2021

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer the following : 1×8

   a) The energy required for various transitions follow the order :

      i) $\sigma \rightarrow \sigma^* > n \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \pi^*$

      ii) $\sigma \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \sigma^* > n \rightarrow \pi^*$

      iii) $\pi \rightarrow \pi^* > n \rightarrow \pi^* > \sigma \rightarrow \sigma^* > n \rightarrow \sigma^*$

      iv) $n \rightarrow \pi^* > \sigma \rightarrow \sigma^* > n \rightarrow \sigma^* > \pi \rightarrow \pi^*$

   b) The radiation in the wavelength range 400-800nm corresponds to ____.

      i) UV

      ii) IR

      iii) Visible

      iv) Far IR

c) How wave number and wavelength are related to each other ?

d) How δ is related to τ scale chemical shift.

e) How many signals are would you expect in the NMR spectrum of ethyl Chloride.

f) Separation of ions in mass Spectrometer takes place on the basis of

i) mass

ii) Charge

iii) Molecular weight

iv) Mass to Charge ratio

g) Write down the Haworth projection formula of α-D-Glucose

h) Which of the following does not exhibit NMR :

i) $_{7}N^{15}$

ii) $_{15}P^{31}$

iii) $_{9}F^{19}$

iv) $_{6}C^{12}$

Part-II

2. Answer any ***eight*** of the following : $1\frac{1}{2} \times 8$

a) What is Hooke's law ?

b) Predict the various electronic transitions possible in H-CHO.

c) Why methanol is a good solvent in UV Spectroscopy ?

d) What do you mean by Hyperchromic shift ?

e) Why water can not be used as a solvent for IR Spectroscopy ?

f) Calculate the energy associated with a radiation having wavelength 4000°A.

g) What are Polysaccharides ? Give any two examples.

h) What do you mean by epimers ?

i) Define coupling constant.

j) What do you mean by base peak ?

Part-III

3. Answer any ***eight*** of the following : 2×8

a) The reduced mass of a diatomic molecule is 2.5×10^{-26}Kg and its vibrational frequency is 2900 cm^{-1}. Calculate the value of force constant.

b) What is the effect of Hydrogen bonding in UV absorption ?

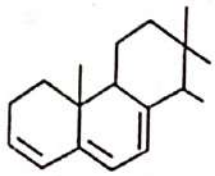
c) What do you mean by the no of fundamental vibrations ?

d) Why is TMS used as a standard reference in NMR Spectroscopy.

e) Explain-Hydrogen bonding causes deshielding.

f) How can be Arabinose is converted to Glucose.

g) Calculate the λ_{max} value for the UV Spectrum of



h) What happens when D-Glucose reacts with Phenyl hydrazine. Give equation.

i) How will you convert Glucose to Fructose.

j) Write notes on-Metastable Peaks.

k) What is Mc-Lafferty rearrangement ?

Part-IV

4. a) Discuss the various types of electronic transitions which occur in the UV region. 6

OR

b) Write notes on any *two* of the following :

i) Chromophore

ii) Blue and Red shift

iii) Auxochrome.

5. a) Write the basic principles of IR Spectroscopy. 6

OR

b) Write notes on any *two* of the following :

i) Finger print region

ii) Effect of Hydrogen bonding in IR Spectrum

iii) Bending and Stretching vibrations.

6. a) The fragmentation of benzene produces peaks at m/e value at 78,77,51 and 39. Identify the base peak and give explanation for the above peaks. 6

OR

b) Write notes on any *two* of the following :

i) Chemical shift

ii) Spin-spin coupling

iii) Shielding mechanism

7. a) What are Poly saccharides ? Elucidate the structure of Maltose. 6

OR

b) Write notes on any *two* of the following :

i) Killiani-Fischer Synthesis

ii) Ruff degradation

iii) Mutarotation.

