(Pages : 3) **N – 4258**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

IC 1121 – METHODOLOGY AND INFORMATICS

(2013 – 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Give the sequence of steps involved in Induction and deduction?
2. What is Positivism?
3. What is the importance of revision of scientific theories?
4. Write down the expression of standard deviation.
5. “Accuracy can be expressed in terms of absolute error.” Justify this statement.
6. What is the meaning of a SMILE file?
7. Which is the origin of scientific creativity?
8. How we can present the frequency of a discrete variable?
9. Who is the founder of “Free Software Movement”?
10. Give the meaning of PDF.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks**.**

11. What is meant by intellectual property right?

12. What are software models?

13. How can we differentiate between static and dynamic models?

14. Describe the precision of a result of a scientific experiment.

15. What is QSAR?

16. What is an e-mail? Give the principle behind that.

17. What is e-ebabled learning?

18. What is database mining?

19. What are the different types of operating systems?

20. What are *Trojans* and *worms*?

21. What is the use of PDB in structure data bank?

22. What are digital signal processing?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. Distinguish between mathematical methods and scientific methods.

24. Exemplify the use of a pi-diagram in presenting the results of a typical experiment.

25. What are the various steps of a scientific research?

26. Write a note on different kinds of models used in science.

27. Name the tree types of determinant errors. How are these errors detected? How we can avoid these errors?

28. What are secondary digital sources?

29. What are the characteristics of a good presentation using visual media?

30. Write a note on e-learning.

31. Discuss about the importance of cheminformatics.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Explain what is hypothesis. Illustrate with an example how one such hypothesis can be framed, confirmed and validated.

33. Explain different types of Errors and the methods used to reduce systematic errors.

34. Discuss about combinatorial chemistry.

35. Explain the role of IT in teaching, learning and research.

(2 × 15 = 30 Marks)

———————

(Pages : 3) **N – 4259**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme Under CBCSS

Chemistry and Industrial Chemistry

IC 1121 - METHODOLOGY AND INFORMATICS

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What is meant by hypothesis?
2. "Theory and experiment are mutually dependent in chemistry". Justify this statement.
3. What is science?
4. Name the commonly employed tests of significance.
5. "Accuracy can be expressed in terms of absolute error". Justify this statement.
6. How we can present the frequency of a discrete variable?
7. Who is the founder of "Free Software Movement"?
8. Give the meaning of PDF.
9. What is LAN?
10. What is a PDB file?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. What is empiricism?
12. Prepare a format for the documentation of the experiment to determine the dissolved oxygen of a sample of water.
13. What is meant by the term data quality?
14. Briefly describe the role of science in social cohesion.
15. Distinguish between objectivity approach and subjectivity approach.
16. What are the basic components of the product of science?
17. Explain the empiricism in chemistry.
18. What is meant by plagiarism.
19. Name few challenges of science in 21st century.
20. Explain the role of INFLIBNET in science education in India.
21. What are the different types of operating systems?
22. What are *Trojans* and *worms?*
23. Define super computers.
24. Describe the meaning of DOS.
25. Give the names of any four computer related crimes.
26. Define search engine.

(8 $\times$ 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Write a note on choice of instruments in the field of scientific research.
28. Write a note on different kinds of models used in science.
29. What are primary digital sources? Explain.
30. Name the tree types of determinant errors. How are these errors detected? How we can avoid these errors?
31. Distinguish between mathematical methods and scientifc methods.

32. Explain the discovery approach in science learning.
33. Exemplify the use of a pi-diagram in presenting the results of a typical experiment.
34. What are the various steps of a scientific research?
35. What are secondary digital sources?
36. What are the characteristics of a good presentation using visual media?
37. Discuss how computers are used for data entry and analysis.
38. Write a note on e-learning.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Discuss about the importance of cheminformatics.
40. "Revision of scientific theories are essential when it is unable to dealt with new situations". Justify this statement by taking atom model as an example.
41. Discuss the significance of statistical tools in data interpretation.
42. Explain the role of IT in teaching, learning and research.
43. Discuss about virtual reality and artificial intelligence.
44. Describe the applications and challenges of information technology.

(2 × 15 = 30 Marks)

———————

(Pages : 3) **N – 4260**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

IC 1141 : INORGANIC CHEMISTRY – I

(2013 – 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. Radial wave function $R(r)$ depends upon the quantum numbers ————————.
2. Energy and ———————— are conjugate variables.
3. The geometry of H_3O^+ is ————————.
4. The ionic radius of the anion is ———————— than the ionic radius of cation of the same atom.
5. Rutile has ———————— structure.
6. The ligand denticity of EDTA is ————————.
7. Dioxygen is ———————— magnetic.
8. The bond order in N_2 is ————————.
9. According to VSEPR theory, the shape of IF_5 is ————————.
10. Diphenyl amine is a ———————— indicator.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Short answer type (Not to exceed **1** paragraph)

Answer **any eight** questions. Each question carries **2** marks.

11. Draw the radial probability distribution curve for 2s and 3p orbitals.

12. What is an orbital?

13. How is a burette calibrated?

14. Calculate the electronegativity of fluorine. Given : $E_{H-H} = 104$ k cal mol^{-1}, $E_{F-F} = 37$ k cal mol^{-1}, $E_{H-F} = 134$ k cal mol^{-1}.

15. Describe briefly the elimination of phosphate ion.

16. What are the factors determining ionization energy?

17. Calculate the bond order of O_2^+.

18. Explain how the limiting radius ratio can be used to predict the shape of the ionic crystals.

19. The first and second electron affinities of oxygen are 141 kJ k $mol^{-1}$and –770 kJ k cal mol^{-1}respectively. Explain.

20. State and explain Aufbau principle.

21. Define R_f value.

22. What is meant by digestion of a precipitate?

(8 × 2 = 16 Marks)

SECTION – C

Short essay (Not to exceed **120** words)

Answer **any six** questions. Each question carries **4** marks.

23. What is the physical significance of Heisenberg's uncertainty principle? Calculate the uncertainty in momentum of a particle whose uncertainty in position is of the order of 1nm.

24. Distinguish between bonding and anti-bonding MOs.

25. Explain ion-exchange chromatography.

26. Calculate the electronegativity of carbon (covalent radius of carbon atom is 0.77 Å).

27. What are the factors that influence electronegativity of an element? Explain.

28. What are complexometric titrations? Explain.

29. Calculate the limiting radius ratio for a cubic site.

30. What are the salient features of MO theory?

31. Discuss the selection of suitable indicators for different acid-base titrations.

(6 × 4 = 24 Marks)

SECTION – D

Long essay (Not to exceed **120** words)

Answer **any two** questions. Each question carries **15** marks.

32. (a) Explain Slater's rules for calculating screening constant

    (b) Calculate the effective nuclear charge felt by a 3d electron of Cr (Z = 24).

33. Discuss the principles underlying the separation of cations into groups in qualitative analysis.

34. What are quantum numbers? Discuss the significance of each quantum number.

35. Explain :

    (a) Fajans rules

    (b) VSEPR theory.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 4261**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme under CBCSS

Chemistry And Industrial Chemistry

IC 1141: INORGANIC CHEMISTRY I

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Calculate the wave number of light with wavelength 5×10^{-9}m.
2. Name a properly which decreases along a period in periodic table.
3. Write a note on Heisenberg's uncertainty principle.
4. What is the geometry of XeF_2 molecule?
5. Explain the bonding in N_2 using molecular orbital theory.
6. Explain in the significance of principal quantum number.
7. Name a redox indicator.
8. Write one example for chromatic graphic technique.
9. Name the most common and stable form of titanium dioxide found in nature.
10. Which is more covalent in character, AgBr or Agl.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions from the following. **Each** question carries **2** marks.

11. Write and explain Bore-Lande equation?

12. Calculate bond order in O_2^+ ion?

13. Predict the structure and hybridization in IF_7.

14. What is meant by lattice energy of an ionic compound?

15. Draw the radial probability distribution curve of 2s orbital.

16. Write time independent Schrodinger wave equation for a one-dimensional box. Explain its terms.

17. Explain Pauli's exclusion principle.

18. Outline the Mullikan scale of electronegativity.

19. Give any two applications of TLC.

20. Describe the effect of temperature on precipitation.

21. What is meant by Rf value? What is it use in chromatography?

22. Why is the dipole moment of NH_3 greater than that of NF_3.

23. Explain the principle of gas chromatography.

24. Explain diagonal relationship in periodic table and give it's significances.

25. Explain redox titrations with example.

26. What is Laplacian operator?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Draw the shapes of all d-orbitals.

28. Discuss valence bond theory.

29. Explain LCAO-MO theory with example.

30. Derive de Broglie relationship.

31. Describe the role of Hund's rule in finding electronic configuration of atoms.

32. Define ionisation enthalpy. How does it vary along a group and period in the periodic table? What are the factors influencing it?

33. Discuss the principle of complexometric titrations with suitable examples.

34. Describe briefly co-precipitation and post-precipitation.

35. Explain Fajan's rules.

36. Explain the theory of acid base indicators.

37. Draw molecular orbital diagram of CO and calculate its bond order.

38. Explain the structure of Rock salt.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Obtain the solution of Schrodinger wave equation of a particle in a one-dimensional box. **15**

40. How can you determine lattice energy of ionic compound? What are its applications? **15**

41. (a) Discuss the structure of any three Xenon Fluorides in different oxidation states. **5**

(b) Explain VSEPR theory, using the explain shapes of **10**

(i) NH_3

(ii) H_2O

(iii) H_3O^+

42. Explain electronegativity in terms of Pauling's scale, Mullikan and Alred – Rochow sacle. **15**

43. (a) Discuss the applications of common ion effect and solubility product in Inorganic qualitative analysis. **10**

(b) Write a note on **5**

(i) metallochromic indicators.

(ii) Elimination of oxalate anion during the analysis of cations.

44. Discuss various chromatographic Techniques. **15**

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 4262**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme Under CBCSS

Mathematics

Complementary Course I for Chemistry and Industrial Chemistry

MM 1131.7 — MATHEMATICS — I COMPLEX NUMBERS, DIFFERENTIATION AND MATRICES

(2013-2018 Admissions)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the first ten questions are compulsory. They carry **1** mark each.

1. Find the modulus of $\frac{3+i}{5+5i}$.

2. State De Moivre's Theorem.

3. What is the natural domain of $f(x)=\sqrt{x+1}+4$?

4. Find the derivative of $y=3x^8-2x^5+6x+1$.

5. Evaluate $Lt_{x\to\frac{\pi}{2}}\frac{1-\sin x}{\cos x}$.

6. Define radius of convergence of a power series.

7. Define Taylor series representation of a function.

P.T.O.

8. If $z = e^{4x} \sin 3y$, find $\frac{\partial z}{\partial x}$.

9. Define symmetric matrix.

10. Check whether the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -6 & -1 \\ 3 & 4 & 2 \end{bmatrix}$ is singular.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **8** questions from among the questions 11 to 22. They carry **2** marks each.

11. Find all the values of $\left(-1+i\sqrt{3}\right)^{\frac{3}{2}}$.

12. Find the principal argument of $-\sqrt{3}+i$.

13. State Rolle's Theorem.

14. Find the slope of the curve $y = 2x^2$ and use it to find the tangent line at $x = 1$.

15. Find the velocity and acceleration at $t = 3$ of a particle which moves along the curve $s(t) = t^3 - 3t^2$.

16. Determine whether the series $\sum_{k=0}^{\infty} \frac{5}{4^k}$ converges and if so find its sum.

17. Test the convergence of the series $\sum_{k=1}^{\infty} \frac{1}{k(k+1)}$. If it is convergent find its sum.

18. Use chain rule to find $\frac{dz}{dt}$ given $z = x^2 y$, $x = t^2$, $y = t^3$.

19. Describe the surface $z = (x-1)^2 + (y+2)^2 + 3$.

20. Define equivalent matrices.

21. Fine the eigen values of A^4 if $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$.

22. Define rank of a matrix.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **6** questions from among the questions 23 to 31. They carry **4** marks each.

23. Express $\sin^7\theta\cos^3\theta$ in terms of sines of multiples of θ.

24. Separate sin *z* into its real and imaginary parts.

25. Find all relative extrema of $f(x) = 3x^5 - 5x^3$.

26. Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/s. How fast is the area of the spill increasing when the radius of the spill is 60 ft?

27. Find the Taylor series expansion for $f(x) = \frac{1}{x}$ about $x = -1$.

28. Find the absolute extreme of the function $f(x, y) = xy - x - 3y$ in the triangular region with vertices (0, 0), (0, 4) and (5, 0).

29. Use the method of Lagrangian multipliers to find the maximum and minimum values of the function $f(x, y) = 4x^3 + y^2$ subject to the constraint $2x^2 + y^2 = 1$.

30. Find the row reduced echelon form of the matrix $\begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -1 & 2 & 2 \\ 3 & 1 & 2 & 3 \end{bmatrix}$ and determine its rank.

31. Solve the following system by Cramer's Rule.

$x + y + z = 11$

$2x - 6y - z = 0$

$3x + 4y + 2z = 0$

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **2** questions from among the questions 32 to 35. They carry **15** marks each.

32. (a) Express $\cos 4\theta$ in terms of powers of $\cos\theta$ and $\sin\theta$.

(b) If $\cos^{-1}(x - iy) = a + ib$, prove that $\dfrac{x^2}{\cos^2 a} - \dfrac{y^2}{\sin^2 a} = 1$.

33. (a) An open box is to be made from a 16 inch $\times$ 30 inch piece of cardboard by cutting out squares of equal size from the four corners and bending up the sides. What size should be the squares be to obtain a box with largest volume?

(b) Find the derivative of $y = \dfrac{x^2\sqrt[3]{7x-14}}{(1+x^2)^4}$, using logarithmic differentiation.

34. (a) Given that $z = e^{xy}$, $x = 2u + v$, $y = \dfrac{u}{v}$, find $\dfrac{\partial u}{\partial u}$ and $\dfrac{\partial z}{\partial v}$.

(b) Find the Jacobian $\dfrac{\partial(x, y)}{\partial(u, v)}$ if $x = \dfrac{u+v}{2}$, $y = \dfrac{u-v}{2}$.

