

Total No. of printed pages = 3

CY 181101

Roll No. of candidate

--	--	--	--	--	--	--	--	--	--

2022

B.Tech. 1st Semester End-Term Examination

CHEMISTRY – 101

**New Regulation (w.e.f. 2017-18) &
New Syllabus (Group-A) (w.e.f. 2018-19)**

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any four from the rest.

1. Answer the following : (All are compulsory) (10 × 1 = 10)

(i) The minimum number of functionality of a monomer is

- | | |
|-------|-------|
| (a) 1 | (b) 2 |
| (c) 3 | (d) 0 |

(ii) The wavelength range corresponding to UV-visible region is

- | | |
|------------------|-----------------|
| (a) 400 – 800 nm | (b) 200 -800 nm |
| (c) 500 – 800 nm | (d) 600- 900 nm |

(iii) The possible transition for water molecule in uv- visible region are

- | | |
|--|--|
| (a) $\sigma \rightarrow \sigma^*$ | (b) $n \rightarrow \pi^*, \pi \rightarrow \pi^*$ |
| (c) $\sigma \rightarrow \sigma^*, n \rightarrow \pi^*$ | (d) $n \rightarrow \sigma^*$ |

(iv) Number of unpaired electrons in N^{2+} is

- | | |
|-------|-------|
| (a) 3 | (b) 1 |
| (c) 2 | (d) 0 |

(v) Who discovered electron

- | | |
|----------------|--------------------|
| (a) Rutherford | (b) J. J. Thomson |
| (c) Neils Bohr | (d) James Chadwick |

[Turn over

- (vi) Select the incorrect statement from the following
- (a) Lubricant keeps out dirt
 - (b) Lubricant act as a seal
 - (c) Lubricant enhance corrosion
 - (d) Lubricant transmit fluid power
- (vii) Heat of hydration in cement is mainly due to
- (a) di-calcium silicate
 - (b) tri-calcium silicate
 - (c) tri-calcium aluminate
 - (d) tetra-calcium aluminate ferrite
- (viii) Which is not a basic refractory
- (a) Silicon carbide
 - (b) Magnesite
 - (c) Dolomite
 - (d) Chrome magnesite
- (ix) One of the principles of green chemistry says that to _____ goods
- (a) Harmful
 - (b) Safer
 - (c) Commercial
 - (d) Most used
- (x) The green synthesis methods should have _____
- (a) Low atom efficiency
 - (b) Low efficiency
 - (c) High harmful products
 - (d) Low energy requirements
2. (a) Write the Schrodinger wave equation and explain terms involved in it
(2+3 = 5)
- (b) Draw the molecular orbital diagram of CO molecule and calculate the bond order.
(3+2=5)
- (c) A polymer sample with five molecules having molecular mass 20,000, seven molecules with molecular mass 30,000 and nine molecules with molecular mass 40,000. Calculate number average and weight molecular weight of the polymer sample. Calculate the polydispersity index (PDI) value. (2+2+1 =5)
3. (a) Define refractory materials? Classify refractory materials with one example for each class.
(1+4=5)
- (b) What is biodegradable polymer? Give two examples of biodegradable polymer.
(1+2 = 3)
- (c) Draw the radial distribution curves with respect to radius for the following orbitals
 - (i) 1s (ii) 2s (iii) 2p
(1+1+1 = 3)
- (d) Write the principle of UV-Visible spectrometer
(4)

4. (a) What is wet corrosion? Describe the mechanism of electrochemical corrosion by hydrogen evolution and oxygen absorption. (1+ 4 = 5)
- (b) Classify the polymer with suitable examples on the basis of mechanical properties. (3)
- (c) Giving the formula for % atom economy, calculate the % atom economy of the following reaction : (3)
$$(Ph)CH(CH_3)OH + 3Cr_2O_3 \cdot 3H_2SO_4 \rightarrow 3(Ph)CO(CH_3) + Cr_2SO_4 + 6H_2O$$
- (d) How will you differentiate benzene and acetone by NMR spectroscopy? (4)
5. (a) What are the raw material used for the manufacture of Portland cement? What are the chemicals these raw materials provide? What is the ratio of silica and alumina for a good quality of cement? (2+2+1= 5)
- (b) Discuss the twelve principle of green chemistry. (6)
- (c) Write the chemical reactions involved in rusting of iron. (4)
6. (a) What is nanomaterial? Classify the nanomaterials on the basis of dimension. (2+3 = 5)
- (b) Define the terms lubrication and lubricants? Explain any one mechanism of lubrication. (2+3 = 5)
- (c) Explain the phenomenon of water-line corrosion. (5)
7. (a) Why are the properties of 'nano materials' different from the 'bulk'? How can 'nano materials' be used as optical sensors? (3+3 = 6)
- (b) What is the physical significance of Ψ and Ψ^2 . (4)
- (c) Write a note on solid waste management? (5)

