FYUG Odd Semester Exam., 2025

CHEMISTRY

(5th Semester)

Course No. : CHMDSC–302T

[Organic Chemistry—III (Heterocyclic, Biochemistry, Natural Products and Photochemistry)]

Full Marks : 70
Pass Marks : 28

Time : 3 hours

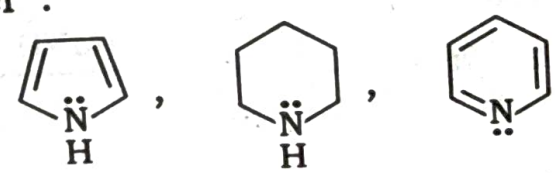
The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* questions from the following : 2×2=4

   (a) Explain why pyridine is less reactive than benzene in electrophilic substitution.

   (b) Arrange the following in increasing order of basic character and justify your answer :



(c) What happens when quinoline and isoquinoline are oxidized with alkaline $KMnO_4$?

2. Answer any *one* question from the following : 10

(a) (i) Discuss Hantzsch synthesis of pyridine with mechanism. 4

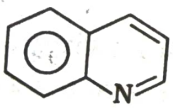
(ii) Explain why nucleophilic substitution of pyridine occurs at 2-position whereas electrophilic substitution occurs at 3-position. 4

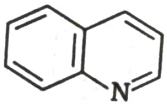
(iii) Explain why furan is less reactive than thiophene towards electrophilic substitution. 2

(b) (i) Discuss Fischer indole synthesis with mechanism. 4

(ii) Explain why quinoline is a stronger base than pyrrole. 2

(iii) Identify the products of the following reactions : 1×4=4

(i)  $\xrightarrow[\text{Conc. } H_2SO_4]{\text{Conc. } HNO_3}$?

(ii)  $\xrightarrow{NaNH_2}$?

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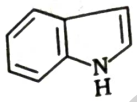
(iii)  $\xrightarrow{CHCl_3,\ KOH}$?

(iv)  $\xrightarrow[\text{Pressure}]{CO_2/\Delta}$?

UNIT—II

3. Answer any *two* questions from the following : 2×2=4

(a) What are essential and non-essential amino acids? Give two examples of each kind.

(b) What is isoelectric point of amino acid? Discuss its significance.

(c) What are proteins? What do you understand by the term 'denaturation of proteins'?

4. Answer any *one* question from the following : 10

(a) (i) Discuss Strecker synthesis of α-amino acids. 3

(ii) Describe Merrifield method of synthesis of polypeptides. What are the advantages of this method? 4+1=5

(Turn Over)

(iii) Which amino acid is optically inactive? Draw its zwitter ionic structure. 3

(b) (i) Describe Sanger's method for determining N-terminal group in a polypeptide. 2

(ii) Discuss primary, secondary and tertiary structures of protein. 4

(iii) What is ninhydrin test? Explain with mechanism. 3

UNIT—III

5. Answer any *two* questions from the following : 2×2=4

(a) What are coenzymes? Give two examples.

(b) What are activators? How are they affect enzyme activity?

(c) What is saponification value? What is its importance?

6. Answer any *one* question from the following : 10

(a) (i) Explain Michaelis-Menten theory of enzyme-catalyzed reaction. What is Michaelis constan 3

(ii) Draw the structures of various purines and pyrimidines bases present in DNA. 3

(iii) What is *trans*-esterification? Explain with example. 2

(iv) Describe competitive and non-competitive inhibitors with example. 2

(b) (i) Describe briefly the major factors influencing enzyme activity. 3

(ii) What are nucleosides and nucleotides? Describe the structure of dinucleotide by taking suitable example. 1+3=4

(iii) What is rancidity? How can rancidity be prevented by antioxidants? 1+2=3

UNIT—IV

7. Answer any *two* questions from the following : 2×2=4

(a) What are isoprene and special isoprene rules?

(b) What are alkaloids? Discuss the physiological actions of alkaloids.

(c) What happens when citral-a is treated with $KMnO_4$?

