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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INDUSTRIAL CHEMISTRY (Paper – XIII)
Organic Chemical Industries

Day and Date : Thursday, 16-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all 5** questions
 - 2) Section – I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section – III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.

SECTION – I

1. Answer the following :

14

- a) What are the uses of zineb ?
- b) What are the raw materials required to produce one ton of oxalic acid ?
- c) What is gammexane ?
- d) What are antipyretics ?
- e) What are antibiotics ?
- f) What are the applications of baygon ?
- g) Ternary azeotrope ($C_2H_5OH + C_6H_6 + H_2O$) distills at _____ °C.
- h) What is carbaryl ?
- i) Give two examples of heterocyclic dyes.
- j) What are analgesics ?

P.T.O.



- k) Why is pure anhydrous acetic acid called glacial acetic acid ?
- l) What are antiskinning agents ?
- m) What are thinners ?
- n) What are extenders ?

SECTION – II

- 2. a) What are sugar based chemicals ? Discuss manufacturing of process of furfural from bagasse. 7
- b) What are paints ? Discuss with flow diagram manufacture of paints and their applications. 7
- 3. a) What are dyes ? Explain with suitable examples preparation, properties and applications of triphenylmethane dyes. 7
- b) What are petrochemicals ? Give an outline of chemicals derived from ethylene. 7
- 4. a) What are agrochemicals ? Describe in brief manufacturing process, properties and uses of BHC. 7
- b) What are vitamins ? Give an account of the types of vitamins. 7

SECTION – III

- 5. a) How is fast green O prepared ? What are its uses ? 5
 - b) Give an account of anticancer drugs. 5
 - c) What are the uses of anhydrous alcohol (100% C₂H₅OH) ? 4
 - 6. a) Discuss commercial syntheses of indigotin and its properties. 5
 - b) How is citric acid manufactured ? 5
 - c) What are pesticides ? How is malathion prepared ? 4
 - 7. Write notes on **any three** of the following : 14
 - a) Vitamin E
 - b) Petrochemical industries in India
 - c) Drug and pharmaceutical industries in India
 - d) Endosulphan.
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Seat No.	
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M.Sc. – I (Semester – I) Examination, 2015
CHEMISTRY (New)
Inorganic Chemistry – I (Paper – I)

Day and Date : Wednesday, 15-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Q. 1 is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** from Section – III.
 - 4) Answer to **all** questions (Section – I, II and III) should be written in **one** answerbook.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. Answer the following : 14
- a) Define artificial radioactivity.
 - b) What is photoelectric effect ?
 - c) Germanium doped with indium is an example of _____ type semiconductor.
 - d) Write two applications of p-n-p junction transistor.
 - e) Complete the reaction. ${}_{92}\text{U}^{235} + {}_0\text{n}^1 \longrightarrow {}_{56}\text{Ba}^{144} + \text{_____} + 2 {}_0\text{n}^1$.
 - f) TiO_2 is colourless, why ?
 - g) How many bond pairs and lone pairs present in SF_4 molecule ?
 - h) Mention any two applications of photovoltaic cell.
 - i) What is Jahn Teller Effect ?
 - j) What is the maximum oxidation state of manganese ?



k) What is Bent rule ?

l) Complete the reaction ${}_{13}\text{Al}^{27} + {}_0\text{n}^1 \longrightarrow \text{_____} + {}_1\text{H}^1$.

m) Write spin only formula for the magnetic moment of transition metals.

n) What is the value of plank's constant ?

SECTION – II

- | | | |
|-------|---|---|
| 2. a) | Derive Schroedinger time independent wave equation. | 7 |
| b) | Discuss the effect of lone pairs and effect of electronegativity on the shapes of molecules, according to VSEPR theory. | 7 |
| 3. a) | What are the transition elements ? Discuss in brief oxidation states and electronic configuration of 1 st , 2 nd and 3 rd transition elements. | 7 |
| b) | Explain in brief nuclear fission reaction. | 7 |
| 4. a) | Explain the Jahn-Teller effect in octahedral complexes with suitable example. | 7 |
| b) | What are semiconductors ? Explain in brief intrinsic semiconductors. | 7 |

SECTION – III

- | | | |
|-------|---|----|
| 5. a) | What are the factors upon which Δ_o depends ? | 5 |
| b) | Discuss in brief black body radiation. | 5 |
| c) | Explain in brief Q value of nuclear reactions. | 4 |
| 6. a) | Describe construction and working of photovoltaic cell. | 5 |
| b) | What are Racah parameters B and C ? | 5 |
| c) | Write note on Bent rule. | 4 |
| 7. | Write a notes (any three) : | 14 |
| a) | Origin of quantum theory | |
| b) | Metal carbonyls | |
| c) | Band theory | |
| d) | Nuclear fusion reaction. | |



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M.Sc. – I (Semester – I) Examination, 2015
CHEMISTRY (New)
Organic Chemistry – I (Paper – II)

Day and Date : Friday, 17-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Max. Marks : 70

- N.B. :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**. Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 3) Answers to **all** questions should be written in the **same** answer book.
 - 4) **All** questions carry **equal** marks.
 - 5) Figures to **right** indicate **full** marks.
 - 6) **Neat** labeled diagrams should be drawn **wherever** necessary.
 - 7) **Use** of log tables and calculator is **allowed**.

SECTION – I

1. a) Select most correct alternative for **each** of the followings : **5**
- i) Among the followings which is the softest base ?
 - a) RCN
 - b) Ar – NH₂
 - c) Pyridine
 - d) R – NH₂
 - ii) Secondary allyl carbocations are stabilised by
 - a) inductive effect
 - b) resonance effect
 - c) hyperconjugation effect
 - d) above all
 - iii) On sulphonation of chlorobenzene _____ is formed.
 - a) m – chlorobenzene sulphonic acid
 - b) o – chlorobenzene sulphonic acid
 - c) p – chlorobenzene sulphonic acid
 - d) mixture of o – and p – chlorobenzene sulphonic acid



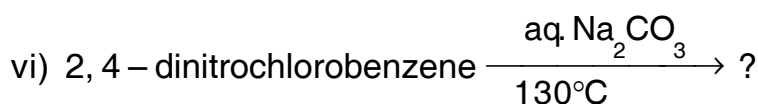
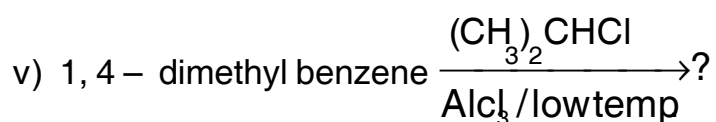
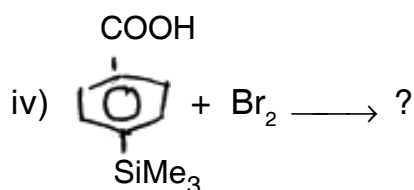
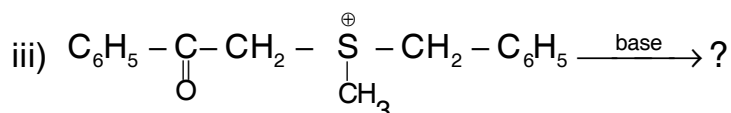
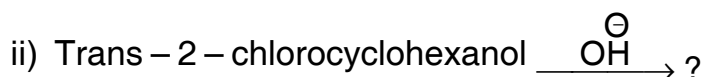
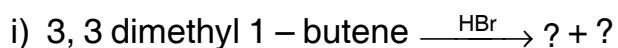
- iv) Tertiary alkyl halides are practically inert to substitution by SN² mechanism because of
- | | |
|---------------------|----------------------------|
| a) steric hindrance | b) inductive effect |
| c) solvent effect | d) hyperconjugation effect |
- v) O – methoxybromo benzene is treated with sodamide and then with ammonia. The product formed is
- | | |
|-----------------------|-----------------------|
| a) o – methoxyaniline | b) aniline |
| c) p – methoxyaniline | d) m – methoxyaniline |

b) State whether the statement is **correct** or **false** :

3

- i) Ethoxymethyl chloride reacts with nucleophile 10⁶ times faster than 1 – chlorobutane.
- ii) With the increasing basicity of the added base, the rates of E₂ reaction have been found to increase.
- iii) The twist boat conformer is about 1.5 KCal /mole lower in energy than the boat conformer at 25°C.

c) Predict the product (s)

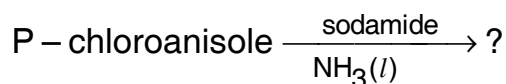




SECTION – II

2. A) Give an account of stability of carbocations on the basis of : 7
- i) Inductive effect
 - ii) Resonance effect
 - iii) Hyperconjugation effect
 - iv) Aromatisation.
- B) Explain the mechanism involved in the conversion of (S) – 1– phenylethanol into (S) – 1– phenyl ethylchloride on treatment with thionyl chloride.

3. A) Complete the reaction and assign mechanism for the following transformation. 7



- B) Discuss the stereochemistry and mechanism of addition of borane to alkene. 7

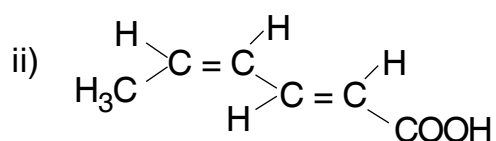
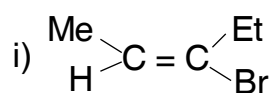
4. A) Give an account of pyrolytic syn. elimination by considering an example of ester. 7
- B) Complete the following reaction. Propose mechanism for the reaction. Discuss its stereochemical aspect.



7

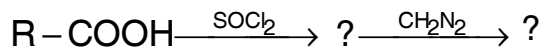
SECTION – III

5. A) What is racemic modification ? Give different methods for their resolution. 5
- B) Discuss the mechanism of Gattermann-Koch reaction. 5
- C) Assign E and Z nomenclature for the following isomers. 4

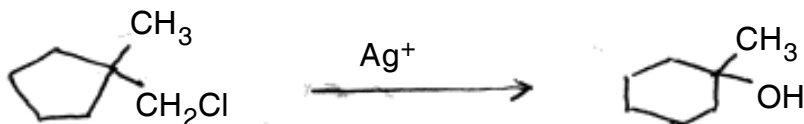




6. A) Complete the following reaction and propose mechanism. 5



B) Outline suitable mechanism for the following conversion. 5



C) Discuss the mechanism of Claisen rearrangement. 4

7. Write notes on (**any three**) : 14

- i) Carbenes – generation, structure and reactions.
 - ii) Conformational analysis of 1, 3 – disubstituted cyclohexane.
 - iii) Sharpless asymmetric epoxidation.
 - iv) Concept of chirality.
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M.Sc. (Part – I) (Semester – I) Examination, 2015
CHEMISTRY (New)
(Paper – III) : Physical Chemistry – I

Day and Date : Monday, 20-4-2015

Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in the **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following :

14

- a) State second law of thermodynamics.
- b) Mention any two state thermodynamic functions.
- c) State Raoult's law.
- d) Define configuration.
- e) Give the relationship between thermodynamic probability and entropy.
- f) What is critical micelle concentration ?
- g) Give the principle of pressure jump method.
- h) Mathematically define weight average molecular mass.
- i) State Henry's law.
- j) Mention any two methods of studying fast kinetics.

P.T.O.



- k) What is colloid ?
- l) Give the significance of entropy.
- m) Mention different types of ensemble.
- n) What do you meant by macromolecules ?

SECTION – II

- 2. a) Mention Maxwell-Boltzmann distribution law. Evaluate the M-B constants α and β . 7
- b) Discuss relaxation method of studying fast kinetics. 7
- 3. a) Derive any one thermodynamic equation of state. 7
- b) Explain viscosity method for determination of molecular weight of polymer. 7
- 4. a) What is colloid ? Describe various properties of colloids. 7
- b) Explain how third law of thermodynamics helps in evaluation of the absolute entropies of a substance. 7

SECTION – III

- 5. a) Write on flash photolysis technique. 5
 - b) What is surfactant ? Give the classification of surfactants. 5
 - c) The intrinsic viscosity of a polymer is $327 \text{ cm}^3 \text{ gm}^{-1}$. Calculate the approximate concentration of the polymer in water having a relative viscosity 2.5. 4
 - 6. a) Discuss chain polymerization. 5
 - b) Explain diagrammatically microcanonical ensemble. 5
 - c) For the dissociation of water, the relaxation time obtained is 80 microseconds and the equilibrium constant is 1×10^{-14} . Calculate the rate constants for both forward and backward reactions. 4
 - 7. Write short notes on **any three** : 14
 - a) Thermodynamic excess functions
 - b) Thermodynamics of ideal solutions
 - c) Relationship between γ_m , γ_c and γ_n .
 - d) Microstates and configuration.
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M.Sc. - I (Semester – I) Examination, 2015
CHEMISTRY (New)
Analytical Chemistry – I (Paper – IV)

Day and Date : Wednesday, 22-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Q. 1 is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of tables and calculators is **allowed**.

SECTION – I

1. Answer the following : **14**
- a) Name the electrode used in amperometric titration.
 - b) What are the methods employed to develop a chromatogram ?
 - c) What is the principle of amperometric titration ?
 - d) The current due to supporting electrolyte is called
 - e) Mention the types of Errors.
 - f) Column chromatography separates the molecules according to their
 - g) Name the detectors used in gas chromatography.
 - h) Do the addition of $168.11 + 7.045 + 0.6832$ by using rules of computation.
 - i) Name the reference electrode used in polarography.
 - j) Round the number 1.00727, 28755 to two significant figures.

P.T.O.



- k) Name the various types of detectors used in HPLC.
- l) What is indeterminate error ?
- m) Define the software.
- n) Write the long form of C.P.U.

SECTION – II

- 2. a) Explain the nature of titration curves obtained in Amperometric titration. Give their advantages. 7
- b) Define precision and accuracy. Explain the analytical methods used for determination of the accuracy. 7
- 3. a) Discuss briefly various types of detectors in HPLC. 7
- b) Discuss the qualitative and quantitative application of polarography. 7
- 4. a) Discuss in detail various types of errors observed in measurement. 7
- b) Discuss the instrumentation of gas chromatography. 7

SECTION – III

- 5. a) Discuss the input and output devices. 5
 - b) Give the classification of errors. 5
 - c) Give an account on half wave potential. 4
 - 6. a) Discuss the use of power point and Excel in chemistry. 5
 - b) Give a general idea of different types of chromatography. 5
 - c) Explain in brief use of internet in computer. 4
 - 7. Write a notes (**any three**) : 14
 - a) Advantages and disadvantages of DME
 - b) Minimization of error
 - c) Linear regression and X-Y plots
 - d) Detectors in Gas Chromatography.
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M.Sc. (Part – I) (Semester – I) Examination, 2015
CHEMISTRY (Old)
Inorganic Chemistry – I (Paper – I)

Day and Date : Wednesday, 15-4-2015

Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions:**
- 1) Attempts in **all five** questions.
 - 2) Section – I (Q – 1) is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) Answer to **all** questions should be written in **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) Neat and labelled diagrams should be drawn **wherever** possible.
 - 8) **Use** of log table and calculators in **allowed**.

SECTION – I

1. Answer the followings :

14

- 1) How the energy of an electron in n^{th} orbital can be calculated ?
- 2) Give a general equation for the wave number in Lyman series of atomic spectra of hydrogen atom.
- 3) If uncertainty in position and momentum are equal, then what is the uncertainty in velocity ?
- 4) Which type of semiconductor will be produced after doping of 'As' in ;Si' ?

P.T.O.



- 5) In the bridge rectifier, how many diodes are used ?
- 6) Give the chemical composition of wood metal alloy.
- 7) How much percentage of copper will be obtained from blister copper ?
- 8) What is Walsh diagram ?
- 9) What is the geometry of ClO_3^- ?
- 10) The magnetic moment of $[\text{MnBr}_4]^{2-}$ is 5.9 BM. Is it a tetrahedral or square planar complex.
- 11) What is spectrochemical series ?
- 12) What is the origin of the intense yellow color of CrO_4^{2-} ?
- 13) Draw the structure of $\text{Fe}_2(\text{CO})_9$.
- 14) What is the EAN of $\text{Fe}(\text{CO})_5$?

SECTION – II

2. A) Derive the schrodinger wave equation for a particle in a three dimensional box. 7
- B) On the basis of band theory, explain various types of metallic solids. 7
3. A) Discuss the process of extraction of gold from their source. Give the properties of Tin. 7
- B) Explain the different reactions of covalently bonded molecules. 7
4. A) Give the general characteristic properties of transition elements. 7
- B) What is crystal field splitting ? Explain the crystal field splitting is $\text{K}_3[\text{Fe}(\text{CN})_6]$ complex. 7



SECTION – III

- | | |
|--|----|
| 5. A) Explain the bonding in metal carbonyl compounds. | 5 |
| B) How the three variables in the wave equation are separated ? | 5 |
| C) With the help of Bent's rule; explain the energy of sp^3 hybridization. | 4 |
| 6. A) Explain the transformation of coordinates of wave equation. | 5 |
| B) How the silver is extracted from argentiferous ore ? | 5 |
| C) Explain the conduction mechanism in pure semiconductors. | 4 |
| 7. Write note on (any three) : | 14 |
| i) Walsh diagram. | |
| ii) Occurrence of lead. | |
| iii) Free electron theory. | |
| iv) Origin of quantum theory. | |
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M.Sc. I (Semester – I) Examination, 2015
CHEMISTRY (Old)
Organic Chemistry – I (Paper – II)

Day and Date : Friday, 17-4-2015

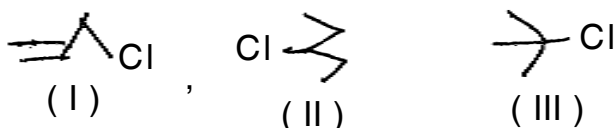
Max. Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- N.B. :**
- 1) Attempt in **all five** questions.
 - 2) Question 1 is **compulsory**. Attempt **any two** questions from question numbers 2-4 and **any two** questions from question numbers 5-7.
 - 3) Answer to **all** questions should be written in the **same** answer book.
 - 4) **All** questions carry **equal** marks.
 - 5) Figures to **right** indicate **full** marks.
 - 6) **Neat** labeled diagrams should be drawn **wherever** necessary.
 - 7) **Use** of log-table and calculator is **allowed**.

1. A) Select most correct alternative for **each** of the following : 4

- i) Arrange the following compounds in decreasing order of the rate of solvolysis by S_N1 mechanism.



- a) III > I > II b) I > II > III c) III > II > I d) II > III > I
- ii) The conversion of phenol to salicylaldehyde by alkaline chloroform proceeds via the formation of _____ intermediate.
- a) Carbocation b) Carbanion c) Carbene d) Carbon free radical
- iii) The product expected in the reaction of (anti)-methyl phenyl ketoxime with P_2O_5 is
- a) methylamine b) acetanilide
c) N-phenylbenzamide d) phenylcyanide

P.T.O.



iv) Among the following elimination reactions, which involves the formation of carbanion as an intermediate ?

- E_1
- E_1Cb
- E_2
- E_i

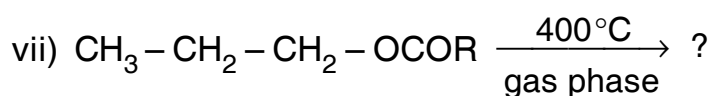
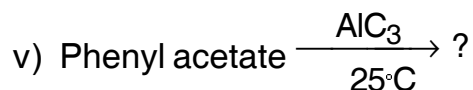
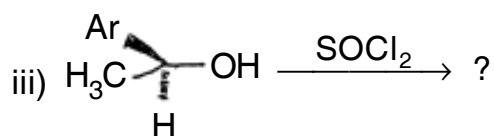
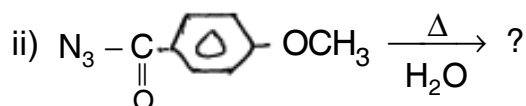
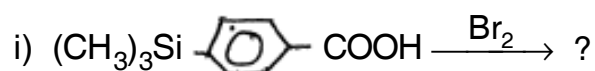
B) Fill in the blanks.

3

- Halobenzene on treatment with sodamide in liq. NH_3 forms _____ intermediate.
- Propionamide on Hoffmann reaction gives _____
- Aromatic substitution in which a substituent already present is replaced is called _____

C) Predict the product(s).