Total No. of printed pages = 3

CY 181101

Roll No. of candidate

2021

B.Tech. 1st Semester End-Term Examination

CHEMISTRY — 101

(New Regulation (w.e.f. 2017-18)

New Syllabus (Group A) (w.e.f 2018-19)

Full Marks - 70

Time - Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer ALL questions : (10 x 1 = 10)

- (i) Which among the following is paramagnetic?

(a) N₂ (b) O₂

(c) O_2^{2-} (d) H_2

- (ii) Which among the following is trifunctional?

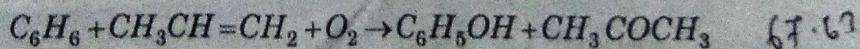
(a) Ethylene glycol

(b) Glycine

(c) Phenol

(d) Vinyl chloride

- (iii) What is the atom economy of the reaction



- (iv) Name two raw materials used for the preparation of cement.

on of cement.
limestone.

Clay, gypsum

[Turn over

3. (a) What is green synthesis? Give one example of a green synthetic reaction explaining the reason why it is green. (5)

(b) Explain rusting of iron with the help of electrochemical theory of corrosion. (5)

(c) A polymer has the following composition :

Mn₂Ni₃ *Mn₂Ni₃* *Mn₂Ni₃* *Mn₂Ni₃* *Mn₂Ni₃* *Mn₂Ni₃*

100 molecules of molecular mass 1000 g/mol, 200 molecules of molecular mass 2000 g/mol and 500 molecules of molecular mass 5000 g/mol. Calculate the number and weight average molecular weight and the polydispersity index. (5)

4. (a) Draw the molecular orbital energy level diagram of NO molecule and find out its bond order and magnetic behaviour. (6)

(b) Explain Top-down and Bottom-up approaches for synthesis of nanomaterials. (4)

(c) What are refractories? How are they classified? Give one example of each class of refractories. (5)

5. (a) What are the significance of radial and angular wave functions of hydrogen atom? (3)

(b) Discuss the various factors influencing the rate of corrosion. (6)

(c) Explain the setting and hardening of cement with chemical reactions involved in it. (6)

6. (a) Give one example each of non-acceptable, acceptable and green solvent. Write a note on alternative solvents. *chloroform acetone ethanol, propylene water* (5)

(b) Explain the principle of UV - visible spectroscopy. (5)

(c) What is cathodic protection? Explain sacrificial anodic protection method. (2+3)

7. (a) What are conducting polymers? Explain the mechanism of conduction in polyacetylene by n-doping. (1+4)

(b) What do you mean by spin active nuclei? Give two examples. Predict the number of NMR signals in the following compounds. (1+1+2)

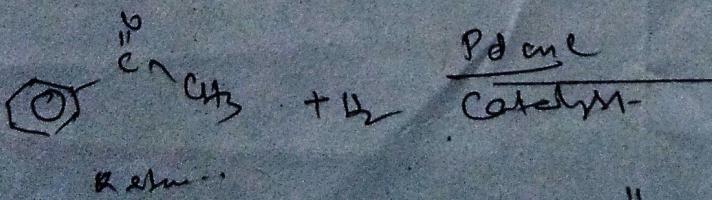


(c) Write the applications of nano materials in the field of

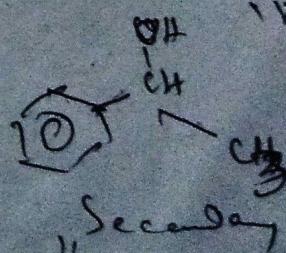
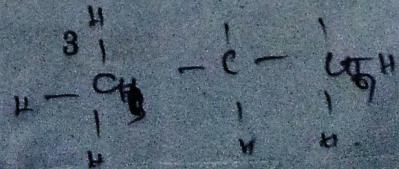
(i) Catalysis

(ii) Medicine.

