**B.Tech / M.Tech (Integrated) DEGREE EXAMINATION, JANUARY 2023**
First Semester

21CYB101J – CHEMISTRY
*(For the candidates admitted from the academic year 2022-2023)*

**Note:**
(i)     **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40$^{th}$ minute.
(ii)    **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours

Max. Marks: 75

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

| | | Marks | BL | CO | PO |
|---|---|---|---|---|---|

1. The crystal field splitting energy ($\Delta_0$) is directly proportional to            | 1 | 2 | 1 | 1
    (A) Geometry                         (B) Number of d-Electrons
    (C) Coordination number              (D) Oxidation state

2. The effective nuclear charge realised by is electron of helium atom is          | 1 | 3 | 1 | 1
    (A) 1.00                             (B) 1.20
    (C) 1.70                             (D) 1.65

3. The complex [Pt (NH$_3$)$_2$Cl$_2$] exhibits           | 1 | 3 | 1 | 1
    (A) Linkage isomerism                (B) Coordination isomerism
    (C) Geometrical isomerism            (D) Optical isomerism

4. The spin only magnetic moment value (In bohr magneton units) of Cr(CO)$_6$ is          | 1 | 3 | 1 | 1
    (A) 0                                (B) 2.84
    (C) 4.90                             (D) 5.92

5. For a reaction that has an equilibrium constant of $3.2×10^{-2}$, which of the following statement must be true?          | 1 | 4 | 2 | 1
    (A) $\Delta H°$ is negative           (B) $\Delta G°$ is positive
    (C) $\Delta G°$ is negative           (D) $\Delta S°$ is positive

6. For an isolated system, $\Delta U = 0$, what will be $\Delta S$?          | 1 | 2 | 2 | 1
    (A) $\Delta S > 0$                    (B) $\Delta S < 0$
    (C) $\Delta S \leq 0$                 (D) $\Delta S \geq 0$

7. In the pourbaix diagram, the form of iron that will predominate at pH12 and at potential of 1.86 V is          | 1 | 3 | 2 | 1
    (A) Fe                               (B) Fe$^{2+}$
    (C) FeO$_4^{2-}$                      (D) Fe(OH)$_3$

8. Helmholtz function F is given by          | 1 | 1 | 2 | 1
    (A) $-U + TS$                         (B) $-U - TS$
    (C) $U + TS$                          (D) $U - TS$

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9. The number of structural isomers for $C_6H_{14}$ is

    (A) 6                         (B) 5

    (C) 4                         (D) 3

1   2   3

10. Reactivity order of alkyl halides in $S_N^2$ reaction is

    (A) $CH_3 \times 1° > 2° > 3°$          (B) $CH_3 \times > 2° > 3° > 1°$

    (C) $3° > 2° > 1° > CH_3 \times$         (D) $3° > 1° > 2° > CH_3 \times$

1   2   3   2

11. Among the following hex-2-ene reacts fastest with?

    (A) HCl                     (B) HF

    (C) HI                      (D) HBr

1   3   3   2

12. Which of the following has the lowest priority according to the CIP sequence rules?

    (A) $CH(OH) CH_3$           (B) $CH = CH_2$

    (C) $-CHO$                (D) $CH_2 CH_3$

1   3   3   2

13. Which of the following is a thermo setting polymer?

    (A) Bakelite              (B) Polystyrene

    (C) PVC                (D) Polyethene

1   1   4   1

14. Which one of the below is used as an insulator and also as a lubricant?

    (A) PVC                 (B) PTFE

    (C) SBR                (D) Poly propylene

1   2   4   1

15. Hemodialysis tubes are made with

    (A) Silicone rubber         (B) Polystyrene

    (C) Polyurethane intermediate   (D) Nylon

1   1   4   1

16. Which of the below polymers show higher crystallinity?

    (A) Isotactic              (B) Atactic

    (C) Random             (D) Syndiotactic

1   2   4   1

17. In fibre reinforced composites which constituent will fail last?

    (A) Filler                (B) Matrix

    (C) Both fail at same time      (D) Need more details on composite

1   2   5   1

18. After the proportionality limit in the stress-strain curve, we observe

    (A) Lower yield point       (B) Upper yield point

    (C) Ultimate point          (D) Elastic point

1   3   5   1

19. Minimum inter planar spacing required for Bragg's diffraction is

    (A) $\lambda/4$                   (B) $4\lambda$

    (C) $\lambda/2$                   (D) $2\lambda$

1   2   5   1

20. Determine young's modulus of a material whose elastic stress and strain are 4 $N/m^2$ and 0.15 respectively

    (A) 26.66 $N/m^2$         (B) 2.666 $N/m^2$

    (C) 266.6 $N/m^2$        (D) 2666 $N/m^2$

1   3   5   1

## PART – B (5 × 8 = 40 Marks)
### Answer ALL Questions

| | | Marks | Bl. | CO | PO |
|---|---|---|---|---|---|

21. a. Find the number of unpaired electrons in strong and weak octahedral field for a $Mn^{2+}$ complex ($d^5$) based on CFT. Calculate CFSE and magnetic moment for both the situation with energy level diagrams.   *8   4   1   1*

**(OR)**

b. Demonstrate with proper examples the isomerism exhibited in transition metal complexes.   *8   3   1   1*

22. a. With appropriate examples, elucidate how Nernst equation can be applied in a redox reaction and in an acid-base reaction.   *8   2   2   1*

**(OR)**

b. Derive Gibbs-Helmholtz equation and given its applications.   *8   1   2   1*

23. a. Compare and contrast $S_N^1$ and $S_N^2$ reactions with an example for each.   *8   2   3   2*

**(OR)**

b. Sketch the potential energy diagram and explain in detail the conformational analysis of n-butane.   *8   1   3   2*

24. a. Provide a conscise note on the synthesis and applications of Teflon and PVC.   *8   2   4   1*

**(OR)**

b. Explain in detail n and p-doping in conducting polymers.   *8   2   4   1*

25. a. Illustrate with a proper stress-strain plot for the following   *8   3   5   1*
      (i)   Elastic region
      (ii)  Plastic region

**(OR)**

b. Explain with an example ceramic matrix composite and metal matrix composite.   *8   2   5   1*

## PART – C (1 × 15 = 15 Marks)
### Answer ANY ONE Questions

| | | Marks | Bl. | CO | PO |
|---|---|---|---|---|---|

26. With an neat sketch discuss pourbaix diagram for iron.   *15   3   2   1*

27. i. Explain E2 mechanism with suitable example.   *5   2   3   2*

   ii. Discuss about the principle and instrumentation of X-ray photo electron spectroscopy.   *10   3   5   1*

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