Chemistry

Subject code: CH102BS

Regulations: R18-JNTUH

Class: I Year B. Tech CSE,EEE & IT I Sem

Department of Science and Humanities

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

Chemistry (CH102BS)

I. COURSE OVERVIEW:

Concepts in Chemistry are the foundation for any Engineering subject. Hence exposure to the basic concepts of Chemistry is a compulsory aspect to an Engineering graduate.

Introduce the students to atomic, molecular and electronic changes and band theory related to conductivity. As a course outcome they also acquire knowledge on electrochemistry, batteries and their function. The students also gain knowledge on corrosion and waste water treatment methods. As a part of this program further they attain the required concepts about stereochemistry and reaction mechanism of organic molecules. They acquire basic knowledge in spectroscopy and its application to medical and other fields. They are also trained in the synthesis of some drug molecules such as aspirin and paracetamol.

This way the course will build a firm base to students to further understand the engineering concepts efficiently and easily. The lab sessions impart practical exposure to different natural phenomenon in chemistry and to understand them completely.

II. PREREQUISITE(S):

- Students entering advanced engineering chemistry should have a firm grasp of basics of Electrochemistry and Stereochemistry

III. COURSE OBJECTIVES:

- To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
- To impart the basic knowledge of atomic molecular and electronic modifications to make the student to understand the technology based on them.
- To understand the basic principles of electrochemistry, corrosion and waste water treatment methods which are essential for the engineers and in industry.
- To acquire the skills pertaining to spectroscopy and to apply them for medical and other fields.
- To accomplish the knowledge of stereochemistry and synthetic aspects useful for understanding reaction pathways.

IV. COURSE OUTCOMES: The student will learn

S. no	Course Outcomes (CO)	Blooms level
CO1	The knowledge of atomic, molecular and electronic changes, band theory related to conductivity.	Theory, Understand, Knowledge
CO2	The required knowledge about importance of water and understanding its treatments methods.	Understand, Remember
CO3	The required principles and concepts of electrochemistry, corrosion.	Apply
CO4	The required skills to get clear concepts on basic spectroscopy and application to medical and other fields.	Apply, Analyse
CO5	The knowledge of configurational and conformational analysis of molecules and reaction mechanisms.	Understand, Remember

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	**2**	Assignments
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	1	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	**2**	Assignments
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**2**	Experiments

PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	**-**	**-**
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	**2**	Assignments
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	**3**	Assignments
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	**-**	**-**
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	**-**	**-**
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation make effective presentations, and give and receive clear instructions	**-**	**-**
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	-	-
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change.	**-**	-

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		**Level**	**Proficiency assessed by**
PSO1	**Software Development and Research Ability:** Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of	-	-

	programming language and open source platforms. Use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.		
PSO2	**Foundation of mathematical concepts:** Ability to apply the acquired knowledge of basic skills, principles of computing, mathematical foundations, algorithmic principles, modeling and design of computer-based systems in solving real world engineering Problems.	-	-
PSO3	**Successful Career:** Ability to update knowledge continuously in the tools like Rational Rose, MATLAB, Argo UML, R Language and technologies like Storage Computing, Communication to meet the industry requirements in creating innovative career paths for Immediate employment and for higher studies.	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)** **- : None**

VII. SYLLABUS:

UNIT I: Molecular structure and Theories of Bonding: Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N_2, O_2 and F_2 molecules. Π molecular orbitals of butadiene and benzene.

Crystal Field Theory (CFT): Salient features of CFT- Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries. Band Structure of solids and effect of doping on conductance.

UNIT II:

Water and its treatment:

Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method.Numericalproblems. Potable water and its specifications- Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and Ozonization. Defluoridation – Nalgonda technique - Determination of F^- ion by ion- selective electrode method.

Boiler troubles:

Sludges, scales and Causticembrittlement. Internal treatment of Boiler feed water – Calgon conditioning – Phosphate conditioning - Colloidal conditioning – Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis. Numerical problems – Sewage water - Steps involved in treatment of sewage.

