DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION,
DECEMBER 2022.

First Semester

INORGANIC CHEMISTRY – I

(CBCS 2018 – 19 Academic Year Onwards)

Time : Three hours　　　　　　　　Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Using electron dot diagrams and formal charges, find the bond order for each bond in POF_3 and XeO_3.

2. Write down the polyatomic molecules with suitable examples.

3. What factors affect intermolecular forces?

4. How do you find the dipole moment of CO_2?

5. What is the order of Lewis acidity of boron halides?

6. Classify the following as hard, soft and border line acids and bases; K^+, SO_2, O^{2-} and H^-.

7. What are the uses of feldspar?

8. How are hetero poly acids classified?

9. Define n-type and p-type semiconductor.

10. Write about F- Centers.

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Discuss about chemical periodicity of

    (i) Ionic radii;

    (ii) Ionization potential;

    (iii) Electron affinity;

    (iv) Electro negativity

Or

    (b) Give the postulates of VSEPR theory. Based on it, predict the structures of the following

    (i) SO^{2-} ;

    (ii) ClF_3

12. (a) How are σ, π and δ orbitals formed? Illustrate their formation with appropriate orbital sketches.

Or

    (b) Derive Born-Meyer equation for the Lattice energy of an ionic solid.

13. (a) Enumerate the applications of isopoly and heteropoly anions.

Or

    (b) Compare between Bronsted and Lewis acids and bases.

2   **D–7583**

14. (a) Discuss the classification of silicates. Draw and explain the structure of any two silicates.

Or

(b) What is the levelling and differentiating solvents?

15. (a) Write about HCP, FCC and BCC type solids.

Or

(b) Discuss any two defects in crystal.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. What is the concept of orbital hybridisation? Explain each with one example sp, sp^2, sp^3, dsp^3, sp^3d and sp^3d^3 hybridisation.

17. What is lattice energy? How is it determined? Discuss the factor on which lattice energy of ionic compounds depends.

18. Explain the structure of zeolite and describe its molecular sieving property.

19. Discuss the principle, application and limitation of Hard and Soft Acid and Bases.

20. Discuss: Ionic structure for AX, AX_2, AX_3 types with proper examples.

————————

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION,
DECEMBER 2022.

First Semester

ORGANIC CHEMISTRY – I

(CBCS 2018 – 19 Academic Year Onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Draw the structure of (a) Bicycle [4.2.1] nonane and (b) tricyclo [1.1.0.0^{2,4}] butane

2. [10] annulenes are not aromatic, why?

3. Define racemic modifications.

4. State Cahn-Ingold -Prelog rules.

5. What are the uses of Hammond postulate?

6. Define nucleofuge.

7. What is the condition required for SEi reaction?

8. Give example for elimination-addition reaction

9. List out ring activating group.

10. State Markovnikov's rule with one example

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Discuss the aromaticity of tropolones and tropylium cations.

Or

(b) Briefly discuss Steric inhibition and steric enhancement of resonance with suitable examples

12. (a) Describe in detail about enantiomers and diastereomer with suitable example

Or

(b) Explain neighbouring group participation with suitable examples.

13. (a) Vinyl carbon undergo substitution reaction slower than allylic carbon — Explain.

Or

(b) What are the factors influencing the Aliphatic nucleophilic substitution reaction.

14. (a) Discuss the following mechanism

(i) VilsmierHaak reaction;

(ii) Benzyne mechanism.

Or

(b) Describe the mechanism of Wagner -Meerwein and Baeyer-Villiger reaction.

15. (a) Explain briefly SE1 and SE2 reaction mechanism.

Or

(b) Write notes on kinetic and non-kinetic methods for determining organic reaction mechanism.

2   **D–7584**

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Write notes on the following

    (a) hyperconjugation;

    (b) Mesomeric effect;

    (c) HMO theory.

17. Differentiate with suitable examples of Homoaromatic. antiaromatic and non-aromatic compound

18. Illustrate rules followed in erythro and threo nomenclature and E & Z nomenclature with suitable example.

19. Discuss the following

    (a) Principle of microscopic reversibility

    (b) Structure and stability of carbocations.

