) $Jm^{-1}s$

23 The transmitted radiations can be expressed by formula--

a) $T = \dfrac{I_t}{I_0}$ b) $T = \dfrac{I_0}{I_t}$ c) $T = I_0$ d) $T = \dfrac{1}{I_t}$

24 Wavelength of maximum absorption (λ_{max}) ----- molar absorptivity required.

a) high b) Low c) equal d) Medium

25 Beer's Law give relationship between-----

a) Only extent of absorption b) Only concentration of sample c) Both A and B d) None

26 The Beer-Lambert's law is valid only when solution does not exceed ----

a) 0.1 M b) 0.01 M c) 0.001 M d) 1 M

27 The molar absorptivity 'ε' depend upon ---- of solution

a) Reactivity b) Refractive index c) Volume d) All of above

28 The requirement of detector is---

a) Respond radiant energy over broad wavelength range b) sensitive c) Both A and B d) None

29 For UV region sample cell is made up of-----

a) Quartz b) Glass c) Silica d) Aluminium

30 For visible region sample cell is made up of------

a) Quartz b) Glass c) Both A and B d) Silica

Q.2 Answer the following (Attempt any 4)   20 Marks

A. Define chemical analysis.Distinguish between Proximate analysis and Partial analysis.

B. What are electroanalytical methods? Explain any two of them.

C. State the objectives of analytical chemistry.

D. Define classical method of analysis. Explain volumetric analysis method as a classical method of analysis.

E. Define chromatography. Explain importance of separation technique with the reference to solvent extraction.

F. The pH of a solution was determined with the following results.

(P.T.O.)

Trial	pH
1	4.50
2	4.53
3	4.55
4	4.51
5	4.57
6	4.52

Calculate the standard deviation, Variance, and coefficient of variation for the set of observation.

Q.3   Answer the following (Attempt any 4)   **20 Marks**

A.   What is the criterion for selection of indicator in acid base titration.

B.   Explain the importance of drying and washing.

C.   Explain the factors affecting solubility of precipitate.

D.   Explain the determination of end point of acid base titration potentiometrically?

E.   Explain the process of nucleation in brief.

F.   Define gravimetric analysis. Explain any two applications of gravimetric analysis.

Q.4   Answer the following (Attempt any 4)   **20 Marks**

A.   State the application of UV-VIS spectrometry

B.   What is the deviation from Beer-Lambert's Law?

C.   Name the different components of spectrophotometer and explain function of each component.

4

D. What is potentiometric titration. Explain its experimental set-up.

E. Derive the mathematical expression for Lambert's Law.

F. The absorbance of 1×10^{-3} M solution placed in a cell with path length 1 cm, was found to be same as another solution of the same substance placed in a cell with path length 3 cm using the same incident radiation. Calculate the concentration of second solution.

Q.5 Answer the following (Attempt any 4) 20 Marks

A. Define error. Write note on operational error and Human errors.

B. The titre of a solution in a volumetric experiment was determined by six separate titrations. The result of the experiment was as follows:

Expt. No	Titr (cm^3)
1	12.25
2	12.24
3	12.30
4	12.28
5	12.25
6	12.26

Calculate mean, median, average deviation and standard deviation for the given data.

C. Write note on use of adsorption indicator.

D. A sample of iron ore weighing 0.6428 g is dissolved in acid, the iron reduced to Fe^{2+}, and the solution is titrated with 36.30 cm^3 of 0.01753 M $K_2Cr_2O_7$ solution. The ionic reaction is,

$$6 \, Fe^+ + Cr_2O_7^{2-} + 14 \, H^+ \rightarrow 6 \, Fe^{3+} + 2 \, Cr^{3+} + 7 \, H_2O$$
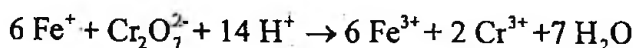
Calculate percentage of iron in the sample (AW = 55.847) in the sample

E How are organic functional groups identified using UV-VIS spectroscopy?

F An aqueous solution which is 10^{-3} M absorbs 10% of the incident radiation in a path length of 1 cm. Calculate the concentration of a solution of the same substance that will absorb 90% of the same incident radiation in the same cell.

5

RIZVI COLLEGE OF ARTS, SC. & COM.
S.Y.B.Sc (Physics)
Paper-I (USPH301)

Time: 3 Hrs

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) The length of equivalent simple pendulum corresponding to a physical

   pendulum is _____.

   a) l

   b) k

   c) $l + \frac{k^2}{l}$

   d) $k + \frac{l^2}{k}$

2) The SI unit of damping constant is _____.

   a) N-s/m

   b) N-m/s

   c) m/N-s

   d) s/N-m

3) The unit of entropy is _____.

   a) $JK^{-1}mol^{-1}$

   b) $KJ^{-1}mol^{-1}$

   c) $JKmol^{-1}$

   d) $J^{-1}K^{-1}mol^{-1}$

4) Q_{triple} = _____.

   a) 272 · 16

   b) 273 · 16

   c) 272 · 26

   d) 272 · 26

5) Cryostat engine in which liquid _____ is used.

   a) ^{1}He

   b) ^{2}He

   c) ^{3}He

   d) ^{4}He

6) A reversible heat engine ca be 100 % efficient if the temperature of the sink is

   a) 0°C

   b) $0°K$

   c) Less than that of source

   d) Equal to that of source

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

1) Define: Centre of mass.

2) Write down Clausius's statement of second law of thermodynamics.

3) One ton of refrigerator is equal to how much.

Q.1 C) Fill in the blanks. (5)
1) The dimensional formula of torque is same as that of _____.
2) 2nd law of thermodynamics establishes the existence of single valued function of state called _____.
3) A machine that convert heat into work is called as _____.
4) The study of various low temperature phenomena has led to growth of fascinating branch of physics called _____.
5) ³He gas is condensed with the help of _____ bath.

