S–7524	Sub. Code
	22MCH1C1

M.Sc. DEGREE EXAMINATION, APRIL 2025

First Semester

Chemistry

ORGANIC CHEMISTRY – I

(CBCS – 2022 onwards)

Time : 3 Hours　　　　　　　　　Maximum : 75 Marks

Part A　　　　　　(10 × 2 = 20)

Answer **all** the questions.

1. What is inductive effect?

2. Write the equation for the dissociation constant of acids.

3. What are symmetry elements? Give any two examples.

4. What is chirality?

5. State Craig's rule.

6. What are alternant hydrocarbons? Give an example.

7. Give the reaction for the formation of carbanion.

8. What is $S_N i$ reaction? Give an example.

9. State Saytzeff rule.

10. What is $S_E i$ reaction? Give an example.

Part B $(5 \times 5 = 25)$

Answer **all** the questions choosing either (a) or (b).

11. (a) State and explain hyperconjugation effect with suitable example.

Or

(b) Discuss the effect of structure on the dissociation constant of acid.

12. (a) State and explain Cahn-Ingold Prelog system of nomenclature.

Or

(b) Discuss the optical activity of Biphenyl compounds.

13. (a) State and explain Huckel's rule of aromaticity and its limitations.

Or

(b) Discuss the chemistry of cubanes.

14. (a) State and explain the principle of microscopic reversibility.

Or

(b) Write the mechanism for S_N1 reaction with a suitable example.

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15. (a) State and explain Brett's rule.

Or

(b) Write a detailed mechanism for Friedel-Craft acylation reaction.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. (a) Write the significance of reaction constant substituent constant.

(b) Discuss the effect of structure on reactivity using Hammett equation.

17. (a) Discuss the chemical methods of determining the configuration of geometrical isomers.

(b) State and explain Cram's rule.

18. (a) What is annulene? Draw the structure of [12] Annulene and [18] annulene.

(b) Discuss the chemistry of adamantine.

19. (a) Write the mechanism of S_N2 reaction with a suitable example. (4)

(b) Discuss the effect of following factors on the rate of substitution reaction. (2+2+2)

(i) Substarate

(ii) Solvent

(iii) Nucleophile

20. (a) Distinguish between S_E1 and S_E2 reaction.

(b) Write the mechanism for Stark Enamine reaction.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

First Semester

Chemistry

PHYSICAL CHEMISTRY – I

(CBCS – 2022 onwards)

Time : 3 Hours　　　　　　　　　　Maximum : 75 Marks

Part A　　　　　　　$(10 \times 2 = 20)$

Answer **all** questions.

1. Mention the various statements of second law of thermodynamics.

2. Define activity and activity coefficient.

3. How may a population inversion be experimentally realised? To what use may such a phenomenon be utilised?

4. Calculate the molecular rotational partition function for nitrogen gas at $27^{\circ}C$. The moment of inertia of nitrogen is 13.9×10^{-47} kg m^{-2}.

5. Distinguish between physisorption and chemisorption.

6. Define Zeta potential.

7. What is meant by over potential?

8. Print out Kohlrauschs law and its importance.

9. Give examples for two component system.

10. Mention Le Chatelier's principle.

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Derive Gibbs - Duhem equation.

Or

(b) What do you mean by partial molar properties? Indicate the relation between partial molar properties.

12. (a) Point out the meaning of an ensemble.

Or

(b) Find out the molar translational partition function for 1 mole of nitrogen gas at 27°C and 1 atm, assuming ideal behaviour.

13. (a) The surface tension of a surfactant decreases linearly with concentration. At 1×10^{-4} m concentration, the surface tension has decreased by 3 dyne cm^{-1}. Calculate surface excess, Γ assuming 25°C.

Or

(b) Write notes on : Electrophoresis and electrosmosis.

14. (a) Point out the features of Helmholtz electrical double layer.

Or

(b) Derive Debye-Huckel-onsager equation.

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15. (a) Mention the factors affecting chemical equilibrium.

Or

(b) What is the importance of phase rule?

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. Based on third law of thermodynamics, show how is the entropy of a substance determined?

17. Compare the features of Fermi-Dirac and Bose-Einstein statistics.

18. Derive Langmuir adsorption isotherm and discuss how it modifies at low and high concentration of substrate.

19. Explain the origin of emf of cells. How would you apply emf to determine equilibrium constant and solubility product of a sparingly soluble salt?

20. Discuss the phase diagram of a two component system like $FeCl_3 - H_2O$.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Chemistry

INORGANIC CHEMISTRY – II

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Calculate the CFSE of a high spin Mn $(Cp)_2$ complex.