2021

Full Marks - 60

Time - 3 hours

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Answer *all* questions

Part-I

1. Answer the following : 1×8

a) Which of the following is known as the Schrodinger equation ?

i) $E = mc^2$

ii) $E = h\gamma$

iii) $\lambda = \frac{h}{p}$

iv) $\hat{H}\psi = E\psi$

b) Number of vibrational degree of freedom in CO_2 is 4 ?

c) The bond order in H_2 molecule is 1 ?

d) The expression for Hamiltonian Operator is :

i) $\frac{h^2}{8\pi^2 m}\nabla^2 + V$

ii) $-\frac{h^2}{8\pi^2 m}\nabla^2 + V$

iii) $\frac{h^2}{8\pi^2 m}\nabla^2 - V$

iv) $-\frac{h^2}{8\pi^2 m}\nabla^2 - V$

e) The total number modes of vibration of a linear molecule consisting of N atoms is given by :

i) $3N - 5$

ii) $3N - 6$

iii) $3N - 2$

iv) $3N - 7$

f) The rotational spectum of a rigid diatomic rotator consists of equally spaced lines with spacing equal to :

i) $\frac{3B}{2}$

ii) B

iii) $\frac{B}{2}$

iv) 2B

g) Which of the following show vibrational spectrum ?

i) H_2

ii) HCl

iii) CO

iv) N_2

h) In triplet state, the number of unpaired electron present is :

i) 0

ii) 1

iii) 2

iv) 3

Part-II

2. Answer any ***eight*** of the following : $1\frac{1}{2} \times 8$

a) What is an operator ?

b) Why He_2 molecule does not exist ?

c) What are photochemical reactions. Give an example.

d) State Grotthus-Draper law.

e) What is Hamiltonian Operator ?

f) Why H_2 molecule does not show rotational spectrocopy ?

g) What do you mean by the term triplet state ?

h) Draw potential energy curve for bonding molecular orbital of H_2 molecule.

i) At room temperature most of the molecules are in the zero vibrational level. Comment.

j) Define the term quenching.

Part-III

3. Answer any ***eight*** of the following : 2×8

a) Find the expression for the following operator :

$$\left(\frac{d}{dx} + X\right)\left(\frac{d}{dx} - X\right)$$

b) What are the draw backs of valence bond theory ?

c) What is Born Oppenheimer approximation ?

d) Distinguish between thermal reactions and Photochemical reactions.

e) What do you mean by Fluorescence ?

f) What is the moment of inertial of a diatomic molecule whose reduced mass is 2.5×10^{-20}kg and bond order distance is 2.5A° ?

g) Give selection rule for rotational spectra.

h) What is Zero point energy of anharmonic oscillator ?

i) What is P, Q and R brances of vibrational - rotational spectrum ?

j) What are Stoke's and anti-stoke's lines ?

Part-IV

4. a) Derive an expression for the wave function of a particle in one dimensional box and how can this function be normalized ? 6

OR

b) Discuss Schrodinger wave equation for hydrogen atom in terms of polar coordinates. Separate the resultant equation in three equations using the technique of separation of variables.

5. a) Write the salient features of molecular orbital theory (MOT) and construct the MO's by LCAO of H_2^+ ion. 6

OR

b) Discuss the formation and stability of hydrogen molecule on the basis of VBT ?

6. a) How vibrational frequency is related to the vibrational energy of a harmonic oscillator ? From this relation, derive expression for zero point energy. 6

OR

b) Derive an expression for rotational energy of diatomic molecule taking as rigid rotator.

7. a) What is Raman effect ? Discuss pure rotational Raman spectra. 6

OR

b) Write notes any *two* of the following :

i) Franck-Condon principle

ii) Quantum yield

iii) Chemiluminiscence.

□□

2021

Full Marks - 60

Time - 3 hours

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Answer *all* questions

Part-I

1. Answer the following : 1×8

   a) Name the monomer of Neoprene ?

   b) Phenol and Formaldehyde resin is called as ____?

   c) Write down the structural formula of Teflon.

   d) Ziegler-Natta Catalyst is ____ ?

   e) Name the monomer of the polymer PVC ?

   f) Write down the structural formula of Polyethylene.

   g) Give an example of a Condensation Polymer.

   h) Buna-S is a co-polymer of ____ and ____.

Part-II

2. Answer any ***eight*** of the following : 2×8

   a) What do you mean by homo polymer ?

b) Define the term-Polymerisation.

c) Find the functionality of Benzene and Phenol ?

d) What is oxidative coupling polymerization ?

e) What are elastomers ?

f) What is Gutta Percha ?

g) What are Plasticizers ?

h) Define the term-Thermosetting.

i) How Poly Vinyl acetate is prepared ?

j) What is Co-ordination Polymerisation ?