Q.2 A) Attempt any TWO of the following. (16)
1) What is compound pendulum? Obtain an expression for the time period of angular SHM of a compound pendulum.
2) Using mathematical method, show that the total external torque acting on the system of particles is given by $\vec{\tau} = \frac{d\vec{L}}{dt}$ rate of increase of the kinetic energy of the system.
3) Explain the concept of centre of mass in detail.
4) What is damped harmonic oscillator? Obtain the differential equation of a damped harmonic oscillator.

Q.2 B) Attempt any ONE of the following. (04)
1) Show that there are four points collinear with the centre of gravity for which the time period of angular SHM of a compound pendulum is the same.
2) Two blocks of masses 0.7kg and 1.4kg are connected with a mass-less spring of force constant 25N/m. Calculate the frequency of oscillation of the system. xonx

Q.3 A) Attempt any TWO of the following. (16)
1) Describe the Carnot Cycle with the help of indicator diagram and derive an expression for the efficiency of a Carnot engine.
2) Explain entropy and unavailable energy with their proper derivation.
3) Using a T – S diagram, explain the concept of reversible heat transfer in Carnot cycle.
4) Explain Kelvin's thermodynamic scale of temperature and derive its derivation.

Q.3 B) Attempt any ONE of the following. (04)
1) Find the efficiency of Carnot's engine working between 177 °C and 77 °C. It absorbs 140 calories of heat. How much heat is rejected.
2) What is the change in entropy, when 20 Kg of water at 150 °C get converted into steam at same temperature. [Given : Latent heat of steam L = 540 cal / gm]

Q.4 A) Attempt any TWO of the following. (16)
1) Explain the working of an Rankine engine with the help of an indicator diagram and obtain an expression for its efficiency.
2) Derive the Clausius – Clapeyron's latent heat equation.
3) What is Joule-Thomson coefficient? Obtain its expression.

2

4) Describe Explain the principle of working of Diesel engine with the help of an indicator diagram and obtain an expression for its efficiency.

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

1) In an Otto cycle engine, petrol vapour mixed with air sucked in the atmospheric temperature 240 . After compression the temperature of the fuel mixture becomes 412 . Immediately after combustion of fuel, the temperature is 1840 . Calculate the adiabatic expansion ratio (ρ) and its efficiency (η).

2) Find the change in boiling point of water, when the pressure is raised by 2 atmosphere.

[Given : Boiling point of water = 100 °C , Specific volume of water = $0 \cdot 001 \; m^3/kg$

Specific volume of steam = $1 \cdot 761 \; m^3/kg$ & Latent heat of steam = $2 \cdot 286 \; J/kg$]

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

1) A particle of mass moves on a path given by $\vec{r} = a \cos \omega t \hat{\imath} + b \sin \omega t \hat{\jmath}$. Calculate the torque about the origin.

2) What are the advantages of a compound pendulum over a simple pendulum?

3) Write down the difference between the reversible and irreversible process.

4) Explain the concept of entropy with their equation.

5) Distinguish between Otto and Diesel cycles.

6) State and explain the third law of thermodynamics.

_____ ******* THE END ******* _____

3

RIZVI COLLEGE OF ARTS, SC. & COM.
S.Y.B.Sc (Physics)
Paper-II (USPHP302)

Time: 3 Hrs
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. Stoke's theorem is used to transform
(a) a surface integral into volume integral
(b) a surface integral into line integral
(c) a volume integral into line integral
(a) none of these

2. Spherical polar coordinate system is _____.
(a) orthogonal system　　　　　　　　(b) non- orthogonal system
(c) parallel system　　　　　　　　　(d) none of these

3. The value of stability factor for a base resistor bias is _____

a) $R_B (\beta + 1)$　　　b) $R_C (\beta + 1)$　　c) $(\beta + 1)$　　　　d) $(\beta - 1)$

4. _____ is called loop gain.

a) $\frac{\beta}{A_v}$　　b) $\frac{A_v}{\beta}$　　c) βA_v　　d) $A_v (\beta + 1)$

5. Close loop gain of OP-AMP in inverting mode.......

a) R_f / R_i　b) $R_f . R_i$　　c) $- R_f / R_i$　d) $-Ri . (R_f)$

6. In a phase shift oscillator R= 1M, C= 0.001µF. The frequency of oscillator is ....Hz.

a) 0.65　　b) 6.5　　c) 65.0　　d) 0.065

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

1. Define the surface integral.

2. What is the unit of power gain?

3. State the condition for sustain oscillation.

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

1. The divergence of vector $x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ is _____.

2. Temperature is an example of _____ field.

3. A CE amplifier produces a phase shift of _____ between input and output voltage at collector.

4. Stabilisation is the process of making the _____ of a transistor independent of temperature.

5. Gain of an OP-AMP in voltage follower is _____.

Q.2 A Attempt any TWO of the following.

1. Verify the fundamental theorem for gradient using $\emptyset = x^2 + 4xy + 2yz^3$, the points are $A = (0,0,0), B = (0,0,0)$ and the paths are $(0,0,0) \rightarrow (0,0,1) \rightarrow (0,1,1) \rightarrow (1,1,1)$.

2. Calculate the surface integral $\int \vec{F} \cdot d\vec{s}$ where $\vec{F} = 4xz\hat{\imath} - y^2\hat{\jmath} + yz\hat{k}$ and S is bounded by planes (i.e. for cube) $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$.

3. Verify stoke's theorem for the function $\vec{F} = xy\hat{\imath} + 2yz\hat{\jmath} + 3zx\hat{k}$ for the triangle area, with the coordinates $O(0,0,0)$, $A(0,2,0)$ & $B(0,0,2)$.

4. Explain cylindrical coordinate system. Obtain expression for position vector, unit vectors, infinitesimal displacement vector, area vector and volume element in terms of Cartesian coordinate system.

