B. TECH.
(SEM I) THEORY EXAMINATION 2022-23
ENGINEERING CHEMISTRY

Time: 3 Hours

समय: ३ घंटे

Total Marks: 70

पूर्णांक: 70

Note:
1. Attempt all Sections. If require any missing data; then choose suitably.
2. The question paper may be answered in Hindi Language, English Language or in the mixed language of Hindi and English, as per convenience.

नोट: 1. सभी प्रश्नों का उत्तर दीजिए। किसी प्रश्न में, आवश्यक डेटा का उल्लेख न होने की स्थिति में उपयुक्त डेटा चुन सकते: मानक प्रश्न को हल करें।
2. प्रश्नों का उत्तर देने हेतु सुविधानुसार हिन्दी भाषा, अंग्रेजी भाषा अथवा हिन्दी एवं अंग्रेजी की मिश्रित भाषा का प्रयोग किया जा सकता है।

SECTION A

1. Attempt all questions in brief.   2 x 7 = 14

   निम्न सभी प्रश्नों का संक्षेप में उत्तर दीजिए।

   (a) On the basis of MO theory calculate the bond order of NO. Will NO be paramagnetic or diamagnetic?

   MO सिद्धांत के आधार पर NO की बंध कोटि की गणना कीजिए। क्या NO अनुचुम्बकीय होगा या प्रतिचुम्बकीय?

   (b) What are Chiral Drugs? Give examples of Chiral Drugs.

   चिरल ड्रग्स क्या है? चिरल औषधियों के उदाहरण दीजिए।

   (c) Give important applications of electrochemical series.

   विद्युत रासायनिक श्रृंखला के महत्वपूर्ण अनुप्रयोग लिखिए।

   (d) A water sample is found to contain 40.5 mg/L Ca(HCO₃)₂; 14.6 mg/L Mg(HCO₃)₂; 22.2 mg/L CaCl₂; 24 mg/L MgSO₄ and 18mg/L NaCl. Calculate the temporary and permanent hardness of the water sample.

   एक पानी के नमूने में 40.5 mg/L Ca(HCO₃)₂; 14.6 mg/L Mg(HCO₃)₂; 22.2 mg/L CaCl₂; 24 mg/L MgSO₄ and 18mg/L NaCl पाया गया। पानी के नमूने की अस्थायी और स्थायी कठोरता की गणना करें।

   (e) Discuss the preparation and uses of PTFE.

   PTFE की निर्माण प्रक्रिया और उपयोगों पर चर्चा करें।

   (f) How does Gross Calorific Value differ from Net Calorific Value?

   सकल कैलोरी मान, शुद्ध कैलोरी मान से कैसे भिन्न होता है?

   (g) What are Chromophores and Auxochromes? Give examples.

   क्रोमोफोर और ऑक्सोक्रोम क्या हैं? उदाहरण दीजिए।

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

   निम्न में से किसी तीन प्रश्नों का उत्तर दीजिए।

   (a) Describe different types of Liquid crystals. Discuss the applications of Liquid crystals.

   तरल क्रिस्टल के विभिन्न प्रकार का वर्णन कीजिए। तरल क्रिस्टल के अनुप्रयोग पर चर्चा करें।

   (b) What is Atropisomerism? Give five examples of compounds showing optical isomerism in the absence of chiral carbons.

   एट्रोपिसोमेरिज्म क्या है? काइरल कार्बन की अनुपस्थिति में प्रकाशिक समावयवता दर्शाने वाले यौगिकों के पांच उदाहरण दीजिए।

   (c) Explain the setting and hardening of cement with relevant chemical reactions involved during the process.

   प्रक्रिया के दौरान शामिल प्रासंगिक रासायनिक प्रतिक्रियाओं के साथ सीमेंट की सेटिंग और कठोरता की व्याख्या करें।

   (d) Explain the stages involved in production of biogas from cattle dung. Compare the impact of use of biogas and coal on the environment.

   गोबर से बायोगैस के उत्पादन में शामिल चरणों की व्याख्या करें। पर्यावरण पर बायोगैस और कोयले के उपयोग से होने वाले प्रभाव की तुलना कीजिए।

   (e) What are organo metallic compounds? Discuss the preparation of Grignard Reagent. Predict the final product obtained when C₂H₅MgBr reacts with

   ऑर्गनो धात्विक यौगिक क्या हैं? ग्रिगनार्ड अभिकर्मक की निर्माण प्रक्रिया पर चर्चा करें। C₂H₅MgBr के साथ प्रतिक्रिया करने पर प्राप्त होने वाले अंतिम उत्पाद की भविष्यवाणी करें

   (i) HCHO (ii) CH₃CHO (iii) (CH₃)₂CO?