20. Explain the following

    (a) Stereochemistry and absolute configuration of allenes and spiranes

    (b) Classical and nonclassical carbocations.

———————

D–7584

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION, DECEMBER 2022.

First Semester

PHYSICAL CHEMISTRY - I

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State the first law of thermodynamics.

2. Calculate the entropy change when 5 moles of an ideal gas expands from a volume of 1.5 litres at 25^0C to 7.5 litres at 50^0C ($Cv = 15$ Cal mol-1).

3. Define transport number.

4. Write Debye-Huckel Onsager equation and explain the terms in it.

5. Show that the function $\Psi = 4e4x$ is an eigen function of the operator d/dx. what is the eigen value?

6. State and explain Heisenberg's uncertainty principle.

7. Explain the concept of potential energy surfaces.

8. What are parallel and consecutive reactions?

9.   What are the differences between Gibbs and Helmholtz free energies?

10. Define the term fugacity.

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) What are the needs for second law of thermodynamics? State the different forms of second law of thermodynamics.

Or

    (b) Derive Gibbs-Duhem equation and write its significance.

12. (a) Derive Nernst equation for electrode potential and highlight its applications.

Or

    (b) Explain Calomel electrode and hydrogen electrode along with their diagrams.

13. (a) What are the inadequacy of classical mechanics? Explain.

Or

    (b) Setup the Schrodinger equation for a particle in a one dimensional box and solve it.

14. (a) Give a comparative account of absolute reaction rate theory and collision theory.

Or

    (b) Discuss the KRRM theory of unimolecular reaction?

D–7585

15. (a) What are electrochemical cells? How are they classified?

Or

(b) State the third law of thermodynamics and explain apparent exceptions to it.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the Carnot cycle and show that in this process the efficiency depends only on the temperature of the source and sink.

17. Derive Butler – Volmer equation and discuss how is it reduced to Tafel equation.

18. Set up and solve Schrodinger equation for a particle in a three dimensional box.

19. What are the first reactions? How are they studied using NMR method?

20. What are activity and activity coefficient? Describe a method to determine mean activity coefficient of electrolytes.

—————————

D–7585

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, DECEMBER 2022.

Second Semester

Chemistry

INORGANIC CHEMISTRY - II

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1.   Describe any two square planar complexes with geometrical isomerism.

2.   Predict the reason for splitting in tetrahedral complexes.

3.   Sketch the d-orbital energy level, label whether it is paramagnetic or diamagnetic and find out the geometry of the below complexes.

   (a) $Ti[H_2O_6]^{2+}$ (b) $[NiCl_4]^{2-}$

4.   What is mean by magnetic susceptibility?

5.   Give some properties of nucleus.

6.   What is mean by nuclear isomerism?

7. Define spallation reaction with example.

8. Explain some of the applications of nuclear chemistry in agriculture.

9. Predict the electronic configuration of Sm and Pu.

10. What are the causes of lanthanides contraction?

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) What is geometrical and optical isomerism? Discuss them in octahedral complexes.

Or

(b) What are the evidences for CFSE?

12. (a) Write about the spectrochemical series of the elements.

Or

(b) Bring out the comparison of VBT and CFT.

13. (a) Explain liquid drop model.

Or

(b) Explain the working principle of scintillation counter.

14. (a) Explain about the transmutation process in nuclear reactions.

Or

(b) What is mean by isotopic dilution analysis?

2 **D–7586**

15. (a) Describe the occurrence and extraction of Lanthanides.

Or

(b) Describe the spectral and magnetic properties of lanthanide compound.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. (a) Predict the limitations of VBT. (4)

(b) Derive the Jorgensen relation for the square planar symmetry (6)

17. Predict the theory of MOT in octahedral, tetrahedral and square planar complexes. (10)

18. (a) Explain meson field theory of nuclear model. (6)

(b) What is mean by half-life period? (4)

19. (a) What are charged particle accelerators? Give its uses. (5)

(b) Describe neutron activation analysis. (5)

20. Explain the lanthanide separation techniques by

(a) Fractional crystallization method (5)

(b) Solvent extraction method (5)

————————

3   **D–7586**

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION, DECEMBER 2022.