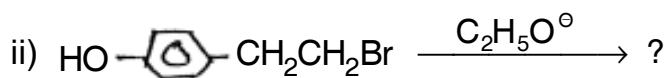
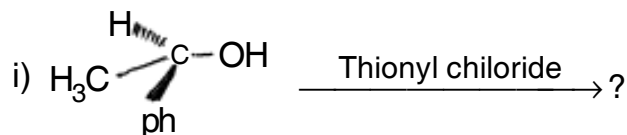
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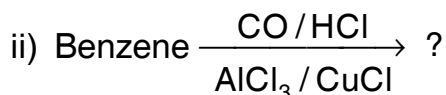
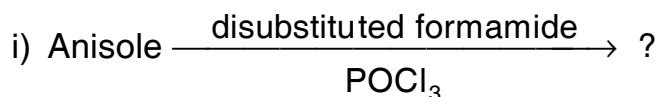


SECTION – II

2. a) What are carbon free radicals ? Discuss their formation, structure and stability. 7
b) Predict the product(s) and discuss their mechanism 7

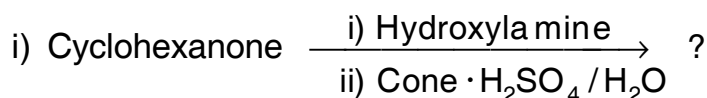


3. a) Complete the following reactions and suggest mechanism. 7



- b) Discuss the mechanism and stereochemistry of addition of borane to alkene. 7

4. a) Predict the product(s) in the followings. Discuss stereochemistry and mechanism of the conversion. 7



- b) Give an account of pyrolytic syn-elimination reaction by giving suitable example. Discuss stereochemistry and mechanism. 7

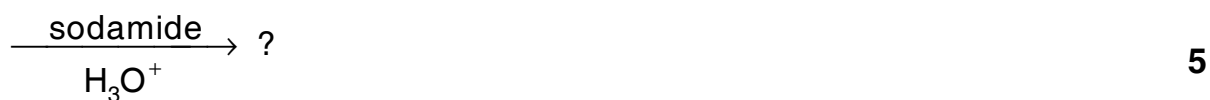
SECTION – III

5. a) What is racemic modification ? Discuss different methods of resolution of racemic modification. 5
b) Arrange the following compounds in order of increasing acidity giving suitable reason. P-nitrobenzoic acid, 2,4-dinitrobenzoic acid, 2, 4, 6-trimethylbenzoic acid, 3,4-dinitrobenzoic acid, p-terbutylbenzoic acid. 5
c) What are phase transfer catalysts ? Explain phase transfer catalysis with suitable example. 4

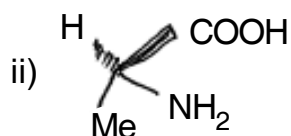
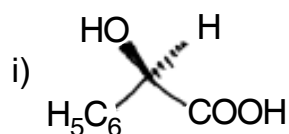


6. a) Discuss the conformational analysis of disubstituted cyclohexane derivatives. **5**

b) Complete the following reaction. Give its mechanism 3-methyl chlorobenzene



c) Assign R or S configuration to the following compound. **4**



7. Write notes on **(any three)**. **14**

i) Nitrenes – generation, structure and reactions.

ii) Mixed SN^1 and SN^2 mechanism.

iii) Diazocoupling reaction.

iv) Benzillic acid rearrangement.



Seat No.	
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M.Sc. – I (Semester – I) Examination, 2015
CHEMISTRY (Paper – III) (Old)
Physical Chemistry – I

Day and Date : Monday, 20-4-2015

Max. Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions :**
- i) Attempt **five** questions.
 - ii) Section I (question 1) is **compulsory**.
 - iii) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - iv) Answers to **all 05** questions (from Section I, II and III) should be written in the **one** and the **same** answer book.
 - v) **All** questions carry **equal** marks.
 - vi) Figures to the **right** indicate **full** marks.
 - vii) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. Attempt the following questions :

14

- i) State the third law of thermodynamics.
- ii) Linear polymers are having higher melting point than that of Branched polymers. True/False.
- iii) What is invariant system ?
- iv) What is osmotic pressure ?
- v) What is degree of freedom ?
- vi) In micellization process the entropy of system decreases. True/False.
- vii) Write the equation of Kinetic theory of gases.
- viii) Raoult studied vapour pressure of a number of binary solutions of volatile liquid at constant temperature. True/False.

P.T.O.



- ix) Give the monomer of polystyrene.
- x) Define the term average degree of polymerisation.
- xi) According to Boltzmann-Planck equation for entropy
- xii) Flash photolysis is also called as Kinetic Spectroscopy. True/False.
- xiii) What is syndiotactic polymer ?
- xiv) Give one example of anion surfactant. SDS

SECTION – II

- 2. A) Explain viscometer method of determination of molecular weight of polymer. 7
- B) Derive the phase rule. 7
- 3. A) Derive an expression for Gibbs free energy change of an mixing for an ideal solution. Show that for an ideal solution
- i) Volume of mixture is zero
- ii) Enthalpy of mixing is zero. 7
- B) Derive the rate expression for step growth polymerization in absence of a catalyst and show that the average molecular weight is proportional to the square root of time. 7
- 4. A) Describe the temperature jump method for studying kinetics of a fast reaction. 7
- B) Derive an expression for most probable velocity of gases. 7

SECTION – III

- 5. A) Write the mechanism and kinetic of anionic polymerisation. 5
 - B) Discuss magnetic resonance method to study the kinetics of fast reactions. 5
 - C) The vapour pressure of pure benzene (A) and toluene (B) at 39° C are 175 torr and 48 torr respectively. Calculate partial pressure of benzene and toluene. The mole fraction of B in vapour has 0.3. Assume that the solution is ideal. 4
 - 6. A) Give the properties of colloidal system. 5
 - B) Give the Boltzmann distribution law for molecule velocities of gases. 5
 - C) The polymer containing 100, 50, 40 molecules of molecular weight 10000; 20000 and 5000 respectively. Calculate the number average and weight average molecular weight of polymer. 4
 - 7. Write short notes on **any three** : 14
 - a) Flash photolysis technique
 - b) Root mean square velocity of gases
 - c) Raoults law
 - d) Fugacity.
-



Seat No.	
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M.Sc. Part – I (Semester – I) Examination, 2015
CHEMISTRY
Analytical Chemistry – I (Paper – IV) (Old)

Day and Date : Wednesday, 22-4-2015

Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions :**
- 1) Attempts in **all five** questions.
 - 2) Section – I (Q. I) is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) Answer to **all** questions should be written in **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Neat** and labelled diagrams should be drawn **wherever** possible.
 - 8) **Use** of log table and calculators is **allowed**.

SECTION – I

1. Solve the following : 14
- a) What is meant by isotopic dilution method ?
 - b) Define standard deviation.
 - c) Who discover chromatography technique ?
 - d) Define an interpreter.
 - e) State quantitative evaluation by voltammetry.
 - f) What is half wave potential ?
 - g) What is column resolution ?
 - h) What is the necessary condition for better separations of the substances ?
 - i) Name the two kinds of high level translator programs.
 - j) Define significant figure.
 - k) Define chromatography.
 - l) Name the reference electrode used in polarography.



- m) Write Ilkovic equation and give the significance of the terms involved in it.
 n) Subtract 01110_2 from 10101_2 .

SECTION – II

2. a) What is meant by HPLC ? Explain in detail the instrumentation of HPLC. **7**
 b) Two analysts gave the following observations. **7**
 Analyst 1. a) 49.01 b) 49.21 c) 49.08
 Analyst 2. a) 49.40 b) 49.42 c) 49.44
 Calculate precision and accuracy of both the analyst. Which analyst is more precise and which is more accurate ?
3. a) What is principle of amperometric titration ? Explain different types of titration curve. **7**
 b) How is fast Fourier transformation used to reduce noise ? **7**
4. a) What is gas chromatography ? Explain in detail sample injection system in gas chromatography. **7**
 b) Explain in detail half wave potential of an electrolyte in polarography. **7**

SECTION – III

5. a) Discuss the methods of minimization of error. **5**
 b) Explain the chromatographic behavior of solutes by partition coefficient and retention behavior. **5**
 c) Explain different types of column used in gas chromatography. **4**
6. a) Give the quantitative application of polarography. **5**
 b) Explain in detail X-Y plot and linear regression. **5**
 c) Explain in short advantages of DME. **4**
7. Write short notes on (**any three**). **14**
 a) Least square method
 b) Sampling of gases
 c) Classification of chromatographic methods
 d) Data representation.
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Seat No.	
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M.Sc. – I (Semester – II) Examination, 2015
CHEMISTRY
Inorganic Chemistry – II (Paper – V) (New)

Day and Date : Thursday, 16-4-2015

Total Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Q. 1 is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. Answer the following : 14
- a) What is the lanthanide contraction ?
 - b) What is the hybridization of boron in B_2H_6 ?
 - c) What is the action of water on diborane ?
 - d) Write the oxides of carbon.
 - e) Name the methods used for the separation of lanthanides.
 - f) Write the names of polymorphism of sulphur.
 - g) Name the trace elements which are used in biological processes.
 - h) What is the function of ferredoxin ?
 - i) Which one shows highest magnetic moment among the tripositive lanthanide ions ?

P.T.O.



- j) What is homogeneous catalysis ?
- k) Write the electronic configuration of Sm^{2+} .
- l) Write functions of haemoglobine.
- m) Which catalyst is used in Wackers process ?
- n) $\text{Fe} + \text{CuSO}_4 \longrightarrow \dots\dots\dots + \text{Cu}$.

SECTION – II

- 2. a) Discuss the factors affecting the stability of metal complexes. 7
- b) What are phosphazenes ? Write the applications of phosphazenes. 7
- 3. a) How is tin extracted ? What are its properties and uses ? 7
- b) Discuss the catalytic cycle involved in hydrogenation of alkene catalyzed by Wilkinson's catalyst. 7
- 4. a) What are boranes ? How they are classified ? Draw the structure of B_5H_9 and $\text{B}_{10}\text{H}_{14}$. 7
- b) Discuss the mechanism involved in Ziegler and Natta catalyzed polymerization. 7

SECTION – III

- 5. a) Discuss the electronic configuration and oxidation states of lanthanides. 5
 - b) Explain in brief Monsanto acetic acid process. 5
 - c) Write note on ferredoxines. 4
 - 6. a) Discuss a brief account of extraction of zinc. 5
 - b) Discuss in brief photosynthesis PS I and PS II. 5
 - c) Explain in brief oxyacids of nitrogen. 4
 - 7. Write a notes (**any three**) : 14
 - a) Applications of actinides.
 - b) Pi-metal complexes
 - c) Polymorphism of phosphorous
 - d) Cytochromes.
-



SLR-DP – 121

Seat No.	
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M.Sc. – I (Semester – II) (New) Examination, 2015
CHEMISTRY (Paper – VI)
Organic Chemistry – II

Day and Date : Saturday, 18-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Question 1 is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) Answer to **all** questions should be written in the **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

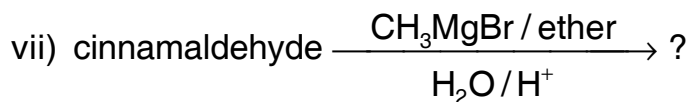
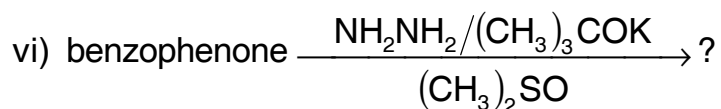
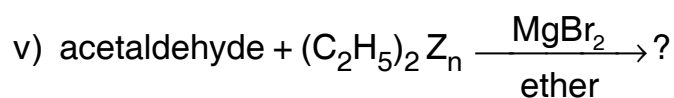
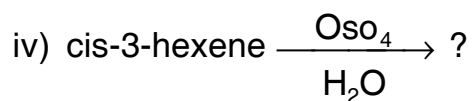
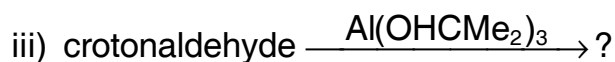
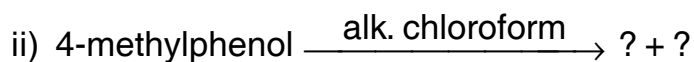
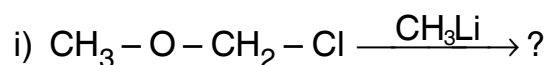
SECTION – I

1. A) Select most correct alternative for **each** of the following : **4**
- i) Among the followings which one will undergo Dakin oxidation ?
a) m-hydroxybenzaldehyde b) catechol
c) O-aminobenzaldehyde d) m-amino benzaldehyde
 - ii) _____ reagent is used for the methylation of hydroxyl group, usually carboxylic acid or phenolic group.
a) CH_2N_2 b) LDA c) DCC d) PTC
 - iii) Hydroboration reaction is an example of _____ addition.
a) syn b) anti c) trans d) nonspecific
 - iv) Anisole on reduction by Li or K or Na in liquid ammonia gives _____
a) 1-methoxy 1,4,-cyclohexadiene
b) 3-methoxy 1,4,-cyclohexadiene
c) 1-methoxy 1,3,-cyclohexadiene
d) 2-methoxy 1,3,-cyclohexadiene

P.T.O.

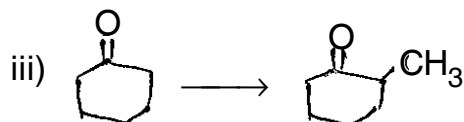
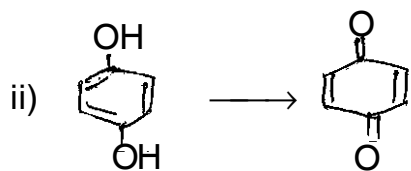
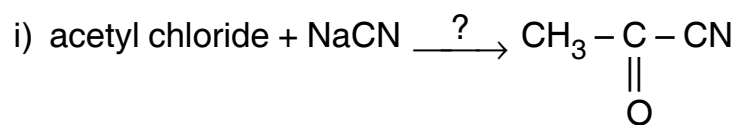


B) Predict the product(s) :



C) Suggest the suitable reagent/catalyst/conditions for the following transformations.

3





SECTION – II

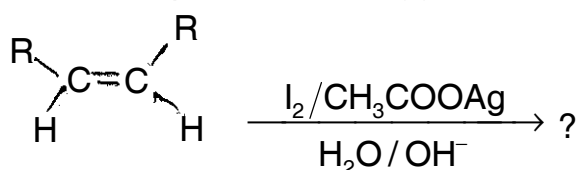
2. A) Suggest the suitable conditions for the following conversions. Outline its mechanism.



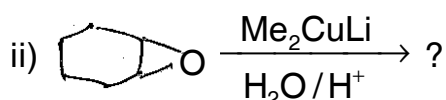
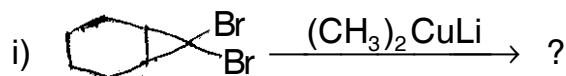
- B) Discuss the applications of Merrifield resin in polypeptide synthesis. 7

3. A) Give the method for the preparation of LiAlH_4 . Explain its importance as a reducing agent. Discuss its mechanism with respect to suitable example. 7

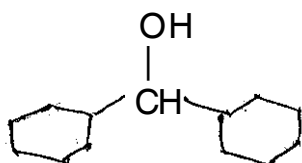
- B) Predict the product and suggest mechanism for the followings : 7



4. A) Complete the following reactions. Give method for the preparation of organocopper compounds. Give its applications. 7



- B) Define synthon and synthetic equivalent. Give the synthesis of following compound using disconnection approach. 7



SECTION – III

5. A) Discuss Oppenauer oxidation with respect to mechanism and synthetic utility. 5

- B) Outline the mechanism of addition of borane to alkene. Explain its orientation and stereochemistry. 5

- C) Complete the following reaction. Give its mechanism





6. A) Explain the importance of protecting groups in organic synthesis. Give various methods employed for protection and deprotection of carboxyl group. **5**
- B) Give preparation of lithium diisopropylamide. Discuss its uses in organic synthesis. **5**
- C) Give an account of formation and reactivity of enamines. **4**
7. Write notes on **(any three)** : **14**
- i) Principle of protection of amino group.
 - ii) Diels-Alder reaction.
 - iii) Chromium trioxide-oxidising agent.
 - iv) Peterson synthesis.
-



Seat No.	
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M.Sc. (Part – I) (Semester – II) Examination, 2015
CHEMISTRY (Paper – VII) (New)
Physical Chemistry – II

Day and Date : Tuesday, 21-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Total Marks : 70

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) **Section I is compulsory.**
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use of log table and calculator is allowed.**

SECTION – I

1. Answer the following :

14

- a) State Grotthos-Draper law of photochemistry.
- b) What is heavy atom effect ?
- c) Draw structure of ATP.
- d) The molecularity of a chemical reaction never be zero. True/False.
- e) Mention lifetime for fluorescence and phosphorescence.
- f) Define exciplex.
- g) Why ozone layer is considered as an Earth's protective umbrella ?
- h) What do you mean by zeta potential ?
- i) Give the mathematical formula for ionic strength. State the significance of the terms involved in it.
- j) Mention different nucleic acids.
- k) Internal conversion is _____ process. (Radiative / Non-radiative).



- l) Give the mathematical expression for Beer-Lambert's law.
- m) What do you mean by ionic atmosphere ?
- n) Define self quenching phenomena.

SECTION – II

- 2. a) State Franck-Condon principle. Give the significance of it. 7
- b) Discuss in brief the kinetics of bimolecular collisional quenching. 7
- 3. a) Using double sphere model, illustrate the influence of solvent on the rate of ionic reaction in solution state. 7
- b) Describe electrical double layer and its structure with the help of Stern's model. 7
- 4. a) Give an account of role of photochemistry in atmospheric chemistry. 7
- b) Explain the method of determination of dissociation constant of monobasic acid by e.m.f. method. 7

SECTION – III

- 5. a) Explain denaturation of proteins. 5
- b) Draw Jablonski's diagram. Mention various non-radiative transitions. 5
- c) Discuss decomposition of ozone reaction. 4
- 6. a) State and explain the laws of photochemistry. 5
- b) Explain the role of ATP in biological systems. 5
- c) H_2 and I_2 reactions takes place as $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$.
 Show that $\frac{1}{2} \frac{d[HI]}{dt} = k [H_2] [I_2]$. The proposed mechanism of the reaction is
 - i) $I_2 \rightleftharpoons 2I$ fast equilibrium step
 - ii) $H_2 + 2I \rightarrow 2HI$ slow step. 4
- 7. Write short notes on **any three** : 14
 - a) Electronic transitions
 - b) Rate determining step
 - c) Characteristics of exciplex species
 - d) Fractional order kinetics.



Seat No.	
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M.Sc. I (Semester – II) Examination, 2015
CHEMISTRY
Analytical Chemistry – II (P-VIII) (New)

Day and Date : Thursday, 23-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Max. Marks : 70

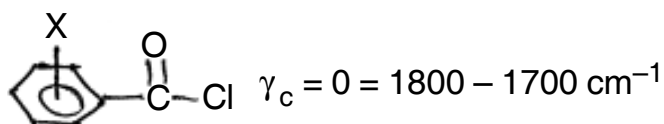
- N.B. :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt to **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all five** questions (from Section I, II and III) should be written in the **one and same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Solve the following.

14

a) Why conjugated acid halide show lower vibrational frequency ?



b) Why β -carotene shows yellow colouration ?

c) What is the nuclear spin of ^1H , ^{13}C , ^{19}F , ^{31}P ?

d) Which device used for the formation of atomic vapour in AAS ?

e) What is meant by the base peak in mass spectrometry ?

f) What is the role of nebuliser in burner system ?

g) What is $n + 1$ rule ?

h) What happens on absorption of infrared and UV radiation by a molecule ?

i) Infrared absorption due to carbonyl stretching occur at higher frequency than stretching of carbon-carbon double bond explain.



- j) Explain nitrogen rule in mass spectrometry.
- k) Chemical shift of nuclei depends upon which factor ?
- l) Plasma source operate at which temperature range ?
- m) Aniline shows which type of transition ?
- n) Explain spectral interferences.

SECTION – II

2. a) Explain basic principle of AAS. Why AAS is more advantages than FES ? 7
- b) Explain factor affecting vibrational frequencies in IR spectroscopy. 7
3. a) Discuss construction and working of plasma torch. 7
- b) An organic compound $C_8H_{11}N$ (MS shows odd molecular weight 121) shows following spectral data. 7

IR : Sharp band around 3400 cm^{-1} , absorption above 3000 cm^{-1} and below 3000 cm^{-1} , 1400 , 1500 and 1600 cm^{-1} , two strong bands around 700 and 750 cm^{-1}

NMR : 6.5 – 7.5 (M, 5H)

1.2 (t)

3.1 (q)

3.3 (S, 1H)

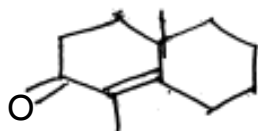
MS : A base peak at $m/z = 106$ suggest structure for the compound.

4. a) Explain basic principle of mass spectrometry and discuss construction and working of mass spectrometry. 7
- b) A compound have molecular formula $C_9H_{10}O_2$
 IR : 1740 and 1220 cm^{-1} , 700 , 750 cm^{-1} , $1600 - 1400\text{ cm}^{-1}$
 MS : $m/z = 150$
 NMR : 7.2 (5H, S)
 1.96 (3H, S)
 5.0 (2H, S)
 Suggest the structure for the compound. 7



SECTION – III

5. a) Write down application of ICP-AES. 5
b) Explain shielding and deshielding in NMR spectroscopy. 5
c) Describe fragmentation pattern of phenol. 4
6. a) Define parent ion peak. Explain its important feature. 5
b) What are application of mass spectrometry ? 5
c) Explain the substitution pattern on following enone and calculate the position peak of κ - band. 4



7. Write short note on (**any three**). 14
- a) Detection limit and sensitivity
b) McLafferty rearrangements
c) Spin-spin splitting
d) Application of UV-spectroscopy.
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Seat No.	
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M.Sc. – I (Semester – II) Examination, 2015
CHEMISTRY (Old)
Inorganic Chemistry – II (Paper – V)

Day and Date : Thursday, 16-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Q. No. **1** is **compulsory**.
 - 3) Attempt **any two** questions from Section **II** and **any two** from Section **III**.
 - 4) Answer to **all** questions (Section **I, II** and **III**) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. Answer the following.