35. (a) Find a and b such that the system

$2x + 3y + 5z = 9$

$7x + 3y - 2z = 8$

$2x + 3y + az = b$

has (i) no solution (ii) unique solution (iii) infinite solutions.

(b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.

(2 $\times$ 15 = 30 Marks)

———————

(Pages : 4) **N – 4263**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme Under CBCSS

Mathematics

Group 2(a) – Complementary Course I for Chemistry and Industrial Chemistry

MM 1131.7 : MATHEMATICS I – CALCULUS, COMPLEX NUMBERS AND VECTOR ALGEBRA

(2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the first ten questions are compulsory. They carry **1** mark each.

1. Write the derivative of $\sin^{-1}\frac{x}{a}$.

2. State the product rule for differentiation of production of two functions.

3. Find the derivative of $f(x) = (5 + 4x^3)^2$.

4. Find $\int x \sin x \, dx$.

5. Evaluate $\int \ln x \, dx$.

6. State De Moivre's theorem.

P.T.O.

7. Define $\cosh x$.

8. Write the hyperbolic identity analogous to $\cos^2 x + \sin^2 x = 1$.

9. Define scalar product of two vectors $\vec{a}$ and $\vec{b}$.

10. What is the scalar triple product of three coplanar vectors?

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions from among the questions **11** to **22**. They carry **2** marks each.

11. Use Leibnitz's theorem to find the third derivative of $\sin x \ln x$.

12. Define stationary point of a function.

13. State Rolle's theorem.

14. Find the mean value of the function $f(x) = x^2$ between the limits $x = 1$ and $x = 3$.

15. Using integration by parts $\int_0^y \sin^{-1} x \, dx$.

16. Find the length of the curve $y = x^{\frac{3}{2}}$ from $x = 0$ to $x = 2$.

17. Express $\cos 3\theta$ in terms of powers of $\cos\theta$ and $\sin\theta$.

18. Find the solutions to the equation $z^3 = 1$.

19. Evaluate $Ln(-i)$.

20. Find the volume V of the parallelepiped with sides $\vec{a} = i + 2j + 3k$, $\vec{b} = 4i + 5j + 6k$ and $\vec{c} = 7i + 8j + 10k$.

21. Write the equation of the plane passing through $\vec{a}, \vec{b}$ and $\vec{c}$.

22. Give the reciprocal set of vectors of $\vec{a}, \vec{b}$ and $\vec{c}$.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions from among the questions **23** to **31**. They carry **4** marks each.

23. Find the lowest value taken by the function $3x^4 + 4x^3 - 12x^2 + 6$.

24. Find the radius of curvature of the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ in the first quadrant.

25. Evaluate $\int_1^y \frac{\ln(a^2 + x^2)}{x^2} dx$.

26. Find the surface area of a cone formed by rotating about the x-axis the line $y = 2x$ between $x = 0$ and $x = h$.

27. Evaluate $\left|\exp\left(\sqrt{i}\right)\right|$.

28. Find a closed-form expression for the inverse hyperbolic function $y = \cosh^{-1} x$.

29. Find the minimum distance from the point P with coordinates $(1, 2, 1)$ to the line $\vec{r} = \vec{a} + \lambda\vec{b}$ where $a = i + j + k$ and $b = 2i - j + 3k$.

30. A line is inclined at equal angles to the $x-$, $y-$ and $z-$axes and passes through the origin. Another line passes through the points $(1, 2, 4)$ and $(0, 0, 1)$. Find the minimum distance between the two lines.

31. Find the radius ρ of the circle that is the intersection of the plane $\hat{n} \cdot \vec{r} = p$ and the sphere of radius *a* centred on the point with position vector $\vec{c}$.

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **two** questions from among the questions **32** to **35**. They carry **15** marks each.

32. (a) For the function $y(x) = x^2c^{-x}$ obtain a simple relationship between y and y' and then, by applying Leibnitz' theorem, prove that $xy^{(n+1)} + (n + x - 2)y^{(n)} + ny^{(n-1)} = 0$.

(b) Show that $f(x) = 5x^4 - 11x^3 + 26x^2 - 44x + 24$ takes negative values for some range of x.

33. (a) By making the substitution $x = a\cos^2\theta + b\sin^2\theta$, evaluate $\int_a^b [(x-a)(b-x)]^{\frac{-1}{2}} dx$.

(b) Evaluate the integral $\int e^{ax}\cos bx\ dx$.

34. (a) Evaluate derivative of $\sinh^{-1}x$ using the logarithmic form of the inverse.

(b) Use de Moivre's theorem with $n = 4$ to prove that $\cos 4\theta = 8\cos^4\theta - 8\cos^2\theta + 1$ and deduce that $\cos\frac{\pi}{8} = \left(\frac{2+\sqrt{2}}{8}\right)^{\frac{1}{2}}$.

35. (a) Establish the reciprocal vectors of $\vec{a} = j + k$, $\vec{b} = i + k$ and $\vec{c} = i + j$ and hence express the vectors $\vec{p} = 3i - 2j + k$, $q = i + 4j$ and $r = -2i + j + k$ in terms of the base vectors $\vec{a}, \vec{b}$ and $\vec{c}$.

(b) Verify that the scalar product $p \cdot q$ has the same value when evaluated using either set of compounds.

(2 × 15 = 30 Marks)

———————

(Pages : 6) **N – 4264**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, June 2022

Career Related First Degree Programme Under CBCSS

Mathematics

Group 2(a) Complementary Course I for Chemistry and Industrial Chemistry

MM 1131.7 MATHEMATICS I – CALCULUS, COMPLEX NUMBERS AND VECTOR ALGEBRA

(2020 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – I

(All the first **10** questions are compulsory. They carry **1** marks each)

1. Write the n^{th} derivative of e^{2x}.

2. Define curvature of a curve.

3. Explain why there is no point c in the interval $(0,\pi)$ such that $f'(c)=0$, even though $f(0)=f(\pi)=0$.

4. Find the mean value of $f(x)=2x$ over [0, 4]

5. Evaluate $\int_0^2 (2-x)^{-1/2}\,dx$.

6. State De Moivre's theorem.

7. Simplify : $\cosh x + \sinh x$.

8. Find the volume of the parallelepiped whose edges are represented by $a = 2i - 3j + 4k$, $b = i + 2j - k$ and $c = 3i - j + 2k$.

9. Define reciprocal system of vectors.

10. Write the vector equation of a sphere with centre at the point ***c*** and radius *a*.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions from the questions 11 to 26. These questions carry 2 marks each.

11. Use Leibnitz theorem to find the fourth derivative of $x^2 e^{4x}$.

12. Given that Rolle's theorem holds with $c = 2 + 1/\sqrt{3}$ for the function $f(x) = x^3 - 6x^2 + ax + b$ on (1, 3). Find the values of a and b.

13. Find the position and nature of the stationary points of the funciton $f(x) = \cos ax$ with $a \neq 0$.

14. show that the maximum curvature of the catenary $y(x) = a\cosh(x/a)$ is $1/a$.

15. Integrate $\tan^{-1} x$ w.r.x.

16. Evaluate $\int \sin^5 x dx$.

17. Write the parametric coordinates of the asteroid and hence find the Cartesian equation from it.

18. Using the method of integration, find the area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1.$

19. Write the real part of e^{-z} .

20. Sketch the part of the Argand diagram Im z>0.

21. Find the equation in terms of x and y of the sets of points in the Argand diagram that satisfy $\mathrm{Re}\, z^2 - \mathrm{Im}\, z^2$.

22. Find dy/dx if $y=\cosh\left(x^2\right)$

23. Find the equation of the plane through (1, 1, 1) and the intersection of the planes $x+2y-z+1=0$ and $3x-y+4z+3=0$.

24. Construct the reciprocal vectors of $a=\left(2i+3j-k\right), b=\left(i-j-2k\right)$ and $c=\left(-i+2j+2k\right)$.

25. Give the equations in vectors form of the straight line joining the points $\left(-2,1,3\right)$ and (3, 1, –2).

26. Find the equation of the sphere described on the join of A and B having position vectors $5i+j$ and $3i-5j+2k$ respectively as a diameter.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions from the questions 27 to 38. These questions carry **4** marks each

27. Verify that the function $f(x) = x^2 - x$ satisfies the hypotheses of the mean value theorem over the interval [–3, 5] and find all values of c in that interval that satisfies the conclusion.

28. Show that the curves $x^3 + y^3 - 12x - 8y - 16 = 0$ touches x-axis.

29. Evaluate $\int_0^{\pi/2} \sin^8 x dx$.

30. Find the perimeter of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$.

31. Find the volume of a sphere of a radius *a*.

32. Find all the cube roots of 27.

33. Evaluate i^{-2i}.

34. Prove that $\ln(\cosh x + \sinh x) + \ln(\cosh x - \sinh x) = 0$.

35. Evaluate $\int \sinh^2 \times \cosh \times dx$

36. For the unit vectors **i, j, k** prove that **i** $\times$ (**j** $\times$ **k**) + **j** $\times$ (**k** $\times$ **i**) + **k** $\times$ (**i** $\times$ **j**) = 0

37. Find the minimum distance from the point P(1, 2, 3) to the line $\mathbf{r} = (\mathbf{i} + \mathbf{j} + \mathbf{k}) + \lambda(2\mathbf{i} - \mathbf{j} + 3\mathbf{k})$.

38. Find the perpendicular distance between one corner of a unit and the major diagonal not passing through it.

(6 $\times$ 4 = 24 Marks)

SECTION – IV

Answer any **two** questions from questions 39 to 44. These questions carry **15** marks each.

39. (a) For the function $y(x)=\sqrt{\frac{1+x}{1-x}}$, prove that $(1-x^2)y_1 = y$ and hence show that $(1-x^2)y_{n+1} - (2nx+1)y_n - n(n-1)y_{n-1} = 0$.

(b) Using Lagrange's mean value theorem, prove that $\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b+a}{1+a^2}$.

40. The equation of a cardiod in plane polar coordinates is $\rho = a(1+\cos\theta)$. Then ,

(a) Sketch the curve

(b) Find its area, perimeter and the surface area of the solid formed by rotation the cardiod about its axis of symmetry

(c) Find the volume of the same solid.

41. (a) Sketch the graph of $y = \sinh$ x,y = cosh x.

(b) Find the n^{th} roots of unity and show that their sum is zero.

(c) If n is a positive integer, use De Moivre's theorem to show that $(1+i)^n + (1-i)^n = \left(\sqrt{2}\right)^{n+2} \cos(n\pi/4)$.

42. (a) If $\mathbf{a},\mathbf{b},\mathbf{c}$ are coplanar, prove that $\mathbf{a}+\mathbf{b},\mathbf{b}+\mathbf{c},\mathbf{c}+\mathbf{a}$ are coplanar.

(b) Show that $\mathbf{a}\times(\mathbf{b}\times\mathbf{c}) + \mathbf{b}\times(\mathbf{c}\times\mathbf{a}) + \mathbf{c}\times(\mathbf{a}\times\mathbf{b}) = 0$

43. Show that the line whose vector equation is $\mathbf{r} = (2\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}) + \lambda(\mathbf{i} - \mathbf{j} + 4\mathbf{k})$ is parallel to the plane whose vector equation is $\mathbf{r}.(\mathbf{i} + 5\mathbf{j} + \mathbf{k}) = 5$. Find also the distance between them.

44. (a) Find the vector equation of the plane which contains the line of intersection of the planes $\mathbf{r}.(\mathbf{i}+2\mathbf{j} + 3\mathbf{k}) - 4 = 0$, $\mathbf{r}.(2\mathbf{i}+\mathbf{j}-\mathbf{k}) + 5 = 0$ and which is perpendicular to the plant $\mathbf{r}.(5\mathbf{i}+3\mathbf{j}-6\mathbf{k})+8=0$.

(b) Find the shortest distance between the lines whose equations are given by

$\mathbf{r} = (\mathbf{i} + \mathbf{j}) + \lambda(2\mathbf{i} - \mathbf{j} + \mathbf{k})$ and $\mathbf{r} = (2\mathbf{i} + \mathbf{j} - \mathbf{k}) + \mu(3\mathbf{i} - 5\mathbf{j} + 2\mathbf{k})$

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 2596**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Industrial Chemistry

MM 1231.7 : ANALYTIC GEOMETRY, INTEGRATION, DIFFERENTIAL EQUATIONS AND THEORY OF EQUATIONS

(2014 – 2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the **first ten** questions are compulsory. They carry **1** mark each.

1. Give geometric definition of an ellipse.
2. Find the parametric equations of the parabola $y^2 = 4x$.
3. Suppose that a particle moves along an S-axis so that its velocity at time t is $v(t) = 3t^2 - 2t$. Find the position function of the particle when $s(0) = 1$.
4. Evaluate $\int \sin^2 x \cos dx$.
5. Evaluate $\int_0^2 \left(3x^2 - 2x\right) dx$.
6. Solve $\frac{dy}{dx} = -4xy^2$.

P.T.O.

7. Solve $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0$.

8. Find the particular integral of $\frac{d^2y}{dx^2}-7\frac{dy}{dx}+6y=e^{2x}$.

9. State the fundamental theorem of algebra.

10. State the Descartes' rule of signs.

SECTION – II

Answer **any eight** questions from among the questions. 11 to 22. These questions carry **2** marks each.

11. Sketch the parabola $y^2=4x$ and label the focus, vertex and directrix.

12. Find the equation of the ellipse with ends of major axis $(\pm 5, 0)$ and ends of minor axis $(0, \pm 2)$.

13. Prove that the line tangent to the parabola $x^2=4py$ at the point (x_0, y_0) is $x_0 x = 2p(y+y_0)$.

14. Find the displacement and distance travelled during the time interval $0 \le t \le 2$ if velocity function is $v(t)=3t-2$.

15. Define the average value of a continuous function $f(x)$ on a closed interval $[a, b]$ and find the average value of $f(x)=x^2$ over $[0, 2]$.