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

1. Find the total work done in moving a particle in a force field given by $\vec{F} = 3xy\hat{\imath} - 5z\hat{\jmath} + 10x\hat{k}$ along the curve $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$.

2. In spherical polar coordinate of a point are $(r, \theta, \phi) = 10, 30°, 45°$. Find the cartesian coordinates of the same plane.

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

1. Derive the relation between gain without feedback and gain with feedback when a negative feedback is introduced.

2. Explain the effect of negative feedback on stability, distortion and output resistance of an amplifier.

3. Explain with circuit diagram the working of collector feedback bias method of transistor biasing.

4. Explain with circuit diagram the working of base resistor bias method of transistor biasing.

Q. 3 B) Attempt any ONE of the following (4)

1. An amplifier has bandwidth of 100 KHz and gain 50, when no feedback is applied. If 5% negative feedback is applied then find the new bandwidth?

2. In an emitter bias circuit $R_c = 4.7$ K, $R_B = 100$K, $R_B = 100$ K $V_{cc} = 20$ V , $-V_{cc} = -20$ V, find I_C.

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

1. Explain the general block of an oscillator. Draw the circuit diagram of COLPITTs oscillator. Explain it's working. What is the frequency of oscillation?

2. Draw the neat labelled diagram of a WIEN-BRIDGE oscillator. Explain the working. Determine The frequency of oscillation.

3. Give any TWO characteristics of OP-AMP. Explain it's use as a differentiator. Draw suitable Graphs of output.

4. Three voltages V_1, V_2, V_3 are to be added. How will you use an OP-AMP in inverting mode To add them through resistors R_1, R_2, and R_3 respectively.

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

1. Determine the output frequency, feedback fraction for COLPITT'S oscillator using Following components: $C_1 = 0.001$ µF, $C_2 = 0.01$ µF. $L = 15$µF.

2. Find the lower frequency limit for the OP-AMP as an integrator. $R_i = 1K$, $R_f = 100K$, $C = 0.01$ µF.

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

1. Calculate the volume integral of the scalar function, $\phi = y + 2z + 3x$ over $(0,0,0)$ to $(2,2,2)$ for the cube.

2. Prove the cylindrical coordinate system is orthogonal.

3. Write a short note on transistor biasing.

4. Explain frequency response curve of an amplifier.

5. Explain response of an op-amp with the help of a suitable graph.

6. Justify the need of 3-RC leg in an oscillator.

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16/11/22

Time: 3 Hrs
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. Which of the following is not the properties of laser?
  a) monochromaticity   b) coherence
  c) directionality   d) proportionality

2. Which type of pumping is used in the He-Ne laser?
  a) electric pumping   b) optical pumping
  c) chemical pumping   d) heat pumping

3. Select the correct statement ...
  a) lattice + basis = crystal   b) unit cell = crystal
  c) unit cell + primitive cell = crystal   d) lattice + unit cell = crystal

4. For .... all angles are 90° but all sides are different.

  a) cubic   b) orthorhombic   c) tetragonal   d) monoclinic

5. Nano- composite materials mostly _____ than other materials.

  a) Weaker.   b) Stronger   c) totally different   d) feeble

6. In the _____ substance whose outermost orbit has odd number of electrons.

  a) Para-magnetism   b) dia-magnetism   c) ferromagnetism   d) anti-ferromagnetism

Q.1 B Answer the following questions in one statement. (03)
    1. What is acoustic of building?
    2. Define primitive cell.
    3. Write a full form of OLED.

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

1. for an empty assembly hall of size $20 \times 15 \times 10$ cubic meter, the total surface area of the

  hall is _____.

2. Fibre optics do not need a _____ connection.

3. There are ------- space lattice.

4. For ....structure none of the angles are 90° and no sides are equal.

1

5. All ferroelectric materials exhibit _____ effect.

Q.2 A Attempt any TWO of the following. (16)
1. Define crystal symmetry. Draw 7 basic crystal systems. Explain them on the basis of length and angles.
2. Derive an expression for the separation distance between two successive planes For a simple cubic.
3. Explain how will you determine i) packing fraction of simple cubic ii) bcc.
4. Explain the X-ray diffraction through the cubic crystal. Derive Bragg.s equation.

Q.2 B Attempt any ONE of the following. (04)
1. Lead is a fcc cubic. Atomic radius is 1.746A.U.Find the distance of
   i) 200-planes   ii) 220-planes.

2. Show that the maximum radius of the sphere that can be fitted into a space of a body center of the fcc structure coordinated by the facial atoms of 0.414r, where r = radius of atom.

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

1. State Sabine's formula for reverberation time of a hall. Show that the absorption coefficient a_1 of the area s_1 is given by $a_1 = \frac{0.161V}{s_1}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

2. Explain with the neat diagram, the process of absorption, spontaneous emission and stimulated emission of light.

3. Explain any three properties of laser.

4. What is Fibre optical cable and draw its sematic diagram? What are its advantages over conductor? What are total internal reflection and critical angle?

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

1. A hall with dimensions $16 \times 10 \times 10$ cubic meter is found up to 2 seconds. What is the total absorbing power of all the surfaces in the hall?

2. Calculate the numerical aperture of a fibre with core index $n_1 = 1.61$ and cladding index $n_2 = 1.55$.

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

1) Explain the magnetic hysteresis property which affects ferromagnetic materials.

2) Explain conductors, semiconductor and insulators on the basis of energy level diagram.

3) Explain what the thin films are, also write the features of the films during growth process.

4) Explain the functionality of ceramic materials.

B Attempt any ONE of the following.   (04)
1. Write a short note on LED.

