B.Tech. DEGREE EXAMINATION, MAY 2019
First / Second Semester

18CYB101J – CHEMISTRY
(For the candidates admitted during the academic year 2018-2019 onwards)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours   Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. Which of the following is known as the Schrodinger equation?
   (A) $E = mc^2$
   (B) $\lambda = h / p$
   (C) $\hat{H}\Psi = E\Psi$
   (D) $\dfrac{-h^2}{2m}\nabla^2$

2. The CFSE for a high-spin d_4 octahedral complex is
   (A) $-0.6\,\Delta_{oct}$
   (B) $-1.8\,\Delta oct$
   (C) $-1.6\,\Delta oct + P$
   (D) $-1.2\,\Delta oct$

3. The allowed electronic transition of hydrogen atom is
   (A) $3d \rightarrow 1S$
   (B) $2p \rightarrow 1S$
   (C) $2P_z \rightarrow 2P_y$
   (D) $2P_z \rightarrow 2P_x$

4. During the motion, if the centre of gravity of molecule changes, the molecule possess
   (A) Electronic energy
   (B) Translation energy
   (C) Rotational energy
   (D) Vibrational energy

5. The correct order of different types of energies is
   (A) $E_{ele} > E_{vib} > E_{rot} > E_{tr}$
   (B) $E_{ele} > E_{rot} > E_{vib} > E_{tr}$
   (C) $E_{ele} > E_{vib} > E_{tr} > E_{rot}$
   (D) $E_{tr} > E_{vib} > E_{rot} > E_{el}$

6. The kinetic energy of the photo electron energies is dependent on _____ of the atom, which makes XPS useful to identify the oxide state.
   (A) Mass
   (B) Charge
   (C) Chemical environment
   (D) Volume

7. Which of the following species has the highest ionization potential?
   (A) Li^+
   (B) Mg^+
   (C) Al^+
   (D) Ne

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. Derive Schrodinger equation for one dimensional box and obtain the Eigen value of solving the equation.

    (OR)

    b. Draw and explain the molecular orbital energy level diagram for CO molecule and calculate the bond order.

29. a. Give the salient features of CFT. Discuss the crystal field splitting of Octahedral complex.

    (OR)

    b.i. What is the condition for a molecule to absorb microwave radiation? Give an example.

    ii. Discuss in detail about the selection rule of a rigid diatomic molecule for obtaining a rotational spectrum.

30. a. Discuss the principle, instrumentation and applications of XPS.

    (OR)

    b.i. Write the following equations of state of real gases.
       i.   Clausius equation   ii.   Berthelot equation   (4 Marks)

    ii. Explain why the substantial decrease in ionization energy is observed between Na and K and not between Al and Ga.   (8 Marks)

31. a. With a neat sketch explain Pourbaix diagram for Iron.
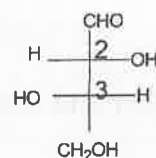
    (OR)

    b.i. Write about the Geometrical isomerism exhibited by transition metal complexes with suitable examples.   (4 Marks)

    ii. Derive Gibb's – Helmholtz equation.   (8 Marks)

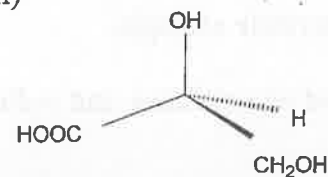32. a. Discuss in brief the Stereochemistry of SN1 and E2 mechanism.

    (OR)

    b.i. Mention R/S notations for the following compounds.
       (i)

       (ii)

          (4 Marks)

    ii. Discuss in detail about the conformations of n-butane.   (8 Marks)

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8. What are the coordination number and the oxidation state of the cobalt atom in the compound $\left[Co(NH_3)_5 Cl\right]Cl_2$?
   - (A) 4 ; +2
   - (B) 4; +3
   - (C) 6; +2
   - (D) 6; +3

9. The spin only magnetic moment value (in Bohr Magneton units) of $Cr(CO)_6$ is
   - (A) 0
   - (B) 2.83
   - (C) 4.90
   - (D) 5.92