14

- a) What is homogeneous catalysis ?
- b) Write the electronic configuration of Sm^{2+} .
- c) Write functions of haemoglobin.
- d) Which catalyst is used in Wackers process ?
- e) $\text{Fe} + \text{CuSO}_4 \longrightarrow \dots + \text{Cu}$.
- f) What is the lanthanide contraction ?
- g) What is the hybridization of boron in B_2H_6 ?
- h) What is the action of water on diborane ?
- i) Write the oxides of carbon.
- j) Name the methods used for the separation of lanthanides.
- k) Write the names of polymorphism of sulphur.
- l) Name the trace elements which are used in biological processes.
- m) What is the function of ferredoxin ?
- n) Which one shows highest magnetic moment among the tripositive lanthanide ions ?

P.T.O.



SECTION – II

2. a) How is tin extracted ? What are its properties and uses ? 7
b) Discuss the catalytic cycle involved in hydrogenation of alkene catalyzed by Wilkinson's catalyst. 7
3. a) What are boranes ? How they are classified ? Draw the structure of B_5H_9 and $B_{10}H_{14}$. 7
b) Discuss the mechanism involved in Ziegler and Natta catalyzed polymerization. 7
4. a) Discuss the factors affecting the stability of metal complexes. 7
b) What are phosphazenes ? Write the applications of phosphazenes. 7

SECTION – III

5. a) Discuss a brief account of extraction of zinc. 5
b) Discuss in brief photosynthesis PS I and PS II. 5
c) Explain in brief oxyacids of nitrogen. 4
6. a) Discuss the electronic configuration and oxidation states of lanthanides. 5
b) Explain in brief Monsanto acetic acid process. 5
c) Write note on ferredoxines. 4
7. Write a notes (**any three**) : 14
a) Polymorphism of phosphorous.
b) Pi-metal complexes.
c) Applications of actinides.
d) Cytochromes.
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SLR-DP-125

Seat
No.

M.Sc. – I (Semester – II) Examination, 2015
CHEMISTRY (Old)
Organic Chemistry – II (Paper – VI)

Day and Date : Saturday, 18-4-2015

Max. Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions :** 1) Attempt in **all five** questions.
2) Section I is **compulsory**. Attempt **any two** questions from Section II and **any two** questions from Section III.
3) Answers to **all** questions should be written in the **same** answer book.
4) **All** questions carry **equal** marks.
5) Figures to the **right** indicate **full** marks.
6) **Neat** labelled diagrams should be drawn **wherever** necessary.
7) Use of log tables and calculator is **allowed**.

SECTION – I

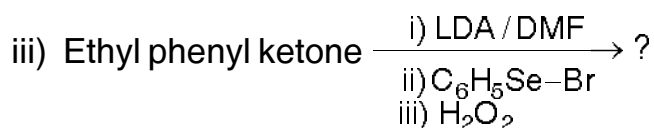
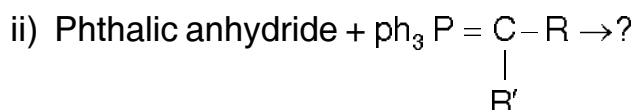
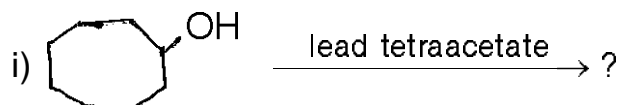
1. a) Select most correct alternative for each of the followings : 4
- i) Among the followings which compound undergoes benzoin condensation ?
a) CH_3CHO b) RCOCHO c) Ar-COCH_3 d) HCHO
- ii) _____ is the mild oxidising agent for the oxidation of speciality allylic and benzylic $-\text{OH}$ group.
a) H_2O_2 b) Lead tetraacetate
c) MnO_2 d) CrO_3
- iii) Aromatic compounds on treatment with $\text{pb}(\text{OAc})_4$ in acetic acid undergoes methylation reaction by _____ mechanism.
a) Free radical b) Electrophilic c) Nucleophilic d) Hydride ion transfer
- iv) Carbodiimidic carbon of DCC is _____ in character.
a) Neutral b) Free radical c) Electrophile d) Nucleophilic
- b) Fill in the blanks : 4
- i) Anisole on Birch reduction gives _____
- ii) Nitriles can be reduced to _____ with LiAlH_4 .
- iii) With respect to the dienophile, in the diels. Alder reaction the addition is stereospecifically _____
- iv) Organic part of organometallic compounds always behaves as _____

P.T.O.



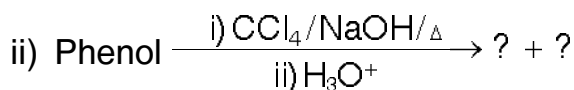
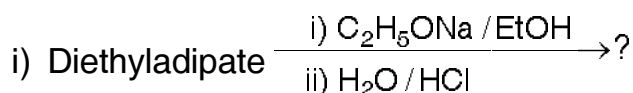
- c) State whether the statement is **correct** or **false** : 3
- Oxidative enzymes are generally simple proteins.
 - Carbondisulphide on reaction with Grignard reagent after hydrolysis gives Alkane sulphinic acid.
 - OSO_4 and alkaline KMnO_4 gives syn. addition from the less hindered side of the double bond respectively that add two $-\text{OH}$ groups.

- d) Predict the products : 3



SECTION – II

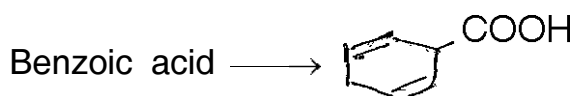
2. A) Predict the product(s) and suggest suitable mechanism for the following conversion. 7



- B) Give the applications of following reagents in organic synthesis. 7

- 1, 3-dithiane
- Lithium diisopropylamide

3. A) How will you affect the following conversion ? Suggest mechanism and give an account of substitution on aromatic compounds on the rate of reaction. 7



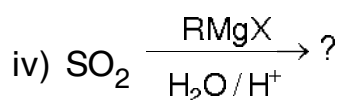
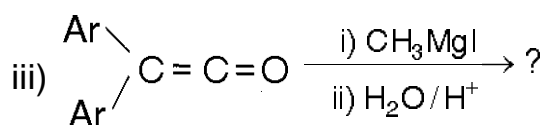
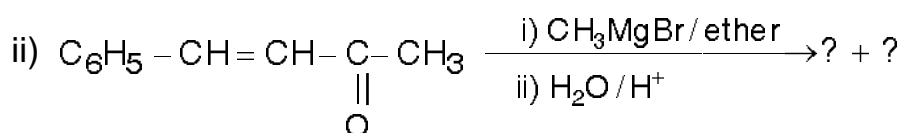
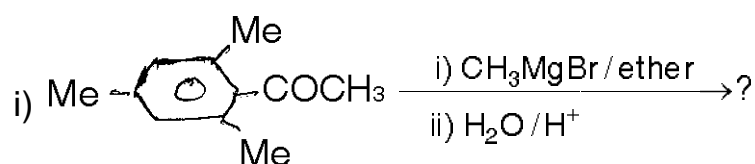
- B) Why ene reactions takes place at higher temperature than Diels-Alder reaction ? Give mechanism of both the reactions. 7



4. A) What is the oxidation product of acetophenone in the presence of trifluoroparacetic acid ? Discuss mechanism and migratory aptitude of various groups. 7
- B) How can the given conversion be performed in acidic condition ? Suggest reagent and propose mechanism. 7
- propiophenone → n-propylbenzene

SECTION – III

5. A) Give method of preparation of organozinc compounds and its synthetic applications. 5
- B) Discuss salient characteristics of enzyme and enzyme action. 5
- C) What are merrifield resin ? Give their applications in polypeptide synthesis. 4
6. A) How will you affect the oxidation of secondary alcohol to ketone by using Aluminium tertiary butoxide in acetone ? Give mechanism and synthetic utility of the reaction. 5
- B) What are Grignard reagents ? How they are prepared ? Predict the product (s) in the following reactions. 5



- C) What are nucleoproteins ? Give structural pattern of nucleic acids RNA and DNA. 4
7. Write notes on (any three) : 14
- i) Stobbe reaction
- ii) Synthetic utility of NaBH_4
- iii) Oxidising agent-osmium tetroxide
- iv) Phase transfer catalyst.
-



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M.Sc. (Part – I) (Semester – II) Examination, 2015
CHEMISTRY (Old)
Paper – VII : Physical Chemistry – II

Day and Date : Tuesday, 21-4-2015
Time : 11.00 a.m. to 2.00 p.m.

Total Marks : 70

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) **Section I is compulsory.**
 - 3) Attempt **any two** questions from **Section II** and **any two** questions from **Section III**.
 - 4) Answer to **all** questions (**Section I, II and III**) should be written in the **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use of log table and calculator is allowed.**

SECTION – I

1. Answer the following :

14

- i) Define Zeta potential.
- ii) What do you mean by Stokes shift ?
- iii) Mention various radiationless transitions.
- iv) What is pseudo molecularity ?
- v) Give basic units of DNA.
- vi) What do you mean by hydrogen overvoltage ?
- vii) Give statement for steady state treatment.
- viii) Define activation energy.
- ix) Fluorescence intensity _____ with rigidity in the structure.
 - a) increases
 - b) decreases
 - c) remains constant
 - d) none of these



- x) What is electrical double layer ?
- xi) State Einstein's photochemical equivalence law.
- xii) Represent lead storage cell.
- xiii) Mathematically define ionic strength of the solution.
- xiv) Define quantum efficiency.

SECTION – II

- | | |
|--|---|
| 2. a) Using Franck-Condon principle, discuss shapes of absorption bands. | 7 |
| b) Discuss inter and intramolecular excitation energy transfer process with example. | 7 |
| 3. a) Using SSA, discuss kinetics of thermal decomposition of acetaldehyde. | 7 |
| b) Illustrate Gouy-Chapmann electrical double layer model. | 7 |
| 4. a) Describe kinetics of bimolecular collisional quenching. | 7 |
| b) With the help of Jablonski's energy level diagram explain all possible photophysical pathways with their typical lifetimes. | 7 |

SECTION – III

- | | |
|---|----|
| 5. a) Write on photoreduction reactions. | 5 |
| b) Explain ozone decomposition reaction. | 5 |
| c) Estimate the ionic strength of mixture of a solution containing 0.025 m KI, 0.025 m $K_2S_2O_8$ and 0.2 m $MgCl_2$. | 4 |
| 6. a) Illustrate bioenergetics of biochemical reactions. | 5 |
| b) Illustrate the effect of ionic strength on the ionic reactions in solution state. | 5 |
| c) Write on structures of proteins. | 4 |
| 7. Write short notes on any three : | 14 |
| a) Photochemical smog formation | |
| b) Alkali storage batteries | |
| c) Fractional order reaction kinetics | |
| d) Characteristics of exciplex. | |
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M.Sc. – I (Semester – II) Examination, 2015
CHEMISTRY (Old)
Analytical Chemistry – II (Paper – VIII)

Day and Date : Thursday, 23-4-2015

Max. Marks : 70

Time : 11.00 a.m. to 2.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. Answer the following :

14

- a) Name the detectors used in UV-visible spectrophotometer.
- b) What do you mean by base peak ?
- c) Define absorbance.
- d) How will you distinguish between cis and trans 1, 3, 5 Hexatrene by UV ?
- e) Define coupling constant.
- f) Name the different types of atomizers used in AAS.
- g) What is the function of nebulizer in ICP ?
- h) Define spin-spin relaxation.
- i) Which is most abundant peak in benzene ?

P.T.O.



- j) Write the wavelength range of finger print region in IR.
- k) Predict the modes of vibration in ethane molecule.
- l) 1-Phenyl ethanol shows the base peak at m/z 107 due to _____ ion.
- m) Name the factors affecting chemical shift.
- n) What is the nuclear spin value for C^{12} and O^{16} nuclei ?

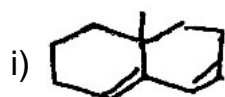
SECTION – II

2. a) Deduce the structure of an organic compound on the basis of following data : **7**
- Molecular Formula : C_7H_7OCl
IR – 3300, 1690, 1600, 1500, 830 cm^{-1}
PMR (ppm) : 2.5 (S, 3H)
 7.3 (d, J = 8Hz, 2H)
 7.9 (d, J = 8Hz, 2H)
Mass (M/z) : 154/156 (3 : 1)
 139/141 (3 : 1)
 111/113 (3 : 1)
- b) Discuss the construction and working of plasma torch. **7**
3. a) Define the term chemical shift. Explain the shielding and deshielding effect. **7**
- b) What is the basic principle of AAS ? Explain the difference types of interference in AAS. **7**
4. a) Explain the effect of following factors on vibrational frequencies in IR spectroscopy. **7**
- b) Explain the fragmentation pattern in t-butyl alcohol and 1-butanol. **7**



SECTION – III

5. a) With the help of Woodward and Fieser's rules Calculate the λ_{\max} values for following compounds. 5



- b) Discuss in brief spin-spin coupling. 5
- c) Explain in brief anisotropic effect. 4
6. a) Explain TMS is used as internal standard in PMR spectroscopy. 5
- b) Give applications of ICP-AES. 5
- c) Describe fragmentation pattern of ethyl benzene. 4
7. Write a notes (**any three**) : 14
- a) Photomultiplier
- b) FT-NMR
- c) McLafferty rearrangements
- d) Applications of IR Spectroscopy.
-



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M.Sc. (Part – II) (Semester – III) Examination, 2015
ORGANIC CHEMISTRY (Paper – IX)
Organic Reaction Mechanism

Day and Date : Wednesday, 15-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- N.B. :** 1) Attempt in **all 5** questions.
2) Section I is **compulsory**.
3) Attempt **any two** questions from Section – II and **any two** from Section – III.
4) Answer to **all** questions should be written in the **same** answer book.
5) **All** questions carry **equal** marks.
6) Use of log-table and calculator is **allowed**.

SECTION – I

1. A) Answer the following : 8
- i) Write the reaction which proceeds through aryne formation.
 - ii) Define the term “stereo selectivity”.
 - iii) Why benzophenone is a good photosensitizer ?
 - iv) Define the term “Non classical carbocations”.
 - v) Enlist any two non-kinetic methods.
 - vi) Name the reaction which involves generation of ketenes from α -diazoketones.
 - vii) What do you mean by photostationary state ?
 - viii) What are ylides ?
- B) State whether **true** or **false** : 3
- i) Owls see very well in dim light but are colour blind.
 - ii) Alkylation of enamines can be carried out by secondary alkyl halides.
 - iii) Barton reaction is intermolecular.

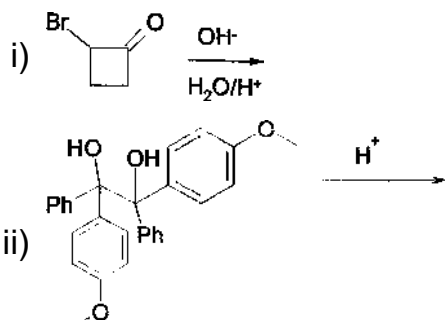
P.T.O.



- C) Select the most correct alternative for **each** of the following : **3**
- i) Chichibabin reaction proceeds through
 - a) hydride ion formation
 - b) H⁺ transfer
 - c) carbocation formation
 - d) carbanion formation
 - ii) Stevens reaction is an example of
 - a) Nitrogen ylides
 - b) Sulphur ylides
 - c) Phosphorus ylides
 - d) Both a and b
 - iii) The heme group found in hemoglobin
 - a) co-ordinates the iron atom in the plane of the heme only when oxygen is bound
 - b) contains a centrally bound Fe (III) atom
 - c) is covalently bound to the molecule
 - d) is held within the central cavity formed between the four hemoglobin subunits

SECTION – II

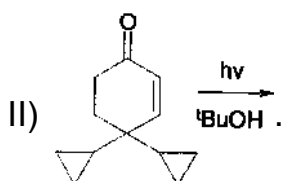
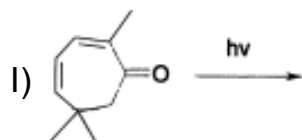
2. a) Describe the following methods used to determine reaction mechanism **7**
- i) Identification of the reaction product
 - ii) Cross-over experiment
 - iii) Isotopic labeling.
- b) Explain the mechanism, stereochemistry, migratory aptitude and applications of following reactions. **7**
- i) Favorskii reaction
 - ii) Baeyer-Villiger reaction.
3. a) Predict the product and justify your prediction : **7**



- b) Explain with suitable examples enantioselectivity and stereoselectivity of alkylation. **7**

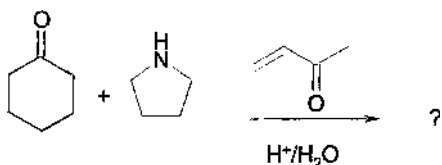


4. a) Answer the following : 7
i) Irradiation of cyclopentanone.
ii) Photoreduction of benzophenone in presence of toluene and 2-propanol.
b) Predict the products and justify your prediction : 7



SECTION – III

5. Explain the mechanism of following :
a) Photochemical reaction of cyclic and acyclic α, β -unsaturated compounds. 5
b) Photorearrangements of 1, 4 and 1, 5-dienes. 5
c) Predict the products and justify your predictions. 4



6. a) Explain synthetic applications of nitrogen ylides. 5
b) Explain in details Hofmann Loafer Fretagreaction. 5
c) Explain the mechanism of oxygen transport by hemoglobin. 4
7. Explain the following (**any three**) : 14
i) Significance of Hammett equations.
ii) Photochemistry of alkynes.
iii) Entropy of activation.
iv) Methods for generation of phosphorous ylides.
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M.Sc. – II (Semester – III) Examination, 2015
ORGANIC CHEMISTRY
Advanced Spectroscopic Methods (Paper – X)

Day and Date : Friday, 17-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

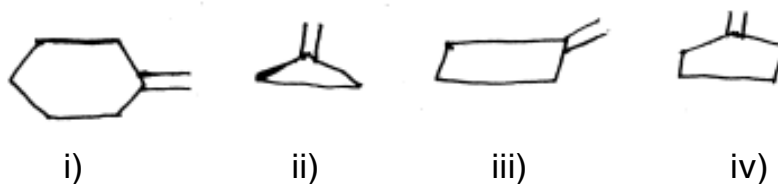
- N.B. :**
- Section I is **compulsory**.
 - Attempt **any two** questions from Section II and **any two** from Section III.
 - Answer to **all** questions (Section I, II and III) should be written in **one** answer book.
 - All** questions carry **equal** marks.
 - Figures to the **right** indicate **full** marks.
 - Use** of log table and calculators is **allowed**.

SECTION – I

1. A) Answer the following :

10

- a) Arrange the following compounds in order to their increasing wave number of absorption due to $>C=C<$ stretching.



- b) Which of the following diatomic molecules don't absorb in the IR region ?

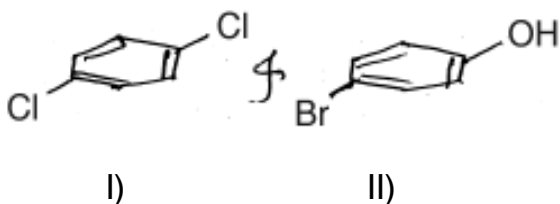
HCl, ClBr, N₂, H₂, O₂

- c) Why methanol is good solvent for UV but not for IR ?
d) What is deshielding of nucleus ?

P.T.O.



- e) How will you explain that the carbonyl stretching frequency of an aldehyde is slightly higher than that of corresponding methyl ketone ?
- f) Predict the number of signals of trans 1,2 Dimethyl cyclopropane in PMR spectroscopy.
- g) How many signals you expect in the proton decoupled ^{13}C spectrum of following compound ?



- h) How many sets of PMR signals are observed in the ethyl methyl ketone ?
- i) What is Nitrogen rule ?
- j) What do you mean by the base peak ?

B) Choose the correct answer :

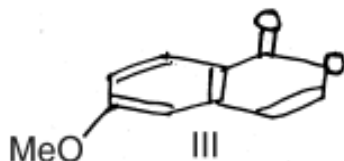
4

- a) HETCOR spectra is used to detect directly bonded :
- | | |
|------------------------------------|-------------------------------------|
| I) $^{13}\text{C} - ^{14}\text{C}$ | II) $^{13}\text{C} - ^{13}\text{C}$ |
| III) $^1\text{H} - ^1\text{H}$ | iv) All |
- b) In proton decoupled CMR spectra of O, M and P-xylenes exhibit signals respectively.
- | | |
|------------|-----------|
| I) 3,4,5 | II) 4,5,3 |
| III) 5,4,3 | IV) 3,5,4 |
- c) The inclusion of any common stable isotopes except O^{18} alters the use of
- | | |
|------------------|------------------------|
| I) Nitrogen rule | II) Ring rule |
| III) Thermospray | IV) Even electron rule |
- d) The actual value of nuclear spin is depends on
- | | |
|----------------------|----------------------|
| I) Mass number | II) Atomic number |
| III) Both I) and II) | IV) Shielding effect |



SECTION – II

2. A) The NMR spectrum of compound III shows the following signals. Assign signals of the different protons. Comment on chemical shift and coupling constant. **7**

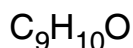


- 3.8 (6 mm, S)
- 6.3 (2 mm, d, J = 10 Hz)
- 6.7 (2 mm, d, J = 2 Hz)
- 6.9 (2 mm, dd, J = 8, 2 Hz)
- 7.3 (2 mm, d, J = 10 Hz)
- 8.1 (2 mm, d, J = 8 Hz).