Second Semester

ORGANIC CHEMISTRY – II

(CBCS 2018 – 2019 Academic Year Onwards)

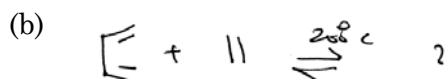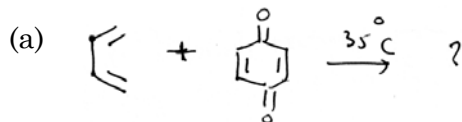Time : Three hours   Maximum : 75 marks
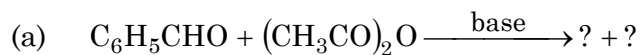
PART A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. State and explain saytzeff rule.

2. Differentiate electrophile and nucleophile.

3. What do you mean by regioselectivity? in addition reaction.

4. Identify the production of the following

    (a)

    (b)

5. Complete the reaction.

    (a) $C_6H_5CHO + (CH_3CO)_2O \xrightarrow{\text{base}} ? + ?$

    (b) $C_6H_5COCH_3 + HCHO + (CH_3)_2NH \rightarrow ?$

6.   What are topicity ligands? Give example.

7.   What are carbenes? Give example.

8.   What are free radicals? What is its stability?

9.   Define quantum efficiency.

10.   Illustrate sigmatropic rearrangement.

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11.   (a)   Describe the factors influence the rate of elimination.

Or

(b)   Explain chemo selectivity in addition reaction by citing suitable examples.

12.   (a)   Explain the mechanism of Claisen-ester condensation.

Or

(b)   Discuss the conformational analysis of substituted cyclohexane.

13.   (a)   What are nitrenes? How are they generated? Discuss any two reactions of nitrenes.

Or

(b)   Explain the following   (2 ½ +2 ½)

(i)   Sandmeye reaction

(ii)   Ullmann reaction

2   **D–7587**

14. (a) Sketch Jablonski diagram and explain the various photophysical process in it.

Or

(b) Sketch the correlation diagram for disrotatory inter conversion of cyclohexadien – hexatrien system and explain.

15. (a) Explain the mechanism of Benzoin condensation.

Or

(b) By citing an example, explain the mechanism of free radical polymerisation reaction.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the mechanism of E_1, E_2 and E_1CB reactions.

17. Explain the mechanisms of the following (5+5)

   (a) Knovenagel condensation

   (b) Mannich condensation

18. Discuss the following by providing appropriate example.
   (5+5)

   (a) Wolff rearrangement

   (b) Beckmann rearrangement

19. Discuss the Norrish type I and type II reaction.

20. Write notes on the following

   (a) Quantum efficiency (3)

   (b) Cope rearrangement (3)

   (c) Cannizaro reaction. (4)

——————

3   **D–7587**

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION, DECEMBER 2022.

Second Semester

PHYSICAL CHEMISTRY II

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define the term surface excess

2. What is the Langmuir-Hinshelwood mechanism?

3. What are the types of surfactants and give each one example?

4. What is mean by initiator?

5. What is mean by intersystem crossing?

6. What is mean by photosensitization?

7. Define the quantum yield.

8. What is called fire retardant?

9. Give any two examples of dendrimer.

10. Explain the artificial photosynthesis.

PART B — (5 × 5 = 25 marks)

Answer ALL questions by choosing either (a) or (b).

11. (a) Explain the type of BET isotherms with example.

Or

(b) What are called detergents? Explain their working principles.

12. (a) Write the difference between fluorescence and phosphorescence.

Or

(b) What is called chemicluminescence? Explain with example.

13. (a) What is mean by flash photolysis? Explain its importance.

Or

(b) Write down the radiolysis of water.

14. (a) Explain the classification of polymers.

Or

(b) What is mean by degree of polymerization and explain?

15. (a) Write about the biodegradable polymers.

Or

(b) Write about the principles of dye sensitized solar cell.