2. Write a short note on soft magnets.

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

1. What are essential features about good acoustics?

2. Explain the use of laser in computer.

3. What are Miller indices? Obtain the Miller indices if a plane cuts the x, y and z- axes at (2,3,1)

4. Copper has an fcc structure. a = 3.61 A^0. Find the radius of copper atom.

5. Draw a neat labelled diagram of spectrum showing electromagnetic radiation.

6. Explain single crystal and poly crystal materials.

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14/11/22   SYS 106

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

Q1. A) Fill in the blanks   (05)

a) Ratio of double recessive epistasis is _____
   (9:7, 9:3:3:1, 15:1)

b) Intermediate traits formed by
   (Codominance, dominance, Incomplete dominance)

c) The _____ occurs at both ends of the chromosome.
   (telomere, centromere, secondary constrictions)

d) Lac repressor binds to _____to prevent transcription
   (operator, promoter, activator)

e) The initiator Amino acid tRNA carries _____
   (Histidine, Tryptophan, Methionine)

Q1.B) Match the column   (05)

A		B	
A	Phenylketonuria	i	Lightly stained
B	Eye colour in *Drosophilla*	ii	Transcription promoter
C	Freemartins	iii	Autosomal recessive
D	Euchromatin	iv	Sterile due to male hormones
E	TATA box	v	Multiple alleles

Q1.C) State whether true or false   (05)

a) Locus is particular location of gene on a chromosome.
b) Widow's peak hairline is a recessive trait in human
c) In Drosophila, the ratio of autosomes to X-chromosomes determines sex.
d) Histone is a pentamer
e) Third base of Amino acid codon is also called as Wobble base

Q1.D) Answer in one sentence   (05)

a) What do you mean by homozygous?
b) What are X-linked genes?
c) Define Euchromatin.
d) Write Chargaff's rule.
e) What is example of Inborn errors of metabolism in man?

Q2.A) Answer the following (any one)   (10)

a) Explain Mendel's laws of inheritance and write briefly with one example about dihybrid cross.
b) What is epistasis? Give a detailed account of double dominant epistasis

Q2.B) Answer the following (any two)   (10)

a) Explain the modern & Classical concept of gene
b) Discuss with appropriate chart pedigree analysis of autosomal dominant inheritance.
c) Describe co-dominance with a suitable example
d) Describe complete linkage

Q3.A) Answer the following (any one)   (10)
  a) Sketch, label and explain the structure of a eukaryotic chromosome.
  b) Discuss in detail the 'Genic Balance Theory' and intersex.

Q3.B) Answer the following (any two)   (10)
  a) Describe the ZZ-ZW mechanism of sex determination.
  b) Write a note on the Lampbrush chromosome
  c) Write a note on sex limited genes.
  d) Describe the parthenogenesis.

Q4.A) Answer the following (any one)   (10)
  a) Describe the process of Replication along with a diagram
  b) Explain Lac Operon regulation in presence and absence of lactose.

Q4.B) Answer the following (any two)   (10)
  a) Griffth Experiment
  b) Difference between B and Z DNA
  c) Write a note on Watson and Crick model of DNA
  d) Give an account of nitrogen bases present in nucleic acids.

Q5)   Write short notes on (any four)   (20)
  a) Dihybrid cross
  b) Lethal alleles
  c) Metacentric chromosome with suitable example and diagram
  d) XX-XO mechanism of sex determination
  e) Hershey and Chase Experiment
  f) One gene one enzyme hypothesis

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SYBSc. Semester III Zoology Paper II

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) Organisms that synthesize their own food from simple substances are called

      _____.

      (Autotrophs, Heterotrophs, Saprophytes)

b) In cockroach _____ are excretory & osmo regulatory in function.
      (G.V. cavity, Protonephridia, Malphighian tubules)

c) Crocodile have _____ chambered heart.
   (two, three, four)

d) The basic unit of nervous system is _____.
      (Glial cells, Neurons, Meninges, Cerebrospinal fluid)

e) Reptiles and birds are
      (Oviparous, Vivivaparous, Ovoviviparous)

B. Match the columns I and II and rewrite   05

Column I	Column II
a) Bile salts	i) Response to contact
b) Vertebrates	ii) Emulsification
c) Book lungs	iii) Acetylcholine
d) Thigmotrophism	iv) Spider
e) Neurotransmitter	v) Closed circulatory system

C. State whether True or False   05

a) Gastrovasular cavity is found in *hydra*
b) Excretion is elimination of toxic nitrogenous waste products of metabolism.
c) Direct respiration is where exchange of gas takes place without aid of respiratory surfaces.
d) Imperfect double circulation is found in mammals
e) Non myelinated neuron is seen in the central nervous system.

D. Answer in only one sentence   05

a) Give the function of gastroliths in pigeon.
b) Define ammonotelic animals.
c) What are formed elements of blood?
d) Define fragmentation.
e) Give the functions of tube feet

Q 2. A. Discuss physiology of digestion in ruminant stomach. 10

OR

A. Discuss physiology of urine formation in man.

Q2. B. Explain any two of the following. 10
a) Gastrovascular cavity of *Hydra*.
b) Digestion in small intestine of man.
c) Structure of kidney
d) Mapliphian tubules in cockroach.

Q3. A. Describe the process of internal respiration in man 10

OR

A. Describe the ⸱heart of shark with suitable diagram.

Q3.B. Explain any two of the following 10
a) Gills of bony fish
b) Lungs of frog.
c) Open circulation.
d) Heart of earthworm

Q.4 A. Describe the conduction of nerve impulse

OR

A. Describe the types of fins in fish

Q.4. B. Explain any two of the following
a) Types of neurons on the basis of function
b) Sol-Gel Theory
c) Legs of cockroach
d) Structure of human sperm

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

a) Heterotrophic nutrition.
b) Uricotelic animals.
c) Direct and indirect respiration
d) Mechanism of respiration in *Clarius*.
e) Stucture of striated muscle fibre.
f) Advantages and disadvantages of asexual reproduction

SYBSc. Semester III Zoology Paper III

Time : 3 hours

N.B :   1. All questions are compulsory.