2. Define ambidentate ligands with suitable examples.

3. Write a reaction mechanism of photo aguoation reaction.

4. Write any three applications of XPES spectroscopy.

5. Comparison between haemoglobin and myoglobin. Justify.

6. Draw the structure of 3-iron ferridoxin and Rubredoxin?

7. What is passive transport write suitable examples?

8. Define the corin ring system? Draw the structure of Vitamine-B_{12}.

9. Write a electronic configurations of actinides.

10. Define the colour of the lanthanides.

Part B   (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a)   Discuss the factors affecting the stability of the complexes.

Or

(b)   Determine the stability constant by using potentiometric techniques.

12. (a)   Illustrate the photochemical reaction for the solar energy conversions of co-ordination complexes. using TiO_2 semiconductor or water hydrolysis method with Ru(bpy)$_3$ complexes.

Or

(b)   Explain the Koopmans's theorem in X-ray photo electron spectroscopy.

13. (a)   Demonstrate the structure and work functions of haemoglobin.

Or

(b)   Illustrate the structure and functions of cytochrome-C.

14. (a)   Explain the Metal ion poisoning of Pb, Give its symptoms, causes and treatments.

Or

(b)   Describe Na+/K+ ion transport across the membrane in biological system.

15. (a)   Explain the separation of lanthanides by ion exchange method.

Or

(b)   Discuss lanthanide contractions and its consequences.

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Answer any **three** questions.

16. Explain the Jahn-Teller distortions of [Cu $(H_2O)_6$]$^{2+}$ complex.

17. Discuss XPES spectrum of N_2 and O_2 molecules.

18. Write the structure and function of Iron-Sulphur proteins.

19. Illustrate the reaction mechanism of Carboxy peptidase-A and Carbonic anhydrase.

20. Explain the colour and oxidation states of lanthanides.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Chemistry

PHYSICAL CHEMISTRY —II

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. Why the breakdowns in the Born-Oppenheimer approximation occur?

2. Write the selection rule of Infrared spectroscopy.

3. What is Raman shift?

4. Give mutual exclusion principle.

5. Mention the point group of the molecules HCl and CO_2.

6. Write matrix form of reflection (σ_v, xz) and inversion (i)

7. What is direct product representation?

8. Define projection operator.

9. Give any two factors which affect the kinetics of explosive reactions.

10. What are steady state approximations? Give their significance.

Part B   (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Brief about the effect of isotopic substitution in rotational spectroscopy.

Or

(b) Differentiate combination and difference band in vibration spectroscopy.

12. (a) Describe the electronic spectra of diatomic molecule with the help of Frank-Condon principle.

Or

(b) Explain the formation of stokes and antistokes lines in vibrational raman spectra.

13. (a) Explain four rules of a group with suitable example for each.

Or

(b) Derive matrix representation of rotation (Cnz) symmetry operation.

14. (a) Determine the IR and Raman active fundamentals of NH_3 molecule (character table given below)

C_{3v}	E	$2C_3(z)$	$3\sigma_v$	Linear functions, rotations	Quadratic functions	Cubic functions
A_1	+1	+1	+1	z	x^2+y^2, z^2	$z^3, x(x^2-3y^2),$ $z(x^2+y^2)$
A_2	+1	+1	−1	R_z	−	$y(3x^2-y^2)$
E	+2	−1	0	$(x,y)(R_x, R_y)$	(x^2-y^2, xy) (xz, yz)	(xz^2, yz^2) $[xyz, z(x^2-y^2)]$ $[x(x^2+y^2),$ $y(x^2+y^2)]$

Or

(b) Determine the allowed electronic transitions in formaldehyde molecule by applying group theory.

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15. (a) Investigate the kinetics of decomposition of acetaldehyde.

Or

(b) Illustrate the salient features of Absolute Reaction Rate Theory.

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Give a brief account on the following : (5)

(i) Overtone (ii) Fermi resonance

(b) Discuss stark effect in microwave spectra. (5)

17. Give comprehensive notes on the followings : (5+5)

(i) Fortrat diagram. (ii) Predissociaton spectra

18. (a) Explain orthogonality theorem and its rules. (5+5)

(b) Construct character table of C_{2v} point group.