16. Evaluate the integral $\int_{-1}^{1}\frac{x^2}{\sqrt{x^3+9}}\,dx$.

17. Solve $\frac{dy}{dx}=e^{x+y}+x^2e^y$.

18. Solve $\frac{dy}{dx}+y\tan x=\cos x$.

19. Solve $\left(D^2+6D+9\right)y=50e^{2x}$.

20. Solve the equation $x^4+2x^3-5x^2+6x+2=0$, given that $1+i$ is a root of it.

21. Show that the equation $x^7-3x^4+2x^3-1=0$ has atleast four imaginary roots.

22. Find the equation whose roots are the roots of $x^5+6x^4+6x^3-7x^2+2x-1=0$ with the signs changed.

SECTION – III

Answer **any six** questions from among the questions. 23 to 31. These questions carry **4** marks each.

23. If an $x'y'$-coordinate system is obtained by rotating an xy-coordinate system through an angle of $\theta=60^\circ$ find the equation of the curves $\sqrt{3}\,xy+y^2=6$ in $x'y'$ coordinates.

24. Completing the square, identify the graph of $x^2-5y^2-4x-10y-9=0$.

25. Evaluate $\int_0^2\int_{\frac{y}{2}}^1 ex^2\,dx\,dy$ by changing the order of integration.

26. Find the area under the curve $y=x^3$ on the interval $[2,3]$.

27. Find the orthogonal trajectories of the family of curves $y=c.x^{\frac{3}{2}}$.

28. Solve : $\frac{dy}{dx}=\frac{y^2-x^2}{2xy}$.

29. Solve : $\left(D^2-a^2\right)y=e^{nx}+e^{ax}$.

30. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$, find the value of

(a) $\Sigma \alpha^2 \beta$

(b) $\Sigma \alpha^3$

(c) $\Sigma \frac{1}{\alpha^2 \beta^2}$.

31. The roots of the equation $8x^3 - 14x^2 + 7x - 1 = 0$ are in geometrical progression, find them.

SECTION – IV

Answer **any two** questions from among the questions. 32 to 35. These questions carry **15** marks each.

32. (a) Identify and sketch the curve $9x^2 - 24xy + 16y^2 - 80x - 60y + 100 = 0$.

(b) Sketch the graph of the ellipse $\frac{x^2}{9} + \frac{y^2}{16} = 1$.

33. (a) Find the area bounded by the parabola $y^2 = 4ax$ and $x^2 = 4by$.

(b) Find the volume of the solid that results when the region bounded between the curves $y = x^2$ and the x-axis from $x = 0$ to $x = 2$ is revolved about the x-axis.

34. (a) A projectile is launched vertically upward from ground level with an initial velocity of 112ft/s.

(i) Find the velocity at $t = 3s$ and $t = 5$ s.

(ii) How high will the projectile rise?

(b) Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} - 5y = \sin \log x$.

35. (a) Solve using Cardan's method the equation $x^3 - 15x - 126 = 0$.

(b) Define a reciprocal equation and solve the equation $6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.

———————

(Pages : 3) **M – 2597**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) Chemistry and Industrial Chemistry

Foundation Course

IC 1221 : FOUNDATION COURSE IN INORGANIC CHEMISTRY

(2015–2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions.
Answer in **one** word to maximum of two sentences. **Each** question carries **1** mark.

1. Write one reaction in liquid HF.
2. What is meant by group displacement law?
3. Explain leveling effect of solvents.
4. Explain the Top-down approach in nanosynthesis.
5. What are SWCNT's?
6. Which among the 3 radioactive rays has highest ionizing power?
7. Write Beer-Lamberts law.
8. What are hard acids?

P.T.O.

9. Explain the reason for the formation of blue colour when metallic sodium react with liq. ammonia.

10. Give one example for an Arrhenius acid.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type (Not to exceed one paragraph)

Answer any **eight** questions from the following.**Each** question carries **2** marks.

11. Explain dipole-induced dipole interactions.

12. Mention any one method for preparation of fullerenes.

13. Write a note on artificial transmutation.

14. What are isobars? Explain with examples?

15. Explain Geiger -Nuttal rule.

16. Name two bottom-up techniques in nanosynthesis.

17. What is the principle of sonochemistry?

18. What are fullerenes?

19. What are protic solvents? Explain with examples.

20. Explain levelling effect with an example.

21. What are Van der Waals forces?

22. Explain Co-precipitation.

(8 × 2 = 16 Marks)

SECTION – C

Short essay (Not exceed **120** words)

Answer any **six** questions from the following. **Each** question carries **4** marks.

23. Discuss SHAB principle

24. Explain mass defect? How is it related to binding energy?

25. Outline the applications of nano gold in medicine.

26. Explain the importance of SWCNT's and MWCNT's in nanotechnology?

27. Write a note on nuclear fission?

28. Discuss Valence bond theory with suitable example?

29. Explain the nano systems existing in nature.

30. Write a note on isotope as tracers.

31. Explain Free electron theory

(6 × 4 = 24 Marks)

SECTION – D

Long essay

Answer any **two** questions from the following. **Each** question carries **15** marks.

32. (a) Explain different theories of acids and bases. **10**

    (b) Write a note on self-ionization of non-aqueous solvents. **5**

33. Write a note on hydrogen bonding in molecules and explain how it influences chemical and physical properties of molecules. **15**

34. How will you prepare nanomaterial using: **15**

    (a) High energy Ball milling

    (b) Sol-gel synthesis

    (c) Hydrothermal technique

35. (a) Calculate the number of alpha and beta particle emitted during the disintegration of $_{92}U^{238}$ to $_{82}Pb^{206}$ **5**

    (b) Outline the principle of neutron activation analysis. **5**

    (c) Write a note on radiocarbon dating **5**

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 2598**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) Chemistry and Industrial Chemistry

Core Course III

IC 1241 : ENVIRONMENTAL STUDIES

(2015-2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What are natural resources?
2. Mention four major fresh water resources?
3. What is meant by 'endemic species' in an ecosystem?
4. What is meant by a 'hot-spot' of biodiversity?
5. List out four renewable energy resources.
6. What are natural disasters?
7. What is meant by red list of IUCN?
8. Give the names of four endangered animals or birds of India.

P.T.O.

9. What is green house effect?

10. What is value education?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. How forests can control soil erosion and flood?

12. How are big dams harmful? Explain.

13. What is acid rain? How is it dangerous?

14. Mention the major purposes of wasteland reclamation.

15. What is meant by in situ and ex situ conservation?

16. Distinguish between genetic diversity and species diversity.

17. Mention the advantages and disadvantages of modern agriculture practices.

18. What is eutrophication? What are its effects?

19. What is meant by sustainable development? How is it significant?

20. Why is the burning of plastics very dangerous? How can you reduce plastic pollution?

21. Write the characteristic features of a desert ecosystem.

22. How does marine pollution adversely affect the aquatic ecosystem?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. What is rain water harvesting? Mention its significance.

24. Write a short note on thermal pollution.

25. Explain the role of information technology in the field of environmental management.

26. What are watersheds? Mention the main objectives and practices of their management.

27. Discuss any two nuclear accidents which occurred in the world.

28. Critically analyse the bio-geographical classification of India.

29. Write a short essay on the sources, harmful effects and management of urban solid waste.

30. What is consumerism? How is it dangerous?

31. How does over exploitation of mineral resources affect the environment?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. What is bio-diversity? Why is its conservation essential? Explain the strategies of bio-diversity conservation.

33. State the salient features of
    (a) Wildlife Protection Act
    (b) Forest Conservation Act and
    (c) Air prevention and control of pollution Act.

34. Explain the sources, effects and control measures of

(a) Air pollution

(b) Water pollution and

(c) Noise pollution.

35. (a) Explain the role of alternative energy resources in solving the growing energy needs of the world.

(b) What is meant by human population explosion? Explain its negative impacts and control measures.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 2599**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Mathematics

Group 2(a) – Complementary Course II for Chemistry and Industrial Chemistry

MM 1231.7 – MATHEMATICS – II PARTIAL DIFFERENTIATION, VECTOR DIFFERENTIATION, INFINITE SERIES AND MULTIPLE INTEGRALS

(2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the first **ten** questions are compulsory. They carry **1** mark each.

1. Find $\frac{\partial F}{\partial y}$ of the function $f(x,y) = \sin\left(\frac{x}{y}\right)$.

2. Show that $x\,dy + 3y\,dx$ is not exact.

3. Find the gradient of the scalar filed $\phi = 3x^2y - y^3z^2$.

4. Find the Laplacian of the scalar field $\phi = xy^2z^3$.

5. Find the divergence of the vector field
$\bar{a} = x^2y^2\hat{i} + y^2z^2\hat{j} + x^2z^2\hat{k}$.

6. Write the sum of *N* terms of Arithmetic-Geometric Series.

7. Evaluate $\sum_{n=0}^{\infty} \frac{1}{2^n}$.

8. State Cauchys root test for convergence of series.

9. Evaluate $\int_0^2 \int_{-y}^{y-y^2} dx\,dy$.

10. Write the Jacobian of the coordinate transformation $x = g(r,\theta), y = h(r,\theta)$.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions. **Each** question carries **2** marks.

11. Find the total differential of the function $f(x,y) = x^2 + y^2x$.

12. Using Chain rule find $\frac{df}{dt}$ given $f(x,y) = xe^{xy}$, $x(t) = t^2$, $y(t) = t^{-1}$.

13. State Taylors theorem for two variables *x* and *y.*

14. Determine the stationary point of the function $f(x,y) = xy$ and determine the nature of the function at that point.

15. A particle moves along a curve $r(t) = e^{-t}\hat{i} + 2\cos 3t\,\hat{j} + 2\sin 3t\,\hat{k}$, where *t* is the time. Find the speed of the particle and magnitude of acceleration at time $t = 0$.

16. Find the curl of the vector field $\bar{a} = x^2y\,\hat{i} - 2xz\,\hat{j} + 2yz\hat{k}$.

17. Prove that $div\,(grad\,\phi) = \nabla^2\phi$.

18. Evaluate the sum $\sum_{n=1}^{N} \frac{1}{n(n+1)(n+2)}$.

19. Find the sum of the series $1+\frac{3}{2}+\frac{5}{2^2}+\frac{7}{2^3}+\cdots$

20. Determine whether $\sum_{n=1}^{\infty}\frac{1}{(n!)^1}$ converges.

21. Find the Jacobian $\frac{\partial(x,y,z)}{\partial(u,v,w)}$ of the transformation $x=u+v$, $y=2V$, $z=3W$.

22. Evaluate $\int_0^{\sqrt{2}}\int_0^{3y}\int_{x^2+3y^2}^{8-x^2-y^2} dz\,dx\,dy$.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions. **Each** questions carry **4** marks.

23. Find the total derivative of $f(x,y)=x^2+3xy$ with respect to x, given that $y=\sin^{-1}x$.

24. Find the Taylor expansion, up to quadratic terms in x and y of $f(x,y)=xe^y+1$ about the point (1, 0).

25. Find the greatest and smallest value the function $f(x,y)=3x+4y$ take on the circle $x^2+y^2=1$.

26. Prove that $div\,(curl\,f)=0$.

27. Find the directional derivative of $\phi=x^2yz+4xz^2+xyz$ at (1, 2, 3) in the direction $\bar{a}=2\hat{i}+\hat{j}+\hat{k}$.

28. Determine whether $\sum_{n=1}^{\infty}\frac{1}{\sqrt{n^3+3}}$ converges.

29. Expand $f(x)=2x^3+x^2+3x-8$ as a Taylor series about $x=1$.

30. Find the expression for volume element in spherical polar coordinate.

31. Evaluate the double integral $I = \int_0^2 \int_{x^2}^{2x} (4x + 2)\, dy\, dx$. Also reverse the order of integration and show that same result is obtained.

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **two** questions. **Each** questions carry **15** marks.

32. (a) Find the stationary values of $f(x, y) = 4x^2 + 4y^2 + x^4 - 6x^2y^2 + y^4$ and classify them as maxima, minima or saddle point.

(b) Find the stationary point of $f(x, y, z) = x^2 + y^2 + z^2$ subject to constraints $y + 2z = 12$ and $x + y = 6$.

33. Show that :

(a) $curl\,(\phi\,\bar{a}) = \phi\, curl\,\bar{a} + grad\,\phi \times \bar{a}$

(b) $curl\,(curl\,\bar{a}) = grad\,(div\,\bar{a}) - \nabla^2\,(\bar{a})$.

34. (a) Find the Taylor polynomial of order 3 generated by $f(x) = \sqrt{x}$ at $x = 4$.

(b) Expand $f(x) = \dfrac{1}{1 - x}$ as a Maclaurin series.

35. (a) Evaluate the volume of the curved wedge bounded by the surfaces $y^2 = 4ax$, $x + z = a$ and $z = 0$.

(b) Find the area of the region R bounded by $y = x$ and $y = x^2$ in the first quadrant.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 2600**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry
Foundation Course

IC 1221 : FOUNDATION COURSE IN INORGANIC CHEMISTRY

(2020 Admission Regular)

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. What is a Lewis acid? Give one example.
2. What is mass defect?
3. What is ammonolysis?
4. Name the nanoparticles that caused dichoric effect in lycurgus cup.
5. Why Ammonia and Methanol are highly soluble in water?
6. What is the hybridization of carbon atoms in fullerene?
7. Write an example for a molecule having dipole-dipole interaction.
8. What are protonic solvents?

P.T.O.

9. State Geiger-Nuttall rule.

10. Name the force of attraction behind the higher boiling point of Krypton compared with Helium.

(10 × 1 = 10 Marks)

PART – B (Short answer type)

Answer **any eight** questions. Each question carries **2** marks.

11. What are ionising and non ionizing solvents?

12. How are Neutrinos created?

13. What are the limitations of Arrhenius concept?

14. Why are gold nanoparticles used in biomedical applications?

15. State any two advantages of sol gel process over other technique.

16. Explain the cause of London dispersion forces in molecules.

17. State group displacement law.

18. Write a short note on advantages of using liquid SO_2 is solvent.

19. What is a solvolysis reaction?

20. What is a hand gap?

21. What is meant by artificial radioactivity? Give with example.

22. What are amphiprotic substance? Give one example.

23. Give any two uses of carbon nanaotubes.

24. Explain why ice is lighter than liquid water?

25. How will you account for the higher boiling point of acetone compared with propane?

26. What are the key factors that affect the stability of a nucleus?

(8 × 2 = 16 Marks)

PART – C (Short essay)

Answer **any six** questions. Each question carries **4** marks.