Marks : 100

2. Figures to the right indicate full marks.

3. Draw neat and labeled diagrams wherever necessary.

Q1.   A)   Fill in the blanks by choosing correct options given below   5

a)   Ant communicate with each other through _____.
   (Pheromones, Waggle dance, Round dance)

b)   Courtship behavior of the great crested grebes is _____.
   (Feeding migration, Habitat selection, Ritualization)

c)   The _____ form of the parasite is usually ingested through feces.
   (excysted, encysted, motile)

d)   *Taenia solium* is commonly called _____.
   (pork worm, hookworm, arrow worm)

e)   The process applicable in milk processing is _____.
   (Baking, blanching, pasteurization)

B)   Match the columns I and II and rewrite

Column I		Column II
a) Insight learning		i) FAP
b) Sign stimulus		ii) Wolfgang Kohler
c) H5N1 virus		iii) Rabies
d) Lyssa virus		iv) Rock bee
e) *Apis dorsata*		v) Avian influenza

C)   State whether True or False

a)   In habituation the animal learns to ignore the stimulus that is insignificant to it.

b)   Altrusim is a type of migration in fish.

c)   An obligatory parasite cannot exist without its host.

d)   Bhavalkar Ecological Research Institute (BERI) is located in Pune.

e)   Sahiwal is milch breed of cow.

D)   Answer in only one sentence

a)   Define instinct.

b)   What is anti–predatory colouration.

c)   What is a biological vector?

d)   Name the diseases caused by bacteria in honey bees

e)   Define vermiculture

Q2. A) Explain classical conditioning and add a note on significance of learning by classical conditioning.　　10

OR

A) Explain the different types of mimicry.

B) Explain any two of the following.　　10
   a) Scope of Ethology..
   b) Types of imprinting.
   c) Territorial behaviour.
   d) Social behavior in Hanuman langur.

Q3. A) Describe the life cycle of *Entamoeba histolytica*. Add a note on amoebiasis.　　10

OR

A) Write in detail the morphology, life cycle, pathogenicity, and control methods of head lice.

Q3. B) Explain any two of the following:　　10

   a) Mode of transmission,signs and symptoms of bird flu.
   b) Structural adaptations of endoparasites
   c) Pathogenicity of *Wuchereria bancrofti*.
   d) Control measures and treatment of mites.

Q4. A) Describe any two methods of vermiculture
OR
A) Describe any two diseases caused by fungus in honey bees

Q4. B) Explain any two of the following
   a) Structure of natural hive
   b) Advantages of vermiculture
   c) Types of cooler used in milk processing
   d) Composition and method of preparation of barfi.

Q5.　Write short notes on any Four　　20
   a) Cryptic colouration.
   b) Types of conflicts with reference to kinship.
   c) Prevention of Rabies.
   d) Prevention and treatment of *Fasciola hepatica*.
   e) Role of honey bee in pollination
   f) Marketing of vermicompost

17/11/22   SYS-111

MATHEMATICS PAPER –I: CALCULUS – III

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 if the series $\sum_{n=1}^{\infty} a_n$ *converges then* $a_n \to 0$.

(b) Show that the geometric series $\sum_{k=1}^{\infty} ar^{k-1}$ converges if and only if $|r| < 1$.

(c) Show that if $\sum_{n=1}^{\infty} a_n$ converges absolutely then $\sum_{n=1}^{\infty} a_n$ *converges.*

(d) If $a_n \geq 0\ and\ na_n \geq 1\ for\ all\ n \in N, show\ that\ \sum_{n=1}^{\infty} a_n$ *diverges.*

(e) Discuss the convergence of the series $\sum_{n=1}^{\infty} \frac{(4n)(-1)^n}{5n-1}$.

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

(a) If f is integrable on $[a,b]$, show that $|f|$ is also integrable on $[a,b]\ and\ \left|\int_a^b f\right| \leq \int_a^b |f|$.

(b) Show that a constant function is integrable on $[a,b]$.

(c) Show that $f:[0,1] \to \mathbb{R}$ defined by $f(x) = x$ is integrable and $\int_a^b f(x)dx = \frac{1}{2}$.

(d) *Show that if f and g are integrable on $I = [a,b]$ and $f(x) \geq g(x)$*

$$for\ all\ x \in I\ then\ \int_a^b f \geq \int_a^b g$$

(e) *If $a < c < b$ and if f is integrable on both $[a,c]and\ [c,b]$ then show that f is integrable on $[a,b]$ and*

$$\int_a^b f = \int_a^c f + \int_c^b f$$

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

(a) Show that if f is Riemann integrable *on $[a,b]$* and $F'(x) = f(x)$ then

$\int_a^b f(x)dx = F(b) - F(a)$.

(b) Find the area of the region bounded by the parabola $y = x^2\ and\ y = 2x - x^2$.

(c) Find the arc length of the curves $x = a(\cos\theta + \theta\sin\theta)$;
$$y = a(\sin\theta - \theta\cos\theta), 0 \leq \theta \leq \pi$$

(d) *Show that* $\beta(m,n) = 2\int_0^{\pi/2}(\sin^{2m-1}\theta)(\cos^{2n-1}\theta)d\theta$.

(e) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

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

(a) Discuss the convergence of $\sum\left(\frac{n}{1+n^2}\right)^n$ by using Root Test.

(b) Discuss the convergence of $\sum\left[\frac{1}{n2^n}\right]$ by using Ratio Test.

(c) *Let* $f(x) = 4x - 3, I = [0,2], P = \{0, 0.5, 1, 1.5, 2\}$.
   Find the value of $L(P,f)$ and $U(P,f)$.

(d) Let $f: [a, b] \to R$ defined by $f(x) = \begin{cases} -1, x \text{ is irrational} \\ 1, x \text{ is rational} \end{cases}$

   Show that the function is not Riemann integrable on R.