- B) Acetone on reaction with a base forms a product having molecular formula $C_6H_{12}O_2$ which shows following signals. Deduce it's structure 1.26 (6H, S), 2.2 (3H, S), 2.65 (2H, S), 3.9 (1H, S), exchanges with D_2O . **7**
3. A) Explain different modes of fragmentation in mass spectroscopy. **7**
- B) Explain Anisotropy effect in PMR and CMR spectroscopic techniques. **7**
4. A) Explain spin-spin coupling and coupling constant by using Karplus curve. **7**
- B) Explain desorption ionisation techniques (FAB & MALDI). **7**

SECTION – III

5. A) What is chemical shift explain factors affecting on chemical shift. **5**
- B) Deduce the structure of organic compound by using spectroscopic data molecular formula : **5**



UV : $\lambda_{max} = 235 \text{ nm}$

IR : 680, 730, 1715 cm^{-1} .

PMR : 2.1 (S), 6 mm; 3.7 (S), 4 mm ; 7.20 (m), 10 mm

CMR: 30, 50, 126, 128, 130, 135, 200

Mass : $m/z = 134, 91, 43$.



- C) Find out the structure for molecular formula C_5H_6O : 4
UV : 220 nm ($\epsilon = 4000$)
IR : 1600, 1500, 780, cm^{-1}
 1H NMR : 2.3 (s, 18 mm), 5.85 (d, $J = 2H_2$, 6 mm);
6.2 (dd, $J = 1.5, 2.0H_2$, 6 mm)
7.2 (d, $J = 1.5H_2$, 6 mm)
6. A) Explain chemical and magnetical equivalence phenomenon in NMR 5
spectroscopy.
- B) What is ortho effect ? Explain with suitable example. 5
- C) Explain distereotopic proton with suitable example and its signals in NMR 4
technique.
7. Write short notes on **(any three)** : 14
- A) AB_2 , AX_2 and $A_2 B_2$ spin system in NMR.
- B) HETCOR technique of 2D-NMR.
- C) Mass spectral fragmentation of amines.
- D) McLafferty rearrangement.
-



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M.Sc. (Part – II) (Semester – III) Examination, 2015
ORGANIC CHEMISTRY (Paper – XII)
Drugs and Heterocycles

Day and Date : Wednesday, 22-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- N.B. :** 1) Attempt in **all five** questions.
2) Section – I (Question **one**) is **compulsory**.
3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
4) Answer to **all 5** questions (from Section – I, II, III) should be written in the **one** and the **same** answer book.
5) **All** the questions carry **equal** marks.
6) Figures to the **right** indicate **full** marks.

SECTION – I

1. a) Draw the structure of the following drugs 7
- i) Oxyphenbutazone
 - ii) Fenediazole
 - iii) Trimeprazine
 - iv) Oxyperanone
 - v) Merpyridine
 - vi) Tetracycline
 - vii) Zidovudine.
- b) Predict the product(s) of the following reactions 7
- i) Ethylacetoacetate + Aniline \longrightarrow ?
 - ii) Ethylacetoacetate + α -chloroacetophenone + Ammonia \longrightarrow ?
 - iii) Ethylacetoacetate + Phenacylbromide \longrightarrow ?
 - iv) Phenylhydrazine amine + acetophenone \longrightarrow ?
 - v) O-nitrotoulene + dimethyl oxalate \longrightarrow ?
 - vi) Pyridine-N-oxide + Oleum \longrightarrow ?
 - vii) Pyrrole + Chloroform \longrightarrow ?

P.T.O.



SECTION – II

2. a) What are antibiotics ? Discuss synthesis and use of penicillin. 7
b) What are antimalerials ? Explain synthesis and mechanism of Trimethoprim. 7
3. a) What are analgesic and antipyretics ? Outline synthesis of Paracetamol. 7
b) What are anti-inflammatory drugs ? Discuss the synthesis and mechanism of action of Indomethacin. 7
4. a) Why Tuberculosis is infectious disease. Comment on synthesis and mechanism of action and application of isoniazide. 7
b) Write note on **any two** :
1) Diazepam
2) Quinidine
3) Diclofenac. 7

SECTION – III

5. a) Describe the synthesis of Benzo-furan and medicinal applications of Benzo-furan. 5
b) Discuss the Skarp-Quinoline synthesis. 5
c) Outline the synthesis of isoquinoline. 4
6. a) Give the synthesis of oxazole from α -acyloamine ketone and suggest the Mechanism of reaction. 5
b) Describe synthesis of purine derivatives by different methods with mechanism. 5
c) Give the synthesis of Azitidine. 4
7. Write a notes on (**any three**) : 14
1) Thiazoles
2) Pyrimidine
3) Indole
4) Imidazole.
-



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M.Sc. – II (Semester – IV) Examination, 2015
ORGANIC CHEMISTRY
Theoretical Organic Chemistry (Paper – XIII)

Day and Date : Thursday, 16-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

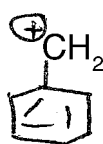
- Instructions :** 1) Attempt in **all 5** questions.
2) Section – I is **compulsory**.
3) Attempt **any two** questions from Section – II and **any two** from Section – III.
4) Answer to **all** questions (Section – I, II and III) should be written in the **one** answer book.
5) **All** questions carry **equal** marks.
6) Figures to the **right** indicate **full** marks.

SECTION – I

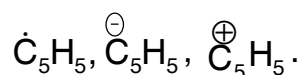
1. A) Answer the following :

7

- i) Calculate the charge density in the following :



- ii) Draw the structure of [18] annulene. Is it aromatic ?
iii) Draw the HOMO and LUMO of 1,3 butadiene.
iv) Explain the term Catenane and Rotananes.
v) How crown ether acts as a phase transfer catalyst ?
vi) Which of the following is most stable :

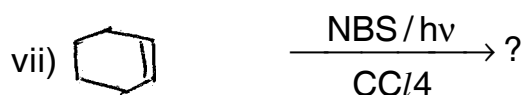
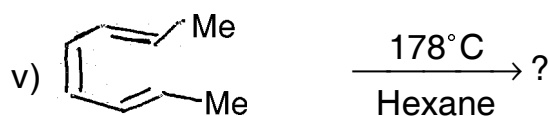
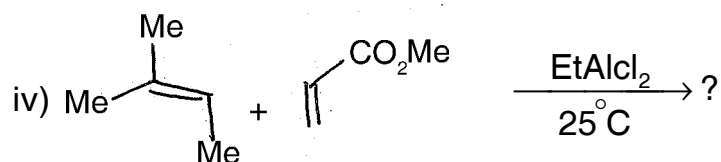
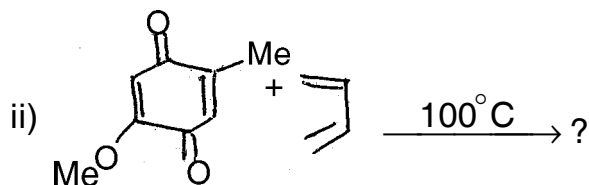
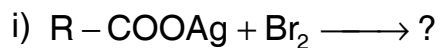


- vii) What are chelotropic reactions ?



B) Predict the products :

7



SECTION – II

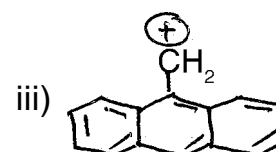
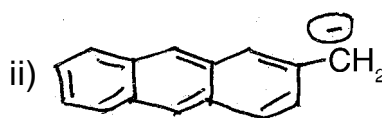
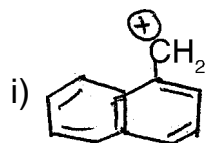
2. a) Calculate Huckel's delocalisation energy in the following molecules and write its stability order :

7



b) Determine the charge density in the following :

7

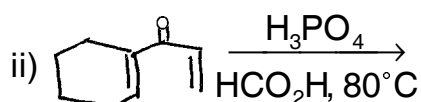
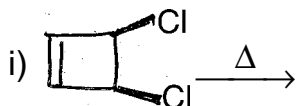




3. a) Explain the aromatic nature, various synthetic methods and chemical reactions of tropone and tropolone. 7
b) What are crown ether complexes? Explain its role in organic synthesis. 7
4. a) Explain the Claisen, Cope and Aza-Cope sigmatropic rearrangement with mechanism. 7
b) Explain the kinetic and thermodynamic control in : 7
i) Friedel-Crafts
ii) Sulphonation of Naphthalene.

SECTION – III

5. a) Explain neighbouring group assistance in free radical reactions. 5
b) Discuss stereochemistry in Diels-Alder reactions. 5
c) Explain [2 + 2] additions of ketene. 4
6. a) Explain Woodward-Hoffmann rule for electrocyclic reactions with any one suitable example. 5
b) Write the necessary selection rule and give stereochemistry of the products that you would expect from each of the following pericyclic reactions : 5



- c) Explain the acid catalysed hydrolysis of esters with suitable examples. 4
7. Write short notes on **any three** : 14
a) Ferrocene
b) Autooxidation
c) Group transfer reactions
d) PMO theory.
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Seat No.	
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M.Sc. – II (Semester – IV) Examination, 2015
ORGANIC CHEMISTRY
Stereochemistry (Paper – XIV)

Day and Date : Saturday, 18-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

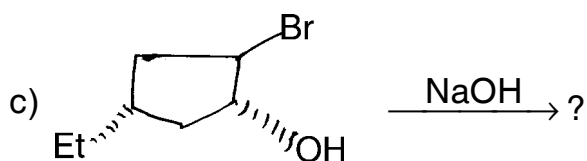
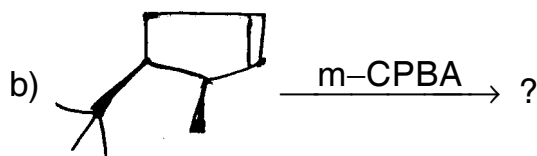
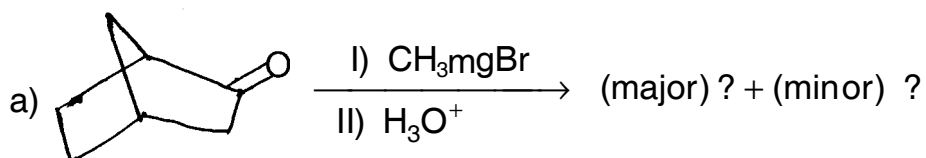
- N. B. :** i) Section – I is **compulsory**.
ii) Attempt **any two** questions from Section – II and **any two** from section – III.
iii) Answer to **all** questions (Section I, II, III) should be written in **one** answer book.
iv) **All** questions carry **equal** marks.
v) Figures to the right indicate full marks.
vi) **Use** of log tables and calculators is **allowed**.

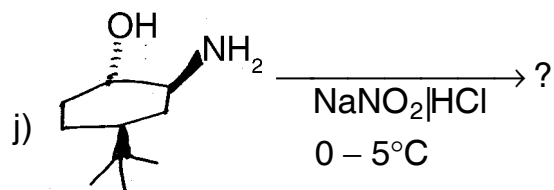
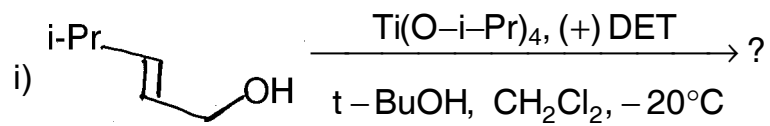
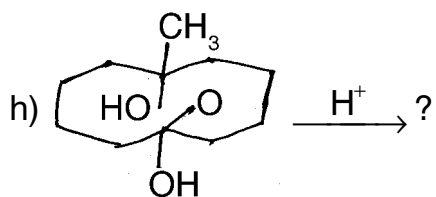
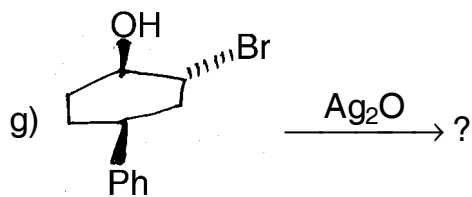
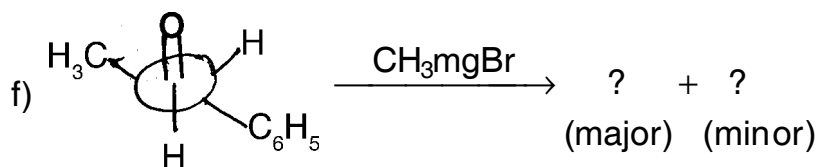
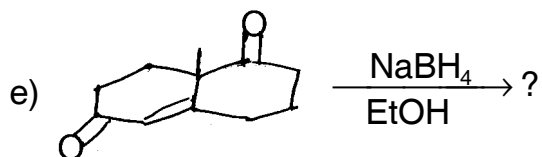
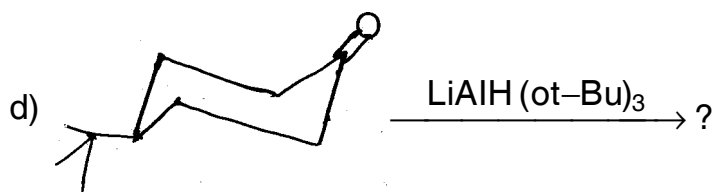
SECTION – I

1. Answer the following :

A) Predict the product with appropriate stereochemistry :

10

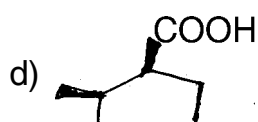
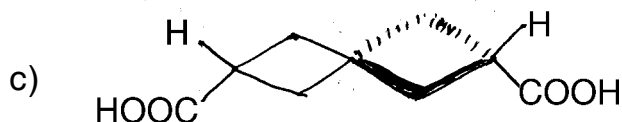
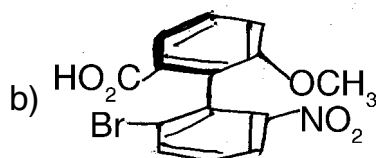






B) Assign R/S configuration to the following :

4



SECTION – II

2. A) Discuss the effect of conformation on chemical reactivity in cyclohexane derivative with respect to 7
- i) Elimination reaction
 - ii) NGP.
- B) Draw the structure of different distereomeric forms of perhydroanthracene and explain their stability. 7
3. A) Draw the conformations of cis|trans 9-methyl decalins and comment on their stability and optical activity. 7
- B) What are stereoselective reactions ? Explain distereoselective synthesis with suitable example. 7
4. A) Describe the methods for determination of configuration in ring system. 7
- B) What is stereospecific reaction ? Explain why addition of bromine to z or E-butene is stereospecific reaction ? 7



SECTION – III

5. A) Explain the terms homotopic, enantiotopic and distereotopic groups and faces. **5**
B) Explain stability of ring as a function of ring size and nature of ring. **5**
C) Explain why thermodynamically less stable endo product is more preferred over exo in Diel's-Alder reaction. **4**
6. A) What are the applications of Cram's rule ? **5**
B) What is Bredts rule ? Explain stereochemical restrictions in ring system. **5**
c) Explain the conformations of 5, 7 and 8 membered ring. **4**
7. Write short notes on (**any three**) : **14**
a) Concept of I-strain
b) Felkin-Ahn model
c) Sharpless Epoxidation
d) Optical purity-Enantiomeric excess.
-



Seat No.	
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M.Sc. II (Semester – IV) Examination, 2015
ORGANIC CHEMISTRY
Chemistry of Natural Products (Paper – XV)

Day and Date : Tuesday, 21-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions:**
- 1) Attempt in **all 5** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section-II and **any two** questions from Section-III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in **one** answerbook.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. A) Answer the following :

5

- i) Name the precursor involved in biosynthesis of cholesterol.
- ii) Draw the structure of morphine and give its medicinal uses.
- iii) Phenylalanine is biosynthesized through which pathway ?
- iv) Citral belongs to which class of terpenoid ?
- v) Which compound is used for biosynthesis of ephedrine ?

P.T.O.



- B) Fill in the blanks : 5
- i) Podophyllotoxin bears _____ chiral centres.
 - ii) Strychnine is an _____ of the glycine receptor.
 - iii) Atropine is _____ type of alkaloid.
 - iv) Reserpine is the main constituent of _____ species.
 - v) Zingiberene is isolated from _____
- C) Match the pairs : 4
- | | |
|-------------------|---------------------------------------|
| i) Camptothecin | a) Antipsychotic and antihypertensive |
| ii) Phenylalanine | b) Antiasthmatic and stimulant |
| iii) Reserpine | c) Anticancer |
| iv) Ephedrine | d) Flavonoid biosynthesis |

SECTION – II

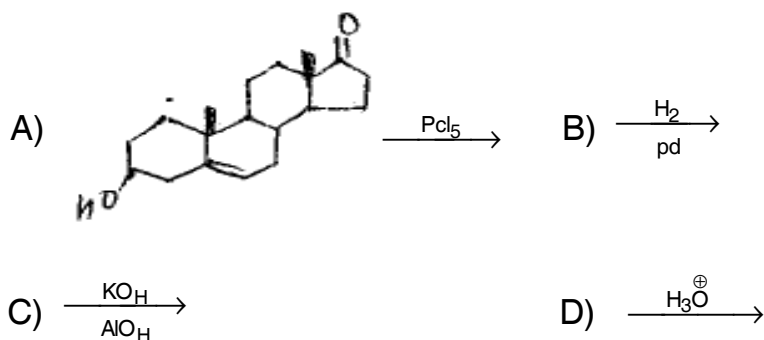
2. A) Explain the biosynthesis of strychnine using tryptophan as precursor. 7
- B) Write down biosynthesis of coumarines from cinnamic acid. 7
3. A) What is isoprene unit ? Give the classification of terpenoids with examples. 7
- B) Explain the stereochemistry of following in reserpine : 7
- i) D/E ring junction
 - ii) Configuration at C₃ and C₁₇.
4. A) Describe the size and nature of sulphur containing ring in biotin. 7
- B) Explain the position of methyl groups in santonin. 7

SECTION – III

5. A) Describe the number and nature of double bonds in zingiberene. 5
- B) Write down the Karrer et.al. synthesis of Riboflavin. 5
- C) Write down synthesis of cholesterol from lanosterol. 4



6. A) Describe mode of action of camptathecine. 5
B) Write down biosynthesis of morphine from tyrosine. 5
C) Identify A, B, C and D in following. 4



7. Write a short note on **(any three)** : 14
- a) Squalene to lanosterol.
 - b) Synthesis of progesterone from diosgenin.
 - c) Structure of Yobyrine.
 - d) Biological role of vitamin B₆ in transamination.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
ORGANIC CHEMISTRY
Applied Organic Chemistry (Paper – XVI)

Day and Date : Thursday, 23-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions:** 1) Attempt in **all five** questions.
2) Section – I (question **one**) is **compulsory**.
3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
4) Answer to **all five** questions (From Section – I, II, III) should be written in the **one** and the **same** answer book.
5) **All** the questions carry **equal** marks.
6) Figures to the **right** indicate **full** marks.

SECTION – I

1. a) Define the terms of the following : 5
- i) Mutarotation
 - ii) Anomers
 - iii) Multicomponent synthesis
 - iv) Ionic liquid
 - v) Disaccharides.
- b) Draw the structures of the following compounds : 9
- i) [BMIM] PF₆
 - ii) Dibenzo [18] crown-6
 - iii) Cyclodextrins
 - iv) Calixarene
 - v) α -D-glucopyranose
 - vi) β -D-glucofuranose
 - vii) D-Ribulose
 - viii) D-Mannose
 - ix) Methyl α -D-glycoside.



SECTION – II

2. a) What is solid phase synthesis ? Explain the menifield resin is used in solid phase synthesis of polypeptide. 7
- b) What is atom economy in green chemistry ? Explain the concept of atom economy with different green reactions. 7
3. a) What are enzymes ? Explain their enzymatic oxidation reactions. 7
- b) What are crown ethers ? Explain the role of crown ethers in organic synthesis. 7
4. a) Why water is used for organic reactions in green chemistry ? Describe the different aqueous phase reactions with suitable examples. 7
- b) Write note on the following : 7
- i) Microwave assisted reactions
- ii) Supramolecular chemistry.

SECTION – III

5. a) Why β -form of glucose is more stable than the α -form ? Explain with the help of α and β -confirmations of glucose. 5
- b) Discuss the D and L configuration with suitable examples. 5
- c) What are the objections to open chain structure of D-glucose. 4
6. a) What is the size of the oxide ring in glucose ? How is it proved by periodic acid method ? 5
- b) What are carbohydrates ? How they are classified ? 5
- c) What happens when glucose is treated with :
- i) Acetic anhydride
- ii) Conc. HNO_3 . 4
7. Write note on (**any three**) : 14
- a) Anomeric effect
- b) Kiliani-Fischer synthesis
- c) Glycoside
- d) Tollens reagent.
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Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
INDUSTRIAL CHEMISTRY (Paper – IX)
Unit Operations of Chemical Engineering

Day and Date : Wednesday, 15-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all 5** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the right indicate **full** marks.
 - 7) **Use** of log tables or calculators is **allowed**.

SECTION – I

1. Compulsory (**one** mark **each**) :

14

- i) Suggest an evaporator for non-viscous solutions without scale formation.
- ii) What is a parallel current condenser ?
- iii) Define flash or equilibrium distillation.
- iv) Define boiling point of a liquid.
- v) Give an example of extraction with agitation.
- vi) Dragg classifiers are used to leach _____ solids.
- vii) What is the significance of filter aids ?
- viii) What is the advantage of plate and frame press over chamber press ?
- ix) For what purpose Trommels are used ?