27. Write a short note on Arrhenius and Bronsted concepts of acids and bases.

28. Explain nuclear fission with an example.

29. Discuss the importance of fullerenes in medical field.

30. Explain how the free election model is capable of explaining the electric conductivity malleability and ductility of metals.

31. Distinguish between Chaotic and controlled process in nanomaterial synthesis.

32. Write a short note on solutions of metal ions in ammonia.

33. What is levelling effect? Explain with an example.

34. What are the advantages and disadvantages of neutron activation analysis?

35. Write a short note on the reactions taking place in liquid HF.

36. Identify the missing species in the reactions.

    (a) $_{7}N^{14} + \text{———} \rightarrow {}_{6}C^{14} + {}_{0}n^{1}$

    (b) $\text{———} + {}_{0}n^{1} \rightarrow {}_{3}Li^{7} + {}_{2}He^{4}$

    (c) $_{6}C^{12} + {}_{1}H^{2} \rightarrow \text{———} + {}_{2}He^{4}$

    (d) $_{9}F^{19} + {}_{2}He^{4} \rightarrow {}_{10}Ne^{22} + \text{———}$

37. Briefly discuss any two weak intermolecular forces.

38. Write a short note on the synthesis of nano particles by

    (a) Combustion technique

    (b) Sonochemistry.

(6 × 4 = 24 Marks)

PART – D (Long essay)

Answer **any two** questions. Each question carries **15** marks.

39. What is H-bond? Discuss various types of H-bonds and also explain the conditions and consequences of Hbonding.

40. Discuss Following types of reactions in non aqueous solvents.

    (a) Salt formation reactions (b) neutralisation reactions (c) metathetical reaction (d) redox reaction.

41. Briefly discuss (a) C-14 dating (b) Rock dating (c) neutron activation analysis (d) Use of radioactive tracers.

42. What is nanotechnology? Discuss the following methods of preparation of nano particles (a) Sol-gel synthesis. (b) Colloidal precipitation. (c) high energy ball milling. (d) hydrothermal technique.

43. Write a short note on various reactions taking place in liquid ammonia also illustrate the advantages and disadvantages of using liquid ammonia as a solvent.

44. Discuss (a) SHAB principle (b) Radioactive disintegration series (c) VB theory of metallic bonding.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 2601**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) – Chemistry and Industrial Chemistry

Core Course

IC 1241 : ENVIRONMENTAL STUDIES

(2020 Admission Regular)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. Which day is celebrated as wet land day?
2. Name two examples for renewable sources of energy.
3. What are particulates?
4. What is the cause for ozone depletion?
5. Write the expanded form of BOD.
6. What are greenhouse gases?
7. Name two process causing marine pollution.
8. Name two pesticides causing water pollution.

9. What is grass land ecosystem?

10. What is meant by food chain?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. Name two methods for solid waste management.

12. What are the reasons for land slide?

13. What is the process of desertification?

14. What is meant by genetic species?

15. What are hotspots in biodiversity?

16. How does construction of dams effects the ecosystems?

17. What is deforestation?

18. How industries cause water pollution?

19. Explain on alternate energy sources

20. What is meant by endangered species?

21. What is the consequences of over exploitation of forest resources?

22. What are urban problems related to scarcity in energy?

23. What is the objective of family welfare programmes?

24. What are the types of desert ecosystem?

25. What is the causes of entrophication?

26. What are the problems of over grazing?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

27. What are the various ways by which bio-diversity can be conserved?

28. Explain the cause for acid-rain.

29. What are sustainable life styles for protection of environment?

30. What are the different methods by which solid waste generation can be reduced?

31. Explain forest conservation act.

32. What are different methods of water preservation?

33. What are the causes and effects of soil erosion?

34. Write a short note on nuclear hazards.

35. Describe on mineral resources and the effects of its over exploitation.

36. Describe on grass land ecosystem.

37. What are the effects of marine pollution?

38. How mining causes environmental pollution?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

39. Illustrate on structure and function of an ecosystem.

40. Explain on bio-geographical classification of India with a neat diagram.

41. Discuss renewable and non renewable energy sources and various pollution it causes.

42. (a) Give an account on thermal pollution and its impact . **8**

(b) Explain on environmental protection act. **7**

43. (a) Give a brief account on human rights. **5**

(b) What are the causes and effects of global warming and ozone depletion? **10**

44. (a) Give a detailed account on various schemes on women and child welfare. **8**

(b) Explain on wild life protection act. **7**

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 2602**

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Mathematics

Complementary Course – II for Chemistry and Industrial Chemistry

MM 1231.7 — MATHEMATICS – II – PARTIAL DIFFERENTIATION, VECTOR DIFFERENTIATION, INFINITE SERIES AND MULTIPLE INTEGRALS

(2020 Admission Regular)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the first ten questions are compulsory. They carry **1** mark each.

1. Show that the differential $x\,dy + 3y\,dx$ is inexact.
2. What is reciprocity relation?
3. Write the formula for the arc length between two points on the curve $r(u)$, given by $u = u_1$ and $u = u_2$.
4. Define radius of curvature.
5. What are coordinate curves?
6. Find the sum of all integers between 1 and 1000.
7. What is an arithmetico-geometric series?
8. State comparison test for convergence.
9. What is volume of revolution?
10. State Pappu's first theorem.

SECTION – II

Answer **any eight** questions from among the questions 11 to 26. These questions carry **2** marks each.

11. Find the first and second partial derivatives of the function $f(x,y) = 2x^3y^2 + y^3$.

12. Show that $(y+z)dx + xdy + xdz$ is an exact differential.

13. State Taylor's theorem for two variables *x* and *y*.

14. A particle of mass m with position vector *r* relative to some origin O experiences a force *F*, which produces a torque (moment) $T = r \times F$ about O. The angular momentum of the particle about O is given by $L = r \times mv$, where v is the particle's velocity. Show that the rate of change of angular momentum is equal to the applied torque.

15. A curve lying in the xy-plane is given by $y = y(x), z = 0$. Show that the arc length along the curve between $x = a$ and $x = b$ is given by $s = \sqrt{1+y'^2}dx$.

16. Derive the formula for calculating the rate of change of ϕ in some particular direction.

17. Find the divergence of the vector field $a = x^2y^2i + y^2z^2j + x^2z^2k$.

18. Find the Laplacian of the scalar field $\phi = xy^2z^3$.

19. Evaluate the sum $\sum_{n=1}^{N} \frac{1}{n(n+1)}$.

20. Test for convergence the series $\sum_{n=1}^{\infty} \frac{1}{(n!)^2}$.

21. Is the series $1 + \frac{1}{2} + \frac{1}{3} + \ldots$ convergent? Why?

22. Determine whether the series $\sum_{n=1}^{\infty} \left(\frac{1}{n}\right)^n$ is convergent.

23. Find the centre of mass of the solid hemisphere bounded by the surfaces $x^2 + y^2 + z^2 = a^2$ and the *xy*-plane, assuming that it has a uniform density ρ.

24. A semicircular uniform lamina is freely suspended from one of its corners. Show that its straight edge makes an angle of 23.0° with the vertical.

25. Find the moment of inertia of a uniform rectangular lamina of mass *M* with sides *a* and *b* about one of the sides of length *b*.

26. State and prove any general property of Jacobians.

SECTION – III

Answer **any six** questions from among the questions 27 to 38. These questions carry **4** marks each.

27. Find the Taylor expansion, up to quadratic terms in $x-2$ and $y-3$, of $f(x,y)=y\ \exp(xy)$ about the point $x = 2$, $y = 3$.

28. Derive the condition for maxima of a function on two variables.

29. The temperature of a point (x, y) on a unit circle is given by $T(x,y)=1+xy$. Find the temperature of the two hottest points on the circle.

30. The position vector of a particle at time t in Cartesian coordinates is given by $r(t)=2t^2i+(3t-2)j+(3t^2-1)k$. Find the speed of the particle at $t = 1$ and the component of its acceleration in the direction $s=i+2j+k$.

31. Prove that :

    (a) $\nabla\times\nabla\varphi=0$ and

    (b) $\nabla\cdot(\nabla\times a)=0$.

32. Express the vector field $a=yz\,i-yj+xz^2k$ in cylindrical polar coordinates, and hence calculate its divergence.

33. Sum the series $S=1+\frac{2}{2}+\frac{3}{2^2}+\frac{4}{2^3}+\ldots$

34. Determine the range of values of x for which the power series $P(x)=1+2x+4x^2+8x^2+\ldots$ converges.

35. Consider a ball that drops from a height of 27m and on each bounce retains only a third of its kinetic energy; thus after one bounce it will return to a height of 9m, after two bounces to 3m, and so on. Find the total distance travelled between the first bounce and the M^{th} bounce.

36. Evaluate the double integral $\iint_R x^2 y\,dx\,dy$ where R is the triangular area bounded by the lines $x = 0, y = 0$ and $x + y = 1$. Reverse the order of integration and demonstrate that the same result is obtained.

37. Find the volume of the region bounded by the paraboloid $z = x^2 + y^2$ and the plane $z = 2y$.

38. A tetrahedron bounded by the three coordinate surfaces and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$, if its density is given by $\rho(x, y, z) = \rho_0\left(1 + \frac{x}{a}\right)$. Find the average value of the density.

SECTION – IV

Answer **any two** questions from among the questions 39 to 44. These questions carry **15** marks each.

39. If $x = \rho\cos\phi$ and $y = \rho\sin\phi$ then derive an expression for $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$ in terms of ρ and ϕ.

40. Find the stationary points of $f(x, y, z) = x^3 + y^3 + z^3$ subject to the following constraints :

    (a) $g(x, y, z) = x^2 + y^2 + z^2 = 1$;

    (b) $g(x, y, z) = x^2 + y^2 + z^2 = 1$ and $h(x, y, z) = x + y + z = 0$.

41. A small particle of mass m orbits a much larger mass *M* centred at the origin *O*. Show that the vector $r \times dr/dt$ is a constant of the motion.

42. Expand $f(x) = \sin x$ as a Maclaurin series about $x = 0$.

43. Evaluate the double integral $\iint_R \left(a + \sqrt{x^2 + y^2}\right) dx\,dy$, where R is the region bounded by the circle $x^2 + y^2 = a^2$.

44. Find an expression for a volume element in spherical polar coordinates, and hence calculate the moment of inertia about a diameter of a uniform sphere of radius a and mass *M*.

———————

(Pages : 3) **N – 2785**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Group 2(a) : Chemistry and Industrial Chemistry

Core Course V

IC 1341 : ORGANIC CHEMISTRY I

(2013-2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION — A

I. Answer **all** questions. Each question carries **1** mark.

1. What are free radicals?
2. Write friedel craft acylation reaction?
3. Write one method for the preparation of chloroprene?
4. Draw the structure of BHC.
5. What are power alcohols?
6. Discuss Wolf-Krishner reduction with suitable example.
7. Write one analytical method to distinguish aldehyde from ketone.
8. Discuss the aromaticity in tropylium cation.
9. What is epoxidation reaction?
10. Write the oxidation product of secondary alcohol using $KMnO_4$.

($10 \times 1 = 10$ Marks)

P.T.O.

SECTION — B

II. Answer **any eight** questions from the following. Each carries **2** marks.

11. Discuss SP_2 hybridization in organic molecules with suitable example.

12. Write note on homolytic and heterolytic bond fission.

13. Explain Anti-Markovnikov's rule with suitable example.

14. Write a brief note on benzyne mechanism.

15. Write one method for the conversion of benzene to chloro benzene.

16. Why vinyl chloride does not undergo substitution reaction?

17. Write the oxidation product of ethanol using PCC.

18. Discuss the industrial importance of ethanol.

19. Write note on Cis-hydroxylation reaction.

20. Discuss the mechanism of Sulphonation of benzene.

21. Discuss Clemmensens reduction with suitable example.

22. Write one method for the preparation of ethylene glycol.

($8 \times 2 = 16$ Marks)

SECTION — C

III. Answer **any six** questions. Each question carries **4** marks.

23. Discuss the various methods for the determination of mechanism of a reaction.

24. What are carbocations and carbanions discuss their stabilities?

25. Discuss the mechanism of SN1 and SN2 reaction.

26. Briefly discuss Huckel's aromaticity rule taking example of non-benzenoid aromatic system.

27. Write note on electrophilic substitution reaction in naphthalene system.

28. Differentiate nucleophilic and electrophilic addition with suitable example.

29. Write note on electrophilic and nucleophilic substitution in aryl halides.

30. Suggest suitable method for the conversion of (a) methanol to ethanol (b) ethanol to methanol?

31. Write one method for the preparation of Naphthalene and Anthracene? What are their uses.

(6 × 4 = 24 Marks)

SECTION — D

IV. Answer **any two** questions. Each question carries **15** marks.

32. Discuss and illustrate the significance of various electron displacement effects in organic molecules.

33. What are nucleophilic substitution reactions? Discuss the mechanism and stereochemistry of E1 and E2 reactions.

34. (a) Discuss one method to distinguish primary secondary and tertiary alcohols.

    (b) Briefly discuss the effect of substitution on the acidity of phenol.

35. (a) Briefly discuss the orientation effect of –OH, $–NH_2$, $–NO_2$ and $–CH_3$ on the electrophilic substitution reaction?

    (b) Discuss the mechanism of Aldol and Benzoin condensation.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 2786**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Core Course VI

IC 1342 : PHYSICAL CHEMISTRY I

(2013-2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define mean by free path.
2. What is meant by compressibility factor?
3. How many atoms per unit cell are present in fcc lattice?
4. Write two examples for cholesteric liquid crystals.
5. What are colligative properties?
6. What is collision cross section?
7. What is an intensive property? Give one example
8. When does the Joule Thomson coefficient become zero in the adiabatic expansion of a gas through a small orifice?

P.T.O.

9. Define chemical potential?

10. List out 5 symmetry elements.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. An element of atomic mass 100 with bcc structure has unit cell edge 400 pm. Calculate the density of the element.

12. Diffraction angle 2θ is equal to 16.8° for a crystal having interplannar distance 0.400 nm for second order diffraction. Calculate the wavelength of X Rays used.