(e) Show that $\int_0^\infty x^{5/2}e^{-x^7}\,dx = \frac{\sqrt{\pi}}{7}$.

(f) *Find the value of the improper integrals (i)* $\int_0^\infty \frac{dx}{1+x^2}$ *and*
$$(ii) \int_0^1 \frac{dx}{\sqrt{1-x^2}}.$$

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2

SYBSC SEM IV EXAMINATION NOVEMBER 2022

MARKS: 75

TIME DURATION: 2 Hr. 30 Min

N.B: 1) All questions are compulsory.
   2) Figures to the right indicate full Marks.

Q.1 Attempt any Four

(20)

(i) Find the solution set for the following system of equations. Also interpret the system and its solution geometrically.

$$2x + 3y + z = 0;$$

(ii) Solve the following equations by Gauss elimination method and write the solution set.

$$x_1 - x_2 + x_3 - 2x_4 = 3$$
$$-x_1 + x_2 + x_3 + x_4 = 2$$
$$-x_1 + 2x_2 + 3x_3 - x_4 = 9$$
$$x_1 - x_2 + 2x_3 + x_4 = 2$$

(iii) Prove that the inverse of an elementary matrix E_{ij} is E_{ij}.

(iv) Prove that, the sum of any two solutions and Scalar multiple of a solution is also the solution of the homogeneous system of linear equations.

(v) Prove that, a non-homogeneous system of m linear equations in n unknowns has infinite solutions if m < n.

Q.2 Attempt any Four.

(20)

(i) Verify whether the set $\mathbb{R}^2 \equiv \{(x, y) \text{ where } x, y \in \mathbb{R}\}$ is a real vector space with respect to usual addition and scalar multiplication of vectors in it.

(ii) Verify whether the subset $W \equiv \{(x, y, z) \text{ where } z = 2x + 3y\}$ is a subspace of $\mathbb{R}^3$.

(iii) Verify whether the set {(1, 2, 0), (0, -1, 2), (1, 1, 1)} is linearly dependent.

(iv) Let V is a real vector space $x, y, z \in V$ & $\alpha \in \mathbb{R}$.

   Prove that, a) if x + z = y + z then x = y.

   b) Identity element in V is unique.

(v) Let W_1 and W_2 be two subspaces of a real vector space V. Prove that $W_1 \cap W_2$ is also a subspace of V.

(20)

Q.3 Attempt any Four.

(i) Solve the following determinant by Laplace expansion method using second column

$$\begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 1 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$$

(ii) Find the inverse of the matrix A by adjoint method

$$A = \begin{bmatrix} 2 & 3 & 1 \\ 1 & 1 & 2 \\ 2 & 3 & 4 \end{bmatrix}$$

(iii) Verify whether the following system of equations is consistent. If it is consistent, find it's solution set.

$$x_1 + x_2 + 2x_3 - x_4 = 4$$
$$3x_2 - x_3 + 4x_4 = 2$$
$$x_1 + 2x_2 - 3x_3 + 5x_4 = 0$$
$$x_1 + x_2 - 5x_3 + 6x_4 = -3$$

(iv) Decompose the matrix A by LU decomposition method.

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$

(v) Prove that

det. $(v_1, v_2, \text{------}, v_i, \text{-------} v_j , \text{-------}v_n) = $ det.$(v_1, v_2, \text{------}, v_i + \alpha v_j, \text{------} v_j, \text{------}v_n)$

Q.4 Attempt any Three. (15)

(i) Reduce the following matrix into a row echelon form.

$$\begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 1 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$$

(ii) Find the inverse of a matrix by Gauss elimination method

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 3 & 1 & -2 \end{bmatrix}$$

(iii) Verify whether the set $\{(1, x, x^2\}$ is a basis of $P_2[x]$.

(iv) Prove that, If V is a real vector space, S is any subset of V and $x \in V$ then $x \in L(S)$ if and only if S∪ $\{x\}$ is linearly dependent

(v) Solve the following equations by Cramer's rule.

$$x + y - z = 2; 3x + 2y + z = 3; 2x - y + z = 5$$

(vi) Solve the following system of equations by LU decomposition method.

$$x + y + z = 1; 3x + y - 3z = 5; x - 2y - 5z = 10$$

S.Y. B.Sc. SEMESTER – III EXAMINATION: NOVEMBER 2022

MATHEMATICS PAPER –III: ORDINARY DIFFERENTIAL EQUATIONS

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 × 5 = 20 *Marks*)

(a) Show that e^x and e^{-x} are linearly independent solutions of $y'' - y = 0$. Hence, write general solution.

(b) Find the general solution of the differential equation $4y'' + 12y' + 9y = 0$.

(c) Find the general solution of $y'' - 4y' - 12y = 3e^{5x}$ by using the method of undetermined coefficients.

(d) Solve the differential equation by using Method of Variation of Parameters
$y'' + y = cotx$

(e) Show that $y = c_1 x + c_2 x^2$ is the general solution of $x^2 y'' - 2xy' + 2y = 0$ on any interval not containing zero.

Qn. (2) Attempt any FOUR questions from the following. (4 × 5 = 20 *Marks*)

(a) Show that $\begin{cases} x = e^{4t} \\ y = e^{4t} \end{cases}$ and $\begin{cases} x = e^{-2t} \\ y = -e^{-2t} \end{cases}$ are the linearly independent solutions of the

homogeneous system $\begin{cases} \frac{dx}{dt} = x + 3y \\ \frac{dy}{dt} = 3x + y \end{cases}$

(b) Find the general solution for the linear system of homogeneous equations

$$\begin{cases} \frac{dx}{dt} = -3x + 4y \\ \frac{dy}{dt} = -2x + 3y \end{cases}$$

(c) Find the general solution for the linear system of homogeneous equations

$$\begin{cases} \frac{dx}{dt} = 5x + 4y \\ \frac{dy}{dt} = -x + y \end{cases}$$

(d) Solve the linear system of homogeneous equations $\begin{cases} \frac{dx}{dt} = 3x - 4y \\ \frac{dy}{dt} = x - y \end{cases}$

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(e) Solve the linear system of homogeneous equations $\begin{cases} \dfrac{dx}{dt} = 2x \\ \dfrac{dy}{dt} = 3y \end{cases}$

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

(a) Given $\dfrac{dy}{dx} = y' = x - y^2$ and $y(0) = 1$, using Taylor'series method

   compute $y(0.1)$ correct to four decimal places.