(3+3)



CY 181101



14

(3+3)

2019

B.Tech. 1st Semester End-Term Examination

CHEMISTRY – 101

(New Regulation) (W.e.f 2017-2018) (Group – A)

(New Syllabus)(W.e.f 2018-2019)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *four* from the rest.

Questions No.2 to 7 carries 15 marks each.

1. $(10 \times 1 = 10)$

- (i) What is the significance of ψ^2 ?
- (ii) What is the chemical formula of most common Bucky ball?
- (iii) Define R_f value.
- (iv) How does polydispersity index (PDI) explain the polydispersity or monodispersity of a polymer.

[Turn over

- (v) Name any two solid lubricants.
- (vi) Where the electrochemical corrosion takes place?
- (vii) Which constituent of cement causes its initial setting?
- (viii) Name two green solvents.
- (ix) What type of excitation can take place in CH_3COCH_3 at 280nm and 190nm in uv-spectroscopy.
- (x) Give two examples of biopolymer.

2. (a) Write schrodinger wave equation for hydrogen atom and explain the different terms involved in it. (3)

(b) Draw the radial probability distribution curves of electron at different radial distance r from the nucleus for $n = 1, l = 0$ and $n = 2, l = 0$ orbitals. (4)

(c) Draw the molecular orbital diagram of CO molecule and calculate the bond order. (4)

(d) The bond order of N_2^+ ion is less than that of N_2 whereas the bond order of O_2^+ is greater than that of O_2 . Explain with the help of molecular orbital theory. (4)

3. (a) Explain addition and condensation polymerisation with suitable examples and state the differences between these polymerisation. (6)

(b) Give reasons

- (i) PVC is soft and flexible
- (ii) Natural rubber need vulcanization. (4)

(c) Give two examples of commercially prepared conducting polymer. How conductivity of a polymer can be increased by doping method? (2+3=5)

✓ 4. (a) What are different types of carbon nano-tubes? Write down the important characteristics and applications of carbon nano-tubes. (5)

(b) Write down the applications of nanomaterials in the field of
(i) medicine
(ii) Catalysis. (5)

(c) State Beer-Lambert law. Explain the following terms in respect of UV-vis spectroscopy with example. (i) Chromophore (ii) Auxochrome

Nitro Acid after OP_{NP} (2+3=5)

5. (a) Write down the major applications of the following (any two)

(i) Infrared spectroscopy

(ii) NMR spectroscopy

(iii) Mass spectroscopy. (4)

(b) What are alternative solvents? Write a note on the following:

(i) Properties of Ionic liquids.

(ii) Advantage of supercritical CO_2 fluid. (6)

(c) What do you mean by

(i) Carbon footprint.

(ii) Carbon sequestration. (2)

(d) How the solid waste effect the public health of an urban area? (3)

6. (a) What is corrosion? Explain rusting of iron with the help of electrochemical theory of corrosion. (2+4=6)

(b) Describe two methods for protection of a metal from corrosion. (5)

(c) What is Galvanic series? How does it differ from electrochemical series. (4)

7. (a) Give the average chemical composition of portland cement. Explain the setting and hardening of portland cement with chemical reactions involved in it. (2+5=7)

(b) Write characteristic of a good lubricating oil. Name the additive used to improve the following desired quality of lubricating oil. (5)

(i) to prevent rusting

(ii) to improve viscosity index

(iii) to prevent oxidation

(c) What are the refractories? Give two essential properties of a good refractory material. (3)

Total No. of printed pages = 6

CY 181201

Roll No. of candidate

--	--	--	--	--	--	--	--	--	--

2019

B.Tech. 2nd Semester End-Term Examination

CHEMISTRY - 201

(New Regulation)

(W.e.f. 2017-18) & New Syllabus

(Group B) (W.e.f. 2018-19)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *four* from the rest.

Q. No. 2 to 7 carries 15 marks

1. Answer the following

$(10 \times 1 = 10)$

- (i) Styrene-acrylonitrile is an example of:
- (a) Co-polymer
 - (b) Homo polymer
 - (c) Linear polymer
 - (d) Amorphous polymer

[Turn over

(ii) In Atomic Absorption Spectroscopy, which of the following is generally used as radiation source?