13. Write down Poiseuille's equation and explain the terms.

14. What are the limitations of first law of thermodynamics?

15. What do you mean by abnormal molecular masses?

16. What is Vant't off factor?

17. A solution of NaCl containing 5.85 g of it per litre has osmotic pressure equal to $4.74^{*}\ 10^{5}\ Nm^{-2}$ at 300K. Calculate the Van't Hoff factor and degree of dissociation.

18. Identify the point group of BF_3. Which symmetry elements are present?

19. How are liquid crystals classified?

20. Calculate the Miller indices of the plane (2a, 3b,c).

21. Define enthalpy of formation and standard enthalpy of formation.

22. Calculate the enthalpy change for the reaction

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. Obtain the virial form of van der Waals equation

24. Compare the structures of NaCI and KCI by using powder method

25. Calculate the RMS velocity and average velocity of SO_2 at 0°C

26. Show that Cp-Cv =R for one mole of an ideal gas.

27. Explain why internal energy is a state function while work is not.

28. Find the change in free energy when the system undergoes reversible change *of* pressure as well as temperature.

29. Derive Maxwells relations?

30. Calculate the effective volume occupied by molecules of one gram mole of a gas taken at NTP. What fraction of the total volume will be occupied by the molecules?

31. Write a note on non-stoichiometric defects.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. (a) What is meant by surface tension? What are the factors affecting surface tension?

    (b) How is surface tension determined using stalagmometer method?

33. What is meant by coefficient of viscosity? How is viscosity determined using Ostwald viscometer?

34. (a) Explain the laws of crystallography

(b) Write a short note on laws of crystallography and Miller indices.

35. Define standard enthalpy of formation. Taking a suitable example, prove that the standard enthalpy of a compound is equal to its standard enthalpy of formation

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 2787**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Industrial Chemistry

MM 1331.7 MATHEMATICS-III-VECTOR DIFFERENTIATION, CO-ORDINATE SYSTEMS, LAPLACE TRANSFORMS AND SERIES SOLUTION OF DIFFERENTIAL EQUATIONS

(2013 – 2018 Admission)

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. If $\vec{u}.\vec{v}=6$, $|\vec{u}|=3$ and $|\vec{v}|=4$, find the angle between $\vec{u}$ and $\vec{v}$?

2. The unit vector in the direction of $\vec{v}=2\vec{i}-2\vec{j}+\vec{k}$ is ————————

3. Find the gradient of $f(x, y, z)=x^2 y z$.

4. Find the divergence of $x\vec{i}+y\vec{j}+z\vec{k}$.

5. Write the standard equation of an ellipse.

6. State Keplers first law.

P.T.O.

7. Find the Laplace transform of $t-1$.

8. State convolution theorem.

9. Define Bessels differential function.

10. State Rodrigues formula for Legendre polynomials.

($10 \times 1 = 10$ Marks)

PART – B

Answer **any eight** questions. Each question carries **2** marks.

11. Find ∇f at $(-2, 0)$ where $f(x, y) = x^3 e^y$.

12. Find the length of an are of the curve $x = 2\cos t; y = 2\sin t, z = 5t$ from $t = 0$ to $t = \pi$.

13. If $\vec{u} = \vec{i} + \vec{j} + \vec{k}$ and $\vec{v} = \vec{i} - \vec{j} - \vec{k}$, find $\vec{u}.\vec{v}$ and $\vec{u} \times \vec{v}$.

14. Find the curl of the vector field $F(x, y, z) = x^2 y\vec{i} + 2y^3 z\vec{j} + 3z\vec{k}$ at $(1, 0, 1)$.

15. Define solenoidal and irrotational vector fields.

16. Find the directional derivative of $f(x, y) = xy$ at $(1, -1)$ in the direction $\frac{\vec{i}}{2} - \frac{\vec{j}}{2}$.

17. Convert the cylindrical co-ordinates $\left(4, \frac{\pi}{3}, -3\right)$ into rectangular co-ordinates.

18. Evaluate $\iiint_S xy^2 z \, dv$, where $S: 0 \le x \le 1, -1 \le y \le 0, -1 \le z \le 1$.

19. Find the Laplace transform of e^{at} and e^{-at}.

20. Find the inverse Laplace transform of $\frac{1}{s^2+25}$.

21. Write the expression for $J_0(x)$ and $J_1(x)$.

22. Find the power series solution of $y' - y = 0$.

($8 \times 2 = 16$ Marks)

PART – C

Answer **any six** questions. Each question carries **4** marks.

23. Let $F(x, y, z) = xz\vec{i} + xy\vec{j} + 3xz\vec{k}$. Find div F and curl F at $(1, -1, 0)$.

24. Show that $\vec{r}(t) = \cos t\,\vec{i} + \sin t\,\vec{j} + \sqrt{5}\,\vec{k}$ has constant length and it is orthogonal to its derivative.

25. Find the angle between the vectors $\vec{u} = \vec{i} - 2\vec{j} + 2\vec{k}$ and $\vec{v} = 2\vec{i} + 7\vec{j} + 6\vec{k}$.

26. Find a polar equation for the ellipse that has its focus at the pole, directrix to the right of the pole, $a = 8, e = 1/2$.

27. Sketch the graph of $r = \frac{6}{2 + \cos\theta}$ in polar co-ordinates.

28. Evaluate $\int_0^1 \int_1^x \int_y^x z\,dz\,dy\,dx$.

29. Evaluate the laplace transform of *t* cost at by differentiation method.

30. Solve $y'' + a^2 y = 0$ with $y(0) = A$ and $y'(0) = B$ using Laplace transform.

31. Solve $y'' + 9y = 0$ by power series method.

($6 \times 4 = 24$ Marks)

PART – D

Answer **any two** questions. Each question carries **15** marks.

32. (a) Find the velocity, speed and acceleration of a particle whose position vector is $\vec{r}(t)=2\cos\vec{i}+\sin t\,\vec{j}+5\cos^2 t\,\vec{k}$.

(b) Find the unit tangent vector and curvature of the curve of position vector $\vec{r}(t)=t\,i+t^2\,\vec{j}$.

33. Use triple integral to find the volume of the solid within the cylinder $x^2+y^2=9$ and between the planes $z=1$ and $x+z=5$.

34. (a) Using Laplace transform method, solve the initial value problem

$y_1'=-y_1+y_2$ and $y_2'=-y_1-y_2$, $y_1(0)=1, y_2(0)=0$

(b) Find $L^{-1}\left[\dfrac{1}{\left(s^2+16\right)^2}\right]$.

35. Find the power series solution in powers of x of the equations $\left(1-x^2\right)y''-2xy'+n(n+1)\,y=0$.

(2×15 = 30 Marks)

———————

(Pages : 3) **N – 2788**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) – Chemistry and Industrial Chemistry

Vocational Course I

IC 1371 – INDUSTRIAL CHEMISTRY I

(2013 – 2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Name one inorganic fertilizer
2. What are monomers?
3. Suggest one example for homo-polymers.
4. Give one method for the purification of solid organic compounds.
5. What is the sublimation process?
6. Name one example for desiccants.
7. What is zone refining?
8. Where is FACT located?

P.T.O.

9. Name two types of glasses.

10. What is the process cracking?

(10 × 1 = 10 Marks)

SECTION – B

(Short answers type, Answer **any eight** question, Each carries **2** marks)

11. Explain the term functionality in polymers.

12. What are thermoplastics, explain with example?

13. Write about the chemistry of H_2SO_4 synthesis.

14. Explain Van Arkel method.

15. What is electrometallurgy?

16. Explain the process froth flotation.

17. What are Chemicals for manufacturing TiO_2?

18. What is the main components of cement?

19. Name two uses of ceramics.

20. Explain about thermosetting plastics.

21. What are copolymers?

22. What are immiscible solvents?

(8 × 2 = 16 Marks)

SECTION – C

(Paragraph type questions, Answer **any six** questions, Each carries **4** marks).

23. Briefly explain on molecular weight of polymer.

24. Explain gravity separation in concentration of ores.

25. Describe pyrometallurgy process with example.

26. What is refractory material, explain with example and uses?

27. Describe the raw material and chemical process for the manufacture of Sugar.

28. Distinguish between Natural and Synthetic Polymers.

29. Explain the structure and uses of ceramics.

30. Describe the leaching process with suitable example.

31. Explain Vaccum distillation process with example.

(6 × 4 = 24 Marks)

SECTION – D

(Essay type questions, Answer **any two** questions, Each carries **15** marks).

32. Explain principle and techniques of any two distillation process.

33. Explain the manufacturing process of glass, types of glass and the annealing process

34. (a) Illustrate the fractionation process of crude oil

    (b) Explain the manufacture of fertilizers.

35. What are the general principles involved in separation of precipitates, explain.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 2789**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) – Chemistry and Industrial Chemistry

Core Course V

IC 1341 : ORGANIC CHEMISTRY – I

(2019 & 2020 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in **one** word to maximum **two** sentences. Each question carries **1** mark.

1. What is the hybridisation of carbon in ethylene?

2. What is homolytic bond fission?

3. What is the IUPAC name of the compound C_6H_5-CH(Cl)-CH_3?

4. What is Borsch's reagent?

5. Give any two synthetic uses of vinyl chloride?

6. What will be the product formed when 2-propanol is treated with Jones reagent?

7. Among the following which is the strongest nucleophile? H_2O, Cl^-, tert-BuO^-, HO^-, CH_3OH.

P.T.O.

8. Draw the structure of quinol.

9. Predict the product formed when C_2H_5MgBr reacts with HCHO followed by acidification?

10. What is power alcohol?

(10 × 1 = 10 Marks)

SECTION – B

Short Answer type. Answer any **eight** questions. Each question carries **2** marks.

11. Define mesomeric effect?

12. What are carbanions? Give an example.

13. Define electromeric effect?

14. Which is more stable 1-butene or 2-butene? Why?

15. Write the chemical equation for the reaction between cinnamaldehyde and lithium aluminium hydride in diethyl ether at room temperature.

16. What is Clemmenson reduction?

17. Comment on the stability of tropylium cation.

18. Explain the mechanism of nitration of benzene using a mixture of cone. H_2SO_4 and conc.HNO_3.

19. Explain hydration reaction of alkenes with a suitable example.

20. What is silver mirror test? Explain.

21. What is Sandmeyer reaction?

22. Explain Saytzeff rule with suitable example.

23. What are the industrial application of cellulose?

24. How naphthaquinone is prepared?

25. Give a method for the preparation of ethylene glycol.

26. What is steric effect? Explain.

(8 × 2 = 16 Marks)

SECTION – C

Short essay type. Answer any **six** questions. Each question carries **4** marks.

27. Write a short note on the formation and stability of carbocations.

28. What is inductive effect? How does it influence the acidity of organic acids?

29. Discuss the mechanism and stereochemistry of S_N2 reaction.

30. Explain epoxidation reaction with a suitable example.

31. Explain the regiochemistry of electrophilic substitution in naphthalene.

32. Phenol is more acidic than ethanol but less acidic than acetic acid. Explain.

33. Explain the reactivity of chlorobenzene and benzyl chloride towards silver nitrate solution.

34. Write a note on the preparation, properties and synthetic uses of CCl_4.

35. Explain Luca's test to distinguish between 1°, 2° and 3° alcohols.

36. Write a note on the preparation, properties and synthetic uses of Freon-12.

37. How vanillin is prepared? What are its uses?

38. Illustrate Kharasch effect.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

39. Discuss :

    (a) Wolff-Kishner reduction

    (b) Aldol condensation

    (c) Preparation and uses of cinnamaldehyde

40. Write a note on :

    (a) Preparation, properties and industrial importance of glycerol.

    (b) Effect of substituents on the acidity of phenol.

41. Write a note on :

    (a) Preparation, properties and synthetic uses of BHC

    (b) Preparation of alkynyl benzenes and biphenyl.

42. Explain :

    (a) Huckel's rule.

    (b) Orienting effect of substituents in aromatic electrophilic substitution reactions.

43. Discuss the following reaction mechanisms :

    (a) S_N1

    (b) E2

    (c) Electrophilic addition

44. Discuss various methods for the determination of reaction mechanism.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 2790**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme Under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Core Course VI

IC 1342 – PHYSICAL CHEMISTRY I

(2019 & 2020 Admission)

Time : 3 Hours Max. Marks : 80

PART – A

(Answer **all** questions. **Each** question carries **1** mark)

1. What is meant by compressibility factor?
2. Write the equation for Maxwell distribution of molecular velocities.
3. Define F centers?
4. State the law of constancy of interfacial angles.
5. Define surface tension.
6. How C_p and C_v are related?
7. Give one example each for state function and path function.
8. Write the Gibbs -Duhem equation and explain the terms involved.

P.T.O.

9. What is Helmholtz free energy?

10. Define plane of symmetry.

(10 × 1 = 10 Marks)

PART – B

(Answer any **eight** questions. Each question carries **2** marks)

11. Calculate the Boyle temperature of CO_2 gas if Van der Waals constant, a = 3.59 $dm^6 atmmol^{-2}$ and b = 0.0427 $dm^3 mol^{-1}$

12. Distinguish between collision number and collision frequency.

13. What are miller indices? Write down the miller indices of crystal plane which cut the crystal axes at (2a, –2b, –3c).

14. Calculate inter planar spacing between (211) planes of a cubic lattice of length 490 pm.

15. If 1% aqueous solution of a certain substance is isotonic with a 3% solution of glucose at a given temperature, calculate its molecular mass.

16. How does the viscosity of a liquid vary with temperature? Give reason.

17. State and explain zeroth law of thermodynamics

18. The enthalpy of neutralization of a strong acid and strong base is always constant. Give reason.

19. Find out the maximum efficiency of a steam engine operating between 127°C and 27 °C.

20. Derive Kirchoff's equation relating the variation of entropy with temperature.

21. Calculate the density of iron, if it crystalizes in a bcc system with an edge length of 286 pm. Molar mass of iron is 55.85 g/mol.

22. Determine the entropy change accompanying change of state of one mole of sulphur from rhombic to monoclinic state, if molar heat of transition is 322 J/mol and transition temperature is 95.6 °C.