19. Deduce the hybridization of CH_4 molecule using group theory.

(refer character table given below)

T_d	E	$8C_3$	$3C_2$	$6S_4$	$6\sigma_d$	Linear functions, rotations	Quadratic functions	Cubic functions
A_1	+1	+1	+1	+1	+1	–	$x^2 + y^2 + z^2$	xyz
A_2	+1	+1	+1	–1	–1	–	–	–
E	+2	–1	+2	0	0	–	$(2z^2 - x^2, y^2, x^2 - y^2)$	–

3

T_d	E	$8C_3$	$3C_2$	$6S_4$	$6\sigma_d$	Linear functions, rotations	Quadratic functions	Cubic functions
T_1	+3	0	−1	+1	−1	(R_x, R_y, R_z)	−	$[x(z^2-y^2),$ $y(z^2-x^2),$ $z(x^2-y^2)]$
T_2	+3	0	−1	−1	+1	(x,y,z)	$(xy,\ xz,\ yz)$	(x^2,y^3,z^3) $[x(z^2+y^2),$ $y(z^2+x^2),$ $z(x^2+y^2)]$

20. Describe the kinetics of the following unimolecular reactions. (5+5)

   (a) Lindmann treatment

   (b) Hinsheiwood

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Chemistry

Elective — PHARMACEUTICAL CHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours　　　　　　　　　　Maximum : 75 Marks

Part A　　　　　　$(10 \times 2 = 20)$

Answer **all** questions.

1. Differentiate prodrugs and soft drugs.

2. Define lipophilicity.

3. Draw the structure of β -lactum.

4. Write symptoms of AIDS.

5. Give the examples of Psychoactive drugs.

6. What is the primary usage of neurodrugs?

7. Predict the role of anti-infective drug.

8. List the two usage of amyl-nitrate.

9. Differentiate clonidine and guanothidine

10. Describe the phenacetin.

Part B $(5 \times 5 = 25)$

Answer **all** the questions, choosing either (a) or (b).

11. (a) Discuss the key role of SAR in pharmaceutical system.

Or

(b) Compare and contrast the pharmacokinetics and pharmacodynamics.

12. (a) Explain the classification and synthesis of chloroquinone.

Or

(b) Describe the theories of drug activity.

13. (a) Explain the cancer chemotherapy.

Or

(b) Describe the action of central nervous system depressant drugs in body.

14. (a) Illustrate the intervention of cardiovascular output.

Or

(b) Elucidate the significance of drug verapamil.

15. (a) Explain the mechanism of paracetamol and phenacetin.

Or

(b) Discuss the role of local anesthetics.

2

Answer any **three** questions.

16. Explain the applications of medicinal chemistry.

17. Describe briefly about the synthesis and usage of penicillin-V and Chloramphenicol.

18. Exemplify the essential role of alkylating agents in drugs development.

19. Explain peripheral sympathetic function.

20. Illustrate the importance of intravenous anesthetics.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Second Semester

Chemistry

NME – CHEMISTRY IN EVERY DAY LIFE

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 2 = 20)

Answer **all** the questions.

1. Write the method of preparation of talcum powder.

2. List out the hazards of cosmetic use.

3. Give a brief account on balanced diet.

4. Mention the classification of carbohydrates.

5. Outline the applications of polythene.

6. Define sedatives.

7. Write a brief note on gasoline.

8. Illustrate the applications of pesticides.

9. Give the composition of oils.

10. Comment on the role of fats in cooking.

Part B (5 × 5 = 25)

Answer **all** the questions, choosing either (a) or (b).

11. (a) Explain the general formulation and preparation of toothpastes.

Or

(b) Discuss about the general formulation and preparation of nail polish.

12. (a) Describe the physiological importance of proteins.

Or

(b) Illustrate the classification and sources of vitamins.

13. (a) Explain the preparation and applications of PVC.

Or

(b) Write a note on vulcanization of rubber and its applications.

14. (a) Give a detailed account of the composition and uses of LPG.

Or

(b) Discuss about the production and feasibility of biomass gas.

15. (a) Describe the effect of prolonged heating on nutritive value.

Or

(b) Explain hydrogenation of oils.

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Answer any **three** questions.

16. Discuss the types and preparation of soaps and detergents. (5+5)

17. Describe the sources and physiological importance of minerals.

18. (a) Demonstrate the preparation and applications of polyesters. (5+5)

    (b) Mention the uses of anesthetics and antipyretics.

19. Give the classification and applications of fertilizers. (6+4)

20. Explicate the changes undergone by oils and fats during storage.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Third Semester

Chemistry

ORGANIC CHEMISTRY – III

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 2 = 20)

Answer **all** questions.

1. Write the classification of molecular rearrangement reaction.

2. Give the reaction for Curtius rearrangement.

3. What is Diets-Alder reaction? Give an example.

4. Write Wittig reaction.

5. What are alkaloids? Give an example.

6. Outline the classification of terpenoids.

7. What is blocking group in organic synthesis? Give an example.

8. What is homogeneous hydrogenation reaction?

9. State Woodward-Hoffmann rule.

10. What is ene reaction? Give an example.

Part B $(5 \times 5 = 25)$

Answer **all** the questions, choosing either (a) or (b).