- (a) Tungsten lamp
- (b) Xenon mercury arc lamp
- (c) Hydrogen or deuterium lamp
- (d) Hollow cathode lamp

(iii) An example of one-dimensional nanomaterial is:

- (a) Carbon nanotube
- (b) Graphene
- (c) Fullerene
- (d) Colloid

(iv) The energy of which of the following is not quantised?

- (a) An electron in an atom
- (b) A free particle
- (c) A particle in a three dimensional box
- (d) An electron in a molecule

(v) In lithium ion battery, which of the following is applicable?

- (a) Li is used as anode
- (b) Li is used as cathode
- (c) Li salts are used as electrolytes
- (d) None of the above

- (vi) Which of the following types of corrosion may not be classified as "dry corrosion"?
- Oxidation corrosion
 - Corrosion by SO_2
 - Electrochemical corrosion
 - Liquid metal corrosion
- (vii) Which of the following is infra-red (IR) active?
- O_2
 - HCl
 - N_2
 - H_2
- (viii) Out of the following points which is not applicable for a liquid crystal.
- It should have a rod-like molecular structure
 - The molecules of a liquid crystal should have sufficient long-range molecular interaction
 - The liquid crystal molecules should have a rigid, isotropic structure
 - The liquid crystal molecules should be easily polarisable
- (ix) Which of the following nuclei is useful in NMR spectroscopy?
- ^1H
 - ^2He
 - ^6C
 - ^8O

- (x) Storing of carbon dioxide (CO_2) underground in rock formation is able to retain large amounts of CO_2 over a long period of time. The process is known as:
- Geological sequestration
 - Terrestrial sequestration
 - Ocean sequestration
 - None of the above
2. (a) What is the significance of ψ^2 ? What are the significance of radial and angular wave functions of Hydrogen atom? (1 + 4)
- (b) Write the chemical reactions to show the preparation of any three of the following: (3)
- Cellulose nitrate
 - Natural rubber
 - Bakelite
 - Teflon
- (c) What do you mean by carbon footprint? Explain primary and secondary footprint with suitable examples. (1 + 3)
- (d) Explain how a metal can be protected from corrosion. (3)
3. (a) Explain one technique for each of the following approaches for the synthesis of nanostructures:
- Top-down approach
 - Bottom-up approach
- (2 + 2)

- (b) Discuss the significance of viscosity average molecular weight in processing of polymers. Describe molecular weight distribution curve. (3 + 2)
- (c) What are secondary cells? Write cell reactions for charging and discharging of lead storage cell. (2 + 4)
4. (a) Why does corrosion take place in metals? Explain with the help of a diagram about
(i) hydrogen evolution and (2 + 2 + 2)
(ii) oxygen absorption types of corrosion.
(b) Draw the molecular orbital diagram of O₂. Arrange the molecules O₂, O₂⁻ and O₂⁺ in the increasing order of their bond strength and bond order. (2 + 3)
(c) Discuss the factors affecting rate of corrosion. (4)
5. (a) Describe the principle of the Gas chromatography. Name a few carrier gases and detectors used in Gas chromatography. (2 + 3)
(b) Justify- "Carbon sequestration can assist significantly in maintaining the natural carbon cycle. (3)
(c) What are liquid crystals and how are they classified? Mention any two applications of liquid crystals. (2 + 3 + 2)
6. (a) Explain the salient features of molecular orbital theory which is useful in the description of electronic structure and bonding in molecules. (5)
(b) Explain the statement - 'Green chemistry is sustainable chemistry'. (3)

- (c) Explain the basic principles of any one of the following: (3)
- (i) Flame photometry
 - (ii) Atomic absorption spectroscopy (AAS)
 - (iii) uv-vis spectroscopy
- (d) What is nanowire? Write a short note about the medicinal applications of nanomaterials. (1 + 3)
7. (a) Discuss the various applications of UV or mass spectroscopy. (4)
- (b) Discuss five among the 12 principles of Green chemistry. (5)
- (c) Write short notes on any *two* of the following: (2 × 3 = 6)
- (i) Biodegradation in biopolymers.
 - (ii) Waterline corrosion
 - (iii) Fuel cell
 - (iv) Conductive polymers.
-

Total No. of printed pages = 4

CY 181201

Roll No. of candidate

--	--	--	--	--	--	--	--	--	--

2021

B.Tech. 2nd Semester (Repeater) End-Term Examination

CHEMISTRY – 201

New Regulation (w.e.f. 2017 – 18) &

New Syllabus (w.e.f. 2018 – 19)

(Group – B)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any Four from the rest.