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

   निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

   (a) Describe the structure and applications of Graphite and Fullerenes. Explain the reasons for electrical and lubricating properties of graphite.

   ग्रेफाइट और फुलरीन की संरचना और अनुप्रयोगों का वर्णन कीजिए। ग्रेफाइट के वैद्युत एवं स्नेहक गुणों के कारणों की व्याख्या कीजिए।

   (b) What are Carbon Nano Tubes? Discuss the applications of nanomaterials.

   कार्बन नैनो ट्यूब क्या हैं? नैनो सामग्री के अनुप्रयोगों पर चर्चा करें।

4. Attempt any *one* part of the following: 7 x 1 = 7

   निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

   (a) Why is TMS used as an internal standard in NMR spectroscopy? Two isomeric compounds A and B have molecular formula C₉H₁₀. The ¹H NMR spectra of these isomers gave the following data:

   Isomer A: δ 1.30 (9H,s); δ 7.28 (5H, s)
   Isomer B: δ 0.88 (6H, d); δ 1.86 (1H, m); δ 2.45 (2H, d); δ 7.12 (5H, s)

   Giving reasons assign the structures for the two isomers

   TMS का उपयोग NMR स्पेक्ट्रोस्कोपी में आंतरिक मानक के रूप में क्यों किया जाता है? दो समावयवी यौगिकों A तथा B का अणुसूत्र C₉H₁₀ है। इन आइसोमर्स के ¹H NMR स्पेक्ट्रा ने निम्नलिखित डेटा दिया:

   आइसोमर A: δ 1.30 (9H,s); δ 7.28 (5H, s)
   आइसोमर B: δ 0.88 (6H, d); δ 1.86 (1H, m); δ 2.45 (2H, d); δ 7.12 (5H, s)
   कारण बताते हुए दो समावयवियों के लिए संरचनाओं का निर्धारण कीजिए

   (b) (i) Explain the basic principle of IR Spectroscopy. What is the significance of Fingerprint region in IR spectroscopy?
       (ii) Identify the chromophoric groups present in cyclopentene, toluene, butanone and methanethiol in UV spectroscopy.

       (i) IR स्पेक्ट्रोस्कोपी के मूल सिद्धांत की व्याख्या करें। IR स्पेक्ट्रोस्कोपी में फिंगरप्रिंट क्षेत्र का क्या महत्व है?
       (ii) UV स्पेक्ट्रोस्कोपी में, साइक्लोपेंटीन, टोल्यूनि, ब्यूटेनोन और मेथेनेथिऑल में मौजूद क्रोमोफोरिक समूहों की पहचान करें।

5. Attempt any *one* part of the following:

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

7 x 1 = 7

(a) Discuss the mechanism of electrochemical theory of corrosion by absorption of oxygen. What effect will increased oxygen supply have on such corrosion? How can corrosion be minimized by proper design?

ऑक्सीजन के अवशोषण द्वारा संक्षारण के विद्युत रासायनिक सिद्धांत की क्रियाविधि की चर्चा कीजिए। ऑक्सीजन की आपूर्ति में वृद्धि का क्या प्रभाव पड़ेगा? उचित डिजाइन द्वारा जंग को कैसे कम किया जा सकता है?

(b) Discuss the differences between anodic and cathodic metallic coatings. Explain what will happen if an iron wire is attached through an insulated metallic wire to a small sheet of magnesium?

ऐनोडिक और कैथोडिक धात्विक लेप के बीच अंतर पर चर्चा करें। गैल्वेनाइजिंग और इलेक्ट्रोप्लेटिंग की प्रक्रियाओं की व्याख्या करें। क्या होगा, यदि समुद्र में यात्रा कर रहे एक लोहे के जहाज को विद्युतरोधी धातु के तार के माध्यम से मैग्नीशियम की एक छोटी शीट से जोड़ दिया जाए?