Part-III

3. Answer any *eight* of the following : 3 × 8

a) What do you mean by Condensation Polymer ?

b) Explain the term-Degree of Polymerisation ?

c) What do you mean by Poly Poly dispersity of Polymer ? How it is expressed ?

d) What do you mean by Specific Viscosity and reduced Viscosity ?

e) Write down structures of monomers of the following polymers :

i) Poly acryl amide

ii) Teflon

f) How Nylon-6, 6 can be synthesized ?

g) What is the difference between number average molecular weight and Weight average molecular weight ?

h) Give the polymerization reaction of Adipic acid with Hexa methylene diamine.

i) 10 numbers of molecules of A (M_1=20,000) and 10 numbers of molecules of B(M_2=200,000) are mixed. Calculate the value of no average molecular weight $\left(\overline{M_n}\right)$?

j) What is Poly urethanes ? Give one application.

Part-IV

4. a) Briefly discuss about the classification of Polymerization. 6

OR

b) Write notes on the *two* of the following :

i) Functionality principle

ii) Synthetic Polymers

iii) Inorganic Polymers.

5. a) Discuss kinetics and mechanism of free radical addition polymerization. 6

OR

b) Discuss kinetics and mechanism of Step growth Polymerization.

6. a) Discuss the procedure of determination of molecular mass of Polymers by end group analysis. 6

OR

b) What do you mean by glass transition temperature ? Discuss various factors affecting glass transition temperature (T_g).

7. a) Discuss one method of preparation from each of the following polymers : 6

i) Bakelite

ii) Polystyrene

iii) Nylon-6.

OR

b) Write short notes on the ***two*** of the following :

i) Bio-degradation

ii) Novalac

iii) Conducting polymers.

□□

2021

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer any ***eight*** of the following : 1×8

   a) Name one Ozone depleting Substance. CFC

   b) What is CFC ? Chloro-fluoro carbon

   c) Who is the father of green Chemistry ?

   d) Give any two examples of non-renewable resources. Coal, Petroleum

   e) TEL is an ___ agent. (Anti Knocking, Reducing, Oxidising).

   f) What is SCORR ?

   g) Which gas was responsible for Bhopal gas tragedy ? Phosgene, $COCl_2$

   h) Name a green nitrating agent.

Composition of Biogas ?

Part-II

2. Answer any ***eight*** of the following : $1\frac{1}{2} \times 8$

a) What is a Solvent less reaction ?

b) What are neat reactions ?

c) What is the composition of Bio gas ?

d) What is Sevin ?

e) What do you mean by Bio-Catalyst ? Give an example.

f) Define atom economy ?

g) What is green solvent ?

h) What is acid rain ?

i) What is green Chemistry ?

j) What are Bio gases ?

Part-III

3. Answer any ***eight*** of the following : 2×8

a) What are the goals of green Chemistry ?

b) What was the cause of Bhopal gas tragedy ?

c) What are the merits of using Bio Catalysts ?

d) What are renewable and non-renewable sources ?

e) Write the green synthesis of adipic acid.

f) Describe the green synthesis of Catechol.

g) What is ultra sound assisted Simmons-Smith reaction ?

h) Calculate % of atom economy in the reaction :

Buta-1, 3-diene + Ethene $\rightarrow$ Cychohexene

i) Give green synthesis of Furfural.

j) What is super critical water ?

Part-IV

4. a) Discuss the "twelve principles of Green Chemistry". 6

OR

b) Write notes on any ***two*** of the following :

i) Super critical CO_2 as a green Solvent

ii) Crown ether

iii) Phase transfer catalyst.

5. a) Discuss-Blocking and de-blocking procedure in organic synthesis. 6

OR

b) How to design a green synthesis ? Explain.

6. a) Describe the green synthesis of any *two* of the following compounds : 6

   i) Paracetamol

   ii) disodium imino di-acetate (DSIDA)

   iii) methyl methacrylate.

OR

   b) Describe the green synthesis of micro wave assisted reactions :

   i) Diels-Alder reaction in Organic Solvent medium

   ii) Hofmann elimination reaction in water solvent medium.

7. a) Explan why right fit Azo Pigments replace the conventional ones like Inorganic and Organic Pigments. 6

OR

   b) What is Sustainable dovelopment ? How can it be realised through green Chemistry ?