23. What do you mean by Fugacity?

24. What are point groups? Give example.

25. Distinguish between Abelian and non- Abelian groups.

26. What are the uses of liquid crystals?

($8 \times 2 = 16$ Marks)

PART – C

(Answer any **six** questions. Each question carries **4** marks).

27. Write a short note on mean free path and its significance.

28. Briefly explain virial equations? Also represent Van der Waals equation in virial form.

29. For H_2 gas, calculate the (a) RMS velocity, (b) average velocity and (c) most probable velocity at 0°C.

30. Distinguish between Schottky and Frenkel defects.

31. Represent (100), (110) and (111) planes of simple cubic lattice and give the ratio of inter planar spacing between these planes.

32. Account for the abnormal molecular masses obtained in colligative property measurements.

33. Discuss the osmotic pressure method for determination of molecular masses and give its advantages.

34. Briefly explain Joule -Thomson effect and derive the expression for Joule - Thomson coefficient.

35. A gas expands isothermally against a constant external pressure of 1 atm from a volume of 20 dm^3 to 40dm^3. During this process the gas absorbs 1600 J of energy from its surroundings. Calculate the value of ΔU in joules.

36. Write a note on entropy and its significance.

37. What is meant by spontaneous process? Explain the criteria of spontaneity and equilibrium in terms of change in Gibb's energy.

38. Deduce point groups of (a) H_2O and (b) BF_3.

($6 \times 4 = 24$ Marks)

PART – D

(Answer any **two** questions. **Each** question carries **15** marks)

39. Discuss about the P-V isotherms of CO_2, continuity of states, critical phenomenon and critical constants. **15**

40. (a) Describe the powder method for x-ray studies of crystals. **9**

    (b) Explain the anomalous diffraction pattern of KCl. **6**

41. (a) Define refractive index. Outline the method for determination refractive index using Abbe refractometer. **9**

    (b) Thermodynamically derive the expression for depression in freezing point. **6**

42. (a) Discuss Hess's law and its applications **9**

    (b) Calculate the standard enthalpy of formation for butane, using the following data. **6**

$$C_4H_{10}(g) + {}^{13}\!/_{2}\, O_2(g) \rightarrow 4CO_2(g) + 5H_2O(g) \qquad \Delta H_1 = -2657.0 \text{ kJ}$$

$$C(s) + O_2(g) \rightarrow CO_2(g) \qquad \Delta H_2 = -393.5 \text{ kJ}$$

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g) \qquad \Delta H_3 = -483.6 \text{ kJ}$$

43. Outline the Carnot cycle for a cyclic process, its efficiency and Carnot theorem. **15**

44. (a) What are liquid crystals? How are they classified? Explain. **9**

    (b) What is group multiplication table? Give the group multiplication table for C_{2v} point group. **6**

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 2791**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Industrial Chemistry

MM 1331.7 — MATHEMATICS – III — THEORY OF MATRICES, VECTOR INTEGRATION, SPECIAL FUNCTIONS AND THEORY OF EQUATIONS

(2019 & 2020 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – I

Answer **all** questions. **Each** question carries **1** mark.

1. Write the augmented matrix of the System of Equations $2x - z = 2$, $6x + 5y + 3z = 7$, $2x - y = 4$.
2. Find the angle between the vectors $A = 3i + 6j + 9k$ and $B = -2i + 3j + k$.
3. Find the commutator of $A = \begin{pmatrix} 3 & -1 \\ -4 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & 2 \\ -7 & 3 \end{pmatrix}$.
4. Write an example of a Hermitian matrix.
5. State Stokes' theorem.
6. Write the geometrical definition of $\nabla \times a$ at a point *P.*
7. Define gamma function.
8. Solve $\int_0^\infty x^3 e^{-4x} dx$.
9. State Descarte's rule of signs.
10. State fundamental theorem of algebra.

($10 \times 1 = 10$ Marks)

P.T.O.

SECTION – II

Answer any **eight** questions from among the questions 11 to 26. **Each** question carries **2** marks.

11. Find a vector perpendicular to both $A = 2i + 3j + k$ and $B = i + 3j + 2k$.

12. Solve $x + y - z = 6, 3x - 2y + z = -5$, $x + 3y - 2z = 14$ using Cramers Rule.

13. Evaluate the determinant $B = \begin{vmatrix} 0 & a & -b \\ -a & 0 & c \\ b & -c & 0 \end{vmatrix}$.

14. Find the distance between the lines $r = i - 2j + (i - k)t$ and $r = 2j - k + (j - i)t$.

15. Find the distance from $P(1, 2, -1)$ to the line joining $P_1(0,0,0)$ and $P(-1,0,2)$.

16. Use a line integral to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

17. Find the vector area of the surface of the hemisphere $x^2 + y^2 + z^2 = a^2$ with $z \geq 0$.

18. Find an Expression for the angular momentum of a solid body rotating with angular velocity ω about an axis through the origin.

19. Find the volume enclosed between a sphere of radius a centered on the origin and a circular cone of half-angle α with its vertex at the origin.

20. Show that $\int_0^\infty \frac{e^{-\frac{k}{\sigma^2}}}{\sigma^6} d\sigma = \frac{3\sqrt{\pi}}{8k^{5/2}}$.

21. Express the integral $I(s) = \int_0^\infty e^{-p^s}\, dp, s > 0$, in terms of Gamma function.

22. Show that $\Gamma(p+1) = p\Gamma(p)$.

23. Express the integral $\int_0^2 \left(8 - x^3\right)^{-1/3} dx$ in terms of Beta function.

24. Discuss the nature of roots of the equation $x^9 + 5x^8 - x^3 + 7x + 2 = 0$.

25. If α is a solution of $f(x) = 2x^6 - 3x^5 + \sqrt{2}x^4 + 7x^3 + \sqrt{2}x^2 - 3x + 2 = 0$, then show that $\frac{1}{\alpha}$ is a solution of $f(x)$.

26. Solve the polynomial equation $x^4 + 4x^3 + 5x^2 + 2x - 2 = 0$ of which one root is $-1 + \sqrt{-1}$.

($8 \times 2 = 16$ Marks)

SECTION – III

Answer any **six** questions from among the questions 27 to 38. **Each** question carries **4** marks.

27. Find $\lambda_1^2 + \lambda_2^2$ where λ_1 and λ_2 are the eigen values of the matrix $A = \begin{pmatrix} 5 & -2 \\ -2 & 2 \end{pmatrix}$.

28. Solve the System of equations : $x + 2y - z = 0,\ 3x + y - z = 0,\ 2x - y = 0$, if it is consistant.

29. Find the rank of the matrix $A = \begin{vmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & -2 & 1 \\ 1 & -1 & 4 & 0 \\ -2 & 2 & 8 & 0 \end{vmatrix}$.

30. Define a vector space.

31. Show that $F = 2xy^3 i + \left(1 + 3x^2y^2\right) j$ is a conservative vector field and find the Scalar potential ϕ.

32. Use divergence theorem to prove $\int_v \nabla\phi\, dv = \oint_s \phi\, ds$.

33. Given the vector field $a = yi - xj + zk$, verify stokes theorem for the hemispherical surface $x^2 + y^2 + z^2 = a^2,\ z \geq 0$.

34. Prove that $\frac{B(m+1,n)}{B(m,n)} = \frac{m}{m+n}, m > 0, n < 0$.

35. Find $I = \int_0^\infty \frac{x^3 dx}{(1+x)^s}$.

36. Prove that $\int_0^\infty e^{-x^2} dx = \frac{1}{2}\sqrt{\pi}$.

37. Find a polynomial equation of fourth degree with rational coefficients, one of whose roots is $\sqrt{2} + \sqrt{-3}$.

38. Solve the cubic equations $x^3 - 18x - 35 = 0$ by Cardano's method

($6 \times 4 = 24$ Marks)

SECTION – IV

Answer any **two** questions from among the questions 39 to 44. **Each** question carries **15** marks.

39. Find the value of μ for which the system of equations $: x + y + z = 1$, $x + 2y + 3z = \mu$, $x + 5y + 9z = \mu^2$ is consistent. For each value of μ obtained, find the solution of the system.

40. Diagonalize $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.

41. Evaluate the line integral $I = \int_C a \cdot dr$, where $a = (x+y)i + (y-x)j$, along each of the paths in the *xy*-plane

    (a) the parabola $y^2 = x$ from (1, 1) to (4, 2),

    (b) the curve $x = 2u^2 + u + 1$, $y = 1 + u^2$ from (1, 1) to (4, 2),

    (c) the line $y = 1$ from (1, 1) to (4,1), followed by the line x **=** 4 from (4,1) to (4, 2).

42. Find $\int_0^{\frac{\pi}{2}} \sin^7 x \, dx$.

43. Show that if $a > 1$, $\int_0^\infty \frac{x^a}{a^x} dx = \frac{\Gamma(a+1)}{(\log a)^{a+1}}$.

44. Use Ferrari's method to solve $x^4 - 2x^3 - 5x^2 + 10x - 3 = 0$.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 2792**

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Vocational Course I

IC 1371 : INDUSTRIAL CHEMISTRY I

(2019 & 2020 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions, **Each** question carries **1** mark.

1. Define the process roasting
2. Name one reducing agent used in metallurgy
3. Name two uses of ceramics.
4. Name two types of glasses
5. What is the process cracking?
6. What are essential nutrients of plants?
7. Define sintering process.
8. What is the chemistry involved in the manufacture of urea?

P.T.O.

9. What are thermosetting plastics?

10. Give one example for monomer?

(10 × 1 = 10 Marks)

SECTION – B

(Short answers type, Answer any **eight** question, Each carries **2** marks)

11. Explain the term functionality in polymers

12. What are thermoplastics, explain with example

13. Write about the chemistry of H_2SO_4 synthesis

14. Explain Van Arkel method

15. Define froth flotation process

16. What is electrometallurgy?

17. What is the process called reformation in petroleum refining?

18. What are ceramics, give examples

19. What are the chemicals derived from distillation of Coal?

20. What are copolymers?

21. What are immiscible solvents?

22. How crystallisation process can be used for purification of organic compounds?

23. What is azeotropic distillation process?

24. What are natural polymers?

25. What is the process for the manufacture of H_2SO_4

26. In which place Cement is manufactured in Kerala and the name of the company.

(8 × 2 = 16 Marks)

SECTION – C

(Paragraph type questions, Answer any **six** question, Each carries **4** marks)

27. Briefly explain on molecular weight of polymer.

28. Explain gravity separation in concentration of ores.

29. Describe pyrometallurgy process with example.

30. What is refractory material, explain with example?

31. Describe the raw material and chemical process for the manufacture of Sugar.

32. What are graft and block copolymers?

33. Explain the structure and use of ceramics.

34. Write down the principle for the extraction of Aluminium.

35. Describe the leaching process with suitable example.

36. Explain the steam distillation process.

37. Describe fractional distillation with suitable example.

38. What are the various standards set for determining purity of compounds?

(6 × 4 = 24 Marks)

SECTION – D

(Essay type questions, Answer any **two** question, Each carries **15** marks)

39. Explain general principles involved in the separation of precipitates

40. Describe on a. Sublimation b. Desiccants c. Vacuum drying d. Crystallization

41. Describe on different coal types, structure and its distillation process

42. Describe various methods for the purification of liquids

43. Explain the principle and process of electrometallurgy

44. Write a note on inorganic fertilizer with their application.

(2 × 15 = 30 Marks)

———————

(Pages : 3) **N – 7998**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2 (a) : Chemistry and Industrial Chemistry

Core Course

IC 1441 : INORGANIC CHEMISTRY III

(2013 – 2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in **one** word to maximum **two** sentences. **Each** question carries **1** mark.

1. Write the electronic configuration of Mu^{2+}.
2. Give the IUPAC name of $[Co(NH_3)_6]Cl_3$.
3. Name the metal ion present in chlorophyll.
4. What is the geometry of $[Ni(CO)_4]$?
5. What are inner-transition elements?
6. Give an example for a diamagnetic complex.
7. What is the formula of hypochlorous acid?
8. Which macromolecule serves as the oxygen storage in muscle cells?
9. Draw the structure of diborane and identify 3c-2e bonds.
10. Give the general formula of silicone.

($10 \times 1 = 10$ Marks)

P.T.O.

SECTION – B

Short answer type. Answer any **eight** questions from the following. **Each** question carries **2** marks.

11. What is Ziese's salt? Give its structure.

12. Calculate CFSE of $[FeF_6]^{3-}$.

13. What is 18-electron rule?

14. What are coordination compounds? How do they differ from double salts?

15. What is Bohr's effect?

16. What are organometallics? Give an example.

17. Which has got greater tendency to form complexes: lanthanides or actinides? Give reasons.

18. Ce(III) complexes are colourless. Why?

19. Why is Mn^{3+} a good oxidizing agent?

20. What is lanthanide contraction?

21. What are pseudo halogens?

22. Arrange HClO, $HClO_2$. $HClO_3$ and $HClO_4$ in the increasing order of acidic strength. Justify your answer.

($8 \times 2 = 16$ Marks)

SECTION – C

Short essay type. Answer any **six** questions from the following. **Each** question carries **4** marks.

23. What are the factors affecting stability of complexes? Explain.

24. Explain the catalytic properties of transition metal compounds.

25. Write a note on complexometric titrations.

26. Explain the preparation of any two oxoacids of phosphorous.

27. Explain the crystal field splitting in tetrahedral field.

28. Distinguish between low spin and high spin complexes with suitable examples.

29. Application of coordination compounds in quantitative analysis.

30. Discuss the nature of bonding in dibenzene chromium.

31. Write a brief note on zeolites and its applications.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Explain how CFT describes magnetic properties and colour of coordination compounds.

33. Discuss the preparation, properties and structure of borazine.

34. Explain the different steps involved in the isolation of lanthanides from monazite.

35. Discuss about
    (a) Classification of organometallic compounds.
    (b) Discuss the structural features and functions of myoglobin.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 7999**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2(a): Chemistry and Industrial Chemistry

Core Course

IC 1442 : PHYSICAL CHEMISTRY II

(2013 - 2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** word to maximum of **two** sentences. **Each** question carries **1** mark.