8. Answer any *one* question from the following : 10

(a) (i) Explain how nicotine can be synthesized from succinimide. 3

(ii) What is Hoffmann exhaustive methylation? Explain by taking suitable example. 3

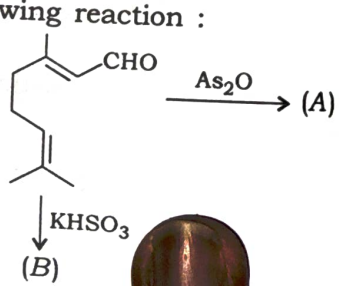
(iii) Describe in detail how structure of citral-a can be elucidated. 4

(b) (i) Describe the synthesis of α-terpineol from *p*-toluic acid. 3

(ii) What is Emde degradation? Illustrate with example. 3

(iii) How can nicotine be converted to hygrinic acid? 2

(iv) Identify the products of the following reaction : 2



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UNIT—V

Answer any *two* questions from the following : 2×2=4

(a) What is Franck-Condon principle? Explain its significance in electronic transitions.

(b) Distinguish between radiative and non-radiative transitions using Jablonski diagram.

(c) What is spin multiplicity? Describe singlet and triplet states.

10. Answer any *one* question from the following : 10

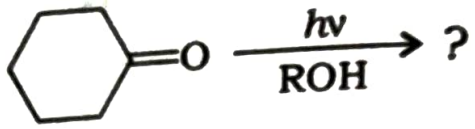
(a) (i) Describe Norrish type I and type II processes by taking suitable examples. 2+2=4

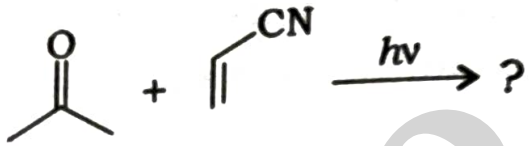
(ii) What is photo-Fries rearrangement? Explain the mechanism by taking suitable example. 3

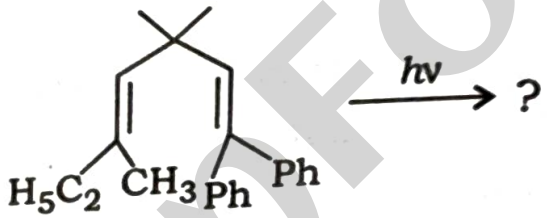
(iii) Discuss the regioselectivity observed in Paterno-Buchi reaction by taking suitable example. 3

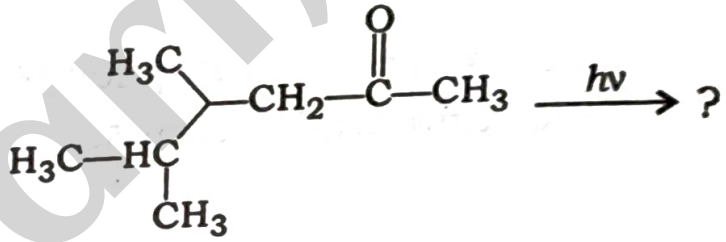
(Turn Over)

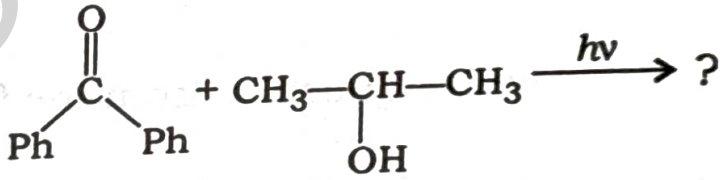
(b) Predict the products and depict the mechanisms (any *four*) : $2\frac{1}{2}\times4=1$

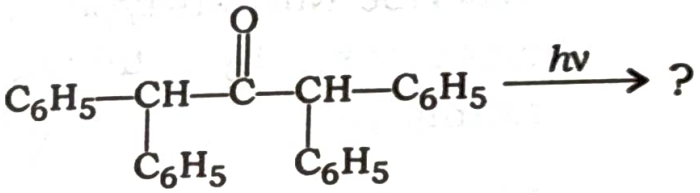
(i) 

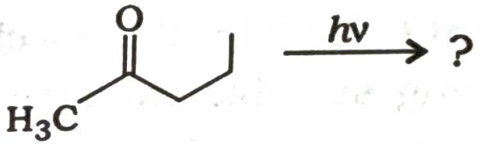
(ii) 

(iii) 

(iv) 

(v) 

(vi) 

(vii) 

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