7 x 1 = 7

6. Attempt any *one* part of the following:

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a) Explain the zeolite process of water softening. What are the advantages and limitations of this process? Calculate the amount of lime and soda required for the treatment of 10,000 litres of water whose analysis is as follows (in mg/L):
$Mg(HCO_3)_2=73$; $CaSO_4=102$; $MgCl_2=95$; $MgSO_4=24$; $Ca(HCO_3)_2=121.5$;
$NaCl=55$.

जल के मृदुकरण की जिओलाइट प्रक्रिया को समझाइए। इस प्रक्रिया के लाभ और सीमाएं क्या हैं? 10,000 लीटर पानी के उपचार के लिए आवश्यक चूने और सोडा की मात्रा की गणना करें जिसका विश्लेषण इस प्रकार है (mg/L में):
$Mg(HCO_3)_2=73$; $CaSO_4=102$; $MgCl_2=95$; $MgSO_4=24$; $Ca(HCO_3)_2=121.5$;
$NaCl=55$.

(b) Explain the different parameters that are determined in the proximate analysis of coal. On burning 0.92g of a solid fuel in a bomb calorimeter, the temperature increased by 2.42°C. Water equivalent of calorimeter and of 3300g of water increased by 2.42°C. If the fuel contains 0.7% hydrogen, calculate its GCV and NCV.

कोयले के प्रोक्सिमेट विश्लेषण में निर्धारित विभिन्न मापदंड की व्याख्या कीजिए। एक बम कैलोरीमीटर में 0.92 ग्राम ठोस ईंधन जलाने पर 3300 ग्राम पानी का तापमान 2.42°C बढ़ जाता है। कैलोरीमीटर का जल तुल्यांक और भाप की गुप्त ऊष्मा क्रमशः 385.0g और 587.0 cal/g के बराबर है। यदि ईंधन में 0.7% हाइड्रोजन है, तो इसके GCV और NCV की गणना करें।

latent heat of steam are 385.0g and 587.0cal/g, respectively. If the fuel contains 0.7% hydrogen, calculate its GCV and NCV.

7 x 1 = 7

7. Attempt any *one* part of the following:

निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a) (i) Differentiate between Chain Growth and Step Growth polymerization.
(ii) Outline the process of vulcanization of rubber. Describe the preparation, important properties and uses of Butyl rubber **or** Kevlar.

(i) श्रृंखला वृद्धि और चरण वृद्धि बहुलकन में अंतर स्पष्ट कीजिए।
(ii) रबड़ के वल्कनीकरण की प्रक्रिया की रूपरेखा प्रस्तुत कीजिए। ब्यूटाइल रबर या केवलर की तैयारी, महत्वपूर्ण गुणों और उपयोग का वर्णन करें।

(b) (i) Differentiate between Thermosetting and Thermoplastic polymers.
(ii) Giving examples write a brief note on conducting polymers.

(i) थर्मोसेटिंग और थर्मोप्लास्टिक पॉलिमर के बीच अंतर करें।
(ii) चालक बहुलकों पर उदाहरण देते हुए एक संक्षिप्त टिप्पणी लिखिए।

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MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Roll No. : ...A.R.P.A.S.H...........

NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250 005 U.P.

Sessional Examination / Class Test – I : Odd Semester 2022-23

Course/Branch	: B Tech (OC1, OC2, OC4, OC6, OC8, OC10)		
Subject Name	: Eng. Chemistry	Semester	: 1
Subject Code	: RAS-102T	Max. Marks	: 60
		Time	: 120 min

CO-1: To enable the students to understand about the Chemistry of Atomic and Molecular structure, Chemistry of advanced Materials like Liquid crystals, Nanomaterials, Graphite & fullerenes and Green Chemistry.

CO-2: Apply the fundamental concepts of determination of structure with various spectral techniques and stereochemistry.

Section – A (CO - 1) # Attempt both the questions # 30 Marks

Q.1 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (2 x 6 = 12 Marks)

a) Arrange the following in increasing bond length or decreasing stability: NO, NO^-, NO^+.

b) Give the properties of mesogen molecule for the formation of liquid crystal.

c) Explain why graphite is used as lubricant?

d) Give the approaches used for the preparation of nanomaterials?

e) What is the importance of Green Chemistry?

f) What are liquid crystals?

g) Explain Four R of green chemistry stands for.