- x) What is the use of cyclones ?
- xi) The separation of solids from a suspension in a liquid by means of a porous medium is called _____
- xii) Define Raoult's law.
- xiii) Mention the first stage of crystallization.
- xiv) Mention any one significance of drying.

SECTION – II

- 2. a) Describe with a neat diagram working of vertical tube evaporator. 7
- b) Discuss the working of bubble cap and valve plate columns in distillation with neat sketch. 7
- 3. a) Describe the working of basket type extractor with a neat sketch. 7
- b) Describe the working of agitated batch crystallizer. 7
- 4. a) Discuss the classification of filters and explain the working of sand filter. 7
- b) Explain with neat diagrams what are parallel and surface current condensers. 7

SECTION – III

- 5. a) Explain the working and advantages of Nutsche filter. 5
 - b) Explain the working of tunnel dryer. 5
 - c) Discuss the characteristics of a good tower packing for gas absorption. 4
 - 6. a) Describe the working of Swenson Walker crystallizer with a neat sketch. 5
 - b) Explain the construction and working of a simple magnetic separator. 5
 - c) Discuss the advantages and disadvantages of filter press. 4
 - 7. Write notes on **any three** : 14
 - a) Factors affecting evaporation.
 - b) Use of vapour liquid equilibrium diagrams in distillation.
 - c) Counter current extraction.
 - d) Determination of moisture of solids.
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M.Sc. II (Semester – III) Examination, 2015
INDUSTRIAL CHEMISTRY
Unit Processes in Chemical Technology (Paper – X)

Day and Date : Friday, 17-4-2015

Max. Marks : 70

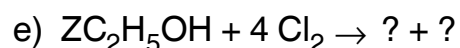
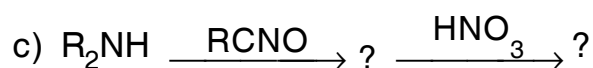
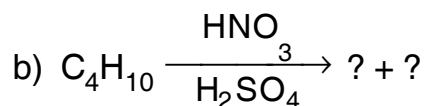
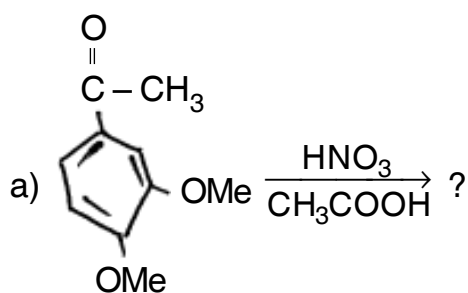
Time : 3.00 p.m. to 6.00 p.m.

- Instructions:** 1) Attempt 5 questions.
2) Section I is **compulsory**.
3) Attempt **any two** questions from Section II and **any two** from Section III.
4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
5) **All** questions carry **equal** marks.
6) Figures to the **right** indicate **full** marks.

SECTION – I

1. Answer the following.

14



P.T.O.



- g) Naphthalene $\xrightarrow[165^\circ\text{C}]{\text{H}_2\text{SO}_4}$?
- h) $2 \text{CH}_3\text{CH}_2\text{SH} \xrightarrow{\text{Oxidation}}$?
- i) $\text{CH}_3\text{OH} + \text{CO} \xrightarrow{\text{BF}_3}$?
- j) What are polymerization techniques ?
- k) What is meant by photohalogenation ?
- l) $(\text{CH}_3\text{CO})_2\text{O} + (\text{CH}_3)_3\text{COH} \xrightarrow{\text{H}_2\text{SO}_4}$? + ?
- m) $\text{CH}_2 = \text{CO} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{BF}_3}$?
- n) $\text{CH}_3\text{CHO} + 3\text{Cl}_2 \rightarrow$?

SECTION – II

2. a) What is nitration ? Explain with suitable examples the nitration of paraffinic hydrocarbons. 7
- b) Give an account of liquid phase oxidation with oxidizing compounds. 7
3. a) How is cellulose acetate manufactured ? What are its applications ? 7
- b) Explain in brief kinetics and mechanism of halogenation reactions. 7
4. a) Describe the manufacturing process of chloral. Give its properties and uses. 7
- b) With a well labelled diagram describe the Schmid nitrator and Biazzi nitrator. 7

SECTION – III

5. a) How is nitrobenzene manufactured ? 5
- b) How is epoxy resins prepared ? What are its properties and applications ? 5
- c) Describe in brief oxynitration. 4



6. a) Discuss the mechanism of aromatic sulfonation. **5**
- b) Discuss the manufacturing process of monochloro benzene. **5**
- c) What are unit processes ? **4**
7. Write notes (**any three**). **14**
- a) Vinyl chloride.
- b) Polystyrene.
- c) Oxidation of methanol.
- d) Nitrate esters.
-



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M.Sc. (Part – II) (Semester – III) Examination, 2015
INDUSTRIAL CHEMISTRY
Pollution Monitoring and Control (Paper – XI)

Day and Date : Monday, 20-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section – I is **compulsory**.
 - 3) **All** questions carry **equal** marks.
 - 4) Answer to the **all** questions (Section – I, II, III) should be written in the **same** answer book.
 - 5) Figure to the **right** indicate **marks**.
 - 6) Attempt at least **two** questions from Section – II and **any two** questions from Section – III.
 - 7) **Use of log table and calculator is allowed.**

SECTION – I

1. Answer the following :
- a) What is the purpose of legal standards ?
 - b) Write the full form of the following :
NDIR, VOC and POC.
 - c) What are the end products of microbial degradation of organic wastes ?
 - d) What are the environmental legislations ?
 - e) Define the term of COD.
 - f) What is the Monitoring ?
 - g) Which method used for the analysis of atmospheric SO_2 ?
 - h) Which instrument techniques are used for the analysis of particulate matter ?
 - i) Name some important sources of chromium, mercury and cadmium metals in the environment.
 - j) What is BOD ?
 - k) A Neutron Activation Analysis (NAA) is a non-destructive technique of analysis based on the measurement of _____ property of element.
 - l) Exposure to Volatile Organic Chemicals (VOC's) can cause _____ diseases.
 - m) What are the sources of Mercury (Hg) in the environment ?
 - n) Physical pollution of water causes changes in _____

14



SECTION – II

2. a) Discuss the powers and functions of Central Control Board (CPCB) regarding prevention and control of water pollution. 7
- b) Which ingredients are covered in the statutory definition of air pollution ? Give the constitutions of Central Pollution Control Boards (CPCB) and State Pollution Control Board (SPCB). 7
3. a) Explain the power and function of Central Pollution Control Board (CPCB) prescribed in the air (Prevention and Control of Pollution) Act – 1981. 7
- b) Describe the separation of solid particulate matter from gaseous stream fabric filters. 7
4. a) Discuss the various toxic emission given out by oil refineries and synthetic fibre industries. What are their impacts on the environment ? 7
- b) Differentiated between BOD and COD. Explain the determination of COD. 7

SECTION – III

5. a) How does micro-organism are effective in decomposition of organic waste in effluent water ? Explain 'activated sludge process'. 5
- b) Give the tolerance limit for industrial effluent discharge as per IS-2490 and IS-3360. 5
- c) Explain the plan of action for prevention and control of water pollution in sugar industry. 4
6. a) How does electrochemical techniques helpful in assessment of pollutional level in the environmental ? Explain the analysis of SO_2 . 5
- b) Explain monitoring and analysis of Carbon Monoxide (CO) and Carbon Dioxide (CO_2). 5
- c) Explain the recovery of chromium and copper from waste water generated by electroplating industry. 4
7. Write short note on **any three** of the following : 14
- a) Chloro-alkali industry and mercury pollution.
- b) Biological methods of waste water treatment.
- c) Analysis of SO_4^{2-} and PO_4^{3-}
- d) Nature of industrial effluents.
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M.Sc. (Part – II) (Semester – III) Examination, 2015
INDUSTRIAL CHEMISTRY
Advanced Topics in Industrial Chemistry (Paper – XII)

Day and Date : Wednesday, 22-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.

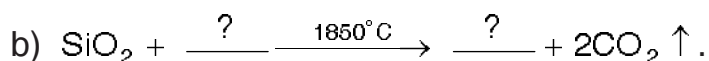
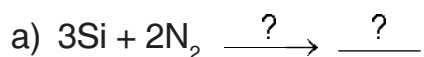
SECTION – I

1. Answer the following : 14
- i) Which internal solution is used to detect SO_2 in analyte solution in gas sensing electrode ?
 - ii) What are the various technique used for the fabrication of germanium nanocrystals ?
 - iii) What is flow work ?
 - iv) Which Ionic conductor is called as Tagushi gas sensor ?
 - v) What is meant by Elastic limit ?
 - vi) What is cold plasma ?
 - vii) What is meant by differential material balance ?
 - viii) Which compounds of silicon are extremely hard, chemically inert, corrosion resistant and used as best engineering material ?

P.T.O.



- ix) What are the various technique used for development of CuCl nanocrystal ?
- x) Write the expression for nucleation rate.
- xi) What is meant by stress and strain ?
- xii) Which solid crystal membrane is employed for the analysis of fluoride ion in analyte solution ?
- xiii) Which ionic conductor is employed as flue gas monitoring sensor ?
- xiv) Complete the following reaction .



SECTION – II

- 2. a) Explain in detail the process involved in the chemical vapour deposition CVD. 7
- b) What is Ion selective membrane electrode ? Explain PH sensor. 7
- 3. a) A mixture containing 45% Benzene(B) and 55% toluene(T) by mass is fed to a distillation coloumn. An overhead stream of 95% B is produced and 8% of the benzene fed to the coloumn leaves in the bottom stream. The feed rate is 2000 Kg/hr. Determine the overhead flow rate and the mass flow rates of benzene and toluene in the bottom stream. 7
- b) Explain in detail the process of spray pyrolysis, hydrothermal synthesis. 7
- 4. a) Describe the preparation and uses of silicon carbide and silicon hydride. 7
- b) Discuss the elastic and rupture behaviour of metallic material with the help of stress-strain curve. 7

SECTION – III

- 5. a) Explain various types of reactor used in chemical industry. 5
- b) Explain the growth of semiconductor nanocrystal in organic solution and polymer. 5
- c) Explain in detail crystalline membrane electrode. 4



6. a) How is semiconductor grade silicon prepared ? 5
- b) Describe the fabrication of Nanocrystals in porous glasses. 5
- c) Discuss in brief the electrical properties of material. 4
7. Write short notes on **any three** : 14
- i) Recycle and bypass.
- ii) Photoenhanced CVD method for the preparation of special material.
- iii) Flame fusion method of single crystal growth from melt.
- iv) Nanocrystals in inorganic matrices.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INDUSTRIAL CHEMISTRY (Paper – XIV)
Inorganic Chemical Industries

Day and Date : Saturday, 18-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions:**
- 1) Attempt in **all 05** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculators is **allowed**.

SECTION – I

1. Answer the following sub questions : (2×7=14)
- a) Name the two ores of iron.
 - b) What is the role of cryolite in the extraction of aluminum ?
 - c) Reduction of Al_2O_3 by carbon is not possible at higher temperature, why ?
 - d) Which constituent is responsible for ultimate strength of the cement ?
 - e) What is clay ?
 - f) What are the reducing agents used in manufacture of glass ?
 - g) Mention the two uses of brass alloy in electrical industry.



SECTION – II

2. A) How is ferrous sulphate prepared ? Discuss the industrial application of manganese dioxide and aluminum chloride. 7
- B) What are the properties and application of zinc oxide and titanium oxide ? 7
3. A) What do you mean by Ellingham diagram ? Explain the oxide metallurgy on the basis of Ellingham diagram. 7
- B) What are the basic raw materials required for glass ? Discuss the manufacture of glasses. How are the colored glasses prepared ? 7
4. A) What is portland cement ? Give its composition. Mention the types of Portland cement. Explain its properties and applications. 7
- B) How does titanium occur in nature ? Explain the separation method of titanium oxide or chloride from its mineral. Give its uses. 7

SECTION – III

5. A) How does zinc occur in nature ? Describe the different oxide processes used for the reduction of zinc oxide. 5
- B) What do you mean by alloy ? Give the purpose of making alloys. Discuss the important uses of various alloys in electronic and electric industries. 5
- C) What is lime ? What are the deposits of lime in India ? How is it extracted from earth crust ? Give the uses of lime and alumina. 4
6. A) How is sodium silicate prepared ? Discuss the industrial application of manganese dioxide. 5
- B) Define the term clay. How is the plasticity of clay increased ? Explain the functions of silica in clay. 5
- C) What is metallurgy ? How ores are normally purified and enriched by chemical methods ? 4
7. Write short notes on **any three** of the following : 14
- a) Copper alloys
 - b) Position of inorganic industries in India
 - c) Kilns
 - d) Ferrites.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INDUSTRIAL CHEMISTRY
Methods of Analysis in Industries (Paper – XV)

Day and Date : Tuesday, 21-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all 5** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** from Section – III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.

SECTION – I

1. Solve the following :

14

- i) Give the significance of digestion process in gravimetry.
- ii) State whether “Complexometric EDTA titrations are pH dependent”.
- iii) Which condition the analyte ion should possess when being titrated in redox titrations ?
- iv) Why analysis of raw materials in chemical industries is essential ?
- v) What is the role of chromatography in the analysis of product ?
- vi) What is standard solution ?
- vii) Give the reactions involved gravimetric estimation of Fe.
- viii) TGA curve is a plot of _____ versus _____. (Fill in the blank)
- ix) What is scintillation process in Scintillation Counter ?
- x) What is Curie temperature ?

P.T.O.



- xi) Name the ions used as probe in Ion Scattering Spectrometer.
- xii) Define binding energy of an electron.
- xiii) State whether beam of energetic electrons or beam of X-ray photon is used in Auger Electron Spectrometer.
- xiv) Define the term water equivalence of Bomb Calorimeter.

SECTION – II

- 2. a) Describe TGA instrument with typical schematic diagram. 7
- b) Explain determination of specific heat and heat of reaction by using DTA. 7
- 3. a) Describe working of diagram of Secondary Ion Mass Spectrometer with suitable schematic diagram. 7
- b) Discuss chemical shift and its significance in ESCA. 7
- 4. a) State and explain radioactive decay law and define half life of radioactive material. 7
 A sample of radioactive ^{133}I gave with a G.M. counter 3150 counts per minute at a certain time and 3055 counts per minute exactly one hour later. Calculate the half life period of ^{133}I .
- b) Discuss importance of electrochemical methods of analysis in chemical industries. 7

SECTION – III

- 5. a) Describe estimation of zinc ion from its solution by gravimetry method. 5
- b) Give a brief account of complexometric titrations. 5
- c) Describe colorimetric method of estimation of sulphadiazine. 4
- 6. a) Discuss use of Orsat apparatus in analysis of gases. 5
- b) Give a brief comment on ultimate and proximate methods of analysis of coal. 5
- c) What is heat of combustion ? How it is determined by Bomb Calorimeter ? 4
- 7. Write notes on **any three** of the following. 14
 - a) Theory of Acid-Base titrations.
 - b) Neutron activation analysis.
 - c) Effluent monitoring and control in Chemical Industries.
 - d) Factors affecting TGA analysis.
 - e) Applications of Ion Scattering Spectrometer.



Seat No.	
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M.Sc. – II (Semester – III) Examination, 2015
POLYMER CHEMISTRY
Paper – IX : Fundamentals of Feedstocks and Polymers

Day and Date : Wednesday, 15-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- i) Attempt **five** questions.
 - ii) Section I (question 1) is **compulsory**.
 - iii) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - iv) Answers to **all 05** questions (from Section I, II, III) should be written in the **one** and the **same** answer book.
 - v) **All** questions carry **equal** marks.
 - vi) Figures to the **right** indicate **full** marks.
 - vii) **Use** of log tables and calculators is **allowed**.

SECTION – I

1.
 - i) Define the “CMC” in emulsion Polymerisation. 14
 - ii) Write the IUPAC names of Polymer PMA and PET.
 - iii) How the separation of water from crude oil is carried out ?
 - iv) Give the order of Knocking.
 - v) Which is the main use of PAN and why its development banned for food packing by FDA ?
 - vi) State the various ways to improve the brittleness of PS.
 - vii) What is autoacceleration in bulk Polymerisation ?

SECTION – II

2.
 - a) Explain the CNSL as a raw material for various classes of Polymers. 7
 - b) Discuss the batch, semi batch and continuous processes. 7



3. a) Why it is necessary to improve antiknocking characteristics of fuel ? Explain the various ways used for improvement. **7**
- b) Describe the manufacturing of polystyrene by various methods. Give its properties and applications. **7**
4. a) Discuss the systematic structure based (IUPAC) nomenclature with suitable examples. **7**
- b) Explain the synthesis properties and application of poly(formaldehyde). **7**

SECTION – III

5. a) Give and account on classification of polymers with suitable examples. **5**
- b) Discuss the use of toluene as resource for chemicals and polymers. **5**
- c) Explain the manufacturing and properties of PP. **4**
6. a) Describe the structure, properties of PVC and explain its manufacturing by suspension polymerization. **5**
- b) Discuss the phase transfer catalyzed interfacial polymerisation method. **5**
- c) Explain the use of acetylene as building block towards polymer industry. **4**
7. Write short notes of **(any three)** : **14**
- a) Solid state polymerisation.
- b) Catalytic cracking.
- c) Polymer nomenclature based on trade name.
- d) Use of butane/butene and butadiene as chemicals and polymers.
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M.Sc. (Part – II) (Sem. – III) Examination, 2015
POLYMER CHEMISTRY
Paper – X : Morphology and Physical Chemistry of Polymers

Day and Date : Friday, 17-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) Section – I (question **one**) is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) Answer to **all 5** questions (Section – I, II, III) should be written in the **one** and the **same** answer book.
 - 5) **All** the questions carry **equal** marks.
 - 6) Figure to the **right** indicates **full** marks.
 - 7) **Use** of the log tables and calculators is **allowed**.

SECTION – I

Answer **all** questions.

(7×2=14)

1. I) Name any four methods by which you can determine Mn.
- II) Polymer single crystals are composed of _____
- III) Oxidative degradation is caused by
 - a) Free Radical formation
 - b) Ion pair formation
 - c) Charge conjugation
 - d) Cooling of polymers
- IV) Above the glass transition temperature, the polymer will be
 - a) Flexible
 - b) Opaque
 - c) Glassy
 - d) None of the above
- V) Polymer dissolution is a slow process because
 - a) Free molecules
 - b) Molecular entanglement
 - c) Weaker intermolecular forces
 - d) None of the above
- VI) Photodegradation is caused by
 - a) Infrared Radiation
 - b) Cosmic Radiation
 - c) U. V. Radiation
 - d) None of the above

P.T.O.



- VII) In DSC instrument, the measurements are
- Heat capacity with temperature
 - Thermal expansion with temperature
 - Change in mass with temperature
 - None of the above

SECTION – II

Answer **any two** of the following :

- Describe a MMD curve. Write the order of different average molecular weights. 7
 - How are polymer single crystals formed and observed ? 7
- Explain the thermal degradation of polymers. How it is taken care ? 7
 - With a neat diagram, describe a dilatometer. How is it used to determine T_g ? 7
- What is GPC ? How do you determine the different molecular weights using this ? 7
 - How XRD is useful for polymers ? Explain with some examples. What are the different methods used for polymers ? 7

SECTION – III

Answer **any two** of the following.

- Explain the different factors affecting T_g of polymers. 5
 - Explain the Ultrasonic degradation of polymers. 5
 - Describe a typical molecular Mass distribution curve. What is its importance ? 4
- Describe a DSC instrument and a DSC curve of a partially crystalline polymer. 5
 - Explain the Krigbaun-Flory theory for polymer solutions. 5
 - Explain the oxidative degradation of rubber. 4
- Write short notes on **any three** of the following : 14
 - Ubbelohde viscometer and molecular weight determination
 - Solubility parameter of polymers and its importance
 - Uperturbed dimensions
 - Mechanical degradation of polymers.



Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
POLYMER CHEMISTRY
Paper – XI : Basic Concept of Polymerization

Day and Date : Monday, 20-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I (question **one**) is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answer to **all 5** questions (Section I, II, III) should be written in the **one** and the **same** answer book.
 - 5) **All** the questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of the log tables and calculators is **allowed**.

SECTION – I

1. Answer the following questions.

14

Indicate **true** or **false** :

- i) In radical chain polymerization, long reaction time give high yield but molecular weight changes little. T/F
- ii) In LRP, the concentration of the dormant species is higher than the concentration of propagating chains. T/F
- iii) In LRP, the \overline{DP} is given by the ratio of concentration of monomer to the concentration of initiator. T/F
- iv) The higher the viscosity of reaction medium, higher will be the value of f (initiator efficiency). T/F
- v) Acrylonitrile can be polymerized by cationic chain polymerization. T/F
- vi) ROP shows characteristics of both, step-growth and chain-growth polymerization. T/F
- vii) Cationic chain polymerizations proceed without termination. T/F

P.T.O.