1. All questions are compulsory : (10 × 1 = 10)

- (i) In UV-visible spectroscopy, the UV region is scanned from
 - (a) 400-800 nm
 - (b) 200-400 nm
 - (c) 1000-1200 nm
 - (d) 0-100 nm
- (ii) A particle in a one-dimensional box can be described by a
 - (a) Progressive wave
 - (b) Stationary wave
 - (c) Micro-waves
 - (d) Transverse wave
- (iii) Examples of volatile corrosion product of metal is
 - (a) Fe₂O₃
 - (b) MO₂O₃
 - (c) AgCl
 - (d) CaCO₃
- (iv) Corrosion of metals with gases (except oxygen) takes place due to
 - (a) Electronegativity of the metal and gas molecules
 - (b) The charge present on the metal ions
 - (c) Electron affinity of the metal and gas molecules
 - (d) By the ionic size of the metal and gas molecules

[Turn over

- (v) Which one of the following nucleus will be NMR active

 - (a) H¹ and He²
 - (b) Li³ and O⁸
 - (c) N⁷ and Mg¹²
 - (d) H¹ and C¹³

(vi) The mass spectra technique suffers from the obvious disadvantage that

 - (a) The molecular mass determined is arbitrary
 - (b) It is time consuming process
 - (c) Samples are destroyed in the process
 - (d) None of the above

(vii) Kevlar is an example of

 - (a) Commodity polymer
 - (b) Engineering polymer
 - (c) Conducting polymer
 - (d) Biodegradable polymer

(viii) The monomer of Teflon is

 - (a) Vinyl chloride
 - (b) Ethyl alcohol
 - (c) Tetrafluoroethylene
 - (d) Hexamethylene diamine

(ix) Which of these historical works of art contain nanotechnology?

 - (a) Medieval stained glass windows
 - (b) Lycurgus Cup
 - (c) Damascus steel swords
 - (d) All of the above

(x) Carbon-di-oxide acts as a supercritical fluid under the following conditions,

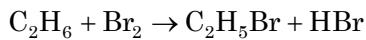
 - (a) Above temp. 31°C and pressure 72.8 atm
 - (b) Below temp. 31°C and pressure 72.8 atm
 - (c) Above temp. 31°C and below pressure 72.8 atm
 - (d) Below temp. 31°C and above pressure 72.8 atm

2. (a) What are the electronic transitions possible for the molecules CH₄ and CH₃CHO? Draw the energy level diagram of a homo-nuclear diatomic molecule. (2 + 3 = 5)

(b) (i) Define an atomic orbital in terms of quantum mechanics. (2 + 3 = 5)
(ii) Discuss the probability of finding a particle in one dimensional box with graphical representation.

(c) (i) Define bond order. (1 + 2 + 2 = 5)
(ii) Discuss the molecular orbital of HF.
(iii) With the help of Molecular orbital theory, discuss why O₂ is paramagnetic.

3. (a) Explain the process of H_2 evolution and O_2 absorption type of electrochemical corrosion. $(2 + 2 = 4)$
- (b) Define the following terms related to sustainable chemistry, $(2 + 2 + 2 = 6)$
- (i) Carbon footprint
 - (ii) Carbon sequestration
 - (iii) Carbon trading
- (c) (i) Write down four important principles of Green Chemistry. $(2 + 3 = 5)$
- (ii) Calculate the percentage of Atom Economy of the following reaction
(atomic weight of Br = 80)



Give your view whether the above reaction follows the principle of Green Chemistry or not?