2   **D–7588**

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Write about the Freundlich and Langmuir type of isotherms with example. (10)

17. Explain

    (a) Gibbs adsorption isotherm (3)

    (b) Contact angle (3)

    (c) Explain the hydrogen-halogen reaction (4)

18. Write about the functionality of monomers and its significance. (10)

19. Write about the mechanism of free radical polymerization. (10)

20. (a) Explain the conducting polymers with example. (5)

    (b) Explain the properties of colloids. (5)

————————

D–7588

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, DECEMBER 2022.

Third Semester

Chemistry

ADVANCED INORGANIC CHEMISTRY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours　　　　　　　　Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1.　What is stepwise stability constant?

2.　What is meant by template effect?

3.　Give an example for aquation reactions.

4.　Deduce the term symbol for d^7 ion.

5.　What are inverse spinels?

6.　What are carboranes?

7.　Illustrate back bonding in metal carbonyls.

8.　Differentiate oxidative addition and reductive elimination.

9.　Define the term in vivo nitrogen fixation.

10.　Name any two chelating agent used in medicine.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

11. (a) Explain anation reaction with suitable example.

Or

(b) List out any two synthesis of macrocyclic ligands.

12. (a) State and explain wade's rule.

Or

(b) Give a brief account on metal clusters.

13. (a) What are hydroformylation reactions? Discuss the mechanism.

Or

(b) Describe the preparation and Structure of $Ni(CO)_4$.

14. (a) How do Na^+/k^+ pump work? Mention its function.

Or

(b) List out the role of alkali and alkaline earth metals in biology.

15. (a) Bring out the differences between labile and inert complexes.

Or

(b) Write a note on orgel diagram.

2 **D–7589**

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questiona.

16. (a) Explain how stability constant of complexes determined by P^H metric method. (6)

   (b) Bring out the differences between trans effect and trans influence. (4)

17. Explain the following

   (a) Bonding in boranes

   (b) Selection rule in electronic spectra

   (c) Perovskite structure. (4+3+3)

18. Write a note on:

   (a) Hydrogenation of olefin

   (b) Dewar-Chatt approaches to bonding in metal-olefin complexes. (6+4)

19. Describe the structure and biological functions of myoglobin and hemoglobin.

20. (a) Explain the reactivity and stability of ferrocene. (5)

   (b) Illustrate in vivo nitrogen fixation. How does it differ from in vitro nitrogen fixation? (5)

————————

3

D–7589

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION,
DECEMBER 2022.

Third Semester

ADVANCED ORGANIC CHEMISTRY

(CBCS 2018-19 Academic Year onwards)

Time : Three hours   Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. How will you prepare allylic alcohol using Luche reduction?

2. How does DIBAL react with esters?

3. Write down the ozonolysis products of 2-methyl -2- pentene.

4. Draw the structures of Flavones.

5. What is meant by protection of functional group?

6. What is retro synthesis?

7. What are coenzymes?

8. What is Sanger's reagent? Give its significance.

9. Give the structure of progesterone.

10. How will you convert camphoric acid into camphor?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) Give the mechanism of Birch reduction.

Or

(b) Compare the reduction of carbonyl compounds using LiAIH$_4$, DIBAL and NaBH$_4$.

12. (a) Write the important steps involved in Baker-Venkataraman synthesis for flavones.

Or

(b) What is functional group interconversion? Explain the interconversion of hydroxyl, carbonyl and carboxylic acid compounds.

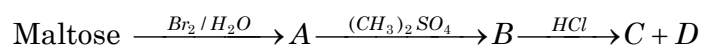13. (a) Write a note on solid phase peptide synthesis.

Or

(b) Give a brief note on cellulose.

14. (a) Give a detailed note on biosynthesis of alkaloids.

Or

(b) List out the biological activities of ascorbic acid and pyridoxine.

15. (a) Formulate the following sequence of reactions:

$$\text{Maltose} \xrightarrow{Br_2 / H_2O} A \xrightarrow{(CH_3)_2 SO_4} B \xrightarrow{HCl} C + D$$

Or

(b) Formulate any one synthesis of atropine.