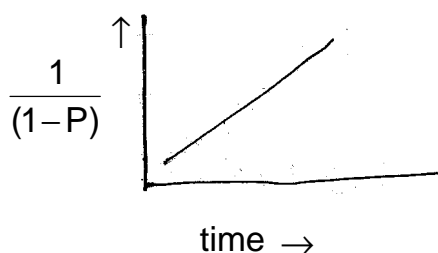


viii) Reactivity ratio of monomer M_1 is given by $r_1 = \frac{k_{11}}{k_{22}}$. T/F

ix) Reactivity of a functional group is dependent on the size of the molecule to which it is attached. T/F

Answer the following questions :

x) Consider the following plot showing kinetic data for a polyesterification. Is this polymerization catalyzed by adding a strong acid. Yes/No



xi) Name the ion formed in the rate determining step (RDS) during polyesterification reaction in the presence of conc. sulfuric acid. Draw the structure of this ion.

xii) What is azeotropic copolymerization ?

xiii) How is kinetic chain length to \overline{DP} of a polymer ?

xiv) What are the units of rate constant for propagation ?

SECTION – II

2. a) Give an account of redox initiators used to initiate radical chain polymerization. **7**
- b) Derive the expressions for rate of cationic chain polymerization. **7**
3. a) Discuss the Finemann-Ross method for the determination of reactivity ratios. **7**
- b) Derive the Mayo equation that correlates the degree of polymerization with the rates of propagation, termination and transfer reactions. **7**
4. a) A polymer of molecular weight $\overline{M}_n=24116$, on hydrolysis yielded 39.30% of p-phenylene diamine; 59.80% of terephthalic acid, and 0.87% of benzoic acid. Calculate the degree of polymerization, extent of reaction (P) and reactivity ratio (r); given MW of the chain repeating unit is = 226. **7**
- b) What is autoacceleration ? Discuss the various factors that affect autoacceleration. **7**



SECTION – III

5. a) Mention reasons for deviation of experimental data from standard straight line, below 80% conversion in a polyesterification of ethylene glycol and adipic acid. **5**
- b) Discuss in brief the range of applications of the copolymer composition equations. **5**
- c) What is NMP ? Explain with suitable example. **4**
6. a) What is 'initiator efficiency, f ' ? Discuss the methods for experimental determination of f . **5**
- b) Write the reactions involved in the polymerization of styrene initiated by sodium/naphthalene. **5**
- c) Calculate the \overline{DP} and proportion of acetic acid in grams for a polyester derived from ethylene glycol and adipic acid with MW = 10,000 at 99.50% conversion. **4**
7. Write notes on **any three** : **14**
- a) Suzuki coupling reaction
- b) RAFT polymerization
- c) ROP of cyclosiloxane
- d) Azeotropic copolymerization.
-



Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
POLYMER CHEMISTRY

Spectral and Instrumental Analysis of Polymers (Paper – XII) (Elective – 1)

Day and Date : Wednesday, 22-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I (question **one**) is **compulsory**.
 - 3) Attempt **any two** questions form Section II and **any two** questions form Section III.
 - 4) Answer to **all 5** questions. (Section I, II, III) should be written in the **one** and the **same** answer book.
 - 5) **All** the questions carry **equal** marks.
 - 6) Figure to the **right** indicates **full** marks.
 - 7) **Use** of the log tables and calculators is **allowed**.

SECTION – I

1. Answer the following questions :

14

- I) Draw the DTA curve for nylon-6.
- II) Write any four drawbacks of solid state CMR.
- III) Define NOE.
- IV) Draw proton decoupled ^{13}C -NMR spectrum of 1-propanol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$).
- V) Calculate the wave number of radiation of wavelength $4 \mu\text{m}$.
- VI) State the rule of selection of target material for X-rays production.
- VII) What is FAB-MS ?
- VIII) The observed chemical shift of a proton is 300 Hz using 100 MHz spectrometer. Calculate the chemical shift in terms of δ .
- IX) List the advantages of SEM.
- X) Explain the meaning of T_{10} in TGA.
- XI) State the Bragg's Law of diffraction.
- XII) Glycerol is used as matrix for FAB-MS. Why ?
- XIII) C_6D_6 shows a triplet in CMR spectrum. Why ?
- XIV) Which spectroscopy is complementary to IR spectroscopy ?

P.T.O.



SECTION – II

2. a) Describe the determination of chain motion and orientation in polyethylene terephthalate (PET) by solid state CMR. 7
- b) Draw a typical TGA curve for a heat resistant polymer and illustrate T_o , T_i , T_{max} and IPDT. 7
3. a) Explain applications of Raman spectroscopy for identification of nylons. 7
- b) Describe the applications of SEM and TEM in polymer analysis. 7
4. a) Discuss the use of rotating crystal diffraction method to determine dimensions of polymer unit cell. 7
- b) Explain the use of IR technique to study polymer blends : poly (vinyl alcohol) with poly (ethylene oxide) and poly (vinyl phenol) with poly (vinyl isobutyl) ether. 7

SECTION – III

5. a) Determine the composition of methyl methacrylate and hexyl methacrylate i.e. MMA/HMA in a copolymer having the peak area 37 and 61 at the NMR signals at 3.6 and 3.9 ppm, respectively. 5
- b) List the advantages and limitations of pyrolysis GC-MS technique. 5
- c) Compare theory and applications of SAXS and WAXS. 4
6. a) Describe the factors affecting thermal stability of polymers. 5
- b) Discuss basic principles of TBA and explain applications of TBA in analysis of polymers. 5
- c) Describe solid state CMR of poly (phenylene sulfide) (PPS). 4
7. Write notes on **any three** : 14
- a) Curie point pyrolysis technique
- b) Types of electronic transitions in UV spectroscopy.
- c) Applications of TGA in polymer analysis.
- d) Nuclear overhauser effect in ^{13}C -NMR.
- e) FAB-MS for polymer analysis.
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
POLYMER CHEMISTRY
Paper – XIV : Stereoregular Polymers, Elastomers and
Polymer Additives

Day and Date : Saturday, 18-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) Section I (question 1) is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all 05** questions (Section I, II and III) should be written in the **one** and the **same** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculators is **allowed**.

SECTION – I

1. Answer the following : (2×7=14)
- I) Which are the components of Z-N initiators ?
 - II) What is the role of stabilizer ?
 - III) Give two example of antioxidant with their structure.
 - IV) Why vinylidene chloride does not show stereoisomer's on polymerization ?
 - V) Define stereoselective and stereoelective polymerization.
 - VI) Write down any four properties and applications of SBR.
 - VII) On which factors the coordination ability of monomer depends.



SECTION – II

2. A) Discuss the stereoisomerism in polymerization of 1-3 butadiene. 7
B) What is ABN ? How ABN is prepared ? Give the properties and applications of ABN. 7
3. A) Explain the bimetallic mechanism in non polar vinyl monomer with help of suitable example. 7
B) Discuss the various types of plasticizers used in vulcanization of rubber with their role. 7
4. A) Discuss the preparation, properties and applications of butyl rubber and chloroprene rubber. 7
B) Discuss the stereoisomerism of polymerization of polyvinyl chloride. 7

SECTION – III

5. A) Compare the properties and applications of natural rubber with vulcanized rubber. 5
B) Explain the kinetic of Z-N polymerization. 5
C) Explain the role of impact modifier and antistatic agents. 4
6. A) Discuss the coordination polymerization with suitable example. 5
B) Describe the ditactic polymers from $\alpha - \beta$ dialkyl substituted ethylene ($R \neq R'$). 5
C) Explain the use of Ultraviolet absorbers in vulcanization of rubber. 4
7. Write short note on (**any three**) : 14
I) Bernoulli model
II) Cyclization of natural rubber
III) E-Z system of nomenclature
IV) Components of Ziegler-Natta initiators.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
POLYMER CHEMISTRY (Paper – XV)
Selected Topics in Polymers

Day and Date : Tuesday, 21-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I (question **one**) is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all 5** questions (from Section I, II and III) should be written in the **one** and the **same** answer book.
 - 5) **All** the questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculator is **allowed**.

SECTION – I

1. Answer the following : 14
- i) Enlist the products of incineration.
 - ii) Lyotropic LCPs exhibit their properties based on temperature. True or false.
 - iii) Why do polymer blends exhibit more than one T_g ?
 - iv) Write down the repeating units for cellulose and cellulose acetate.
 - v) Depict the typical structure of a peptide molecule.
 - vi) What is the melting point range of UHMWPE ?
 - vii) What are the prerequisites for a polymer to behave as hydrogel ?



SECTION – II

2. a) Write a note on carbon foot print. 7
b) What are self-assembling polymers ? Enlist the uses and applications of the same. 7
3. a) Explain etherification reaction in detail. How properties of cellulose ether are different from cellulose ? 7
b) Write a note on synthesis of A-B diblock copolymer. 7
4. a) Discuss solid phase peptide synthesis in detail. 7
b) Write a note on ionic polymers. Discuss the area of application. 7

SECTION – III

5. a) Write a note on Energy and feedstock recovery through recycling. 5
b) Discuss any one method to prepare polymer membranes. 5
c) Describe the positive photoresist working in lithography. 4
6. a) Explain the mechanism of control release drug system. 5
b) Discuss polymer supported catalysts and their advantages. 5
c) Differentiate between sortation and microsortation. 4
7. Write notes on **any three** : 14
a) Conducting polymers
b) Grafting and radiation crosslinking
c) Adhesives
d) Polymers in tissue engineering.
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Seat No.	
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**M.Sc. (Part – II) (Semester – IV) Examination, 2015
POLYMER CHEMISTRY (Paper – XVI) (Elective Paper)
Processing Technology and Polymer Properties**

Day and Date : Thursday, 23-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I (question **one**) is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all 5** questions (from Section I, II, III) should be written in **one** and the **same** answer book.
 - 5) **All** the questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) Use of log tables and calculators is **allowed**.

SECTION – I

1. I) Modulus of elasticity is unitless parameter. True or False. **14**
- II) What type of intermolecular forces are present in Fibers ?
- III) Define Refractive Index.
- IV) What is Iodine number ?
- V) What is Yellowness index ?
- VI) Calendaring is used to make plastic pipes. True or False.
- VII) Define Haze.
- VIII) Twin screw extruder acts as a positive pump. True or False.
- IX) What type of articles are made by Rotational Moulding ?
- X) Name the method by which high strength polyethylene fibers are made.
- XI) What is viscosity ?
- XII) Define dielectric constant of a medium.



XIII) What is Heat Distortion Temperature ?

XIV) Refractive index varies with temperature. True or False.

SECTION – II

- | | |
|--|---|
| 2. a) Describe the wet spinning process. What type of fibers are made by this method ? | 7 |
| b) Explain Voigt model. What is its importance ? | 7 |
| 3. a) Describe the compression test. What is its importance ? | 7 |
| b) Explain the Maxwell model. How it is useful to explain Stress-Relaxation ? | 7 |
| 4. a) Describe the Injection moulding Technique. What type of articles are made by this method ? | 7 |
| b) Describe the phase separation and reaction spinning methods. | 7 |

SECTION – III

- | | |
|---|----|
| 5. a) Describe the method of determining bulk density of a polymer. | 5 |
| b) Explain the Maxwell model. | 5 |
| c) How do you measure dielectric constant of polymers. | 4 |
| 6. a) Describe the Melt spinning and wet spinning of fibres. | 5 |
| b) Describe the Thermoforming and Vacuum Thermoforming. | 5 |
| c) Discuss the mechanical spectra and explain the different factors influencing mechanical spectra. | 4 |
| 7. Write notes on any three of the following. | 14 |
| a) Cone and Plate Rheometer | |
| b) Sandwich moulding and Foaming | |
| c) Post spinning processes | |
| d) Calendaring Technique. | |
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Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICAL CHEMISTRY
(Paper – IX) : Quantum Chemistry

Day and Date : Wednesday, 15-4-2015

Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to all questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) Use of log table and calculator is **allowed**.

SECTION – I

1. Answer the following :

14

- i) What do you mean by orthonormal set of wave functions ?
- ii) Define the term eigen function.
- iii) Quantization concept was first introduced by
 - a) Einstein
 - b) Pauli
 - c) De Broglie
 - d) Planck
- iv) Give the expression for kinetic energy operator.
- v) Put the condition for Hermitian operator.
- vi) What is bond or resonance integral ?
- vii) Mention the value for a_0 (Bohr radius).
- viii) Give the expression of zero point energy for particle translating in two dimensional box of length 'a'.

P.T.O.



- ix) The Compton shift depends on
 - a) angle of scattering
 - b) wavelength of incident light
 - c) interacting material
 - d) all of these
- x) Construct the secular determinant for allyl molecule.
- xi) Write down the recursion formula.
- xii) Define mathematically bond order.
- xiii) State Stefan-Boltzman law.
- xiv) The number of nodes for 3d atomic orbital is

SECTION – II

- 2. a) Derive time independent Schrodinger wave equation. 7
- b) Derive Planck's distribution law for black body radiation. 7
- 3. a) Discuss perturbation theory used for finding approximate solutions for the Schrodinger equation. 7
- b) Write in detail the radial eigen functions of Hydrogen atom. 7
- 4. a) Deduce the expression for Schrodinger wave equation for particle in a cubical box. 7
- b) Using HMO approach, evaluate the MO coefficients for wavefunctions of ethylene molecule. 7

SECTION – III

- 5. a) State the eigen values for following eigen functions of d^2/dx^2 5
 - i) $6 \cos 4x$
 - ii) $5 e^{-3x}$
 - iii) e^{-ax^2}
- b) Explain Slater and Guassion type orbitals. 5
- c) Evaluate the commutator $[x, d/dx]$. 4
- 6. a) Discuss Stern-Gerlach experiment. 5
- b) Show that $\psi = \sin(k_1x) \sin(k_2y) \sin(k_3z)$ is an eigen function of ∇^2 operator. 5
- c) Calculate the value of lowest energy for an electron moving back and forth between the barrier having length 10^{-9} m. 4
- 7. Write short notes on **any three** : 14
 - a) Bohr atomic model
 - b) Hermit polynomials
 - c) Various integrals involved in Huckel molecular orbital theory
 - d) Slaters determinant.



Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICAL CHEMISTRY
(Paper – X) : Electrochemistry

Day and Date : Friday, 17-4-2015

Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following.

14

- i) The Bjerrum ion pair association constant is given by
- ii) Write corrected Debye-Huckel limiting law for concentrated solutions.
- iii) Define overvoltage.
- iv) Hydration energy of an ion _____ on the size of the ion. (increases/ decreases).
- v) Estimate the wavelength at which Debye-Falkenhagen effect observed for 1:1 electrolyte having concentration 0.01 m.
- vi) What do you mean by zeta potential ?
- vii) Write the expression for efficiency of fuel cells.
- viii) Give the value of Onsagar constant A.
- ix) Write Butler-Volmer equation at low field.



- x) The thickness of the ionic atmosphere is _____ to the concentration of an electrolyte.
- a) inversely proportional b) directly proportional
c) equal to d) all of these
- xi) Name the catalyst used in CO-Air fuel cell.
- xii) Which is mobile phase in electrophoresis ?
- xiii) Pourbaix diagram is the plot of
- xiv) Name the effects which support ionic atmosphere formation.

SECTION – II

2. a) Describe Born model of ion solvent interaction. 7
b) Discuss in detail Bjerrum theory of ion pair association. 7
3. a) What is electrolysis ? Explain how it is used in electroplating. 7
b) Give the construction and working of hydrogen-oxygen fuel cell. 7
4. a) Derive Debye-Huckel-Onsager equation for an equivalent conductance of strong Electrolyte. 7
b) Discuss Stern theory of electrical double layer. 7

SECTION – III

5. a) Describe electrochemical nature of corrosion. 5
b) For an electrode reaction show that $i = i_0 \{F n/RT\}$. 5
c) Calculate the thickness of ionic atmosphere for an 1:1 electrolyte in acetonitrile at 298K at 0.05 and 0.001 M. [D = 37.5] 4
6. a) Give an explanatory note on abnormal conductance of hydroxyl and hydrogen ions. 5
b) Discuss the importance's of diffusion overpotential. 5
c) Estimate zeta potential of a particle moving with velocity 1×10^4 cm/s in water under potential gradient of 15V. Given $\eta = 0.01$ poise and D = 78.6 at 298 K. 4
7. Write short notes on **any three** : 14
- a) Polarization phenomena
b) Methods of corrosion prevention
c) Electrokinetic effects
d) Wein effect.
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Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICAL CHEMISTRY
Paper – XI : Molecular Structure – I

Day and Date : Monday, 20-4-2015

Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Question **one** is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) **All** questions carry **equal** marks. Figures to **right** indicate marks.
 - 5) **Neat** and labeled diagrams should be drawn.
 - 6) **Use** of calculator and logtable is **allowed**.

SECTION – I

1. Answer the following.

14

- i) What is a symmetry operation ?
- ii) The product $C_2\sigma_v$ of water molecule is equal to
- iii) The symmetric top molecules have all the three moment of inertia equal. True or False.
- iv) When an atom in a diatomic molecule is replaced by its heavier isotope the B value decreases ? True or False.
- v) The period of rotation of a diatomic molecule is 1.0×10^{-12} s. What will be its rotational frequency, ω ?
- vi) The lowest vibrational energy of harmonic oscillator is
- vii) Can we get vibrational spectra of a homonuclear diatomic molecule ?

P.T.O.



- viii) The spacing between P and R branches of $^{16}\text{O-C-}^{16}\text{O}$ is $4B$. What would be the corresponding spacing of $^{16}\text{O-C-}^{18}\text{O}$?
- ix) What are the term symbols for a state $S = \frac{1}{2}$ and $L = 2$?
- x) State Franck-Condon principle.
- xi) What are Stokes lines ?
- xii) No rotational Raman effect is observed for spherical top molecules. True or False.
- xiii) In Photo Electron Spectroscopy _____ energies are measured when electrons are ejected from different orbitals.
- xiv) The binding energies of 1 s electrons increase with atomic number due to increased _____ charge on the nucleus.

SECTION – II

2. a) Identify symmetry elements of ammonia molecule and construct the multiplication table. 7
- b) Give the matrix representation of identity, reflection (through x-y, x-z and y-z planes) and inversion operations. 7
3. a) Discuss the rotational spectrum of a rigid diatomic molecule. 7
- b) The rotational constant of CO is 3.8626 cm^{-1} . Calculate the moment of inertia and the transition which gives most intense spectral line at 300 K. (Given $h = 6.626 \times 10^{-34} \text{ Js}$, $k = 1.381 \times 10^{-23} \text{ JK}^{-1}$, $c = 3.0 \times 10^8 \text{ ms}^{-1}$). 7
4. a) Discuss the effect of rotation on parallel and perpendicular vibrations of a linear molecule and its spectra with suitable example. 7
- b) One of the fundamental vibration mode of H_2^{16}O occurs at 3652 cm^{-1} . What would be the frequencies of corresponding mode in D_2^{16}O and H_2^{18}O ? 7



SECTION – III

5. a) Describe in detail the instrumentation of a Raman spectrometer. **5**
- b) Why anti-stokes lines are less intense than stokes lines ? **5**
- c) The first three rotational Raman lines of a linear triatomic molecule are at 4.86, 8.14 and 11.36 cm^{-1} from the exciting Raman line. Estimate the rotational constant B and moment of inertia. ($h = 6.625 \times 10^{-34}$ Js, $c = 3.0 \times 10^8$ ms^{-1}). **4**
6. a) Explain the ionization process occurring in Photoelectron Spectroscopy. **5**
- b) Explain the terms progression and sequences. **5**
- c) Find the quantum numbers for the states represented by 3P_2 , 3P_1 and 3P_0 . **4**
7. Write short notes on **any three** : **14**
- a) Orthogonality theorem.
- b) Classification of molecules based on their moment of inertia.
- c) Mutual exclusion principle.
- d) Born-Oppenheimer approximation.
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Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
PHYSICAL CHEMISTRY
Paper – XII : Solid State and Nuclear Chemistry (Elective)

Day and Date : Wednesday, 22-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) **All** questions carry **equal** marks.
 - 3) Question No. 1, Section I is **compulsory**. Attempt at least **two** questions from **each** Section II and III.
 - 4) Figures to **right** indicate **marks**.
 - 5) **Neat** and labelled diagrams should be drawn **wherever** necessary.
 - 6) **Use** of calculator and log-table is **allowed**.

SECTION – I

1. **Compulsory (one mark each) :**

14

- a) How many basic crystal system are present in crystalline solids ?
- b) How many elements of symmetry are present in a cubic system ?
- c) Give the number of Bravais lattices are existing in cubic crystal.
- d) In a NaCl, how many Na ions are surrounded by each Cl ions ?
- e) One Curie of radioactivity is equal to 3.7×10^{10} disint/sec.
- f) In a nuclear reactor moderator is used to slow down the fast neutrons in a fission process. True/False
- g) If U 238 give alpha particles product equal to Th 234. True/False
- h) ^{13}C is used in determination of age of dead plants and animals. True/False
- i) Atoms bombs are based on the nuclear fission reaction. True/False
- j) When the layer deposition is done on an already existing substrate surface is called as _____
- k) Give one example of single crystal prepared by crystal pulling method.
- l) Give the composition of Fricke solution used in Fricke dosimeter.
- m) What is hydrothermal reaction ?
- n) What is induction period ?

P.T.O.