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer the following : 1×8

   a) Ultra-violet spectroscopy is useful for the detection of ____ .

      i) Functional group
      ii) geometrical isomers
      iii) extent of conjugation
      iv) all of these.

   b) The effect of the ultraviolet radiation on organic compound is to cause ____.

      i) bond vibration in the molecule
      ii) electronic transitions
      iii) rotation in the molecule
      iv) all of these.

c) The absense of absorption bands near 1600, 1580 and 1500 cm^{-1} is a sure proof for the absence of ____.

i) Aromatic ring
ii) Carbonyl group
iii) -OH group
iv) Secondary amino group.

d) For CO_2 molecules, number of modes of vibration are ____.

i) 6 ii) 5
iii) 4 iv) 3

e) How many numbers of NMR signals obtain in 1,2-dicloropropane molecule ?

i) 2 ii) 3
iii) 4 iv) 5

f) Which of the followings Peak is most intense peak in mass spectrum ?

i) Metastable peak
ii) Isotopic peak
iii) Base peak
iv) Parent ion peak.

g) Which of the following is non reducing carbohydrates ?

i) Cellulose
ii) Ketose
iii) Aldose
iv) None of these.

h) Which of the following is the simplest form of carbohydrates ?

i) Carboxyl groups
ii) Aldehyde and Ketone groups
iii) Alcohol and Carboxyl groups
iv) Hydroxyl group and Hydrogen groups.

Part-II

2. Answer any ***eight*** of the following : $1\frac{1}{2} \times 8$

a) What do you mean by Hypsochromic shift ?

b) What is the effect of hydrogen bonding on ultra-violet adsorption ?

c) What is the range of UV-visible Spectroscopy ?

d) Why water cannot be used as a solvent for IR-Spectroscopy ?

e) Can you distinguish a pair of enantiomers by Infra-red Spectroscopy ? justify your answer.

f) ^{13}C is NMR active while ^{12}C is not, explain.

g) Define the term 'Precessional frequency'.

h) Name the carbohydrates which is not optically active. Give its IUPAC name.

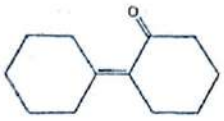
i) Why prefix D-is given to fructose even though it is laevorotatory ?

j) What do you mean by base peak ?

Part-III

3. Answer any ***eight*** of the following : 2×8

a) Applying Woodward Fieser rules, calculate λmax values for the following compound.



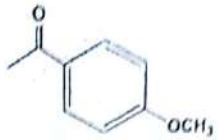
b) When a UV light is passed through the given solution, the radiation power is reduced to 50%. Calculate the absorbance.

c) Write the Basic Difference between Auxochromes and Chromophores.

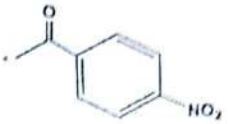
d) How will you distinguish between phenol cyclohexanol using IR ?

e) Which compound shows lower C=O stretching frequency and why ?

i)



ii)



f) Why TMS used as a standard reference in NMR spectroscopy ?

g) Write the names of two scales commonly used to measure the chemical shift in NMR Spectroscopy and their relationship.

h) Define Nitrogen rule in Mass Spectrometry with example.

i) How will you convert Glucose to Fructose ?

j) Glucose and fructose give the same Osazone, Explain.

Part-IV

4. a) Define electronic spectroscopy. Write a detail account of the types of electronic transition involved in the UV spectroscopy with example. 6

OR

b) i) Explain the effect of polar solvent on $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transition. 4

ii) Describe the term Bathochromic effects. 2

5. a) Discuss the various factors which influence the vibrational frequency from their normal values in IR spectroscopy. 6

OR

b) What is Infrared spectroscopy ? Write a note of different modes of vibration in diatomic and polyatomic molecules. 6

6. a) Define the term Chemical shift. Describe various factors which affect the magnitude of the Chemical shift. 6

OR

b) Write short notes on the following : 3×2

i) McLafferty rearrangement

ii) Metastable ion.

7. a) Describe Kiliani-Fischer synthesis. 6

OR

b) Discuss various steps leading to the cyclic structure of D(+) Glucose. 6

□□

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer the following : 1×8

   a) Write down the expression for Schrodinger equation.

   b) The energy possess by a particle trapped in one-dimensional box will be :

      i) continuous

      ii) discrete

      iii) both

      iv) None.

   c) The bond order in H_2^+ ion is _____ .

   d) Write the relationship between bond order and bond length ?

e) Rational transition of a molecule appears in the _____ region of electro-magnetic spectrum.

f) The total number of fundamental modes of vibration of a non-linear molecule consisting of N number of atoms is given by :

i) 3N-5

ii) 3N-6

iii) 3N-7

iv) 3N-N

g) Movement of nuclei is negligible during time taken by electronic transition. This phenomenon is known as_____ .

h) What is the unit of Absorbance ?