2 **D–7590**

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Write notes on:

    (a) Meerwein – Pondorff - Varley reduction

    (b) Hydroboration

    (c) Prevost hydroxylation   (4+3+3)

17. (a) Outline the synthesis of anthocyanin.   (5)

    (b) Enumerate the structure and reactivity of oxazole.
                                                    (5)

18. Describe the configuration and conformation of cellobiose.

19. How will you establish the following in cholesterol?

    (a) Position of hydroxyl group

    (b) Position of double bond

    (c) Position of side chain   (3+4+3)

20. (a) Explain the steps involved in the synthesis of
        indole.   (5)

    (b) Describe the pinacol and acyloin formation.   (5)

_____

D–7591	Sub. Code
	34433

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION, DECEMBER 2022.

Third Semester

SPECTROSCOPY-APPLICATIONS IN ORGANIC AND INORGANIC CHEMISTRY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1.   What are chromophores?

2.   How can IR spectroscopy be used to identify hydrogen bonding in a molecule?

3.   What are combination bands in IR spectra?

4.   What is meant by spin tickling?

5.   Define Chemical shift

6.   What is meant by cotton effect?

7.   How many ESR signal that could be expected for methyl radical?

8.   State α-haloketone rule.

9.   Provide the principle of Flame photometry.

10.   Mention any two applications of turbidimetry.

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Calculate λ_{max} max for the following compounds
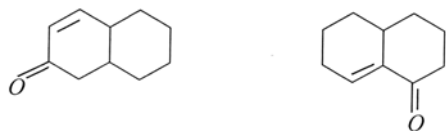
Or

(b) Discuss how inductive effect and conjugation affects the carbonyl stretching frequency.

12. (a) Write about shift reagents in NMR.

Or

(b) List out the applications of NMR spectroscopy.

13. (a) Explain base peak and isotopic peaks in mass spectra.

Or

(b) Give a brief account on the principle of ESR spectra.

14. (a) Illustrate the theory of flame photometry.

Or

(b) List out any five applications of nephelometry.

15. (a) Write a note on:

   (i) Circular birefringence

   (ii) ORD curves   (2+3)

Or

(b) With a suitable diagram explain the effect of solvent polarity on $n-\pi^*$ and $\pi-\pi^*$ transition

2   **D–7591**

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. With a suitable block diagram explain various components of UV-Visible spectrophotometer.

17. Give a brief account on:

    (a) Spin—spin coupling

    (b) NOE

    (c) Deuterium exchange reactions   (4+4+2)

18. Write note on general fragmentation patterns in mass spectrometry.

19. Explain the principle and applications of thermo gravimetric analysis.

20. (a) Explain instrumentation of turbidimetry.   (5)

    (b) Explain double resonance in NMR spectroscopy. (5)

————————

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION,
DECEMBER 2022.

Fourth Semester

ANALYTICAL CHEMISTRY

(CBCS 2018-19 Academic Year onwards)

Time : Three hours   Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1.   Distinguish between systematic error and random error?

2.   What do you mean by accuracy?

3.   Define significant figures?

4.   Sketch and name the ion selective electrodes.

5.   Give an advantage of dropping mercury electrode.

6.   How to calculate the Rf value.

7.   Write the principle of coulometry?

8.   List out any four applications of HPLC.

9.   Give principle involved in ion exchange chromatography.

10.   Explain Di-electrophoresis.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b)

11. (a) Derive calibration graph using Least Square method.

Or

(b) Comment on the following i) absolute and relative errors.

12. (a) Discuss principle, instrumentation and application of cyclic voltammetry.

Or

(b) Explain about chronopotentiometry and their applications.

13. (a) Write a short note on TLC.

Or

(b) Illustrate the interpretation and application of GC-MS.

14. (a) Comment on

(i) Vacuum distillation; (ii) Fractional distillation

Or

(b) List out the application of gel permeation chromatography.

15. (a) Draw principle and instrumentation of electrophoresis.

Or

(b) Discuss: Normal and reversed phase liquid chromatography.

D–7592

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Describe the following

    (a) significant figures;

    (b) F-test and T – test.

17. Write the principle, function and applications of polarography.

18. Discuss detail about Gas chromatography injection system, column and various detector.

19. Explain theory and application of cationic and anionic exchange chromatography.

20. Discuss the following

    (a) Regression analysis;

    (b) Paper chromatography.

————————————

DISTANCE EDUCATION

M.Sc. (Chemistry) DEGREE EXAMINATION,
DECEMBER 2022.