SECTION – II

2. a) Describe the $\sin^2\theta$ method for the crystal structure determination of cubic systems. 7
- b) Draw the schematic diagram of Czochralski method to grow single crystals and mention its advantage over the other. 7
3. a) What is Fricke dosimeter ? Give its important application for the measurement of intensity of energy. 7
- b) Discuss the formation of compound nucleus and compound nucleus theory to explain the nuclear reaction mechanism. 7
4. a) What is nuclear reactor ? Give its components and working to generate energy. 7
- b) Discuss the tarnish reactions with reference to mechanism quoting with suitable example. 7

SECTION – III

5. a) Give an overview of single crystal rotation method for the crystal structure determination. 5
- b) Give the importance of addition reactions. 5
- c) Define the term structure factor and electron density. 4
6. a) What is homogeneous nucleation ? How this nucleation affects on the single crystal growth ? 5
- b) Give an explanatory note on the four factor formula of nuclear reactor. 5
- c) Give the mechanism of semiconductor detector used in the nuclear radiation. 4
7. Write notes on **(any three)** : 14
- a) Frenkel defect.
- b) Neutron detector.
- c) Bridgeman method for single crystal growth.
- d) Ceric sulphate Dosimeter.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICAL CHEMISTRY
Paper – XIII : Statistical Mechanics and Thermodynamics

Day and Date : Thursday, 16-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following :

14

- a) What do you mean by residual entropy ?
- b) State Boltzmann-Planck equation.
- c) Evaluate Q_{el} of an atom whose atomic state is $^2P_{3/2}$.
- d) Give any two examples of flux.
- e) State third law of thermodynamics.
- f) The ortho state of hydrogen is associated with _____ values of rotational quantum number.
i) odd ii) even iii) both iv) none of these
- g) Evaluate $6.023 \times 10^{23} !$ (Use Stirling's approximation).
- h) Mention Euler's theorem of exactness.
- i) Put the limits for Eulerian angles θ , ϕ and ψ .



- j) Mention classical value of heat capacity of any substance.
- k) Give any one statement of second law of thermodynamics.
- l) Give the symmetry number for HCl and HBr molecule.
- m) Entropy is path dependent/independent function. Choose correct alternative.
- n) Name any two inexact differentials.

SECTION – II

- 2. a) Discuss in brief Debye heat capacity theory for solids. 7
- b) How entropy change can be estimated during various phase transformations ? 7
- 3. a) Show that $Q_{rot} = 8\pi^2 I kT / \sigma h^2$. 7
- b) What is ensemble ? Explain in detail canonical ensemble. 7
- 4. a) Derive an expression for Sackur-Tetrode equation. 7
- b) Illustrate Onsagar's theory for mciroscopic reversibility. 7

SECTION – III

- 5. a) Derive the expression for MB constant β . 5
 - b) Discuss in detail predominant configurations. 5
 - c) Calculate the number of ways the 12 persons can occupy 6 chairs. 4
 - 6. a) Write on conservation of energy in closed and open system. 5
 - b) Discuss the assumptions made by Debye during his heat capacity theory of solids. 5
 - c) Calculate S_{trans} of He gas at 300 K and 1 atm pressure (Given-Mass of He is 3.99 gm). 4
 - 7. Write short notes on **any three** : 14
 - a) Ortho and para hydrogen
 - b) Free energy concept
 - c) Phenomenological equations and coefficients
 - d) Legendre transformation.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICAL CHEMISTRY
(Paper – XIV) Chemical Kinetics

Day and Date : Saturday, 18-4-2015

Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following.

14

- i) Give one example of consecutive reaction.
- ii) What is trajectory in potential energy surface ?
- iii) Define collision number.
- iv) What do you mean by inelastic collision ?
- v) Write the expression for t_{\max} of a consecutive reaction.
- vi) State Steady state approximation.
- vii) Define saddle point.
- viii) Give the expression for partition function of an activated complex.
- ix) For a chain reaction the value of steric factor $P =$
 - a) greater than one
 - b) less than one
 - c) equal to one
 - d) all of these
- x) Order of a chemical reaction may be
 - a) integer
 - b) half integer
 - c) zero
 - d) all of these

P.T.O.



- xi) Mention the order of a unimolecular reaction at low pressure.
- xii) What do you mean by temperature coefficient of a reaction ?
- xiii) Mention any two characteristics of a catalyst.
- xiv) What is autocatalysis ?

SECTION – II

- 2. a) Discuss the kinetics of protolytic acid catalyzed reaction. 7
- b) For a typical consecutive reaction $A \rightarrow B \rightarrow C$, derive an expression for $[C]$ at a given point. 7
- 3. a) What are complex reactions ? Explain the kinetics of parallel reactions in detail. 7
- b) Derive the rate equation using transition state theory. 7
- 4. a) Discuss Lindemann mechanism for unimolecular reactions. 7
- b) Write in detail on hydrogen-halogen reactions. 7

SECTION – III

- 5. a) Discuss the kinetics of thermal decomposition of acetaldehyde. 5
 - b) Write on weaknesses of the collision theory. 5
 - c) The gaseous decomposition of ozone takes place as $2O_3 \rightarrow 3O_2$ the rate is $-d[O_3]/dt = k[O_3]^2/[O_2]$ prove that the proposed mechanism is correct
 - $O_3 = O_2 + O$ fast equilibrium
 - $O + O_3 \rightarrow 2O_2$ slow. 4
 - 6. a) Give the general scheme of enzyme catalyzed reaction and derive the rate law. 5
 - b) Explain catalytic activity. 5
 - c) Can the activation energy of a reaction be zero or negative ? Explain. 4
 - 7. Write short notes on **(any three)**. 14
 - a) Oscillatory reactions
 - b) Acidity functions
 - c) Lineweaver-Burk plots
 - d) Effect of temperature on enzyme catalysis.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICAL CHEMISTRY
Paper – XV : Molecular Structure – II

Day and Date : Tuesday, 21-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answers the following.

14

- a) What do you mean by dipole moment ?
- b) According to Debye equation write the expression for the induced polarization.
- c) The cylindrical charge cloud around acetylenic triple bond causes shielding effect in NMR. True or false ?
- d) When the substance acts as a paramagnetic substance ?
- e) Write the expression for Curie temperature.



- f) Mention any one advantage of Quinck's method of determining magnetic susceptibility.
- g) When a nucleus has even number of protons and neutrons what would be its spin ?
- h) Define isomer shift.
 - i) The chemical shift in NMR is independent of the applied field. True or false.
 - j) Give the Lande splitting factor g for electron ?
- k) To record ^{13}C -NMR greater sensitivity is required. Why ?
 - l) Give the expression for nuclear Bohr magneton β_N ?
- m) Predict the number of lines in an ESR spectrum of naphthalene radical.
- n) State Zeeman effect.

SECTION – II

- 2. a) In NMR spectroscopy for a nucleus with $I = 1$, obtain expression for allowed energy levels and frequency of transition in presence of magnetic field. **7**
- b) Give the number of NMR signals and their splitting of the following compounds
 - i) propanoic acid
 - ii) acetaldehyde
 - iii) acetic acid. **7**
- 3. a) Using Langevin theory of diamagnetism. Derive an expression for molar susceptibility. **7**
- b) Explain the Bhatnagar-Mathur method of determining magnetic susceptibility. **7**
- 4. a) Illustrate with the help of chemical shift concept why OH proton requires low field and CH proton requires high field for methanol. **7**
- b) Describe the double resonance phenomena in ESR spectroscopy. **7**



SECTION – III

5. a) Define paramagnetic susceptibility. How is it determined experimentally ? **5**
b) Distinguish between spin lattice and spin-spin relaxations. **5**
c) NMR instrument operates at 30.2×10^6 Hz, what magnetic fields are required to bring proton and ^{13}C nuclei to resonance at the given frequency ? **4**
6. a) How Gouy's balance is used for measuring the specific magnetic susceptibility ? **5**
b) Write on Mossbauer spectrometer. **5**
c) Predict the number of lines in the esr spectrum of the following radicals $[\text{CF}_2\text{D}]$ and $[\text{CClH}_2]$. **4**
7. Write short notes on **(any three)** : **14**
a) Dipole moments of dichlorobenzenes
b) NOE
c) Quinck's method of determining magnetic susceptibility
d) Doppler effect.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
PHYSICAL CHEMISTRY
Paper – XVI : Surface Chemistry (Elective)

Day and Date : Thursday, 23-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions:**
- 1) Attempt in **all 5** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any 2** questions from Section II and **any 2** questions from Section III.
 - 4) **All** question are to be written in the **same** answer book.
 - 5) Figures to the **right** indicate **full** marks.
 - 6) **All** questions carry **equal** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following : (14×1=14)

- i) “Increase in hydrophobicity of surfactant decreases the term $-\left(\frac{d\gamma}{dC}\right)$ with increase in concentration of surfactant solution”, state whether this statement is true or false.
- ii) What is isostatic pressing ?
- iii) How fluorescence test helps to predict type of emulsion ?
- iv) What is the effect of temperature on surface tension of liquid ?
- v) Define adsorption isotherm.

P.T.O.



- vi) What is catalytic poison ?
- vii) Give the names of solid lubricants.
- viii) Define the term heat of wetting.
- ix) Why falling drop of liquid takes the shape of sphere ?
- x) State the effect of temperature on the rate of physical adsorption.
- xi) Complete the following equation :
$$\gamma = \frac{\Delta G}{?}$$
- xii) Indicate the meaning of contact angle hysteresis.
- xiii) Point out the effect of temperature on detergent efficiency.
- xiv) Define critical micelle concentration.

SECTION – II

- 2. a) Describe theories of emulsion stability. 7
- b) Derive Gibb's adsorption equation and give its significance. 7
- 3. a) Give an account of volumetric method of measuring gas adsorption. 7
- b) Describe capillary rise method of determination of surface tension of liquids. The surface tension of toluene at 293 K is 0.0284 Nm^{-1} and its density at this temperature is 0.866 gm per cc. What is the largest area of the capillary that will permit the liquid to rise $2 \times 10^{-2} \text{ m}$? 7
- 4. a) Derive Kelvin equation for vapour pressure of inside and outside the droplet. Gibb's Adsorption equation with usual notations for dilute solution. 7
- b) Discuss various types of adsorption isotherms. Give advantages and disadvantages of Langmuir adsorption isotherm. 7



SECTION – III

5. a) What is heterogeneous catalysis ? Explain the mechanism and kinetics of catalysis gaseous reaction by solid surfaces. **5**
- b) State and explain Trube's rule. **5**
- c) At 200 C water formed 29 drops when flowing through the capillary of a stalagmomete, while an equal volume of ether formed 86 drops. If the densities of water and ether are 0.997 and 0.70 gm per cc respectively, find the surface tension of ether, if that of water is 72.8 dynes per cm. **4**
6. a) Discuss Freundlich adsorption isotherm and its application to adsorption of nitrogen gas on mica surface at 90°C. **5**
- b) What is chemisorptions ? Explain kinetics of chemisorptions. **5**
- c) Discuss mechanism of sintering. **4**
7. Write notes on (**any three**) : **14**
- a) Surface tension method of cmc determination
- b) Selective wetting
- c) Langmuir-Adam surface pressure balance
- d) Tilting plate method.
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Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
ANALYTICAL CHEMISTRY
(Paper – X) Instrumental Methods of Analysis – I

Day and Date : Friday, 17-4-2015
Time: 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** questions from Section III.
 - 4) Answers to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answers the following :

14

- i) Diagrammatically represent diffusion current region and limiting current.
- ii) Mention the dead time of GM counter.
- iii) Which electrolytes are used in construction of salt bridge ?
- iv) Mention any two microelectrodes used in amperometric technique.
- v) Give any two examples of organic scintillation detectors.
- vi) Mention typical band gap of Germanium semiconductor.
- vii) Define dielectric constant.
- viii) What is the basis of thermo gravimetric analysis ?
- ix) Sketch typical TGA curve.
- x) Write Nernst equation and give the significance of the terms involved in it.
- xi) Lists various nuclear radiations.

P.T.O.



- xii) Mention different types of DSC technique.
- xiii) The range of frequency that can be used in high frequency titrations is _____
- xiv) Radioactive disintegration follows _____ kinetics.

SECTION – II

- 2. a) What are different types of ion selective electrodes ? Explain glass electrode. 7
- b) What do you mean by tracer technique ? Describe applications of this in agriculture and industry. 7
- 3. a) Discuss various applications of DTA. 7
- b) Explain how isotope dilution analysis is used in various biomedical investigations. 7
- 4. a) Discuss principle and technique of electrogravimetry. 7
- b) Describe with suitable example solid state electrodes. 7

SECTION – III

- 5. a) Describe radiochromatography technique. 5
 - b) Draw the thermogram of calcium oxalate and discuss the features of the curve. 5
 - c) Explain dead stop end point method. 4
 - 6. a) Discuss principle involved in stripping voltametry. 5
 - b) Mention advantages of high frequency titrations. 5
 - c) With the help of DTA curve for manganese carbonate, explain various reactions involved in it. 4
 - 7. Write short notes on **any three** : 14
 - a) Types of cells used in High Frequency titrations.
 - b) Nuclear radiations.
 - c) Typical amperometric titration curves.
 - d) Kinetic parameters of thermal degradation.
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M.Sc. (Part – II) (Semester – III) Examination, 2015
ANALYTICAL CHEMISTRY
Paper – XI : Applied Analytical Chemistry

Day and Date : Monday, 20-4-2015

Max.Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

Instructions: 1) Q. No. 1 is compulsory.

2) Attempt **any two** questions **each** from Section II and Section III.

3) **All** questions should be written in **same** answer book.

4) Figures to **right** indicate **full** marks.

SECTION – I

1. Answer the following :

(14× 1=14)

- 1) What are mineral ?
- 2) What is use of *thio meter* ?
- 3) Chemical composition of illuminite ores.
- 4) What is composition of bronze ?
- 5) Why urea is neutral fertilizer ?
- 6) What are insecticides ?
- 7) Define the term alloy.
- 8) The estimation of nitrogen method consists of heating a substance with sulphuric acid. (True/False)
- 9) Why zinc oxide is used in cosmetic ?
- 10) Name the steps involved in plant material analysis for metal context.
- 11) Define the term slag.
- 12) Give composition of Cu-Ni alloy.
- 13) What is role played by pH of soil fertility ?
- 14) Hexachlorophenone is deodorants. (True/False).

P.T.O.



SECTION – II

2. A) What are basic composition of soil ? How pH of soil is determined ? 7
B) Explain how sample is prepared for plant analysis. 7
3. A) How boric acid is analysed from face powder ? Give experimental detail. 7
B) Explain in detail analysis of Cu-Ni alloy give experimental detail. 7
4. A) How metal alloy steel and Cu-Ni is analysed ? 7
B) Name of different components of cream and lotion. How propylene glycol is analysed ? 7

SECTION – III

5. A) Give classification of insecticides in the analysis of ziram. 5
B) Explain role of soil reaction and pH as a measure of soil fertility. 5
C) What are ^{SIP} anti pers^{ant} ? Explain briefly method of determination of its major contents. 4
6. A) How will you analysed D.D.T ? 5
B) Explain role of methanamine in deodorants. 5
C) Explain how will you determine the pH content from solder material. 4
7. Write note on **any three** : 14
a) Analysis of starch and sugar
b) Analysis of thiometen
c) Estimation of phosphorous in fertilizer
d) Analysis of aluminium.
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Seat No.	
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M.Sc. (Part – II) (Semester – III) Examination, 2015
ANALYTICAL CHEMISTRY
Paper – XII : Analytical Spectroscopy

Day and Date : Wednesday, 22-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) **Section I is compulsory.**
 - 3) Attempt **any two** questions from **Section II** and **any two** questions from **Section III**.
 - 4) Answers to **all** questions (**Section I, II and III**) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answers the following :

14

- i) List the techniques of Scanning Probe Microscopy.
- ii) Which radiation source is commonly used in microwave spectroscopy ?
- iii) Which is the ESR standard ?
- iv) List factors affecting isomer shift in Mossbauer spectroscopy.
- v) Write theoretical value of Linde's splitting factor in ESR.
- vi) Give the selection rule for rotational Raman spectra.
- vii) What are the characteristics of Mossbauer nucleus ?
- viii) List the primary beams in photoelectron spectroscopy.
- ix) Which type of electron beam is used for image formation in SEM ?
- x) Draw oblate charge distribution of a nucleus in NQR.
- xi) What is the long form of HRTEM ?



- xii) How many ESR lines would possible for CD_3 radical ?
- xiii) Which radiation is absorbed by ESR active molecules ?
- xiv) What is the selection rule used in NQR ?

SECTION – II

- 2. a) What is isomer shift in Mossbauer spectroscopy ? What are factors affecting it ? Explain with illustrative examples. 7
- b) Discuss quantum theory of Raman spectroscopy. 7
- 3. a) What is ESCA spectroscopy ? Discuss its instrumentation in details. 7
- b) Outline principle and applications of scanning probe microscopy. 7
- 4. a) What is the basic principle of ESR spectroscopy ? Draw a schematic diagram of instrument used in ESR. Discuss its various components. 7
- b) Compare between electron microscopy and electron spectroscopy. 7

SECTION – III

- 5. a) Draw neat labeled diagram of SEM. Explain its various components in detail. 5
 - b) Calculate the number of ESR peaks in CH_3 radical and interpret their intensity ratios. 5
 - c) How NQR is used for studying molecular structure of a compound ? 4
 - 6. a) Explain principle of NQR spectroscopy. Discuss the NQR spectrum for a nucleus with $I = 5/2$. 5
 - b) What are the applications of resonance Raman effect ? 5
 - c) Differentiate between PAS and UPS. 4
 - 7. Write notes on **any three** of the following : 14
 - a) Rotational and vibrational Raman spectra
 - b) Quadruple shift in Mossbauer spectroscopy
 - c) Hyperfine splitting in ESR
 - d) Scanning electron microscopy.
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M.Sc. II (Semester – IV) Examination, 2015
ANALYTICAL CHEMISTRY (Paper – XIII)
Advance Analytical Techniques

Day and Date : Thursday, 16-4-2014
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- N.B. :**
- 1) Attempt in **all five** questions.
 - 2) Section – I is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) Answer to **all** questions should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to **right** indicate **full** marks.
 - 7) **Use** of log-table and non programmable calculator is **allowed**.

SECTION – I

1. A) Attempt the following : 10
- i) Define the term coupling constant.
 - ii) Give the two names of eluents used in ion chromatography.
 - iii) Mention type of non discrete methods.
 - iv) Define the term auxochrome.
 - v) Give meaning of base peak.
 - vi) Define critical pressure.
 - vii) Explain in short spin-spin coupling.
 - viii) Give names of extractors.
 - ix) Define hyphenated technique.
 - x) Explain the term magnetic nuclei.



- B) Fill in the blanks : 4
- i) Na_2CO_3 is used as eluent in _____ chromatography.
 - ii) Function of PMT in Dynamic light scattering is _____
 - iii) Density range in the supercritical fluid substances is _____ to _____ gms/cm^3 .
 - iv) _____ type pattern is showed in Fraunhofer theory.

SECTION – II

2. A) Derive mathematical expression for first order reaction. 7
- B) Explain the advantages of supercritical fluid chromatography over GC and HPLC. 7
3. A) Give advantages and disadvantages of automated analysis. 7
- B) Describe the gas chromatography with the help of flow sheet diagram. 7
4. A) Describe the supercritical fluid chromatography with diagram. 7
- B) Describe the instrumentation in ion chromatography. 7

SECTION – III

5. A) Explain the applications of kinetic methods of analysis. 5
- B) Write note on flow injection titrations. 5
- C) Explain instrumentation of FIA with flow sheet diagram. 4
6. A) Give applications of DLS. 5
- B) Explain ion chromatography using ion chelation. 5
- C) Explain principle of mass spectroscopy. 4
7. Write notes on (**any three**) : 14
- i) Electron ionization and chemical ionization.
 - ii) Analytical applications of ion chromatography.
 - iii) Enzyme catalysed reactions.
 - iv) Particle size analysis.
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
ANALYTICAL CHEMISTRY
Paper – XIV : Instrumental Methods of Analysis – II

Day and Date : Saturday, 18-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) **Section I is compulsory.**
 - 3) Attempt **any two** questions from **Section II** and **any two** questions from **Section III.**
 - 4) Answers to **all** questions (**Section I, II and III**) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed.**

SECTION – I

1. Answers the following :

14

- i) Mention different X-ray diffraction methods.
- ii) What do you mean by the term specific refraction ?
- iii) Why do excited molecules emit band spectra while excited atoms emit line spectra ?
- iv) Mention any two chiroptical techniques.
- v) Define elastic scattering.
- vi) What is the basis of nephelometric analysis ?
- vii) State Kasha's rule.
- viii) Name any two systems which show chemiluminescence.
- ix) Define concentration quenching.
- x) Estimate the energy in joules for Cu K α line having wavelength 1.5406 Å.
- xi) Define refractive index of a medium.



- xii) Which electronic transitions produce fluorescence emission ?
- xiii) X-rays are discovered by _____
- xiv) What is nebulization process ?

SECTION – II

- 2. a) Discuss various kinds of interferences encountered in flame photometry. **7**
b) Explain cotton effect. **7**
- 3. a) Describe various applications of fluorimetry. **7**
b) Write on general techniques utilized in surface spectroscopy. **7**
- 4. a) Diagrammatically explain critical angle principle, a basis of refractometry. **7**
b) Describe the principle and working of circular dichrograph. **7**

SECTION – III

- 5. a) Write on instrumentation of interferometry. **5**
b) Explain the theory of X-ray generation. **5**
c) Compare fluorimetry and phosphorimetry with each other. **4**
 - 6. a) What do you mean by quantum efficiency ? How it is estimated ? **5**
b) Illustrate various parameters which influence refraction. **5**
c) Discuss various types of emission spectra. **4**
 - 7. Write short notes on **any three** : **14**
 - a) XRF technique
 - b) Advantages and disadvantages of emission spectroscopy
 - c) Surface contamination
 - d) Jablonski's diagram.
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
ANALYTICAL CHEMISTRY
(Paper – XV) : Bio-Chemical and Food Analysis

Day and Date : Tuesday, 21-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions (Section II and **any two** from Section – III).
 - 4) Answer to **all** questions (Section I, II and III) should be written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.