Part-II

2. Answer any ***eight*** of the following : 1½ × 8

a) Write down the notation for linear momentum operator along X-axis.

b) What is the condition for a wave function to be orthonormal ?

c) Explain polar covalent bond with a suitable example.

d) Write down the molecular orbitals (MOs) electronic configuration of N_2^+-ion.

e) Write the basic conditions for overlap of atomic orbitals (AOs).

f) Cl_2 molecule does not show rational spectra. Explain.

g) Write down the selection rule for rational spectra.

h) Calculate the number of fundamental modes of vibration in CO_2 molecule.

i) Between Stokes and anti-Stokes lines, which one is more intense and why ?

j) How hot band arises ?

Part-III

3. Answer any ***eight*** of the following : 2×8

a) Prove that the energy of a free particle is not quantized.

b) Define Hamiltonion Operator.

c) He_2 molecule does not exist. Explain.

d) Out of O_2, O_2^+, O_2^- and O_2^{2-}, which one is diamagnetic in nature ?

e) Calculate the vibrational frequency in cm^{-1} for Co-molecule, if the force constant of CO molecule is 1840 kg s^{-2}. Given atomic masses are :

$C^{12} = 19.9 \times 10^{-27}$kg and $O^{16} = 26.6 \times 10^{-27}$kg

f) What happens when a substance is irradiated with infra-red (IR) radiations ?

g) What is the moment of inertia of a diatomic molecule whose internuclear bond distance is 130 pm and the reduced mass is 2.0×10^{-47}kg ?

h) Define chemiluminescence.

i) What is the condition for the molecule to be Raman active ?

j) Write down two basic laws that govern photochemical reactions.

Part-IV

4. a) Give an account about the significance of Schrodinger wave equation. 6

OR

b) Write short notes on the following : 3×2

i) Quantization of energy levels

ii) Zero point energy

5. a) Discuss and draw the molecular orbital (MO) energy level diagram for BeH_2 molecule. 6

OR

b) Describe the common features and differences between valence bond (VB) and molecular orbital (MO) method for the formation of a covalent bond. 6

6. a) Using energy level expression and the appropriate selection rule, discuss the spectral transitions for the rotational-vibrational spectrum of diatomic molecule. 6

OR

b) Write short notes on the following : 3×2

i) Born Oppenheimer approximation

ii) Morse Potential.

7. a) What do you mean by Raman Scattering ? Discuss pure vibrational Raman spectra of diatomic molecules. 6

OR

b) Explain the following : 3×2

i) Fluorescence

ii) Photosensitized Reaction.

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer ***all*** questions

Part-I

1. Answer the following : 1×8

   a) What is organic polymer ?

   b) Degree of polymerization gives information on _____ of a polymer.

   c) _____ is an example of a condensation polymer.

   d) As the crystallinity increases the brittleness of the polymer _____ .

   e) Mz stands for_____ .

   f) Polydispersity Index = _____ .

   g) Does polymer exist as plastic ?

   h) Teflon is used for making _____ .

Part-II

2. Answer any ***eight*** of the following : 1½ × 8

a) What are different scheme of polymer classification ?

b) What is bifunctional monomers system of polymerization ?

c) What does crystallinity mean ?

d) Differentiate between condensation and addition polymerization.

e) How the degree of crystallinity affects a polymer ?

f) How does molecular weight affect T_g ?

g) Why is molecular weight of a polymer important ?

h) Why is polyacrylamide used for ?

i) What is Thermosetting Plastics ?

j) What are polyurethanes ? Give one example.

Part-III

3. Answer any ***eight*** of the following : 2 × 8

a) What are the factors that affect degree of polymerization ?

b) What is co-ordination polymerization ?

c) Write a brief note on polymerization tehcniques.

d) What is meant by polydispersity of polymer ?

e) How polymers nomenclature takes place ? Give examples.

f) What are the differences between specific and reduced viscosity ?

g) Define thermoplastic and thermosetting polymers.

h) Write a short note on biodegradable polymer.

i) What anionic polymerization is called living polymerization ?

j) Give preparation and uses of polyolefin.

