



Reg. No. : .....

Name : .....



M 7111

V Semester B.Sc. Degree (CCSS – Reg./Supple./Imp.)  
Examination, November 2014  
CORE COURSE IN CHEMISTRY  
5B08 CHE : Physical Methods in Chemistry

Time : 3 Hours

Max. Weightage : 25

SECTION – A

Answer **all** questions. Choose the correct answer. **Each** bunch of **four** questions carries a weightage of 1.

1. i) The wave number of radiation of wavelength  $100 \text{ \AA}$  is  
a)  $10^5 \text{ cm}^{-1}$     b)  $10^9 \text{ cm}^{-1}$     c)  $10^5 \text{ m}^{-1}$     d)  $10^8 \text{ m}^{-1}$
- ii) Which among the following is NMR active ?  
a)  $^{16}\text{O}$     b)  $^{12}\text{C}$     c)  $^{18}\text{O}$     d)  $^1\text{H}$
- iii) How many fundamental modes of vibration are possible for  $\text{CH}_4$  molecule ?  
a) 6    b) 5    c) 9    d) 10
- iv) In rotational spectrum, the separation of adjacent rotational lines is  
a)  $2B$     b)  $B$     c)  $6B$     d)  $4B$
2. i) The possible electronic transition in methane molecule is  
a)  $\sigma \rightarrow \sigma^*$     b)  $\pi \rightarrow \pi^*$     c)  $n \rightarrow \pi^*$     d)  $n \rightarrow \sigma^*$
- ii) The nuclear spin quantum number of  $^2\text{H}$  is  
a)  $1/2$     b)  $3/2$     c) 1    d) 0
- iii) The spin only value of cobalt ion in  $[\text{CoF}_6]^{3-}$  is  
a) 1.73    b) 0    c) 4.89    d) 3.87
- iv) Among the following techniques which measures current under constant applied voltage  
a) Polarimetry    b) Amperometry  
c) Coulometry    d) Electrogravimetry

P.T.O.



3. i) Which among the following can be studied by TG ?  
 a) Oxidation                                b) Phase transition  
 c) Melting                                    d) Glass transition
- ii) Unit of molar absorption coefficient is  
 a)  $L \text{ mol}^{-1} \text{ cm}^{-1}$                         b)  $L^{-1} \text{ mol cm}$   
 c)  $L^{-1} \text{ mol}^{-1} \text{ cm}$                         d)  $L^{-1} \text{ mol cm}^{-1}$
- iii) The expansion of HPLC is  
 a) High Performance Liquid Chromatography  
 b) High Pressure Liquid Chromatography  
 c) High Partition Liquid Chromatography  
 d) Both a) and b)
- iv) Which among the following is diamagnetic ?  
 a)  $[\text{Ni}(\text{CN})_4]^{2-}$                                 b)  $[\text{CoF}_6]^{3-}$   
 c)  $[\text{NiCl}_4]^{2-}$                                     d)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
4. i) One nano meter is  
 a)  $10^{-11} \text{ m}$     b)  $10^{-9} \text{ cm}$     c)  $10^{-7} \text{ cm}$     d)  $10^{-9} \text{ m}$
- ii) Among the following which is a 2D nano structure ?  
 a) nano tube                                    b) nano shell  
 c) nano belt                                    d) nano sheet
- iii) Which is a non-quantum mechanical computational method ?  
 a) Molecular mechanics                        b) HF  
 c) ab initio                                        d) DFT
- iv) The computational method which makes use of electron density is  
 a) HF    b) SCF  
 c) DFT    d) Semi empirical method

(Weightage 4×1=4)

## SECTION – B

Answer **any 5** questions. **Each** question carries a weightage of **1**.

5. Write two factors which govern the intensities of rotational spectral lines.
6. What are fundamental bands and overtones ?



7. Write the molecular ion and base peak for methanol.
8. Give the significance of half wave potential and diffusion current in polarography.
9. What is  $R_f$  value in thin layer chromatography ?
10. Calculate the CFSE in a weak field complex with  $d^5$  configuration.
11. What is single electron tunnelling ?
12. What are Gaussian Type Orbitals ? (Weightage 5×1=5)

## SECTION – C

Answer **any 4** questions. **Each** question carries a weightage of **2**.

13. What are stokes and anti-stokes lines ? Compare their intensities.
14. Explain the NMR spectrum of  $\text{CH}_3 - \text{CH}_2 - \text{CO} - \text{CH}_2 - \text{CH}_3$ .
15. What is glass transition temperature ? How is it useful in the characterization of polymers ?
16. How  $\text{Fe}^{3+}$  is estimated colourimetrically ?
17. Write any two methods of preparation of nano materials.
18. Obtain the Z matrix of  $\text{H}_2\text{O}$ . (Weightage 4×2=8)

## SECTION – D

Answer **any 2** questions. **Each** question carries a weightage of **4**.

19. Describe the principle and applications of thermogravimetry.
20. Explain the different factors that influence the vibrational frequencies.
21. i) How is nano technology is used in bio-engineering ?  
 ii) Give an account on DFT. (Weightage 2×4=8)