Q.2 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) Describe twelve principles of Green Chemistry. What is the Environmental impact of Green chemistry on society?

b) Discuss the structure, properties and application of an allotrope of carbon having truncated icosahedrons geometry.

c) Discuss the classification of liquid crystal based on temperature.

d) Give the Synthesis of Paracetamol by Conventional and Green Route.

e) Draw molecular orbital diagram for CO molecule. Calculate its bond order and magnetic behavior.

Section – B (CO - 2) # Attempt both the questions # 30 Marks

Q.3 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (2 x 6 = 12 Marks)

a) Give the structure of TMS and why it is used as reference in NMR spectroscopy.

b) Comment on the statement 'IR peaks often characterized as molecular finger print'

c) Calculate the fundamental vibrational mode for CH_4 and H_2S molecule.

d) Write possible optical isomer in tartaric acid.

e) Explain why absorption maxima shifted to longer wavelength upon addition of Auxochrome.

f) Give possible electronic transition in HBr molecule?

g) How many signals will be observed in the 1H-NMR of CH_3CH_2OH?

Q.4 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) Explain various electronic transitions in UV-Visible spectroscopy. What are possible electronic transition in NO molecule.

b) Explain Beer-Lambert law. A compound having concentration 10^{-3} g/L resulted absorbance value 0.4 at $\lambda_{max} = 510$ nm using 2.0 cm cell. Calculate its absorptivity and molar absorptivity value. Molecular weight of compound is 400.

c) Explain the term chemical shift along with the shielding and deshielding in NMR spectroscopy.

d) Describe the principle of NMR spectroscopy. What do you mean by equivalent proton in NMR spectroscopy?

e) Write possible optical isomers in tartaric acid. What is the difference between enantiomers and diastereoisomers?

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... OF ENGINEERING AND TECHNOLOGY

Sessional Examination / Class Test – II : Odd Semester 2022-23

Course/Branch : B Tech – C4, C6, C8, C10

Subject Name : Engineering Chemistry

Subject Code : BAS102

17/1/23

240

Semester : I

Max. Marks : 60

Time : 120 min

CO-3 : To enable the students to understand and apply the concepts related to Electrochemistry, Batteries, Corrosion and Chemistry of Engineering Materials like cement.

CO-4 : To enable the students to understand and apply detailed concepts of water source, water impurities, hardness of water and boiler troubles used in industry as well as analysis of coal & determination of calorific values.

Section – A (CO - 3) # Attempt both the questions # 30 Marks

Q.1: Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (2 x 6 = 12 Marks)

a) How much rust ($Fe_2O_3.6H_2O$) can be produced by 2gm of iron?

b) Write half-cell reactions, complete cell reaction and calculate EMF of the cell for the given cell:Zn / Zn^{2+} [0.01M] ||Cu^{2+} [0.02M] / Cu Standard reduction potential of Zn^{2+} and Cu^{2+} are -0.76V and 0.34V respectively

c) Give the construction & working of Leclanche cell.

d) Why a block of magnesium attached through an insulated metallic wire to an underground iron pipeline.

e) Derive Nernst equation.

f) What is salt bridge? Mentions its function in an electrochemical series.

g) Explain why sheets of Zinc metal are hung around the ship hull of ocean-going ship.

Q.2: Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) The voltage of the cell $Pb/PbSO_4/Na_2SO_4.10H_2O/Hg_2SO_4/Hg$ is 0.9647 V at 25 °C. The temperature coefficient is $1.74 \times 10^{-4} VK^{-1}$. Calculate the value of ΔG, ΔH and ΔS.

b) How corrosion can be prevented by sacrificial anodic protection and impressed cathodic protection.

c) Discuss the electrochemical theory of corrosion along with equations.

d) Define corrosion. Explain how anodic and cathodic inhibitors provides protection against corrosion. Give suitable examples.

e) Discuss the working and all the reactions involved in lead-acid storage battery. Explain with the help of neat diagram.

Section + B (CO - 4) # Attempt both the questions # 30 Marks

Q.3: Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (2 x 6 = 12 Marks)

a) What is potable water? What are its chemical requirements?

b) What is meant by calorific value of a fuel? What are its units?

c) Differentiate between scale and sludge by giving suitable examples.

d) Why should an ideal fuel have moderate ignition temperature?

e) What is hardness? What are the units of hardness? Convert 50 ppm into degree French and degree Clarke.

f) Write a short note on reverse osmosis.

g) What is biogas? What are the main constituents present in biogas?