Part-IV

4. a) What are functionality of the polymers and how it affects the polymer formation ? Give a brief idea of synthetic criteria of polymer formation .6

OR

b) Justify the following statements :

i) "All polymers are macromolecules but all macrcomolecules are not polymers."

ii) All the plastics are polymer but all the polymers are not plastic.

5. a) Derive equations of cationic mechanism of addition polymerization process. 6

OR

b) i) Define crystallinity and crystallisability ? What factors are mostly responsible for an effective crystallisability ?

ii) Discuss effect of temperature and pressure on chain polymerisation.

6. a) Why molecular weight of polymers is taken as 'average' ? Explain end group analysis method of determining molecular weight of polymers. 6

OR

b) Explain the following :

i) molar mass of polymer and

ii) Polydispersity index.

7. a) Briefly Discuss the preparation, properties and uses of Nylon-6 and polyvinyl chloride. 6

OR

b) Write notes on the following :

i) Conducting polymer

ii) Bakelite.

2022

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

Part-I

1. Answer should in one word each : 1×8

   a) Name the gas which was responsible for Bhopal gas tragedy in 1984.

   b) _____ metal causes "itai itai" disease.

      i) Cadmium ii) Zinc

      iii) Copper iv) Titanium

   c) Give any two examples of renewable resources.

   d) The monomer of Nylon-6 is _____.

   e) Name the starting material for synthesis of paracetamol.

f) Write the structure of Catechol.

g) Chlorofluorocarbons (CFCs) are responsible for ____ depletion.

h) Which medium is chosen to synthesize rightfit pigments ?

Part-II

2. Answer any ***eight*** of the following : $1\frac{1}{2} \times 8$

a) Write down any three factors which are considered as need for Green Chemistry.

b) What is photochemical smog ?

c) Define biocatalyst with an example.

d) Write the names of any three solvents which are used in microwave irradiation (MWI) technique ?

e) What is the cause of Flixborough disaster ?

f) What is DSIDA ?

g) Which anti-fouling agent is marketed as Sea-Nine™ ?

h) What is multifunctional reagent ? Give example.

i) What is importance of combinatorial green chemistry ?

j) Write the structure of an environmentally friendly rightfit Azo pigment that contains calcium metal.

Part-III

3. Answer any ***eight*** of the following : 2×8

a) Define the term "Green Chemistry".

b) Write any four unique properties of supercritical carbon dioxide.

c) What are the four R's (4 R's) used to manage waste in green chemistry ?

d) Describe microwave (MW) assisted Diels-Alder reaction.

e) What are the four strategies in inherent safer design (ISD) ?

f) How furfural is prepared from biomass ?

g) Write the reaction to prepare Methyl Methacrylate (MMA) by sustainable approach.

h) Describe the microwave (MW) assisted Hofmann elimination reaction.

i) Explain biomimetic approach to Green Chemistry.

j) What is biogas ?

Part-IV

4. a) Discuss the advantages and disadvantages of ionic liquids as Green Solvent. 6

OR

b) Write short notes on any *two* of the following : 3×2

i) Atom Economy

ii) Phase Transfer Catalysts (PTC)

iii) Global Warming.

5. a) Discuss various energy efficient techniques used in organic synthesis. 6

OR

b) Describe any *two* of the following : 3×2

i) Heterogeneous Catalysis

ii) Reduction of derivatives

iii) TiO_2 as Photo-catalyst.

6) a) Describe the green synthesis of any *two* of the following compounds : 3 × 2

i) Paracetamol

ii) Adipic Acid

iii) Urethane.

OR

b) Write short notes on any *two* of the following : 3 × 2

i) Saponification by ultrasound technique

ii) Microwave assisted oxidation of alcohols

iii) Simmons-Smith reaction under sonication.

7) a) Describe the green synthesis of poly-lactic acid from corn. 6

OR

b) Describe any *two* of the following : 3 × 2

i) Bio-diesel

ii) Cradle to Cradle (C_2C) Carpeting

iii) Solvent-less reaction for crossed Aldol Condensation.