UNIT III: Electrochemistry and Corrosion:

Electrochemistry: Electrode potential, standard electrode potential, types of electrodes –Construction and functioning of Standard hydrogen electrode, calomel and glass electrode. Nernst equation, electrochemical series and its applications. Electrochemical cells: Daniel cell – cell notation, cell reaction and cell EMF – Concept of concentration cells – Electrolyte concentration cell –Numerical problems.

Batteries: Cell and battery - Primary battery (dry cell, alkaline cell and Lithium cell) and Secondary battery (lead acid, Ni-Cd and lithium ion cell),

Corrosion: Causes and effects of corrosion, Theories of chemical and electrochemical corrosion-Mechanism of electrochemical corrosion, Types of corrosion: Galvanic, Water-line and pitting corrosion. Factors affecting the rate of corrosion.

Corrosion control Methods: Cathodic protection-Sacrificial anode and impressed current cathodic methods. Surface coatings-metallic coatings-methods of application.Electroless plating of Nickel.

UNIT IV:

Stereochemistry, Reaction Mechanism and synthesis of drug molecules:

Introduction to representation of 3-dimensional structures, structural and stereoisomers, configurations, symmetry and chirality. Enantiomers, diastereomers, optical activity an Absolute configuration. Conformational analysis of n-butane.

Substitution Reactions: Nucleophilic substitution reactions: Mechanism of S_N1, S_N2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard additions on carbonyl compounds . Elimination reactions: Dehydro halogenations of alkyl halides. Saytzeff rule.

Oxidation Reactions: Oxidation of alcohols using$KMnO_4$ and chromic acid.

Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$ and $NaBH_4$. Hydroboration of olefins, structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

UNIT V: Spectroscopic techniques and applications:

Principles of spectroscopy, selection rules and applications of electronic spectroscopy.Vibrational and rotational spectroscopy.Basic concepts of Nuclear Magnetic resonance Spectroscopy, chemical shift.Introduction to Magnetic resonance imaging.

SUGGESTED BOOKS:

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, New Delhi (2010)
2. Physical chemistry by P.W. Atkins
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell
4. Organic chemistry: Structure and Function by K.P.C. Volhardt and N.E. Schore, 5th Edition.
5. University Chemistry by B. M. Mahan, Pearon IV Edition.

REFERENCE BOOKS:

6. Engineering Chemistry by ShikhaAgarwal, Cambridge University Press, Delhi (2015)
7. Engineering Chemistry by ShashiChawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)
8. Engineering Chemistry by Thirumala Chary and Laxminarayana, Scitech Publishers, Chennai (2016).

GATE SYLLABUS: NA

IES SYLLABUS: NA

VIII. COURSE PLAN:

Lecture No.	Week No.	TOPIC	Course learning outcomes	Text books
	UNIT - 1			

1.		Introduction to Atomic and Molecular Orbitals -Bonding in molecules	Theory	
2.		Linear Combination of Atomic Orbitals (LCAO)	Theory	
3.		Molecular orbitals of diatomic molecules		
4.		Molecular orbital energy level diagrams introduction		
5.	2	Molecular orbital energy level diagrams of N_2, O_2 and F_2 molecules.	Understand, Apply	
6.		Pi molecular orbtals of butadiene and benzene	Remember	1, 2, 7
7.		Introduction to Crystal Field theory (CFT)- Salient features of CFT	Theory	
8.		Crystal field splitting of d orbitals in Tetrahedral, Octahedral and Square Planar geometries	Understand	
9.	3	Band structure of solids	Theory	
10.		Effect of doping on conductance.	Understand	
11.		Revision of unit-1		
12.		***Mock Test – I***		
	UNIT – 2			
13.	4	Hardness of water, Causes, Expression ,Units, Types of Hardness: temporary and permanent	Understand, Remember	1,6,7
14.		Estimation of Hardness by complexometric method (EDTA), Numerical Problems.	Apply, Apply	
15.		Potable water- Its Specifications, steps involved in Treatment of potable water	Understand, Remember	
16.		Disinfection of Potable water by Chlorination &Ozonization, Defluoridation- Nalgonda technique	Understand, Apply	
		Bridge Class # 1		
17.	5	Determination of fluoride ion by ion selective electrode method	Apply	