Q.4 :Attempt any THREE questions (Medium Answer Type). Each question is of 6 marks. (3 × 0 ... | Expla nsiti

a) What is the principle of EDTA method? Explain the estimation of hardness of water by complexometric method. 0.8g of CaCO3 was dissolved in HCl and the solution made up to 300ml with distilled water. 50ml of the solution required 48ml of EDTA solution for titration. 50ml of hard water sample required 15ml of EDTA and after boiling and filtering required 10ml of EDTA solution. Calculate the hardness.

b) Calculate the gross and net calorific values of a coal sample containing 84% of Carbon, 1.5% sulphur, 6% nitrogen, 5.5% hydrogen and 8.4% oxygen. The Calorific values of carbon, hydrogen sulphur are 8080 Kcal/Kg, 34500 Kcal/Kg and 2240 Kcal/Kg respectively, and latent heat of steam i 587 Cal/g.

c) Describe permutit process for water softening. Give it demerits over ion exchange process of wate softening. A sample of water was found to contain 20.5 mg/L $Ca(HCO_3)_2$, 24 mg/L $Mg(HCO_3)$ 34mg/L $CaSO_4$, 10 mg/L $MgSO_4$, 52.5 mg/L $CaCl_2$, 44.5 mg/L $MgCl_2$, 21.5 mg/L HCO^{3-} and 38 mg/L NaCl. Calculate lime and soda required for softening of hard water. (Lime = 90% and So 80%)

d) How the calorific value of a solid fuel is determined using bomb calorimeter? Draw a neat diagra of bomb calorimeter.

e) Describe the process of manufacture of Portland cement with the help of schematic diagram.

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$1g \rightarrow 1000\, ml.$

$1\, l = 1000\, ml.$

$ml \rightarrow \dfrac{1}{100}$

$1\, l \rightarrow 0.2$

$1\, ml \, q$

$300\, ml \rightarrow 0.8g$

$300\, ml \rightarrow 800\, mg$

17/2/23   OC-1 — OC-13

030   Roll No. : ....

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NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250 005 U.P.

Pre University Test (PUT) : Odd Semester 2022-23

Course/Branch	: B Tech – 1st year	**Semester**	: 1
Subject Name	: Engineering Chemistry	**Max. Marks**	: 100
Subject Code	: BAS102T	**Time**	: 180 min

CO-1 : Apply fundamental concepts of chemistry in different fields of Engineering.
CO-2 : Identify compounds using different spectroscopic techniques.
CO-3 : Understand the basic principles of electrochemistry for different Engineering applications and understanding engineering materials (cement and POP) and their applications
CO-4 : Illustrate analysis of coal for its calorific value and different types of impurities in water along with its softening techniques.
CO-5 : Recall the basic knowledge of polymerization.

Section – A # 20 Marks (Short Answer Type Questions)

Attempt **ALL** the questions. Each Question is of 2 marks (10 x 2 = 20 marks)

Q. No.	COx	Question Description # Attempt ALL the questions. Each Question is of 2 marks
1 A	CO1	Arrange the following according to their increasing bond length : C_2, N_2, F_2
B	CO1	Define pitch in liquid crystal. Which type of liquid crystal shows this parameter?
C	CO2	IR peak is often characterized as molecular finger print. Comment on it.
D	CO2	Identify which of the molecules will be IR active. Also give reason for your answer: CO, CS_2, N_2 and COS.
E	CO3	Explain why zinc metal is connected to underground tanks.
F	CO3	Give the reactions of Lead acid storage battery during discharging.
G	CO4	Give the reaction involved in the removal for temporary and permanent hardness of magnesium using lime and soda method of water softening.
H	CO4	Calculate the mass of air needed for complete combustion of 10.0 kg of coal containing 80% carbon 15% hydrogen and rest Oxygen.
I	CO5	Give the essential condition for the biodegradable polymer.
J	CO5	How is the conductivity of conjugated conducting polymer increased by doping?

Section – B # 30 Marks (Medium Answer Type Questions)

Attempt **ALL** the questions. Each Question is of 6 marks (5 x 6 = 30 marks)

Q.2 (CO-1) : Draw the molecular orbital diagrams of: O_2 and CO. Calculate their bond orders and also comment on their magnetic behavior giving reasons for their magnetic behavior.