4. (a) What is Energy Density and Power Density? Discuss the basic mechanism of Lithium ion battery? Why is it considered as the best battery? $(2 + 2 + 1 = 5)$
- (b) What are the liquid crystals and write their classification? Write the structural characteristics for the liquid crystal formation? $(3 + 2 = 5)$
- (c) What do you understand by shielded and deshielded protons in NMR spectroscopy? Draw the NMR spectrum of Ethanol in Low Resolution and High Resolution NMR spectroscopy. $(3 + 2 = 5)$
5. (a) Why are the nanomaterials different from the bulk materials? Classify nanomaterials. $(3 + 2 = 5)$
- (b) Discuss any two important optical properties of nanomaterials? Write down the application of such materials in important technological fields? $(2 + 3 = 5)$
- (c) Explain Quantum Fluorescence. What do you mean by Red-Shirt and Blue- Shift of the wavelength in case of "Nano" structured materials? $(2 + 3 = 5)$

6. (a) Define the following terms related to polymers with proper example
 $(2 + 2 + 2 = 6)$

- (i) Functionality
- (ii) Repeating unit
- (iii) Degree of Polymerization

(b) Write down the free radical addition polymerization mechanism to produce polyethylene. (5)

(c) Give two examples of each of the following $(2 + 2 = 4)$

- (i) Biodegradable polymers
- (ii) Engineering polymers

7. Write short notes on (any *five*) : $(5 \times 3 = 15)$

- (a) Conducting polymers
 - (b) Fullerenes
 - (c) Ionic liquids as alternative solvents
 - (d) "Corrosion is the reverse process of extraction"
 - (e) Working principle of flame photometry
 - (f) Application of liquid crystals
 - (g) Bionanomaterials
 - (h) The basic principle of column chromatography
-

CHEMISTRY QUESTION PAPER 2018

Q. Answer the following

$1 \times 10 = 10$

- i) In some region of space around the nucleus $\Psi^2 z_0$, what name is given to this region?
- ii) Arrange O_2, O_2^-, O_2^{2-} in order of increasing bond order
- iii) Write down the names of two equation used in free radical addition polymerization.
- iv) Write two example of conducting polymer.
- v) What is endohedral fullerene?
- vi) Name two green solvents.
- vii) Which of the following metal should provide cathodic protection of iron
Al, Zn, Cu, Ni .
- ix) Why Epsom is added to Portland cement?
- x) Give two example of solid lubricants.
2. a) Write Schrodinger waves equation & explain the term evolution in it? $2+1+2=5$
- b) What do you mean by eigen value & function? 4
- c) On the basis of MOT explain $1+1=2$
- i) Which of the following is more stable and why, N_2^+ & N_2^-
- ii) Paramagnetic character of O_2
- d) Draw MO diagram for NO molecule & explain the paramagnetic character of NO molecule. $3+1=4$
3. a) Classify the polymers on the basis of structure with suitable example of each one. 3
- b) What is meant by degree of polymerization. 2
- c) Identify the monomer of the following:
i) Polypropylene.
ii) Natural rubber.
iii) Polymethyl acrylate (PMMA).
- d) Distinguish between thermoplastic & thermosetting plastic polymers. 2
- e) What are nano material? Write down the application of nano material in the field of catalysis. $1+3=4$
- f) What is nano wire? 1
4. a) What are different types of carbon nano tubes (CNTs)? Write down two important characteristic and application of CNT. 5
- b) Calculate the atom economy of the following reaction: 3
- i) $C_6H_6 + CH_3COH \rightarrow C_6H_5COCH_3 + HCl$
- ii) $C_6H_5MgBr + CH_3Br \rightarrow C_6H_5CH_3 + MgBr_2$
- c) Give two example of ultrasound assisted reaction. 2
- d) Discuss any five principle of green chemistry. 5

5. a) What is corrosion explain rusting of iron with the help of electro chemical theory of corrosion? 2+4=6
- b) Discuss any two factor affecting the rate of corrosion? 4
- c) What is Lambert-Beer law? 5
6. a) Give example of the compound where following transition occurs: 3
 $\sigma - \sigma^*, n \rightarrow \sigma^*, \pi \rightarrow \pi^*$
- b) Write down two application of IR spectroscopy. 2
- c) What is Flame Photometry? 2
- d) Write short note on high pressure liquid chromatography. 3
- e) What are galvanic and pitting corrosion ? Explain galvanic corrosion with one example. 5
7. a) Give the avg chemical composition of pooldand cement? Explain briefly of setting and hardening of cement. 2+3=5
- b) What are refractory materials? Give the essential requirement of good refractory. 2+3=5
- c) What are lubricants & lubrication ? Write the important function of lubricants. 2+3=5

CY 181101

Roll No. of candidate

--	--	--	--	--	--	--	--	--	--

2023

B.Tech 1st Semester End-Term Examination

CHEMISTRY — 101

(Group A) (w.e.f. 2018-19)

(New Regulation and New Syllabus)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *Four* from the rest.

