

**5 SEM TDC CHMH (CBCS) C 11**

**2024**

( November )

**CHEMISTRY**

( Core )

Paper : C-11

( **Organic Chemistry** )

*Full Marks* : 53

*Pass Marks* : 21

*Time* : 3 hours

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

1. Choose the correct answer from the following : 1×4=4

(a) Uridine present in RNA is

- (i) nucleotide
- (ii) pyrimidine
- (iii) purine
- (iv) nucleoside

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(b) A DNA segment contains 100 adenine and 100 cytosines, how many nucleotides are present in the segment?

(i) 100

(ii) 200

(iii) 400

(iv) 50

(c) Which of the following is not a lipid?

(i) Fat

(ii) Oil

(iii) Protein

(iv) Wax

(d) Which of the following best describes a synthon?

(i) A synthetic reagent used in a reaction

(ii) A key intermediate in a reaction sequence

(iii) A transition state involved in a reaction mechanism

(iv) A hypothetical structure that would result in a given reaction if it existed

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### UNIT—I

2. (a) DNA is more stable than RNA. Explain. 2

Or

Synthesize any *one* of the following bases : 2

(i) Adenine

(ii) Guanine

(b) Discuss the biological roles of DNA and RNA. 2

(c) Discuss the Watson model of DNA molecule. 2

Or

What are complementary bases? Draw the structure to show hydrogen bonding between adenine and thymine. 1+1=2

### UNIT—II

3. (a) How are  $\alpha$ -amino acids prepared? Describe the important reactions of  $\alpha$ -amino acids. 2

(b) What happens when glycine is treated with 2,4-dinitrofluorobenzene (DNFB)? 2

(c) Synthesize glycine with the help of Strecker's reaction. 2

(d) Discuss the  $\alpha$ -helical structure of protein. 2

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UNIT—III

4. (a) Define enzyme. How does pH affect the activity of enzymes? 1+1=2
- (b) Write a short note on specificity of enzymes with the help of a suitable example. 2
- (c) Define the term 'active site'. Give a brief diagram for the mechanism of enzymatic action. 1+2=3
- (d) What are the cofactors present in enzymes? Give an example of a coenzyme with a specific reaction. 1+1=2

UNIT—IV

5. (a) What are oils and fats? How do they differ from each other? 1+1=2
- (b) What is rancidity? How can you prevent rancidity? 1+1=2

Or

- What is iodine value? What is its significance? 1+1=2
- (c) What are triglycerides? Identify the hydrophobic and hydrophilic regions of a triglyceride. 2
- (d) How do you isolate carboxylic acid and alcohol from fats and oils? 2

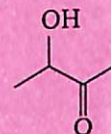
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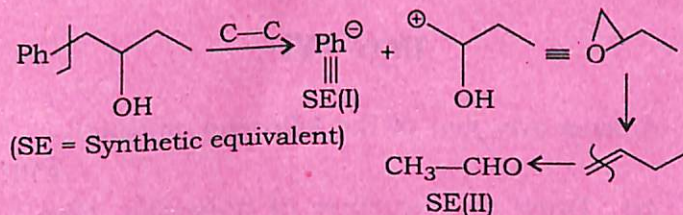
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UNIT—V

6. (a) Simply show that where to disconnect and mention the synthons and synthetic equivalents of the following : 2



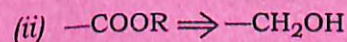
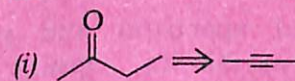
- (b) From the disconnection pattern shown below, synthesize the following TM : 2



- (c) How would you synthesize the following TM, working reverse with Wittig reaction? 2



- (d) How can the following FGIs be carried out? 2



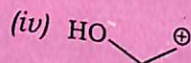
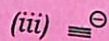
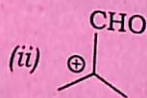
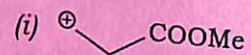
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- (e) Write the synthetic equivalent of the following compounds :

2



### UNIT—VI

7. Answer any four of the following questions :

2×4=8

- (a) Draw the structure of Ibuprofen. Give one important use of it.
- (b) How do the sulpha drugs prevent the growth and multiplication of bacteria when administered into a host body?
- (c) Synthesize a drug which can be used as analgesic and antipyretic from phenol.
- (d) Define broad spectrum and narrow spectrum antibiotics giving one example of each.

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- (e) What is tincture of iodine? What is its use?
- (f) Write in brief about the medicinal importance of *Azadirachtin* (Neem).