SECTION – I

1. Answer the following : **(1×14=14)**
- a) What are dangerous drugs ?
 - b) Define the term “narcotic” with its effects on human body.
 - c) How will you confirm the presence of drugs in urine sample ?
 - d) What is drug assay ?
 - e) Define the principle components of urine.
 - f) Give the normal range of bilirubine and creatinine.
 - g) Give specific test for reducing sugars.

P.T.O.



- h) How will you collect the blood sample of an HIV infected patient ?
- i) Give the deficiency symptoms of selenium in human body.
- j) Define acid value of oil.
- k) Write the structure for oxytocin.
- l) Suggest few chemical preservatives used in food sample.
- m) Write the major components present in honey ?
- n) What is the significance of LD50.

SECTION – II

- 2. a) Give a resume on forensic analysis with respect to symptoms, fatal dose, fatal period, post-mortem findings, isolation, detection and estimation in case of cyanide poisoning. 7
- b) What are the types of drugs ? Give their classification and give limit test for impurities of free halogen and iron. 7
- 3. a) How are mineral oil, castor oil, argamone oil and cotton seed oil in edible oils tested ? Explain the saponification value of an oil sample. 7
- b) Describe the principle and estimation of blood urea and uric acid in serum. Give their clinical interpretation. 7
- 4. a) Describe the administration, complication, withdrawal symptoms and uses of narcotics. 7
- b) Explain a method for determination of the following enzymes : 7
 - i) Pepsin and ii) tyrosinase enzyme.



SECTION – III

5. a) Indicate the form in which phosphorus is present in food materials. Explain with relevant chemistry a spectrophotometric method for its determination. **5**
- b) Write a method of estimating mercury from the body of the person suspected of mercury poisoning. **5**
- c) Give the composition, collection and preservation of blood samples. **4**
6. a) Write the structure and biological significance of vitamin A. Describe a method for its determination. **5**
- b) How will you estimate blood glucose ? Explain its clinical interpretation. **5**
- c) What are the types of drugs ? Give their classification. **4**
7. Write a note on **any three** : **14**
- a) Biological assay of ascorbic acid.
- b) Estimation of added salt in butter and added water in milk.
- c) Method estimating phosphate in urine sample.
- d) Assay of morphine sulphate in drug formulation.
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M.Sc. – II (Semester – IV) Examination, 2015
ANALYTICAL CHEMISTRY
Environmental Chemical Analysis (Paper – XVI)

Day and Date : Thursday, 23-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Max. Marks : 70

- N.B. :**
- 1) Attempt in **all five** questions.
 - 2) Question No. **1** is **compulsory**.
 - 3) Attempt **any two** questions **each** from Section – **II** and Section – **III**.
 - 4) Answers to **all** the questions are to be written in **one** and the **same** answerbook.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Draw** neat labelled diagrams **wherever** necessary.

SECTION – I

1. Attempt the following questions :

14

- i) What were the reasons for Bhopal gas tragedy ?
- ii) Name the methods for measurement of tanins and lignans.
- iii) What are the objectives of water analysis ?
- iv) Explain the term activated sludge.
- v) How will you detect the presence of chloride and sulphate in water ?
- vi) Give physical classes of hazardous waste.
- vii) What is atmosphere ?
- viii) Enlist the chemical methods for hazardous waste treatment.
- ix) Define the term ion-exchange.
- x) Why, activated carbon is used in water treatment ?
- xi) Which mercury compound was responsible for minamata disease ?



- xii) Which parameters are important while analysing water ?
- xiii) What is reverse osmosis ?
- xiv) What is equalization ?

SECTION – II

- 2. a) Discuss in brief the effects of water pollution on human health. 7
- b) Discuss the different components of biosphere. 7
- 3. a) Explain the principle, sampling and reactions involved in determination of CO. 7
- b) What is TOC ? How is it estimated ? 7
- 4. a) What is the objective of tertiary treatment of waste water ? 7
- b) Which reactions are involved in determination of hydrocarbons in air ? Explain in brief. 7

SECTION – III

- 5. a) What is eutrophication ? What are its consequences ? 5
 - b) Describe the method for measurement of surfactants from water sample. 5
 - c) Comment on physical quality parameters of waste water. 4
 - 6. a) State different types of soil erosion. Explain any two. 5
 - b) Explain the bio-geochemical cycle of sulphur. 5
 - c) How is hazardous waste disposed off ? 4
 - 7. Write short notes on **any three** of the following : 14
 - a) Disinfection of water
 - b) Pollution caused by paper industry
 - c) Aerated lagoons
 - d) Health significance of arsenic.
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M.Sc. (Part – II) (Semester – III) Examination, 2015
INORGANIC CHEMISTRY (Paper – IX)
Inorganic Chemical Spectroscopy

Day and Date : Wednesday, 15-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) **Section I is compulsory.**
 - 3) Attempt **any two** questions from **Section II** and **any two** from **Section III.**
 - 4) Answer to **all** questions (**Section I, II and III**) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) Use of log tables and calculators is **allowed.**

SECTION – I

1. Answer the following :

14

- a) Calculate ground term for $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ complex ion.
- b) Among HCl , Cl_2 and C_2H_4 , which is the microwave active species ?
- c) Which type of scattering of light causes Raman effect ?
- d) To which point group does water molecule belong ?
- e) For the nuclei with nuclear spin quantum number $I = \frac{1}{2}$, what are the values of m_I ?
- f) What is red shift ?
- g) What is meant by symmetry element ?
- h) Define spin-spin coupling.
- i) How many modes of vibrations occur in CO_2 molecule ?
- j) Why does vibration spectrum appear as bands rather than lines ?
- k) Define spin selection rule.
- l) Which radiation source is used in photoelectron spectroscopy ?
- m) Give the selection rule for rotational Raman spectra.
- n) Why water can't be used as a solvent in IR spectroscopy ?

P.T.O.



SECTION – II

2. a) What is multiplication table in molecular symmetry ? Construct the multiplication table for C_{3v} point group. 7
- b) Explain mutual exclusion principle for knowing IR and Raman active vibrational modes of molecules. 7
3. a) What is NMR spectroscopy ? Discuss its instrumentation in detail. 7
- b) Draw a neat Orgel diagram for d^1 case. On the basis of this diagram, predict nature of electronic absorption spectra of octahedral Ti^{3+} complexes. 7
4. a) Describe the principle, instrumentation of Photo Electron Spectroscopy (PES). 7
- b) Explain the difference between IR and microwave spectroscopy. Why are pure rotational spectra studied only in gaseous states of atoms and molecules ? 7

SECTION – III

5. a) Describe rigid rotor model in microwave spectroscopy. 5
- b) With suitable examples, describe the applications of NMR in structural inorganic chemistry. 5
- c) Explain Auger effect with illustrative diagram. 4
6. a) What are reducible and irreducible representations ? Explain with suitable examples. 5
- b) Draw and explain Morse potential energy diagram. 5
- c) The fundamental vibrational frequency of HCl is 2890 cm^{-1} . Calculate force constant of HCl. Atomic masses : $^1\text{H} = 1.673 \times 10^{-27}\text{ kg}$, $^{35}\text{Cl} = 58.06 \times 10^{-27}\text{ kg}$. 4
7. Write notes on **any three** of the following : 14
- a) Factors affecting nuclear relaxation
- b) Applications of microwave spectroscopy
- c) Charge transfer spectra
- d) Axis of symmetry and plane of symmetry.
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M.Sc. II (Semester – III) Examination, 2015
INORGANIC CHEMISTRY (Paper – XI)
Nuclear Chemistry

Day and Date : Monday, 20-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- N.B. :**
- 1) Attempt in **all five** questions.
 - 2) Section – I is **compulsory**.
 - 3) Attempt **any two** questions from Section – II and **any two** questions from Section – III.
 - 4) **Use only one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use of log tables and calculators is allowed.**

SECTION – I

1. Answer the following.

14

- a) What is binding energy of ${}^2_1\text{H}$?
- b) Who independently developed liquid drop model ?
- c) What is the nuclear temperature of aluminium, when excited to 25 MeV above the fermi level ?
- d) How the compound nucleus is formed ?
- e) What is the relation between reaction cross-section and rate of reaction ?
- f) What is symmetrical fission ?
- g) What are the prompt neutrons ?
- h) In India, which mineral is used for extraction of thorium ?
- i) What is nuclear reactor ?
- j) How much power will be produced in graphite moderated reactor ?
- k) Give the equation for determination of power of nuclear reactor.

P.T.O.



- l) What is Fermi's four factor formula ?
- m) What are the major products of water radiolysis ?
- n) What is the basic unit of radiation energy ?

SECTION – II

- 2. a) Explain the manufacture of heavy water in India. **7**
- b) What is nuclear fission ? Discuss various types of nuclear fission. **7**
- 3. a) What is semi-empirical mass equation ? Discuss various energies in semi empirical mass equation. **7**
- b) On the basis of fermi gas model, explain the structure, density and temperature of nuclei. **7**
- 4. a) What is radiolysis ? Explain the radiolysis of some aqueous solutions. **7**
- b) What is gamma interaction ? Discuss different types of gamma interactions. **7**

SECTION – III

- 5. a) What are the units of radiation energy ? **5**
 - b) Explain the parity and magnetic momentum of nuclei. **5**
 - c) Give the merits of liquid drop model. **4**
 - 6. a) Comment on nuclear fission as a source of energy. **5**
 - b) What are the possible fission fragments of uranium ? Explain their mass distribution. **5**
 - c) How the energy is distributed in fission fragments ? **4**
 - 7. Write a notes (**any three**) : **14**
 - a) Hydrated electrons
 - b) Thermonuclear reactions
 - c) Natural uranium reactor
 - d) Thorium and uranium resources in India.
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INORGANIC CHEMISTRY (Paper – XIII)
Instrumental Techniques

Day and Date : Thursday, 16-4-2015

Total Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions:**
- 1) Attempt in **all five** questions.
 - 2) Question no. **1** is **compulsory**.
 - 3) Attempt **any two** question from Section – II and **any two** from Section – III.
 - 4) Answer to **all** questions (Section – I, II and III) should written in the **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following :

14

- a) Give the relation between asymmetric parameter η and components of field gradient.
- b) Define quadrupole moment.
- c) Draw a schematic diagram of (100) plane.
- d) Write the expression for the energies of various quadrupole states in an axially symmetrical field.
- e) Write the Debye Scherrer formula for calculation of particle size of a material.
- f) Which reference material is used in DSC ?

P.T.O.



- g) Give the relation between nuclear magnetic moment and nuclear spin.
- h) Mention different modes of thermogravimetry analysis.
- i) Mention X-ray wavelength region used for diffraction phenomenon.
- j) Why does Copper (1) compound does not give ESR spectra ?
- k) Give the relation between Doppler shift and energy difference between excited state and ground state of nucleus.
- l) Write the equation for energies of γ - ray emitter.
- m) What kind of DTA curve do we get when compound melts ?
- n) Mention the factors affecting DSC curves.

SECTION – II

- 2. a) What is the principle of NQR spectroscopy ? Discuss the nature of NQR spectra of a molecule with $q_{xx} = q_{yy} \neq q_{zz}$ and nuclei with nuclear spin quantum number $I = 1$ and Calculate the transition energy. **7**
- b) Explain the principle and instrumentation of neutron diffraction. **7**
- 3. a) What is a Mossbauer effect ? How this Mossbauer effect is used in investigation of compounds of Iron and Tin ? **7**
- b) Explain TMA with respect to principle, instrumentation and application. **7**
- 4. a) What is DTA ? Explain the factors affecting DTA curve. **7**
- b) What is the principle of ESR Spectroscopy ? State and explain the Karmar's degeneracy and zerofield splitting. **7**

SECTION – III

- 5. a) Explain the applications of DSC. **5**
- b) What is lattice constant for BCC and FCC ? Calculate the lattice spacing for NaCl crystal having density 2.18g/cc and its molecular weight is 58.5. **5**
- c) Explain the factors affecting the magnitude of g value in ESR spectroscopy. **4**



6. a) Explain the nature of decomposition curve of $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$. 5
- b) Explain the relationship between the electric field gradient and molecular structure in NQR. 5
- c) Predict the number of lines and allowed transitions for a particular Mossbauer nuclei having spin $5/2$ and $3/2$ in its excited and ground state respectively, if nucleus is :
- i) under the influence of internal electric field gradient.
- ii) only extended magnetic field is applied. 4
7. Write notes on **(any three)** : 14
- a) Application of TMA.
- b) Principle of Mossbauer spectroscopy.
- c) Applications of X-ray diffraction.
- d) Crystal structure determination from Bragg's law.
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INORGANIC CHEMISTRY (Paper – XIV)
Coordination Chemistry – II

Day and Date : Saturday, 18-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) **Section I is compulsory.**
 - 3) Attempt **any two** questions from **Section II** and **any two** from **Section III**.
 - 4) Answer to **all** questions (**Section I, II and III**) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figure to the **right** indicate **full** marks.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following :

14

- a) Why $[\text{Co}(\text{NH}_3)_5\text{Br}]^{2+}$ reacts more rapidly than $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$?
- b) What is the role of Nicol prism in polarimeter ?
- c) What is the effect of increase in negative charge of non-labile ligands on SN^1 rate ?
- d) Arrange the following isoelectronic series with increase their lability
 SF_6^- , AlF_6^- , PF_6^- , SiF_6^- .
- e) State the following reaction takes place either by inner sphere or outer sphere electron transfer mechanism.
 $[\text{Fe}(\text{CN})_6]^{3-} + [\text{Fe}(\text{CN})_6]^{4-} \rightarrow [\text{Fe}(\text{CN})_6]^{4-} + [\text{Fe}(\text{CN})_6]^{3-}$
- f) Which transition in tris (ethylenediamine) cobalt (III) complex gives strong optical activity ?

P.T.O.



- g) Give the decreasing order of reactivity of NO_3^- , Cl^- , Br^- , I^- .
- h) The SN^2 mechanism is also known as _____
- i) Give an example of photoisomerization reaction.
- j) Which of the following complexes of the metal ion are expected to be kinetically inert ?
- i) Y(III)
- ii) Cr (III).
- k) What do you mean by labile complex ?
- l) Arrange in increasing efficiency of the following bridging ligands CN^- , OH^- , F^- , Cl^- .
- m) What is inorganic reaction mechanism ?
- n) Give the general reaction for electrophilic Substitution Reaction (SE).

SECTION – II

2. a) Discuss the mechanism of base hydrolysis of Co(III) complexes. Illustrate your answer with at least four evidences in support of the proposed mechanism. 7
- b) Which physical techniques are used to follow the rates of Inorganic reactions ? Explain one method in detail. 7
3. a) Discuss the relationship between Optically Rotatory Dispersion (ORD) and Circular Dichroism (CD) curves. 7
- b) Discuss the photochemistry of Cr(III) complexes. 7
4. a) What is the π -bonding theory of trans effect ? How is the trans effect used in synthesis of *cis* and *trans*- $[\text{Pt}(\text{NH})_3\text{Cl}_2]$ complexes ? 7
- b) Explain the redox mechanism with reference to electron transfer through extended bridge. 7

SECTION – III

5. a) Explain the stereochemical change accompanying reaction of *cis*- MA_4BX complex with Y by a dissociative mechanism. 5
- b) Explain the mechanism involved in racemization reaction in octahedral complexes. 5
- c) Give a brief account on optical activity of metal complexes. 4



6. a) Discuss the reaction of octahedral complexes without metal-ligand bond cleavage. 5
- b) Explain the substitution reactions of labile transition metal complexes in nonaqueous solvent. 5
- c) Distinguish between plane polarized rays and circularly polarized rays. 4
7. Write short notes on **any three** of the following : 14
- a) Acid hydrolysis
 - b) Types of photochemical reaction
 - c) Applications of ORD
 - d) Electron tunneling hypothesis.
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INORGANIC CHEMISTRY (Paper – XV)
Chemistry of Inorganic Materials

Day and Date : Tuesday, 21-4-2015
Time : 3.00 p.m. to 6.00 p.m.

Total Marks : 70

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) **All** questions carry **equal** marks.
 - 4) Answer to the **three** Sections should be written in the **same** answer book and attempt at least **two** questions from Section II and III.
 - 5) Figures to the **right** indicate marks.
 - 6) **Neat** labeled diagrams should be drawn **wherever** necessary.
 - 7) **Use** of log table and calculator is **allowed**.

SECTION – I

1. Answer the following : **14**
- a) What kind of binding forces present in the ionic, metallic, covalent and molecular solids ?
 - b) Why ferroelectric oxides are used in capacitors ?
 - c) What are the applications of soft magnetic materials and hard magnetic materials ?
 - d) What type of nonstoichiometry is observed in FeO, TiO, ZnO ?
 - e) Give the examples of superionic conductors.
 - f) Name two ceramic and alloy superconductors.
 - g) Give two commercial applications of nanomaterials.
 - h) What are CNT and MNT ?



- i) What are types of LASERS ?
- j) Which method is used for the synthesis of ZnFe_2O_4 and NiFe_2O_4 spinels ?
Which reactants are used for synthesis of Spinel ?
- k) What is the difference between semiconductor and ionic conductors ?
- l) The temperature at which the transition of antiferromagnetism to paramagnetism takes place is called
- m) Polyacetylene is a semiconductor while polyethylene is solid.
- n) What is flint glass ? Where it is used ?

SECTION – II

- 2. a) How is the charge neutrality maintained in nonstoichiometric solids ? What are different types of nonstoichiometric defects ? Explain semiconducting properties of nonstoichiometric ionic crystals. 7
- b) Describe the following for the synthesis of solid state materials.
 - i) Sol gel technique
 - ii) Co-precipitation technique. 7
- 3. a) Explain the magnetic hysteresis loop of a typical ferromagnetic sample on the basis of Domain structure. 7
- b) What is meant by crystal imperfections ? Classify them in the order of their geometry. Explain point, line and surface imperfections found in solid state materials. 7
- 4. a) What are superconductors and superconductivity ? Explain the BCS theory of superconductivity. 7
- b) What are type I and type II superconductors ? Discuss important applications of superconductors. 7



SECTION – III

5. a) What are the nanocrystalline materials ? Describe the ceramic structure with reference to electrical conductivity and give its technological importance. **7**
- b) Describe the structure of spinels. **7**
6. a) What are the principal properties used to explore nanomaterials and explain top-down and bottom-up approach with suitable examples ? **7**
- b) How does paramagnetic susceptibility of a metal vary with temperature ? Discuss the Langevin's theory of paramagnetism gas and obtain an expression for the paramagnetic susceptibility of a solid. **7**
7. Write short note on **any three** of the following : **14**
- a) Applications of magnetic materials
- b) Organic semiconductors
- c) Refractory materials
- d) Piezoelectricity and Pyroelectricity.
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Seat No.	
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M.Sc. (Part – II) (Semester – IV) Examination, 2015
INORGANIC CHEMISTRY (Paper – XVI)
Applied Inorganic Chemistry

Day and Date : Thursday, 23-4-2015

Max. Marks : 70

Time : 3.00 p.m. to 6.00 p.m.

- Instructions :**
- 1) Attempt in **all five** questions.
 - 2) Section I is **compulsory**.
 - 3) Attempt **any two** questions from Section II and **any two** from Section III.
 - 4) Answer to **all** questions (Section I, II and III) should be written in **one** answer book.
 - 5) **All** questions carry **equal** marks.
 - 6) Figures to the **right** indicate **full** marks.
 - 7) **Use** of log tables and calculators is **allowed**.

SECTION – I

1. Answer the following :

14

- a) Write the allotropes of carbon.
- b) Define hapticity of ligand.
- c) What are the sources of geothermal energy ?
- d) What is co-ordination polymer ?
- e) Name the minerals of zeolite.
- f) Name the sandwich compounds.
- g) What are the type's solar cells ?
- h) Define fusion reaction.
- i) Name the biomass conversion technique.
- j) Define zeolite.



- k) What are chalcogenide glasses ?
- l) What are metallocene ?
- m) Which techniques used for characterization of nanomaterials ?
- n) What are nanoforms of carbon ?

SECTION – II

- 2. a) Explain in brief combustion method. 7
- b) Write a brief account of Boron based polymers. 7
- 3. a) Discuss the structures, properties and uses of various types of silicon polymers. 7
- b) Explain the energy conversion from fission and fusion reactions. 7
- 4. a) Outline the various characterization techniques for nanomaterials. Explain in detail scanning Electron Microscope. 7
- b) Explain in detail structure and properties of ferrocene. 7

SECTION – III

- 5. a) Discuss the theories of catalysis. 5
 - b) Write a brief account for energy from biogas. 5
 - c) Write the general properties of inorganic polymers. 4
 - 6. a) Explain the ion exchange method for making nanomaterials. 5
 - b) Write the advantages of geothermal energy. 5
 - c) Distinguish between natural and synthetic polymer. 4
 - 7. Write a notes (**any three**) : 14
 - a) Tidal wind energy
 - b) Homogenous catalysis
 - c) Chain coordination polymers
 - d) Photovoltaic cell.
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