1. Give the value of Boltzmann constant.

2. Colloids in which dispersed phase and dispersion medium are Liquids are called ————————

3. Number of degenerate states possible for a particle in a cubical box with energy $11h^2 / 8ma^2$ is ————————

4. Calculate the eigen value for a function e^{ikx} for the operator d^2/dx^2 ————————

5. The element which cannot be detected by ESCA is ————————

6. The energy in eV corresponding to one joule is ————————

P.T.O.

7. The selection rule for pure rotational Raman spectrum of a diatomic molecule is $\Delta J =$ ————————

8. TMS peak in $H'NMR$ will appear at ———————— in δ scale.

9. Number of spin states possible for ${}_7N^{14}$ is ————————

10. Ensembles which can exchange energy but not particles are called ————————

(10 × 1 = 10 Marks)

SECTION – B

Short answer type. Answer any **Eight** questions. **Each** question carries **2** marks.

11. Briefly describe parachor.

12. Describe the importance of Magnetic quantum number.

13. Differentiate between normalization and orthogonality for two given wavefunctions Ψ_a and Ψ_b.

14. Calculate Compton wavelength for a scattering angle of 90º.

15. Explain Einstein's photoelectric equation.

16. Describe the term 'Auger effect'.

17. Describe the importance of Born-Oppenheimer approximation.

18. Calculate the vibrational degrees of freedom for CO_2 and H_2O molecules.

19. Describe the term molar extinction coefficient.

20. Calculate the energy per mole of a radiation of wavelength 500 nm.

21. Identify two commercial applications of adsorption.

22. Give Planks statement for 3rd law of thermodynamics.

(8 × 2 = 16 Marks)

SECTION – C

Short essay type. Answer any **six** questions. **Each** question carries **4** marks.

23. Describe four important differences between lyophobic and lyophilic colloids.

24. Express the Schrodinger wave equation in spherical polar coordinates and describe the terms.

25. Explain the formation of *Balmer* series with the help of *Rydberg* equation.

26. Describe the condition for a well behaved wave function.

27. Differentiate between Raman line and Rayleigh line.

28. Calculate the moment of inertia of CO from its microwave spectrum with equally spaced lines separated by $2.77\,cm^{-1}$. ($h = 6.626 \times 10^{-34}\,kg\,m^2 s^{-1}$ and $c = 3 \times 10^8\,ms^{-1}$).

29. Calculate the vibrational frequency in cm^{-1} of HI with force constant 273.6 kg s^{-2}. (H=1.008 and I=126.9).

30. Describe the theory of ESR spectroscopy.

31. Explain the principle of SEM analysis.

($6 \times 4 = 24$ Marks)

SECTION – D

Essay type. Answer any **two** questions. **Each** question carries **15** marks.

32. (a) Derive an expression for Langmuir adsoption isotherm;

    (b) Describe a method for measuring magnetic susceptibility. (7+8)

33. Explain the terms,

(a) Streaming potential;

(b) Optical properties of colloids;

(c) Zeta potential.

34. Write none on,

(a) Chemical shift;

(b) Spin-spin coupling;

(c) Singlet and triplet states.

35. Explain the important postulates of quantum mechanics.

(2 × 15 = 30 Marks)

———————

(Pages : 3) **N – 8000**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2 (a) : Chemistry and Industrial Chemistry

Vocational Course

IC 1471 : INDUSTRIAL CHEMISTRY II

(2013 – 2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** carries **1** mark.

1. Write one example for inorganic polymer.
2. Define non-newtonian liquids.
3. What are the basic components in paint?
4. What is the composition soap?
5. Define calorific value of fuels.
6. What are fillers in Soap making?
7. Write one example for nano composites.
8. Name one chromatographic technique.
9. Write one example for indigo dye.
10. Define Reynold's number.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Short answers type, Answer any **eight** questions. **Each** carries **2** marks.

11. What are the basic treatment given during first aid?
12. Explain shell type heat exchangers.
13. Define polymer molecular weight.
14. What is meant by energy balance?
15. Explain the process called polymer blending.
16. What you meant by a composite material?
17. How silicones are manufactured?
18. Explain different sweetening agents and their adverse effect in human body.
19. Why do polymers have poor solubility?
20. What are the uses of phenol-formaldehyde resin?
21. What you will do if acid spillage occurs in lab?
22. Explain the principle behind flame photometer.

($8 \times 2 = 16$ Marks)

SECTION – C

Paragraph type questions, Answer any **six** questions. **Each** carries **4** marks.

23. Give a description on classification and preparation of cream.
24. Discuss various types food preservatives used in packaged foods.
25. Illustrate on theory and application of X-Ray Fluorescence spectroscopy.
26. Explain the main components of a refrigeration cycle.

27. Describe various applications of inorganic polymers.

28. What is food packaging and what are the types of food packaging?

29. Describe on different health hazards caused by adulteration.

30. Explain different types of heat exchangers.

31. Explain different types of chromatography technique.

(6 × 4 = 24 Marks)

SECTION – D

Essay type, Answer any **two** questions. **Each** carries **15** marks.

32. (a) Describe on different types of polymers and their properties.

    (b) Give an account on concept and manufacture of cosmetics.

33. (a) Explain the Chemistry of Varnishes.

    (b) Discuss about various types of Synthetic detergents.

34. (a) Describe on conducting polymers and their application.

    (b) Illustrate on manufacture and uses of PF resin.

35. (a) Illustrate the theory and application of Atomic Absorption Spectrometer.

    (b) What are the characteristics of Silicone Polymers and their applications?

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 8001**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Industrial Chemistry

MM 1431.7 – MATHEMATICS IV – LINEAR TRANSFORMATIONS, VECTOR INTEGRATION, ABSTRACT ALGEBRA, FOURIER SERIES AND TRANSFORMS

(2013-2018 Admissions)

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. If T is a linear transfirmation, then prove that $T(0) = 0$.

2. Define a contraction from $\mathbb{R}^2 \to \mathbb{R}^2$.

3. Define shear transformation.

4. Find a parametrization of the cylinder $z = x^2 + y^2 = 4, 0 \le z \le 6$.

5. State Stoke's theorem.

6. Give an example of a cyclic group having only one generator.

7. Is $\mathbb{Z}$ under multiplication a group?

8. Give an example of a ring with unit element.

9. Find the fundamental period of $\cos 2x$.

10. Write the Euler formulae for the Fourier coeffiecients.

($10 \times 1 = 10$ Marks)

PART – B

Answer **any eight** questions. Each question carries **2** marks.

11. Find the standard matrix A for the transformation $T(x) = 5x$.

12. Define $T : \mathbb{R}^2 \to \mathbb{R}^2$ by $T(x) = 3x$. Show that T is a linear transformation.

13. Let $A = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ and define $T : \mathbb{R}^2 \to \mathbb{R}^2$ by $T(x) = Ax$. Find the images under T of $u = \begin{bmatrix} 1 \\ -3 \end{bmatrix}$.

14. Evaluate the line integral $(1 + xy^2)dx$ along $C : \vec{r}(t) = t\vec{i} + 2t\vec{j}\ (0 \le t \le 1)$.

15. Find the workdone by the force field $F(x, y) = x^3 y\vec{i} + (x - y)\vec{j}$ on a particle that moves along the parabola $y = x^2$ from $(-2, 4)$ to $(1, 1)$.

16. Use the divergence theorem to find the outward flux of the vector field $F(x, y, z) = 2\vec{k}$ across the sphere $x^2 + y^2 + z^2 = a^2$.

17. Find the order of the subgroup of $\mathbb{Z}_4$ generated by 2.

18. Find all solutions of the equation $x^2 + 2x + 3 = 0$ in $\mathbb{Z}_6$.

19. Express (3, 2, –5) as a linear combination of (2, 0, 0), (0, 2, 0) and (0, 0, 2).

20. Define a field. Give an example.

21. Find the Fourier cosine series of the function $f(x) = 1, 0 < x < L$.

22. Define an odd function. Give an example.

($8 \times 2 = 16$ Marks)

PART – C

Answer **any six** questions. Each question carries **4** marks.

23. Let T be the linear transformation whose standard matrix is $\begin{bmatrix} 1 & -4 & 8 & 1 \\ 0 & 2 & -1 & 3 \\ 0 & 0 & 0 & 5 \end{bmatrix}$.

Does T map $\mathbb{R}^4$ onto $\mathbb{R}^3$? Is T a one-tone-mapping?

24. Let $A = \begin{bmatrix} 1 & -3 & -4 \\ -4 & 6 & -2 \\ -3 & 7 & 6 \end{bmatrix}$ and $b = \begin{bmatrix} 3 \\ 3 \\ -4 \end{bmatrix}$. Determine whether b is in the column space of A.

25. Show that $\vec{F} = (e^x \cos y + yz)\vec{i} + (xz - e^x \sin y)\vec{j} + (xy + z)\vec{k}$ is conservative and find a potential function for it.

26. Find the area of the cap cut from the hemisphere $x^2 + y^2 + z^2 = 2, z \geq 0$ by the cylinder $x^2 + y^2 = 1$.

27. Use a line integral to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

28. Find all subgroups of $\mathbb{Z}_{20}$.

29. Show that Klein 4 group is non cyclic.

30. Find the Fourier sine series of $f(x) = x + \pi$, $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$.

31. Find the Fourier coefficients of the periodic function $f(x)$ where $f(x) = x^3, -\pi < x < \pi$.

($6 \times 4 = 24$ Marks)

PART – D

Answer **any two** questions. Each question carries **15** marks.

32. Find a basis for the mill space of the matrix

$$\begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix}$$

33. (a) Evaluate the surface integrl $\int\int x^2 dS$ over the sphere $x^2 + y^2 + z^2 = 1$.

(b) Use the divergence theorem to find the outward flux of the vector field $F(x, y, z) = 2x\vec{i} + 3y\vec{j} + z^2\vec{k}$ across the unit cube bounded by $x = 0, x = 1$, y = 0, $y = 1, z = 0, z = 1$.

34. Let $G = \mathbb{R} - 1$. Define an operation $*$ on R by $a * b = a + b - ab$. Show that $(G, *)$ is a group.

35. Find the fourier series of

$$f(x) = \begin{cases} k; \dfrac{-\pi}{2} < x < \dfrac{\pi}{2} \\ 0; \dfrac{\pi}{2} < x < \dfrac{3\pi}{2} \end{cases}$$

and show that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ... = \frac{\pi}{4}$.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 8002**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2(a) : Chemistry and Industrial Chemistry

Core Course

IC 1441 : INORGANIC CHEMISTRY – III

(2019 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. What is a *metalloenzyme*?

2. Write the formula of Borax.

3. The magnetic susceptibility of a ferromagnetic substance ———————— with increase of temperature.

4. Give one example for optical isomerism in complexes.

5. Why actinides form complexes more easily than lanthanides?

6. What is meant by chelate effect?

7. Why Sc^{3+} ion is colourless, while Cr^{3+} ion is coloured?

P.T.O.

8. What are silicides?

9. Give two examples for organometallic compounds which contain 3c,2e bonds.

10. The $CFSE_{oct}$ for a d^7 low spin system will be ——————.

SECTION – B

Answer **any eight** questions. Each question carries **2** marks.

11. Tetrahedral complexes are generally high-spin. Why?

12. Explain term coordination isomerism with suitable examples.

13. What are the main functions of iron containing biomolecules?

14. Why do europium and ytterbium exhibit +2 oxidation state?

15. Explain why lanthanides do not easily form complexes when compared to transition metals?

16. Write the formula of

    (a) pentaamminebromocobalt (III) chloride

    (b) potassium hexacyanocobaltate(III).

17. Calculate the spin-only magnetic moment of Fe^{3+}.

18. What is meant by the term CFSE?

19. Why the oxides of Mn show an increase in the acidity of its oxides?

20. What happens when $Fe_2(CO)_9$ is heated in toluene solvent at 343 K?

21. Why is Cu^{2+} more stable than Cu^{+} in aqueous solution?

22. How can ferrocene be converted to ferrocene sulphonic acid?

23. Comment on the structure of trimethylaluminium compounds.

24. Transition metal ions form a large number of interstitial compounds. Explain.

25. What are carboranes?

26. What are inorganic polymers? Give an example.

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

27. What structural changes do occur when haemoglobin carries oxygen and when it detaches oxygen?

28. Discuss the structure and applications of silicones.

29. What are the factors influencing the magnitude of crystal field splitting?

30. How is borazine prepared? Explain its reactions with HCl and water.

31. Discuss organometallic compounds with multicentre bonding, taking suitable examples.

32. What are the oxyacids of phosphorous?

33. How CFT is useful in explaining the colour of transition metal complexes?

34. Explain the MO theory for 18 electron rule.

35. Citing examples, discuss the *cis-trans isomerism* exhibited in complexes.

36. Discuss the alloy formation characteristics of transition metals.

37. How do lanthanides and actinides differ with respect to oxidation state and their colour?

38. Why does the magnetic moment of +2 oxidation state in the first transition series increase up to Mn (II) and then decrease?

SECTION – D

Answer **any two** questions. Each question carries **15** marks

39. Explain the method for glass manufacture. Give any four types of glasses and their uses.

40. Discuss the bonding in ferrocene and its structure.

41. On the basis of VBT, account for the fact that $[Ni(CN)_4]^{2-}$ is a square planar, while $[Ni(Cl)_4]^{2-}$ is tetrahedral.

42. (a) Explain sodium-potassium pump.

    (b) Outline the toxic effect of CO and CN in haemoglobin.

43. Discuss the classification of silicates with special reference to their structures.

44. (a) Write notes on magnetic properties of lanthanides;

    (b) Consequences of lanthanide contraction.

———————

(Pages : 4) **N – 8003**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2(a) – Chemistry and Industrial Chemistry

Core Course

IC 1442 : PHYSICAL CHEMISTRY II

(2019 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions, each question carries **1** mark.

1. Define IIIrd law of thermodynamics
2. What is an adsorbate?
3. Example for emulsion system.
4. What is the reference used in NMR?
5. What are paramagnetic substances?
6. Write one application for rotational spectroscopy.
7. What are antistokes lines?
8. Define Hardy-Schultz rule.

P.T.O.

9. What is the expansion of ESCA?

10. What is the selection rule for diatomic molecule in rotational spectroscopy?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. Explain hyper fine splitting?