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**5 SEM TDC CHMN (CBCS) C 12**

**2024**

( November )

**CHEMISTRY**

( Core )

Paper : C-12

**( Physical Chemistry, Quantum Chemistry  
and Spectroscopy )**

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct answer from the following : 1×4=4

(a) The degeneracy of a particle of mass  $m$  confined in a 3-D box having energy

level equal to  $\frac{19h^2}{8ma^2}$  is

(i) 7

(ii) 19

(iii) 6

(iv) 3

( 2 )

(b) The wavefunction  $\psi = e^{ax^2}$  in the range  $-\infty < x < \infty$  where  $a$  is a finite quantity is

(i) acceptable wave function

(ii) not acceptable wave function

(iii) eigenfunction of  $\frac{d}{dx}$

(iv) a normalized wave function

(c) Intersystem crossing refers to

(i) transition between two states of a system

(ii) radiationless transition between states of different spin multiplicities

(iii) transition between excited and ground states with same multiplicities

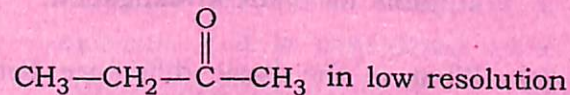
(iv) All of the above

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(d) The number of NMR signal formed by



is

(i) 2

(ii) 3

(iii) 4

(iv) 5

2. Answer any four from the following :  $2 \times 4 = 8$

(a) State whether the function

$$\psi = \sin(k_1x) \sin(k_2y) \sin(k_3z)$$

is an eigenfunction of the operator  $\nabla^2$ .

If it is an eigenfunction, find the eigenvalue.

(b) Determine the normalization constant of the function  $\psi = x^2$  in the range  $0 \leq x \leq k$ , where  $k$  is a constant.

(c) Microwave studies are done only in gaseous state. Explain.

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- (d) Explain why the nuclei  $^1\text{H}$  and  $^{13}\text{C}$  are suitable for NMR investigation.
- (e) What is the basic difference between fluorescence and phosphorescence?
- (f) Determine the value of  $[x, P_x]$ .

3. Answer any four from the following :  $4 \times 4 = 16$

(a) Solve the Schrödinger wave equation for a particle having mass  $m$  moving freely in a 1-D box of length  $a$ . Find out the energy expression.  $3+1=4$

(b) Write the conditions for acceptability of wave function. Prove that  $\tan x$  is not acceptable wave function in the range  $0 \leq x \leq \pi$ .  $2+2=4$

(c) Write Schrödinger's wave equation for rigid rotator system and separate the variables. 4

(d) (i) Write down the Schrödinger's wave equation for H-atom in Cartesian and polar coordinates.  $1+1=2$

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(ii) What is zero-point energy? Calculate zero-point energy of a molecule if it is considered as a simple harmonic oscillator.  $1+1=2$

(e) (i) Prove that the eigenvalues of Hermitian operator are real. 2

(ii) Calculate the value of  $\left[ x, \frac{d^2}{dx^2} \right]$ . 2

(f) Sketch the variation of radial wave function and radial probability distribution against the distance from the nuclei (i)  $2S$  and (ii)  $2P$ .  $2+2=4$

4. Answer any four from the following :  $4 \times 4 = 16$

(a) Show that the lines in the rotational spectra of a diatomic molecule are equispaced under rigid rotator approximation. 4

(b) The C—H vibration (stretching) in chloroform occurs at  $3000 \text{ cm}^{-1}$ . Calculate the C—D frequency (stretching) in deuterated chloroform. Suppose force constant remains same during isotopic substitution. 4

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(c) (i) What are *P*, *Q* and *R* branches of vibration-rotation spectra? 3

(ii) Why is electronic spectrum a band spectrum? 1

(d) Write short notes on the following :  $2 \times 2 = 4$

(i) Larmor frequency

(ii) Bathochromic shift

(e) (i) Why is TMS used as a reference standard in NMR spectra? 2

(ii) Draw the high and low resolution NMR spectra of the ethanol. 2

5. Answer any *two* questions from the following :

$4\frac{1}{2} \times 2 = 9$

(a) What are photochemical reactions? Write the difference between photochemical and thermal reactions. Discuss the reason for low and high quantum yields of photochemical reaction.  $\frac{1}{2} + 2 + 2 = 4\frac{1}{2}$

(b) State and explain Lambert-Beer law. Write the significance of molar extinction coefficient.  $4\frac{1}{2}$

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(c) (i) Write short notes on any one of the following : 2

1. Actinometry

2. Chemiluminescence

(ii) A certain system absorbs  $3 \times 10^{20}$  quanta of light per second. On irradiation for 20 minutes, 0.02 mole of the reactant was found to have reacted. Calculate the quantum yield of the reaction.  $2\frac{1}{2}$

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