18.		Boiler Troubles - Scale &Sludges, Caustic Embrittlement	Apply	
19.		Internal Treatment of Boiler feed Water- calgon, phosphate & colloidal conditioning	Understand	
20.		Desalination of water-reverse osmosis. Numerical problems	Theory	
		Sewage water-steps involved in treatment of sewage	Understand	
21.	6	Revision of Unit-II		
	UNIT III			
22.	6	Electrode potential, standard electrode potential	Theory	1, 6,7
23.		Types of electrodes- construction and working of standard hydrogen electrode, calomel electrode	Theory	
24.		Types of electrodes- construction and working of glass electrode, Nernst equation, Electrochemical series & its applications	Understand, Derive	
		Bridge Class # 3		
25.	7	Electrochemical cells- Daniel cell- cell notation, cell reaction & cell EMF	Understand	
26.		Concentration cells- electrolyte concentration cells, numerical problems.	Theory, Remember	
27.		Cells & batteries- primary battery(dry cell, alkaline cell, lithium cell)	Apply	
28.		Secondary batteries(lead acid, Ni-Cd, lithium ion)	Apply	
		Bridge Class # 4		
29.	8	Causes And effects of Corrosion-theories of chemical and electrochemical corrosion-mechanism of electrochemical corrosion.	Understand	
30.		Types of Corrosion:Galvanic, water-line and pitting corrosion, Factors affecting rate of corrosion.	Theory	

31.		Corrosion control methods-Cathodic protection-Sacrificial anode and impressed current cathodic methods.	Apply	
32.		Surface coatings-metallic coatings-methods of application. Electroless plating of Nickel.	Apply	
		Bridge Class # 5		
	I Mid Examinations			
	UNIT – IV			
33.	9	Introduction to representation of 3- dimensional structures, structural and stereoisomers.	Understand	4
34.		Configurations, symmetry and chirality.	Understand	
35.		Enantiomers and diastereomers.	Remember	
36.		Optical activity and Absolute configuration	Understand	
		Bridge Class # 6		
	UNIT – IV contd.			
37.	10	Conformational analysis of n-butane.	Apply	4
38.		Substitution reactions: Nucleophilic substitution reactions	Understand	
39.		Mechanism of SN_1 and Mechanism of SN_2 reaction.	Understand	
40.		Electrophilic and nucleophilic addition reactions	Understand	
		Bridge Class # 7		
41.	11	Addition of HBr to propene. Markownikoff and anti Markownikoff's additions.	Understand, Remember	
42.		Grignard additions on carbonyl compounds.	Apply	
43.		Elimination reactions: Dehydro halogenations of alkyl halides. Saytzeff rule.	Understand	
44.		Oxidation of alcohols using$KMnO_4$ and chromic acid.Reduction of carbonyl compounds using $LiAlH_4$ and $NaBH_4$.	Apply	

		Bridge Class # 8		
45.	12	Hydroboration of olefins.	Understand	
46.		Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.	Apply, understand	
47.		Revision		
48.		Revision		
		Mock Test - II		
	UNIT –V			
49.	13	Principles of spectroscopy	Theory	3
50.		selection rules and its applications	Understand	
51.		Vibrational spectroscopy	Theory	
52.		Rotational spectroscopy	Theory	
		Bridge Class # 9		
53.	14	Basic concepts of Nuclear Magnetic Resonance spectroscopy	Understand	
54.		Chemical Shift	Analyze	
55.		Introduction to Magnetic resonance imaging	create	
56.				
		Bridge Class # 10		
57.	15	Revision		
58.		Revision		
59.		Revision		
60.		Revision		
		Bridge Class # 11		
61.	16	Mock test - 1		

62.		Paper discussion and revision		
63.		Mock test - 2		
64.		Paper discussion and Revision		
		Bridge Class # 12		
	II Mid Examinations			

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

CO's	**Program Outcomes (PO's)**											
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	1	2	1	2	-	-	-	-	-	-	1
CO2	2	1	3	1	2	-	-	-	-	-	-	1
CO3	2	1	3	1	1	-	-	-	-	-	-	1
CO4	2	2	2	1	1	-	-	-	-	-	-	1