(b) Using Picard's Method find the first approximation for $y' = x + y^2$; $y(0) = 1$

(c) Given $\dfrac{dy}{dx} = 1 + y^2$; $y(0) = 0$; $h = 0.1$, find $y(0.2)$ using Euler's method.

(d) Given that $y' = x^2 + y$; $y(0) = 1$; $h = 0.05$. Using Modified Euler's method find

   $y(0.1)$.

(e) Given $\dfrac{dy}{dx} = y - x$; $y(0) = 2$. Find the value of $y(0.1)$ and $y(0.2)$ using

   Runge − kutta method second order formula with $h = 0.1$.

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

(a) Solve the differential equation $y'' + y' - 6y = 0$.

(b) Find the Particular Integral of $(D^2 + 4D + 4)y = e^{2x}$.

(c) Verify that $\begin{cases} x = 4e^t \\ y = 2e^t \end{cases}$ and $\begin{cases} x = e^{-t} \\ y = -e^{-t} \end{cases}$ are the linearly independent or linearly dependent

   solutions of the homogeneous system

$$\begin{cases} \dfrac{dx}{dt} = 6x - 2y \\ \dfrac{dy}{dt} = 5x + 3y \end{cases}$$

(d) Find the general solution for the linear system of homogeneous equations

   $\begin{cases} \dfrac{dx}{dt} = 7x + 6y \\ \dfrac{dy}{dt} = 2x + 3y \end{cases}$

(e) Given $\dfrac{dy}{dx} = x + y^3$; $y(0) = 1$; $h = 0.2$. Find $y(0.2)$ by using

   Runge − Kutta Method fourth order formula correct four places of decimals.

(f) Given $\dfrac{dy}{dx} = x + y$; $y(0) = 2$; $h = 0.1$ Find $y(0.1)$ by using

   Runge − Kutta Method second order formula correct four places of decimals.

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Semester III

Botany I

Time: 3 Hrs

Marks :100

All questions are compulsory and carry equal marks.
Illustrate your answers with neat and labelled diagrams.
Figures to the right indicate full marks.

Q.1.A. Answer any two of the following question.   10

a.   *Sargassum* belongs to division _____.
     i. Chlorophyta   ii. Cyanophyta   iii. Rhodophyta   iv. Phaeophyta

b.   The scientific name of Gulf Weedis _____.
     i. *Sargassum*   ii. *Ectocarpus*   iii. *Dictyota*   iv. *Macrocystis*

c.   In *Funaria*the sporophyte shows the presence of _____ to differ from *Anthoceros*.
     i. foot   ii.seta   iii.capsule   iv.thallus

d.   The*Anthoceros*is abryophyte belonging to group of _____.
     i. Liverworts   ii.Hornworts   iii.Moss   iv.Fern

e.   The type of inflorescence represented by Sunflower is _____.
     i.Corymb   ii.Cymose   iii.Capitulum   iv. Cyathium

f.   Whichof the following is the member sub-family Fabaceae?
     i. Sunflower   ii. Wheat   iii. Coconut   iv. Green peas

g.   International Code of Botanical Nomenclature mainly deals with _____ of plants.
     i. fruits   ii.naming   iii.chemicals   iv.characters

h.   The corolla is indicated by _____symbol in the floral formula.
     i.C   ii.G   iii.A   iv.%

i.   The mobile phase in paper chromatography is
     i. liquid   ii. solid   iii. gas   iv. inert

j.   Themaximum magnification of the specimen is observed under_____ microscope.
     i. Dissecting   ii. Light   iii. Electron   iv. Compound

Q.1.B. Answer the following questions in one to two lines.   10

a.   Name the types of thallus found in *Sargassum*.

b.   What is protonema in *Anthoceros*?

c.   Describe papilionaceous corolla.

d.   What is Electrophoresis?

e.   Write the formula of R$_f$ value.

Q.2. **Answer any two of the following question.** 20

a. State the general characters of Phaeophyta.

b. How does *Sargassum* reproduce?

c. Draw and describe the structure of Anthoceros sporophyte.

d. Explain internal structure of *Funaria* thallus.

Q.3. **Answer any two of the following questions.** 20

a. What is Classification in Taxonomy? Comment on its types?

b. Explain the significance of Cytology in Taxonomy.

c. Give classification, distinguishing characters and floral formula of family Asteraceae.

d. State classification, general characters and floral formula of sub-family Papilionaceae.

Q.4. **Answer any two of the following questions.** 20

a. Explain horizontal Electrophoresis in detail with suitable diagram.

b. Describe thin layer chromatography.

c. Explain Transmission Electron Microscopy with suitable diagrams.

d. Explain compound Microscope and its functioning.

Q.5. **Answer any four of the following questions.** 20

a. Circular Paper Chromatography.

b. Economic importance of *Sargassum*

c. Documentations in Taxonomy

d. Sex organs in *Anthoceros*

e. Advantages and disadvantages of Microscopy

f. Economic importance of Caesalpinae

Semester III

Time: 3 Hrs

Botany II

Marks :100

All questions are compulsory and carry equal marks.

Illustrate your answers with neat and labelled diagrams.

Figures to the right indicate full marks.