DSE-1 POLYMER CHEMISTRY

PART I (1 mark)

5th Semester

1. Define polymerization.
2. What is degree of polymerization ?
3. What are the different types of elastomers?
4. What is the functionality of teraphthalic acid?
5. What are fibers?
6. What is functionality ?
7. What is melt condensation ?
8. Give two examples of condensation polymers ?
9. Give two examples of polymers which are formed by free radical polymerization?
10. Polystyrene is also known as_____ ?
11. Which of the following polymers contain nitrogen_____

    (a)Nylon (b)Teflon (c)PVC (d)Ethylene
12. What are resins?
13. _____ is the copolymer of butadiene and styrene
14. Useful temperature range for vulcanized rubber is_____
15. What is poly dispersity index(PDI)?
16. What is glass transition temperature ?
17. What is an elastomer ?
18. Write short notes on ladder polymers ?
19. What is the molecular weight of raw natural rubber ?
20. Polyurethanes are prepared by mixing of_____ and _____ ?
21. Name two epoxy resins used in our daily life ?
22. Nylon 66 is a _____?
23. Give two examples of addition polymers and write the structures of the monomers.

PART II (1.5 marks)

24. Write the different factors which affect the free radical copolymerization process?
25. How can we determine the rate of a polymerization reaction?
26. What is linear termination ?

27. What is crystallinity index ?
28. What is polydispersity ?
29. What does a sample of PS having PDI of 1.03 tell you ?
30. What is the unit of intrinsic viscosity ?
31. Which method is used to determine z-average molecular mass of a polymer ?
32. What do you mean by intrinsic viscosity?
33. Write the expression to determine weight average molecular mass ?
34. In which solvent the polymer completely goes into solution ?
35. How can you precipitate polymer from the solution ?
36. Write the functionality of phenol? Give one example of polymer where it is used as monomer?
37. Write two factors which can affect the degree of crystallinity? What is the degree of crystallization?
38. Write short notes on coordination polymerization?
39. What is condensation polymerization?
40. What is the effect of a good solvent in the polymerization process ?
41. Give three examples of natural polymers?
42. What is copolymerization?
43. Write the mechanism of cationic polymerization.
44. What do you mean by morphology of crystalline polymers? Write its importance.

PART III (2 marks)

45. What do you mean by Coordination polymerization ?
46. Distinguish between the following with examples :
    (i) Natural and synthesis polymers .
    (ii) Addition and condensation polymers .
    (iii) Thermoplastic and thermosetting resins.
47. What is gas phase polymerization ?
48. Write short notes on:
    (a) Emulsion polymerization
    (b) Polyamides
    (c) Ring formation of condensation polymers
    (d) Amino resins

(e) Polyester

49. What is bulk polymerization ?
50. Distinguish between addition and condensation polymerization .
51. Briefly discuss the measurement of crystalline melting point by DSC.
52. Give an account of the principles of technique involved in the end-group analysis?
53. What are polyanilines? Write their preparation methods and explain how they conduct electricity ?
54. What is PET ? Discuss its properties and applications .
55. What are the advantages of blending PET with wool or cotton?
56. What is crystalline melting point? Discuss the factors affecting crystalline melting point.
57. What is condensation polymerization? Explain with one example.
58. Describe coordination polymerization.

PART IV (6 marks)

59. Write the mechanism and kinetics for cationic polymerization?
60. What are natural and synthetic polymers ?
61. What types of forces present in between polymer molecules ?
62. Write the preparation and properties of HDPE and LDPE ?
63. Write the mechanism and kinetics for Anionic polymerization process ?
64. Differentiate between thermosetting polymers and thermoplastic polymers ?
65. Write two difference between bulk polymerization & suspension polymerization ?
66. Write the mechanism and kinetics for catalysed condensation polymerization?
67. State preparation, uses of:
68. (i) Bakelite (ii) Synthetic rubber?
69. Describe the various schemes of classification of polymer with giving suitable case ?
70. What is Ziegler Natta catalyst. Explain its mechanism with a suitable example ?
71. .What is Free radical polymerization ? Discuss with examples ?
72. What is vinyl polymerization ? Give some examples of vinyl or addition polymers?
73. What is ionic polymerization ?Explain with suitable examples ?
74. Write the mechanism and kinetics for uncatalysed condensation polymerization?
75. Discuss about the crystalline melting point and degree of crystallinity of polymers?
76. Write the factors affecting crystalline melting point ?