Fourth Semester

APPLIED CHEMISTRY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1.   Write the effects of acid rain.

2.   Define the term break-point chlorination.

3.   What is pitting corrosion?

4.   How galvanic series differ from electrochemical series?

5.   How does pH affect electroplating?

6.   What is brush plating?

7.   Give a brief note on microemulsion method.

8.   Explain the CVD method.

9.   Mention any two databases used in chemistry.

10. Point out the advantages of MOOC.

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Write the main causes and effects of air pollution.

Or

(b) Explain the various types of fuel cells.

12. (a) Write briefly about high temperature corrosion.

Or

(b) Discuss briefly about Pourbaix diagram of Fe-H_2O system.

13. (a) Give an account on electroplating of Nickel.

Or

(b) Write the applications of electroforming.

14. (a) Provide the computer program for the calculation of bond energy Using Born-Lande equation.

Or

(b) Write briefly about virtual lab.

15. (a) Explain the characterization of nanomaterials using XPS technique.

Or

(b) Write a suitable computer Programming for the determination of solubility product.

2   **D–7593**

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss the various steps involved in the waste water treatment.

17. Explain the following:
    (a) Corrosion inhibitors
    (b) Sacrificial anodic protection method   (5+5)

18. Write a note on
    (a) Composite coating
    (b) Anodizing   (5+5)

19. (a) How nanomaterials are synthesized by following methods?
        (i) Pulsed laser deposition
        (ii) Spray pyrolysis deposition   (3+3)
    (b) Write briefly about NPTEL.   (4)

20. (a) Explain the following preparatory synthesis of nanomaterials:
        (i) Solvothermal method
        (ii) Sol-gel method   (3+3)
    (b) How nanomaterials are characterized Using XRD?   (4)

————————

D–7593

DISTANCE EDUCATION

M.Sc. DEGREE EXAMINATION, DECEMBER 2022.

Fourth Semester

Chemistry

ADVANCED PHYSICAL CHEMISTRY

(CBCS 2018 – 2019 Academic Year Onwards)

Time : Three hours　　　　　　　　Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. How does entropy and probability related?

2. Calculate the total number of ways in which four distinguishable particles get distributed among five energy level.

3. What are Bosons?

4. What is the zero point energy for a one dimensional harmonic oscillator?

5. State Dulong-petit's law.

6. State Pauli exclusion principle.

7. How many normal modes of vibration are possible for water molecule? of which how many are A, and B_2 symmetric.

8. What are the two important electronic transitions of formaldehyde? of these two, according to group theory which in electronically allowed?

9. Write Hammelt equation and explain the terms in it.

10. Define Hammelt acidity function.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Derive the expression for Fermi-Dirac distribution law.

Or

(b) Deduce the expression of Sackur-Tetrode equation.

12. (a) What do you mean by a rigid rotator? From classical considerations, show that the total energy of a rigid rotator is $L^2/2I$ when L is the angular momentum and I is the moment of Inertia. How does it differ from the quantum mechanical result?

Or

(b) What is the variation principle? How can this principle be used to find the ground state energy of a hydrogen atom C (Interelectronic repulsion is neglected)?

13. (a) (i) What are symmetry elements and symmetry operations?

(ii) Identify point group for the following.

(1) Clf_3

(2) Pyridine

(3) Biphenyl

Or

2

(b) Comment the character table for NH_3 molecule and explain the same.

14. (a) Discuss the effect of internal pressure on reaction rate in solution.

Or

(b) Discuss the effect of PH and temperature on enzyme catalyzed reaction.

15. (a) State and explain great orthogonality theorem.

Or

(b) Write an account on negative absolute temperature.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Give a comparative account of Maxwell's Boltzman Bose- Binstein and Fermi-Drac statistics.

17. Write the approximations of Huckel molecular orbital theory and apply the same to butadine.

18. Apply group theory to identify the IR and Raman active vibrations of H_2o molecule.

19. Derive Michaclin-Menton equation. How is it verified by Lineweaver-Burk method.

20. Apply perturbation method to find the ground state energy of helium atom.

————————

3

D–7594