CO5	1	-	2	-	1	-	-	-	-	-	-	1
Average (Rounded)	2	1	2	1	1	-	-	-	-	-	-	1

X. QUESTION BANK: (JNTUH)

Definitions of the different levels of cognitive skills in Bloom's taxonomy marked in descriptive questions (where the highest level in question bits is only marked) are as follows:

BLOOMS LEVEL	COGNITIVE SKILL	DEFINITION
Level–1 (L1) :REMEMBER	Knowledge	Recalling/Retrieving relevant terminology, specific facts, or different procedures related to information and/or course topics. (At this level, student remembers something, but may not really understand it fully.)
Level–2 (L2) :UNDERSTAND	Comprehension	Determining the meaning of instructional messages (facts, definitions, concepts, graphics etc.)
Level–3 (L3) : APPLY	Application	Carrying out or use previously learned information in another familiar situations or in problem solving
Level–4 (L4) :ANALYZE	Analysis	Breaking information into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose. Analysis refers to the process of examining information in order to make conclusions regarding cause and effect, interpreting motives, making inferences, or finding evidence to support statements/arguments
Level–5 (L5) :EVALUATE	Evaluation	Making judgment's based on criteria and standards, personal values or opinions

Level–6 (L6) : CREATE	Synthesis	Create or uniquely apply prior knowledge and/or skills to form a novel, coherent whole or original product or produce new and original thoughts, ideas, processes,...

DESCRIPTIVE QUESTIONS: (WITH BLOOMS PHRASES)

UNIT I

S.no	Short Answer Questions	Blooms taxonomy Level	Course out come
1	What are atomic and molecular orbital?	Remember	1
2	Calculate the bond order in molecules of O_2, O_2^-, O_2^{2-} and N_2^+, N_2^-	Analyze	4
3	Define bond order. Explain the factors affecting it	Understand	2
4	Write notes on Linear combination of atomic orbitals	Remember	1
5	What is meant by doping, and how it affects on conduction?	Understand	2

S.No	Long Answer Question	Blooms taxonomy Level	Course out come
1	Draw the molecular orbital energy level diagrams of N_2, O_2 and F_2 molecules and work out bond order and magnetic properties in them.	understand	2
2	What is the reason for crystal field splitting and what are thefactors	Apply	3

	affecting crystal field splitting?		
3	Explain the important postulates of Molecular orbital theory Explain the CFT splitting in octahedral and tetrahedral geometries?	Understand	2
5	Write salient features of CFT?	Remember	1

UNIT – II

S.No	**Short Answer Questions**	**Blooms taxonomy Level**	**Course out come**
1	Why are NH_4Cl and NH_4OH buffer added during the determination of hardness?	Apply	3
2	What is the indicator used in EDTA method?	Remember	1
3	A sample of hard water contains 14.6 g of $Mg(HCO_3)_2$ and 9.5 g of $MgCl_2$ and 13.6 g of $CaSO_4$. What is the temporary, permanent and total hardness of the water sample?	Apply	3
4	Explain the role of anion exchange resin.	Understand	2
5	How is caustic embrittlement avoided?	Understand	2

S. no	**Long Answer Questions**	**Blooms taxonomy Level**	**Course out come**
1	Distinguish between temporary and permanent hardness of water.	Understand	2
2	Write a note on complexometric titrations used for estimation of hardness of water by EDTA method	Understand	2
3	Why is hard water harmful to boilers? Discuss the causes and harmful effects of scale formation.	Understand	2
4	What are the factors that lead to caustic embrittlement in boilers? How can it be prevented?	Remember	1
5	Explain the softening of water by Ion exchange process.	Remember	1
6	Define Potable water and give an account of disinfection of water by chlorination and ozonisation.	Apply	3

7	Define Desalination and explain the methods of desalination.	Understand	2
8	Write a brief account on internal conditional methods of treatment of water.	Apply	3