77. What is the difference between the number average and weight average molecular weight of a polymer? Which is greater?
78. What do you mean by polydispersity of the polymer? How it is expressed?
79. Write some disadvantages of plastics over metals?
80. What are copolymer ? Classify with suitable examples?
81. What is Latex? How is natural rubber isolated from it?
82. Which polymer content in commercially available M-seal in market? Write its preparation?
83. Give brief account of :-(i)Urea-formaldehyde resin (ii) Reinforced plastics.
84. Write the preparation and properties of i) PVC ii)Nylon-6,6 iii)Teflon
85. What is Biodegradable polymers? Discuss about two Biodegradable polymers?
86. Write a mechanism for polymerization of ethylene in the presence of organic peroxides.
87. Discuss the techniques of Bulk polymerization and Solution polymerization. Compare their merits and limitations.

2021

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

1. a) What are some basic principles that one has to keep in view before designing any green synthesis ? 9

   b) Write short notes on the following : 2 × 3

   i) Atom economy

   ii) Green solvent.

OR

   c) What is green chemistry ? Highlight the twelve basic principle of green chemistry. 10

   d) How green chemistry is different from any such classical chemistry ? Discuss with a suitable example. 5

2. a) What is catalysis and how has it become a part of green chemistry ? Illustrate briefly different classes and advantages of the use of various catalysis in chemical syntheses. 12

b) How generation of the hazardous chmicals can be minimized during chemical synthesis ? 3

OR

c) Write short notes on the following : 3 × 5

i) Phase transfer catalyst

ii) Inherent safer design

iii) Greener route of synthesis of carbaryl.

3. a) Discuss microwave-assisted reaction and explain how sonochemistry is linked to green chemistry ? 6

b) Is the Diels-Alder reaction follow green chemistry principles ? Support your answer with at least one suitable example. 5

c) How do surfactants become helpful in reducing smog formation and ozone depletion ? 4

OR

d) Write short notes on the following : 3 × 5

i) Supercritical fluids

ii) Green synthesis of catechol

ii) Marine antifouling coating.

4. a) How rightfit pigment becomes a sustainable substitute for toxic pigments ? 6

b) Discuss the role of green chemistry in sustainable development. 5

c) Calculate atom economy of butyl bromide in the following reaction : 4

$$CH_3CH_2CH_2CH_2OH + NaBr + H_2SO_4 \rightarrow C_4H_9Br + NaHSO_4 + H_2O$$

OR

d) Write short notes on the following : 3 × 5

i) Cradle to cradle design

ii) Polylactic acid as green and sustainable plastic

ii) Enzymatic interesterification.

2018

Full Marks - 60

Time - 3 hours

The figures in the right-hand margin indicate marks

Answer *all* questions

1. a) What is Green Chemistry ? What are the goals and limitations of Green Chemistry ? 9

   b) i) Write notes on Atom economy. 3

   ii) Write notes on Green synthesis. 3

   OR

   c) What are the twelve principles of green chemistry ? Explain brifly. 9

   d) i) Write notes on Poly Ethylene Glucol (PEG). 3

   ii) Write notes on pollution prevention hierarchy. 3

3. a) Discuss briefly different types of catalysis involved in Green Chemistry. 9

b) i) Explain how use of microwaves energy is the alternative sources of energy for reactions ? 3

ii) Give brief idea on selection of starting material in Green technology. 3

OR

c) Explain briefly on biocatalysis, asymmetric catalysis and photocatalysis with examples. 9

d) i) How the chemical accidents can be prevented by green processes ? 3

ii) Write notes on greener alternative to Bhopal Gas Tragedy. 3

4. a) Discuss in brief the green synthesis of adipic acid and catechol with detailed mechanism. 9

b) i) Write notes on Hofmann Elimination reaction. 3

ii) Write notes on Diels-Alder reaction. 3

OR

c) Give a brief idea about Sonochemistry in green synthesis. 9

d) i) Write notes on environmentally friendly oxidation reaction. 3

ii) Write notes on environmentally safe marine antifoulant. 3

4. a) Discuss in brief on the enzyme inter esterification for production of no Trans-Fats and oils. 9

b) i) Write notes on synthetic azopigments. 3

ii) Write notes on cradle carpeting. 3

OR

c) "Green Chemistry is sustainable chemistry" – Explain the statement. 9

d) i) What do you mean by Biomimetic ? 3

ii) Write notes on solventless synthesis in green chemistry. 3