1. Answer the following: (All are compulsory) $(10 \times 1 = 10)$
- (i) In hypsochromic shift, the absorption maximum is shifted towards shorter wavelength.
 - (ii) Graphene is 2D dimensional allotropic form of carbon.
 - (iii) The oxygen molecule is paramagnetic due to presence of +NO number of unpaired electrons.
 - (iv) The monomer of teflon is TETRA FLUOROETHYLENE
 - (v) NMR spectroscopy indicates the chemical nature of the _____ and spatial position of _____
 - (a) Electrons, protons
 - (b) Neutrons, electrons
 - (c) Nuclei, electrons
 - (d) Nuclei, neighbouring nuclei
 - (vi) Which of the following is a greener route to produce ethanol commercially
 - (a) Catalytic cracking of ethanol
 - (b) Dehydrogenation of ethylene
 - (c) Steam reforming of methanol
 - (d) Oxidation of ethene with an ionic catalyst

[Turn over

- (vii) Which one of the following is the least heat and corrosion resistant material
(a) Ceramics
✓(b) Metals
(c) Semiconductors
(d) Polymers

(viii) Concrete and fibre glass are the examples of

- (a) Polymers
(b) Ceramics
(c) Semiconductors
✓(d) Composites

(ix) Which of the following is an example of optical properties of nanostructure materials

- (a) Melting point
✓(b) Absorption and scattering of light
(c) Both (a) and (b)
(d) None of the above

(x) Corrosion due to the formation of cavities around the metal is called as the

- (a) Waterline corrosion
(b) Galvanic corrosion
✓(c) Pitting corrosion
(d) Soil corrosion

2. (a) Derive the Schrodinger Wave Equation. (5)
(b) Discuss in brief the Quantum Mechanical Treatment of Hydrogen-like system. (5)
(c) What are conducting polymers? Classify different types of conducting polymers. What is p and n-doping? (1 + 2 + 2 = 5)
3. (a) A polymer sample with four molecules having molecular mass 34,000, six molecules having molecular mass 20,000, eight molecules having molecular mass 25,000 and 2 molecules having molecular mass 1,00,000. Calculate number average and weight average molecular weight of the polymer sample. Calculate the PDI value of the polymer sample. (2 + 2 + 1 = 5)
(b) What is Pilling-Bedworth rule? Explain Small anodic area results in intense corrosion. (2 + 3 = 5)
(c) Discuss in details the cause of wet corrosion and the mechanism of wet corrosion with the help of chemical equation involved. (5)

4. (a) Discuss six important principle of green chemistry. (6)
- (b) What do you say about the molecular ion peak in the mass spectrum of alcohols? Which peak is of largest abundance in primary alcohols? (4)
- (c) Write the principle and applications of IR spectroscopy. (3 + 2 = 5)
5. (a) What is refractory materials? Classify refractory materials with one example for each class. (1 + 4 = 5)
- (b) Discuss the following terms :
- (i) Carbon footprint,
 - (ii) Ionic liquids (2 + 2 = 4)
- (c) Calculate the percentage of *Atom Economy* of the following reaction (Atomic weight of Fe = 56)
- $$\text{Fe}_2\text{O}_3(s) + 3 \text{CO}(g) \Rightarrow 2\text{Fe}(l) + \text{CO}_2(g) \quad (4)$$
- (d) Write two examples of biodegradable polymers. (2)
6. (a) Write various reactions involved during the setting of cement. What are the functions of gypsum during setting of cement? (5 + 1 = 6)
- (b) What are the basic requirements for lubricants? How a lubricant can eliminate contaminants and debris? (3 + 3 = 6)
- (c) Discuss the principle of NMR spectroscopy. (3)
7. Write notes on following (*any three*) (3 × 5 = 15)
- (a) Eigen function and Eigen value
 - (b) Types of polymerization
 - (c) Bio-nanomaterials
 - (d) Solid waste management
 - (e) Atomic absorption spectroscopy
 - (f) Mechanism of electrochemical corrosion