11. (a) Write   the   mechanism   for   Fisher-Hepp
         rearrangement.

                    Or

     (b) Give   a   detailed   mechanism   for   Wolff
         rearrangement.

12. (a) Explain Mannich reaction with a suitable example.

                    Or

     (b) What is Michael addition? Give an example for
         1, 2 and 1, 4 addition reaction.

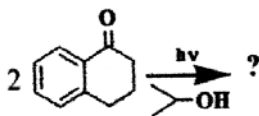13. (a) Elucidate the structure of Zingiberene.

                    Or

     (b) Outline the biosynthesis of alkaloids.

14. (a) Discuss the role of transition metal complexes in
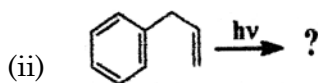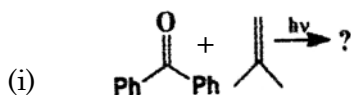   organic synthesis.

                    Or

     (b) Write the reaction for

         (i)   Umpolung synthesis and

         (ii) Robinson annelation.

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15. (a) Write the product(s) of the given photoredox reaction and write a suitable mechanism.

Or

(b) Write the product(s) and their mechanism for the given photochemical reactions.

(i)

(ii)

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Write the mechanism for the given rearrangement reaction.

(a) Bamberger rearrangement

(b) Wagner-meervin rearrangement.

17. (a) Write nucleophilic addition reaction with a relevant example.

(b) How do the following reagents add to propene?

(i) Br₂

(ii) HI

(iii) HOCl.

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18. Elucidate the structure of Reserpine.

19. With the help of a schematic diagram, explain the total synthesis of Trans-9-methyl-1-Decalone.

20. (a) Write Hofmann Loffler Freytag reaction.

   (b) Based on FMO method, draw a correlation diagram for the disrotatory ring closure of $\pi^{4s} - \pi^{2s}$ cycloaddition reaction.

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	22MCH3C2

M.Sc. DEGREE EXAMINATION, APRIL 2025

Third Semester

Chemistry

INORGANIC CHEMISTRY – III

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1.   Write a short note on trans effect.

2.   Comment on labile and inert complex with example.

3.   Write a short note on Ferromagnetism and anti-ferromagnetism

4.   Brief about the spectrochemical and Nephelauxetic series.

5.   Write a short note on Recoiling effect.

6.   Express the use of shift reagent in NMR technique.

7.   Illustrate the agnostic bond.

8.   Justify the Isolabal analogy

9.   What are the conditions favors for oxidative addition reaction?

10.   Write short note on migratory insertion.

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) What are the factor affecting the reactivity of octahedral complex.

Or

(b) Write the reaction mechanism of acid hydrolysis when the ligand is a pi donor.

12. (a) Draw and discuss the qualitative correlation diagram of the following systems. d^3 octahedral and d^7 tetrahedral.

Or

(b) Describe the detail mechanism of breakdown of selection rule.

13. (a) Discuss the detail note on $Fe_3[Fe(CN)_6]^{3-}$ and $Na_2[Fe(CN)_5 NO]$ complex Mossbauer spectroscopy.

Or

(b) Explain ESR spectrum of methyl and naphthalene radicals.

14. (a) What is fluxional molecule? Discuss the structure of one such molecule.

Or

(b) Elucidate the nucleophilic substitution reaction of metal aryl complexes.

15. (a) Write the reaction mechanism of cobalt catalyzed hydroformylation of alkene by oxo process.

Or

(b) Discuses and draw the reaction mechanism of olefin polymerization.

2

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the detail note on electron transfer reactions.

17. (a) State and explain Jahn- Teller effect;

    (b) Why are Jahn- Teller distrotions automatic for octahedral geomentry of some metal ions?

18. Write a note

    (a) Isomer shift.

    (b) Importance of g-value

    (c) Karmer's degeneracy.

19. Comment the structure and effect of substituent in the bond length and bond order of Zeise's salt.

20. Write a detail note on Wilkinson's catalyst and Tolman catalytic loops.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Third Semester

Chemistry

PHYSICAL CHEMISTRY – III

(CBCS – 2022 onwards)

Time : 3 Hours　　　　　　　　　　Maximum : 75 Marks

Part A　　　　　　(10 × 2 = 20)

Answer **all** questions.