Q.1.A. Answer any two of the following question.   **10**

a. Which of the following nitrogen base pairs with Cytosine?
    i. Adenine   ii. Guanine   iii. Uracil   iv. Thymine

b. G_2 phase of Interphase in the Cell cycle is responsible for preparing the cell for _____.
    i. G_1 Phase   ii. S Phase   iii. M Phase   iv. Cytokinesis

c. _____ is known as power house of the cell.
    i.Nucleus   ii. Glyoxysome   iii. Peroxisome   iv. Mitochondrion

d. The ribosomes found in prokaryotic cells are _____.
    i. 50S   ii. 60S   iii. 70S   iv. 80S

e. *Fragaris* ZO-ZZ pattern of sex determination is found in _____ female.
    i. Homogametic   ii. Heterogametic   iii. Isogametic   iv. Agametic

f. Which of the following is an example influenced inheritance?
    i. Baldness   -   ii. Colour blindness   iii. Haemophilia   iv. Eye colour

g. Which of the following plant was used to demonstrate male sterility?
    i. Rice   ii. Wheat   iii. Maize   iv. Coconut

h. Semiconservative DNA was discovered by _____.
    i. Griffith   ii. McAvery   iii. Watson-Crick   iv. Meselson-Stahl

i. DNA give the coded information in the form of _____.
    i. daughter DNA   ii. mRNA   iii. rRNA   iv. tRNA

j. _____ is actively involved in synthesising Protein.
    i. Ribosome   ii. Lysosome   iii. Peroxisome   iv. Glyoxisome

Q.1.B. Answer the following questions in one to two lines.   **10**

a. Name the types and subtypes of Nucleic acids.

b. What is the difference in Inversion and Translocation of chromosomes?

c. Define Meiosis.

d. What happens duringadenylation & capping?

e. Name any twoenzymes involved in protein synthesis.

Q.2. Answer any two of the following question. 20

a. Draw and describe the stages of Mitosis. Comment on Cytokinesis in plants and animals.

b. Explain the structure and state the functions of Mitochondrion.

c. With neat & labelleddiagramof Glyoxysome comment on its structure and functions.

d. Distinguish between mRNA, rRNA & tRNA.

Q.3. Answer any two of the following questions. 20

a. Discuss deletion and Translocation and give genetic significance.

b. Explain sex determination in heterogametic females with examples.

c. What is cytoplasmic inheritance? Discuss in detail with reference to Chlamydomonas.

d. Explain X- linked inheritance with suitable examples.

Q.4. Answer any two of the following questions. 20

a. Explain in detail theta model of DNA replication in prokaryotes.

b. Describe transcription in eukaryotes.

c. How does protein get synthetised?Explain through central dogma.

d. Give an account on production of mRNA in prokaryotic and eukaryotic cell.

Q.5. Answer any four of the following questions. 20

a. Telophase I and Telophase II

b. Structure of Interphase Nucleus

c. Genetic effects of inversions

d. Sex linked traits

e. Semiconservative DNA

f. Genetic Code

Semester III

Time: 3 Hrs

Botany III

Marks :100

All questions are compulsory and carry equal marks.
Illustrate your answers with neat and labelled diagrams.
Figures to the right indicate full marks.

Q.1.A. Answer any two of the following question. 10

a. Which of the following forests are found along Andaman and Nicobar Islands?
   i. Alpine   ii. Scrub   iii. Evergreen   iv. Swamp

b. *Polyalthialongifolia* bark powderis commonly used as an adulterant for _____.
   i. Neem   ii. Ashoka   iii. Quinine   iv. Digital

c. Which country is the largest producer of jute?
   i. India   ii. Bangladesh   iii. Pakistan   iv. China

d. Which of the following is not a Littoral and Swamp forests?
   i. Beach forests   ii.Tidal forests iii.Mangrove forests   iv. Pine forests

e. _____ forests are found in Western Ghats.
   i. Deciduous   ii. Evergreen   iii. Scrubs   iv. Swamp

f. The drug for malaria is _____.
   i. neem   ii. haldi   iii. quinine   iv. digital

g. Cardamom is a _____.
   i. fruit   ii. seed   iii. root   iv. leaf

h. _____ simply means raising trees in farm in an integrated manner.
   i. Apiculture   ii. Urban forestry   iii.Agroforestry   iv. Silviculture

i. Which of the following is not advised to be used in organic farming?
   i.Manure   ii. Earthworms   iii.Biofertiliser iv.Chemicals

j. To which family does the Jute plant belong to?
   i. Tiliaceae   ii. Compositae   iii. Malvaceae   iv. Solanaceae

Q.1.B. Answer the following questions in one to two lines. 10

a. Define forestry.

b. State the botanical name of false ashok.

c. Name different types of fibres.

d. Name two aromatic plants.

e. How *Chlorella* is used as Nutraceutical?

Q.2. Answer any two of the following question. 20

a. Describe monograph of *Saraca indica.*

b. Explain adulterant with reference to *Terminaliaarjuna&Terminaliatomentosa.*

c. Explain the significance of primary and secondary metabolites.

d. Give an account of alkaloids and its sources and uses.

Q.3. Answer any two of the following questions. 20

a. Define Forest. And explain moist and dry tropical forests.

b. Write botanical sources, morphology and uses of cardamom.

c. How are papers made? Discuss different types of papers.

d. Define Fibres. State the properties and uses of cotton fibres.

Q.4. Answer any two of the following questions. 20

a. What are Biofuels? Explain Jatropha as Biofuel.

b. Define Enzyme and explain its significance using suitable examples.

c. Explain Aromatherapy using the suitable examples.

d. Give the botanical source, nutritional value and uses of *Garciniaindica.*

Q.5. Answer any four short notes of the following 20

a. Indian pharmacopoeia

b. Glycosides

c. Properties of Cotton fibres

d. Uses of Lemon

e. Economic importance of Pinus and Wheat

f. Cellulose and cellulase