



SLR-SB – 51

Seat No.	
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Set **P**

**B.Sc. – III (Semester – V) (Entrepreneurship) (CGPA) Examination, 2018**  
**INDUSTRIAL CHEMISTRY**  
**Spectroscopic Methods**

Day and Date : Tuesday, 17-4-2018  
Time : 2.30 p.m. to 5.00 p.m.

Max. Marks : 70

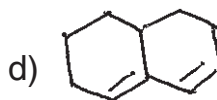
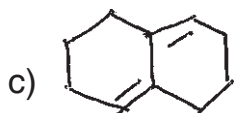
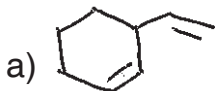
- Instructions :** 1) **All questions are compulsory.**  
2) **Figures to the right indicate full marks.**  
3) **Draw neat labelled diagram.**

1. Select most correct alternative among the following and rewrite the following : **14**
- i) IR spectroscopy is mainly useful in the determination of
    - a) Conjugation
    - b) Functional group
    - c) Molecular weight
    - d) Atomic weight
  - ii) An example of Auxochrome is
    - a)  $C \equiv C$
    - b)  $-CO-$
    - c)  $-NH_2$
    - d) All these
  - iii) In mass spectroscopy, the intensity assigned to base peak is
    - a) 50%
    - b) 90%
    - c) 0%
    - d) 100%
  - iv) When a halogen atom is attached to methyl group, then the  $\delta$  values
    - a) decreases with electronegativity of halogen atom
    - b) not affected by electronegativity
    - c) increases with electronegativity
    - d) negligible
  - v) The finger print region of the IR spectrum lies in the range
    - a)  $1350 - 650 \text{ cm}^{-1}$
    - b)  $4000 - 1350 \text{ cm}^{-1}$
    - c)  $4000 - 650 \text{ cm}^{-1}$
    - d)  $650 - 50 \text{ cm}^{-1}$
  - vi) The transition energy for  $\pi \rightarrow \pi^*$  is \_\_\_\_\_ than  $n \rightarrow \pi^*$  transition.
    - a) less
    - b) equal
    - c) half
    - d) greater

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- vii) Molecular ions peak is not generally visible in case of  
 a) halides   b) alcohols  
 c) aldehydes   d) ketones
- viii) Among the following which is magnetic nuclei  
 a)  ${}_1\text{H}^1$                                  b)  ${}_6\text{C}^{12}$                                  c)  ${}_1\text{H}^2$                                  d)  ${}_7\text{N}^{14}$
- ix) \_\_\_\_\_ is an example of homocyclic diene.



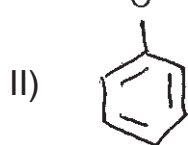
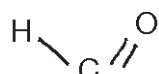
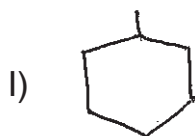
- x) Mass spectroscopy is a \_\_\_\_\_ technique.  
 a) high pressure   b) low temperature  
 c) low pressure   d) high temperature
- xi) The proton is charged spinning nuclei with a nuclear spin equal to  
 a)  $\frac{1}{2}$                                  b) 0   c)  $\frac{1}{3}$    d)  $\frac{2}{3}$
- xii) The stretching frequency of  $\begin{matrix} \diagup & & \diagdown \\ & \text{C}=\text{C} & \\ \diagdown & & \diagup \end{matrix}$  chromophore is \_\_\_\_\_ than that of C – C.  
 a) more   b) less   c) half   d) equal
- xiii) In NMR spectroscopy, absorption of long wavelength radio frequency radiations by molecule causes change in  
 a) Electronic state  
 b) Vibrational state  
 c) Rotational state  
 d) Spin state
- xiv) For a non-linear molecule the number of fundamental modes of vibrations are calculated by the relation  
 a)  $3N$    b)  $3N - 5$   
 c)  $3N - 6$    d)  $3N - 2$



2. Answer **any seven** of the following :

14

- i) Calculate the modes of vibration in CO<sub>2</sub> molecule.
- ii) What is delta scale and Tau scale ?
- iii) Define the term :
  - a) bathochromic shift
  - b) hypsochromic shift.
- iv) Predict the frequency shift of the carbonyl absorption in the following aldehyde.



- v) Define coupling constant with example.
- vi) What is magnetic nuclei and non magnetic nuclei ?
- vii) Define parent ion and fragment ion.
- viii) Name the different transitions involved in UV spectroscopy.
- ix) Explain peak area.

3. A) Write short notes on (**any two**) :

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- i) Why tetramethyl silane (TMS) is used as internal reference in NMR spectroscopy ?
- ii) Explain application of mass spectroscopy.
- iii) Discuss on functional group region.

B) State and explain Lambert's-Beer Law with mathematical expression.

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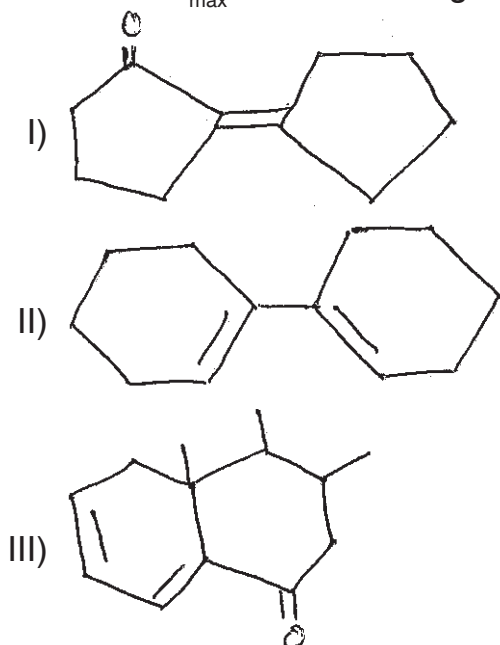
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4. Answer **any two** of the following :

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i) Calculate  $\lambda_{\max}$  of the following compound.



ii) Write the different basic parts used in proton nuclear magnetic resonance spectroscopy with schematic diagram.

iii) State Hooke's law. How it is used to calculate the vibrational frequency of diatomic group ?

5. Answer **any two** of the following :

14

i) State and explain the theory of mass spectrometer with diagram.

ii) Explain what types of vibrations are observed in IR spectroscopy.

iii) Define chemical shift and deduce the structure of compound with following data :

Molecular formula :  $C_4H_8O$

IR :  $1720\text{ cm}^{-1}$

M/e : 88

PMR :  $2.7\ \delta(\text{q}, 2\text{H})$

$1.05\ \delta(3\text{H}, \text{t})$

$1.12\ \delta(\text{s}, 3\text{H})$

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