1. What are radiationless transitions?

2. Define Chemluminescence.

3. Write the quantum mechanical operator for $\hat{p}_x$ and $\hat{H}$.

4. Verify whether cos3x function is an eigen function or not with respect to $\dfrac{d^2}{dx^2}$ operator.

5. What is the tunneling effect?

6. State Pauli's exclusion principle.

7. Define chemical shift.

8. What is zero field splitting?

9. Define catalyst.

10. What is autocatalysis?

Answer **all** questions, choosing either (a) or (b).

11. (a) Differentiate fluorescence and phosphorescence.

Or

(b) Summarize the effect of temperature on emission process.

12. (a) Discuss the postulates of quantum mechanics.

Or

(b) Explain the properties of Hermitian operators with an example.

13. (a) Apply variation method to H atom.

Or

(b) Compare VBT and MOT.

14. (a) Write a short note on NQR spectroscopy and its applications.

Or

(b) Elaborate spin-spin splitting in NMR.

15. (a) Write the characteristics of a good catalyst.

Or

(b) Differentiate Homogeneous and Heterogeneous catalysis.

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Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain Jablonski diagram in detail.

17. Derive the Schrodinger wave equation for 1D box and calculate energy of an electron in first three levels in 1D box with the box length of 0.1 nm.

18. Apply SWE for H atom.

19. Explain the ESR spectra of hydrogen radical and naphthyl radical.

20. Discuss

    (a) Flash Photolysis

    (b) Enzyme catalysis.

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Chemistry

INSTRUMENTAL METHODS OF ANALYSIS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** the questions.

1. Write a note on significant figures.

2. What is t-test?

3. Give any two applications of gravimetric methods.

4. Write a brief note on drying of precipitates.

5. What is Reference electrode?

6. Define coulometry.

7. Explain the thermal behavior of zinchexafluorosilicate.

8. Enlighten the principle of TGA.

9. List out any two applications of flame photometry.

10. Give the principle of fluorimetry.

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Explain the classification of errors.

        Or

    (b) Discuss the standard deviation of computed results.

12. (a) Elucidate the post precipitation method with an example.

        Or

    (b) Describe about the precipitates from homogeneous solution.

13. (a) Discuss the theory of electro gravimetric analysis.

        Or

    (b) Demonstrate the amperometric titrations.

14. (a) Illustrate the principle and applications of DTA.

        Or

    (b) Sum up the factors affecting Position of TGA traces.

15. (a) Describe the conditions for a satisfactory coloumetric analysis.

        Or

    (b) Explain the principle and applications of turbidimetry.

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Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. Elucidate the linear regression (least square) in error analysis.

17. Describe the properties of precipitates and Precipitating agents.   (5+5)

18. Demonstrate the stripping voltammetry and chronopotentiometry.   (5+5)

19. Elucidate the degree of conversion of high alumina cement.

20. Explain the principle, instrumentation and applications of AAS.   (3+4+3)

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M.Sc. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Chemistry

NANO CHEMISTRY

(CBCS – 2022 onwards)

Time : 3 Hours　　　　　　　　　　Maximum : 75 Marks

Part A　　　　　　　$(10 \times 2 = 20)$

Answer **all** the questions.

1. Classify the Nano-Synthetic methods.

2. State the Combustion process shortly.

3. Give the examples of polymer nanoparticles.

4. Present the nanoparticles applications in the field of defence.

5. Write short notes rotaxanes.

6. Draw the structure of TiO_2.

7. Describe shortly Particle size analyser.

8. List out the characterization techniques for nanomaterials.

9. Define Molecular diodes.

10. Describe the DNA as a nanomaterial.

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Converse the Protein microtube method synthesis.

Or

(b) Explain the Sonochemical Synthesis with neat diagram.

12. (a) Elucidate the structural benefits of Graphenes.

Or

(b) Describe the applications of nanomaterials in medical and health.

13. (a) Illustrate the inorganic nanomaterials with few applications.

Or

(b) Differentiate between the C_{60} Larger and Smaller fullerenes.

14. (a) Exemplify the structural analysis using XRD.

Or

(b) Elucidate the significance of TEM analysis while compare with SEM.

15. (a) Enlighten the concepts of Knots and Junctions in nanodevices.

Or

(b) Describe the role of Protein nano-array in analytical techniques.

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Answer any **three** questions.

16. Explicate briefly about the Microwave method of synthesis.

17. Describe briefly about the semiconductor of quantum dots.

18. Epitomize the organic nanomaterials Catenanes with examples.

19. Demonstrate the Atomic force Microscope with applications.

20. Summarize the force measurements in simple protein molecules.

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