OR

Define mesomorphic state? Describe the various types of liquid crystals based on temperature. Give the applications of liquid crystals.

Q.3 (CO-2) : Explain various types of fundamental vibrational modes observed in molecule using IR spectroscopy. How many vibrational modes is possible for SF_6 and C_2H_2 molecule?

OR

Explain various shifts observed in UV –Visible spectroscopy and what is the effect of solvent in π-π^* transition? Give the possible UV-visible transition in possible in CH_3COCH_3.

Q.4 (CO-3): Derive Nernst equation. Consider a cell reaction: Zn / Zn^{2+} [0.01M] ||Cu^{2+} [0.001M]/Cu. Standard potential of Zn^{2+} and Cu^{2+} are -0.76V and 0.34V respectively. Calculate EMF of the cell, ΔG, ΔS the temperature coefficient is 10^{-4} VK^{-1}.

OR

Give the working and reaction of Leclanche cell.

Q.5 (CO-4): Discuss the working principle of Bomb Calorimeter. A coal sample has following analysis by weight: C= 90%, O= 3%, S= 0.5%, N=0.5% and ash= 2.5. Net calorific value of the coal was found to be 8490.5 Kcal/Kg. Calculate the percentage of hydrogen and gross calorific value.

OR

With the help of neat sketch, discuss ion exchange process for water softening. Compare its merit over zeolite process. A zeolite softener was completely exhausted by removing the hardness when 10,000 litres of hard water was passed through it. The exhausted zeolite bed required 100 liters of 5.8% sodium chloride solution for its complete regeneration. Calculate the hardness of water sample.

Q.6 (CO-5): Give the preparation of $LiAlH_4$. Write any 5 application of $LiAlH_4$?

OR

Give preparation, properties and application of following polymer:
i) Neoprene   ii) Nylon 6, 6   iv) Kevlar   v) Lucite
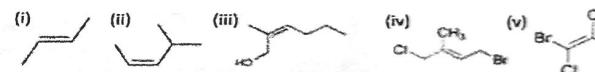
Section – C # 50 Marks (Long Answer Type Questions)

Attempt **ALL** the questions. Each Question is of 10 marks.

Q.7 (CO-1): Attempt any **ONE** question. Each question is of 10 marks.
a. Give the importance of green synthesis. Also give the synthesis of adipic acid by conventional and paracetamol by Green route
b. Discuss 12 principles of green chemistry and its impact on environment.

Q.8 (CO-2): Attempt any **ONE** question. Each question is of 10 marks.
a. Write the principle of NMR spectroscopy and describe its instrumentation. Explain the effect of shielding and deshielding on chemical shift with the help of CH_3Br, CH_3Cl & CH_3I.
b. Optical isomerism in compounds without chiral carbon. Assign following molecule as E or Z

(i)   (ii)   (iii)   (iv)   (v)

Q.9 (CO-3): Attempt any **TWO** questions. Each question is of 5 marks.
a. Define corrosion. Explain sacrificial anodic protection and impressed cathodic protection.
b. Discuss the electrochemical theory of corrosion using rusting of iron as an example.
c. What is Portland cement? Give the composition of Portland cement. Write the reactions involved in setting and hardening of cement.

Q.10 (CO-4): Attempt any **ONE** question. Each question is of 10 marks.
a. 1 g of $CaCO_3$ was dissolved in HCl and the solution made up to 500 ml with distilled water. 50 ml of the solution required 25 ml of EDTA solution for titration. 25 ml of hard water sample required 20 ml of EDTA and after boiling and filtering required 10ml of EDTA solution. Calculate the temporary, permanent and total hardness in given sample water.
b. What is the principal to determine the alkalinity of given water sample with numerical? 200 ml of a sample require 20 mL of N/50 HCl using methyl orange as indicator. Another 200 mL of the same sample required 8 ml of N/50 HCl using phenolphthalein as indicator. Express the alkalinity and its amount in terms of CaCO3 equivalent.

Q.11 (CO-5): Attempt any **TWO** question. Each question is of 5 marks.
a. Differentiate between: - (i) Homopolymer and co-polymer
(ii) Thermoplastic and Thermosetting polymers
b. Why do we use THF or dry ether in preparation of Grignard's reagent? Write the reaction of C_2H_5MgBr with carbon dioxide, Chloramine, Acetone and formaldehyde.
c. Write short notes on polymer composites and polymer blends.