UNIT – III

S.No	Short answer type questions	Blooms taxonomy Level	Course out come
1	Why does dry cell become dead aftertime even though it is not used?	Evaluate	5
2	What are secondary cells? Give two examples.	Remember	1
3	What is meant by rusting of iron?	Understand	2
4	Write the Nernst equation in terms of reduction potential.	Apply	3

S.No	Long Answer Questions	Blooms taxonomy Level	Course out come
1	What do you understand by electrochemical series? How is this series useful in the determination of corrosion of metals?	Understand	2
2	What are concentration cells? Explain the concept of electrolyte concentration cell.	Apply	3
3	Write short notes on electrode potential and standard hydrogen potential.	Remember	1
4	Explain Calomel electrode. Mention its advantages.	Remember	1
5	Write a note on hydrogen–oxygen fuel cells.	Understand	2
6	Explain the construction and working of Lead acid battery.	Understand	2
7	Mention the electrode reactions and advantages	Apply	3

UNIT – IV

S.No	Short answer questions	**Blooms taxonomy Level**	**Course out come**
1	Differentiate between enantiomers and diastereomers.	Understand	2
2	State and explain saytzeff rule.	Remember	1
3	What do you mean by conformational isomers.	Remember	1
4	What is peroxide effect?	Apply	3
5	What do you mean by Hoffmann's elimination?	Apply	3

S.No	**Long answer questions**	**Blooms taxonomy Level**	**Course out come**
1	Explain the mechanism of SN_1 and SN_2 reactions with examples	Understand	2
2	Write the mechanism of HBr addition to propene in presence of peroxides. Explain using antimarkownikoff rule.	Understand	2
3	Draw the conformational isomers of n-butane and explain.	Apply	3
4	Explain the reduction of carbonyl compounds using $LiAlH_4$	Remember	1
5	Write the synthesis and pharmaceutical applications of Aspirin and Paracetamol.	Understand	2

UNIT – V

S.No	**Short answer questions**	**Blooms taxonomy Level**	**Course out come**

1	Write any three applications of UV and IR spectroscopy.	Understand	2
2	Write about Chemical shift in NMR.	Apply	3
3	Define the term red shift and blue shift. Increased conjugation will cause which shift?	Evaluate	5
4	State the selection rules in IR Spectroscopy.	Understand	2
5	With the help of IR how would you differentiate between o-nitro phenol and p-nitro phenol.	Analyze	4

S.No	**Long answer questions**	**Blooms taxonomy Level**	**Course out come**
1	Discuss about Shielding and deshielding in NMR with examples	Apply	3
2	What is Beer Lambert Law? Show that the absorption is linearly proportional to concentration.	Understand	2
3	Write the basic principles of IR spectroscopy. Describe various molecular vibrations in the technique.	Understand	2
4	Describe briefly the theory of NMR spectroscopy? What information can be obtained from NMR absorption peaks?	Remember	1
5	Schematically represent and discuss different types of electronic transitions and hence show that n to π^* transition is the lowest energy demanding among all of them.	Analyze	4

XI. OBJECTIVE QUESTIONS: JNTUH

UNIT: I

1. The bond order of N_2 molecule is _____.
   a) 2.0 b) 3.0 c) 2.5 d) 1.0

2. The bond order of a molecule can be calculated using MOT as ----------

3. The bond order is _____ proportional to its bond length.
   a) directly b) Inversely c) no relation

4. The electron density of Pi Molecular Orbital along internuclear axis is ----------..

5. The magnetic nature of O_2 molecule is ----------.

6. Which of the following molecular orbitals have lowest energy?
   a) $\sigma 2p_z$ b) $\sigma^* 2p_z$ c) $\pi 2px$ d) $\pi^* 2px$

UNIT-II

1. The indicator used for the estimation of total hardness of a given water sample by EDTA method is _____.
   a) Starch b) EBT c) Ferroin d) Methyl orange

2. Temporary hardness of water is caused due to the presence of _____.
   a) Calcium carbonate b) Calcium chloride c) Magnesium bicarbonate d) None

3. The method used for desalination of water is _____.
   a) zeolite process b) Lime soda process c) Ion exchange process d) Distillation

4. The soft, loose and slimy precipitate formed within the boiler is called _____.
   a) Scale b) Sludge c) embrittlement d) Coagulation