10. Which of the following groups has the highest priority in the Cahn-Ingold-Prelog sequence rules?
    - (A) $-CH_2OH$
    - (B) $-CH_2OCH_3$
    - (C) $-CH=O$
    - (D) $-COOH$

11. For the reduction of silver ions with copper metal the standard cell potential was found to be +0.46 eV at 25°C. The value of standard Gibbs energy, $\Delta G°$ will be _____. $\left(F = 96500\, Cmol^{-1}\right)$.
    - (A) -44.5 KJ
    - (B) -98.0 KJ
    - (C) -89.0 KJ
    - (D) -89.0 J

12. Helmholtz – free energy A is expressed as
    - (A) $A = U + TS$
    - (B) $A = H + TS$
    - (C) $A = U - TS$
    - (D) $A = H - TS$

13. In a reversible process $\Delta S_{sys} + \Delta S_{surr}$ is
    - (A) > 0
    - (B) < 0
    - (C) ≥ 0
    - (D) $= 0$

14. The major product formed in the addition reaction of

 with HI is

   - (A)
   - (B)
   - (C)
   - (D) CH₃-CH₂-CH=CH₂+CH₃I

15. The most suitable reagent for the following transformation is

   - (A) $KMnO_4$
   - (B) OsO_4
   - (C) $K_2Cr_2O_7$
   - (D) PCC

16. Which is unreactive in hydride reduction with $NaBH_4$?
    - (A)
    - (B)
    - (C)
    - (D)
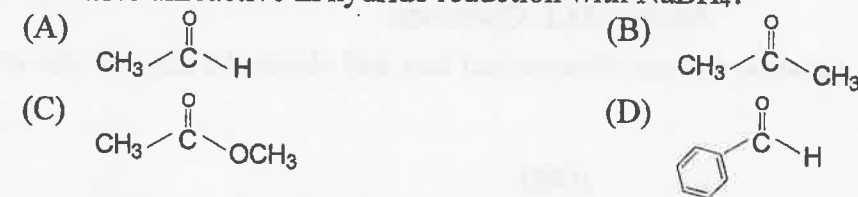
17. Repeatable entity of a crystal structure is known as
    - (A) Crystal
    - (B) Lattice
    - (C) Unit cell
    - (D) Miller indices

18. The ionization isomer of $\left[Cr(H_2O)_4 Cl(NO_2)Cl\right]$ is
    - (A) $\left[Cr(H_2O)_4(ONO)\right]Cl_2$
    - (B) $\left[Cr(H_2O)_4 Cl_2\right](NO_2)$
    - (C) $\left[Cr(H_2O)_4 Cl(ONO)Cl\right]$
    - (D) $\left[Cr(H_2O)_4 Cl_2(NO_2)\right]H_2O$

19. The isomer of diethyl ether is
    - (A) $(CH_3)_2 CHOH$
    - (B) $(CH_3)_3 C-OH$
    - (C) C_3H_7OH
    - (D) $(C_2H_5)_2 CHOH$

20. A possible set of quantum numbers for the last electron added to a gallium atom (Z = 31) in its ground state is _____ (values of n ℓ m_ℓ m_s are given sequentially).
    - (A) 4 1 −1 $+\frac{1}{2}$
    - (B) 4 0 0 $-\frac{1}{2}$
    - (C) 3 2 +2 $+\frac{1}{2}$
    - (D) 3 0 0 $-\frac{1}{2}$

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. State Fajans Rule. Give example.

22. What are fundamental and overtones in IR spectra?

23. Compute the Miller Indices for a plane intersecting at $x = \frac{1}{4}$, $y = 1$ and $z = \frac{1}{2}$.

24. What is galvanic cell? Give its representation.

25. Define plane of symmetry and centre of symmetry with suitable example.

26. Give the reaction in which $K_2Cr_2O_7$ and $NaBH_4$ are used as oxidizing and reducing agents respectively.

27. Outline the synthesis of paracetamol and mention its uses.