5. Permanent hardness of water is caused due to the presence of _____.
   a) Calcium carbonate b) Calcium chloride c) Magnesium bicarbonate d) None

6. Cation exchange resin contains _____ mobile ions.
7. Hardness of water is expressed in terms of _____.

UNIT –III

1. _____ converts chemical energy into electrical.
   a) Galvanic cell b) Daniel cell c) Dry cell d) all
2. In the anodic chamber _____ reaction takes place.
   a) Oxidation b) Reduction c) Addition d) Substitution
3. In the cathodic chamber _____ reaction takes place.
   a) Oxidation b) Reduction c) Addition d) Substitution
4. Origin of electrode potential is explained in _____.
   a) Nernst theory b) Helmholtz double layer theory
   c) galvanic theory d) Electrochemical theory
5. In two half cells, the one which is having high negative value acts as _____.
   a) anode b) Cathode c) Dry cell d) None
6. Rusting of iron is an example for _____.
   a) Dry corrosion b) electrochemical corrosion c) acid corrosion d) None
7. Coating used for the iron container used for food package coated with _____.
   a) Zn b) Sn c) Pb d) Al

UNIT - IV

1. The number of stereo isomers in tartaric acid
   a) 1 b) 2 c) 3 d) 4
2. The correct reactivity order of A) primary alkylhalide, B)secondary alkyl halide C) tertiary alkyl halide toward SN^1 reaction
   a) A>B>C b) B>C>A c)C>A>B d)C>B>A
3. The number of optically active isomers in glucose
   a) 4 b) 8 c) 16 d) 2

4. The correct reactivity order of A) primary alkylhalide, B)secondary alkyl halide C) tertiary alkyl halide towards SN^2 reaction

   a) A >B >C b) B > C >A c) C> A >B d) C > B >A

5. Polar protic solvents favour _____reaction mechanism.

6. The major product in the addition of HBr to propene in presence of benzoyl peroxide
   a) 1-bromopropane b) 2- bromopropane c) 1,2 ibromopropane d) n-propane

7. The major product in the addition of HBr to propene
   b) 1-bromopropane b) 2- bromopropane c) 1,2 ibromopropane d) n-propane

UNIT - V

1. Which of the following compounds have most deshielded protons
   a) CH_3I b) CH_3Br c) CH_3Cl d) CH_4
2. How many signals would the following molecule show in its ^1H NMR spectrum? of benzene
   a) 5 b)1 c) 6 d) 8

3. In NMR spectroscopy, the radiation used for nuclear excitation is

   a) microwaves b) IR c) Radio wave d) UV

4. A quartet has intensity ratio

   a) 1:3:2:1 b)1:2:3:1c)1:3:3:1 d)1:1:2:3

5. Increasing order of wavelength is

   a) x-ray, UV, IR, microwave b) microwave, x-ray, UV, IR, c) x-ray,IR, microwave, UV d) UV, IR, microwave, x-ray

XII. GATE QUESTIONS: NA

XIII. WEBSITES:

1. http://nptel.ac.in/courses/104103019/40
2. http://nptel.ac.in/courses/104105039/
3. http://pubs.acs.org/doi/abs/10.1021/ed059p724
4. ocw.mit.edu › Courses
5. online.stanford.edu/course/introduction-chemical-engineering-self-study-resource
6. Engineering chemistry (NPTEL web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan.

XIV. EXPERT DETAILS:

1. Dr Y. BharathiKumari, Retd Professor, Department of Chemistry, JNTU, Hyderabad
2. Dr. B. Rama Devi, Department of Chemistry, JNTU, Hyderabad

XV. JOURNALS: Journal of Industrial and Engineering Chemistry: Elsevier

XVI. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Batteries
2. Waste water Treatment methods
3. stereochemistry
4. Crystal Field theory
5. NMR applications in medical field

XVII. CASE STUDIES / SMALL PROJECTS:

1. Estimation of Hardness of water
2. Preparation of Drugs
3. Optical activity measurements of some R and S drugs
4. NMR spectra interpretation of some compounds
5. Applications of MRI in diagnosis of diseases