12. Explain Born-Oppenheimer equation?

13. Define the term parachor.

14. What is molar refraction?

15. Define Frank-Condon principle.

16. What is meant by adsorption isotherm?

17. Write Morse equation and explain the terms.

18. Explain Freundlich adsorption isotherm.

19. Explain dialysis process for purification of colloids?

20. What is the selection rule in IR spectroscopy?

21. Write the Schrodinger wave equation and explain the terms.

22. Explain the two scales in NMR spectroscopy.

23. Describe the term molar extinction coefficient.

24. Calculate the energy per mole of a radiation of wavelength 500 nm.

25. Identify two commercial applications of adsorption.

26. Write the Planks statement for 3rd law of thermodynamics.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carry **4** marks.

27. Explain electronic spectra of poly atomic molecule

28. Discuss Boltzmann distribution law

29. Detail the various application of colloids?

30. What are the application of IR spectroscopy?

31. Apply Schrodinger wave equation to spherical polar coordinates

32. Explain singlet and triplet state using suitable examples

33. The free energy change ΔG accompanying a process is $-75.27 kj$ at 30 °C and –80.58kj at 40°C. Calculate the change in enthalpy ΔH for the process at 35 °C

34. Distinguish between diamagnetism and paramagnetism

35. The fundamental vibration frequency of HCl molecule is 2800nm^{-1} Calculate force constant of this molecule. Atomic mass of H = 1.673 10^{-27}kg and Cl 58.06×10^{-27} kg

36. Calculate the moment of inertia of CO from its microwave spectrum with equally spaced lines separated by 2.77cm^{-1}. $\left(h = 6.626 \times 10^{-34}\, kg\ 2s^{-1} and\ c = 3 \times 10^{8}\, ms^{-1}\right)$

37. Describe the theory of ESR spectroscopy.

38. Explain the principle of SEM analysis.

($6 \times 4 = 24$ Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. (a) Derive equation for particle in 3D box.

    (b) Describe Nernst heat theorem and its consequences.

40. (a) State and explain Gibbs adsorption Isotherms.

(b) Explain ESR spectroscopy and its application.

41. (a) An electron is confined in a one-dimensional box of length 2 A° Calculate the ground state energy in electron volts (eV).

(b) Explain different type of operators in quantum mechanics.

42. (a) Describe Langmuir adsorption isotherm.

(b) Give an account on application of microwave spectroscopy.

43. Describe different methods for measuring magnetic susceptibility.

44. Explain the important postulates of quantum mechanics.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 8004**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Group 2 (a) : Chemistry and Industrial Chemistry

Vocational Course

IC 1471 : INDUSTRIAL CHEMISTRY II

(2019 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. For an ideal fluid its viscosity is ————————.

2. In ———————— flow the speed of the fluid at a point is continuously undergoing changes in both magnitude and direction.

3. Name any two synthetic rubbers.

4. ———————— is a conducting polymer containing nitrogen as the hetero atom.

5. Conversion of a lipid into soap and alcohol by the action of aqueous alkali is called ————————.

6. The most common domestic detergents are chemically ————————.

7. ———————— is a metal oxide used in sunscreen formulations.

8. Aspartame is well known ——————.

9. Acid dyes are sodium salts of ——————.

10. Name a common fluorescent brightening agent used in fabric materials.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Differentiate between Newtonian and non-Newtonian fluids.

12. Define calorific value. How can it be expressed?

13. What is Reynolds Number?

14. What are homopolymers and co-polymers? Give examples.

15. What is degree of polymerisation? Illustrate.

16. How PF resins are prepared? What are its uses?

17. Define glass transition temperature of a polymer. Compare it with the melting point.

18. What are inorganic polymers? Give examples.

19. What is a talc? What are its uses?

20. What is the general composition of lipsticks?

21. Name any two natural and artificial colourants used in food industry.

22. State the principle of paper chromatography.

23. What is the working principle of Flame photometry?

24. What is specific ion electrode?

25. What are azo dyes? Give examples.

26. Mention any two features of reactive dyes.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Compare the shell type and plate type heat exchangers.

28. Explain the classification of polymers according to the chain structure.

29. Discuss the characteristics of silicone polymers? Give applications.

30. Write a note about different types of synthetic detergents.

31. Illustrate the cold process of soap production.

32. Discuss about the builders and tillers added to detergents.

33. What are the features of artificial sweeteners?

34. What are sunblock creams? What are the main ingredients in a sunblock cream?

35. Explain the principle of column chromatography.

36. What is Thin layer chromatography? What are its advantages?

37. What are the major components of a permanent hair dye? What is their role?

38. Briefly explain the chemistry of varnishes.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Give an account of the safety concerns in chemical industry.

40. Write a note about the following (a) Number average and weight average molecular weight of polymers (b) Polymer composites. **5 + 10**

41. Briefly discuss the techniques of polymer processing.

42. Note down the features of colouring and flavouring agents used in food industry.

43. Illustrate theory and application of

    (a) Atomic absorption spectro photometer

    (b) X-ray fluorescence spectrometer

44. Explain the classification of dyes based on their application. Give suitable examples.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 8005**

Reg. No. : .....

Name : .....

Fourth Semester B.Sc. Degree Examination, August 2022

Career Related First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry and Industrial Chemistry

MM 1431.7 — MATHEMATICS IV – ABSTRACT ALGEBRA, LAPLACE TRANSFORMS, FOURIER SERIES AND DIFFERENTIAL EQUATIONS

(2019 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – I

All the first **10** questions are compulsory. They carry **1** mark each.

1. Define cyclic group.

2. Show that every cyclic group is abelian.

3. Write all generators of Z_8.

4. Find the Laplace transform of $\cos 2\pi t$.

5. Find $1 * (-1)$ where $*$ indicate the convolution.

6. Laplace transform of first derivative of $f(t)$ is equal to ————.

7. Average of $f(x)$ on (a, b) is ————.

8. Write complex form of Fourier series.

P.T.O.

9. Find the total differential of $u(x, y) = x + x^2y^3$.

10. Test for exactness of $\cos(x+y)dx + (3y^2 + 2y + \cos(x+y))dy = 0$.

SECTION – II

Answer **any eight** questions. These questions carry **2** marks each.

11. Find the number of generators of a cyclic group having order 5.

12. If a, b and c are group elements and $|a| = 6, |b| = 7$, express $(a^4c^{-2}b^4)^{-1}$ without using negative exponents.

13. Give two reasons why the set of odd integers under addition is not a group.

14. Find the inverse of the element 2 in Z_5.

15. Find the inverse Laplace transform of $\frac{2\pi}{(s+\pi)^3}$.

16. Find the Laplace transform of $4te^{-2t}$.

17. State convolution theorems.

18. Represent the function $f(t) = t - 8 (t > 8)$ using unit step function and find its transform.

19. State Dirichlet conditions.

20. Define Fourier Sine Transform.

21. Find the Fourier coefficient a_0 of $f(x) = \begin{cases} 0; if & -\pi \le x \le 0 \\ x, if & 0 \le x \le \pi \end{cases}$

22. Find the Fourier coefficient b_n of $f(x) = K$ in $(0, \pi)$.

23. Test for exactness. If exact, solve $2xy\,dx + x^2dy = 0$.

24. Find the integrating factor for the ODE $(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0$.

25. Find the general solution of $y'' + 6y' + 9y = 0$.

26. Write example of linear and nonlinear ordinary differential equation.

SECTION – III

Answer **any six** questions. These questions carry **4** marks each.

27. Find the number of elements in the cyclic subgroup of Z_{30} generated by 25.

28. Find all subgroups of Z_{12}, and draw the subgroup diagram for the subgroups.

29. Define a ring and give an example of a ring.

30. Find the inverse Laplace transform of $\frac{1}{(s+\sqrt{2})(s-\sqrt{3})}$.

31. Find $L\left[e^{-2t}\left[\cos 4t + 3\sin 4t\right]\right]$.

32. Using convolution theorem, find the inverse Laplace transform of $\frac{w}{s^2(s^2 - w^2)}$.

33. Obtain the Fourier series for the function $f(x) = x^2$, $-\pi \le x \le \pi$. Deduce the relation $\frac{1}{1^2} + \frac{1}{2^2} + \frac{2}{3^2} = ... = \frac{\pi^2}{2^6}$.

34. Find the Fourier series of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval $0 \le x \le 2\pi$. Hence deduce that $\sum_{n=1}^{\infty} \frac{1}{n^4} = \frac{\pi^4}{90}$.

35. Find the Fourier transform of $f(x) = \begin{cases} x, 0 < x < a \\ 0, \text{otherwise} \end{cases}$

36. Solve the initial value problem $y'' + y' + 0.25y = 0, y(0) = 3, y'(0) = -3.5$.

37. Find the general solution of $x^2y'' - 5xy' + 9y = 0$.

38. Solve the initial value problem $y' + y\tan x = \sin 2x,\ y(0) = 1$.

SECTION – IV

Answer **any two** questions from among the questions 39 to 44. These questions carry **15** marks each.

39. (a) Prove that every field *F* is an integral domain.

    (b) Show that If *G* is a group with binary operation $*$, and if *a* and *b* are any elements of *G*, then the linear equations $a * x = b$ and $y * a = b$ have unique solutions *x* and *y* in *G*.

40. Let *G* be a cyclic group with generator α. If the order of *G* is infinite, then *G* is isomorphic to $<\mathbb{Z}, +>$. If *G* has finite order *n*, then *G* is isomorphic to $<\mathbb{Z}, +>$

41. (a) Using Laplace transform of derivatives, solve the initial value problem

    $y'' + y' = 3\cos 2t,\ y(0) = y'(0) = 0$

    (b) Find the Laplace transform of $f(t) = \sin(at + b)$.

42. (a) Represent the function $f(t) = \sin t\left(\frac{\pi}{2} < t < \pi\right)$ using unit step function and find its transform.

    (b) Find the Laplace transform of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$.

43. (a) If $f(x) = x + x^2$, for $-\pi < x < \pi$, find Fourier series expansion of $f(x)$.

    (b) Determine the Fourier series of the function $f(x) = x\sin x$ in $0 < x < 2\pi$.

44. (a) Solve the initial value problem $(x^2D^2 - 3xD + 3)y = 3\ln x - 4$, $y(1) = 0$, $y'(1) = 1$.

    (b) Solve $y'' + 5y' + 6y = 2e^{-x}$.

———————

(Pages : 4) **M – 1815**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Core Course XI

IC 1541 : ORGANIC CHEMISTRY – II

(2014, 2016 & 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. What is meant by racemisation?
2. Give an example for a ketose sugar.
3. What are crown ethers? Give an example.
4. What are the nitrogen bases and sugar present in RNA?
5. Give any one example for an acidic amino acid.
6. What are epimers? Give an example.
7. Name a deficiency disease associated with the deficiency of vitamin A.
8. Give any two industrial applications of cellulose?
9. Draw the zwitter ionic form of alanine.
10. What are Grignard reagents? Give one example.

(10 × 1 = 10 Marks)

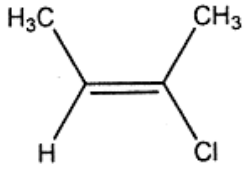
P.T.O.

SECTION – B

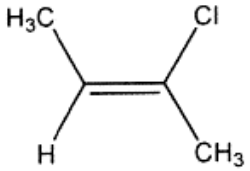
Answer **any eight** questions. **Each** question carries **2** marks.

11. Draw the Newman projection formula of staggered and eclipsed conformations of n-butane and arrange them in the increasing order of their stability.

12. Which of the following have (Z) configuration? Explain why.



(I)



(II)

13. Explain special isoprene rule with an example.

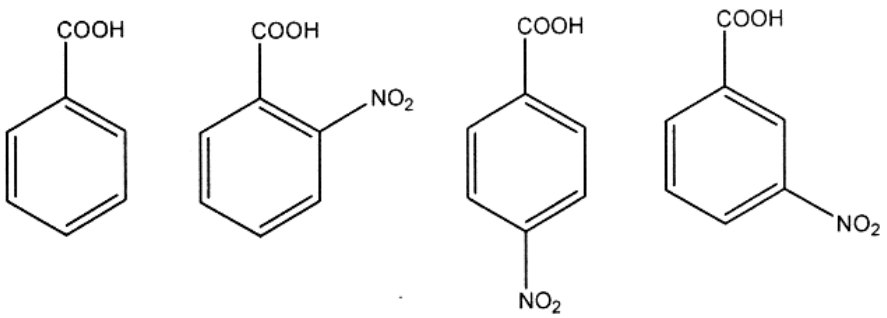
14. Define iodine value of an oil.

15. What are diastereomers? Give one example.

16. List any four characteristics of enzymes.

17. Draw the chair and boat conformations of cyclohexane and comment on their relative stability.

18. Arrange the following carboxylic acids in the increasing order of their strength and explain why?



19. Give any one general method of preparation of amino acids.

20. What is Williamson's synthesis? Give any two examples.

21. What are androgens? Give any two examples.

22. Give one method to synthesis acetoacetic ester.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

23. Write a short note on the synthesis of cinnamic aud and lactic acid.

24. What is mutarotation? Give its Mechanism.

25. Discuss the structure of starch.

26. Explain how methyl magnesium bromide is synthesized? Explain how it can be used to synthesize ethanol, 2-propanol and acetone.

27. Explain how D-glucose is converted into D-mannose.

28. What are fatty acids? Give any two examples.

29. Discuss the primary structure of proteins.

30. Explain optical isomerism in substituted biphenyls with an example.

31. What are terpenoids? Draw the structure of citral and geraniol.

(6 × 4 = 24 Marks)

SECTION – D

Long essay questions.

Answer **any two** questions. **Each** question carries **15** marks.

32. Explain how acetic acid is prepared from methyl magnesium bromide. Explain how acetic acid can be converted into acetyl chloride, acetic anhydride, ethyl acetate, and acetamide. Give chemical equations.

33. (a) Give an account of the classification and biological functions of vitamins.

(b) Give any two examples for alkaloids and give their importance.

34. Discuss the carbobenzoxy method for the synthesis of peptides.

35. What is malonic ester? How is it prepared? Give any four synthetic applications of diethyl malonate.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 1816**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Vocational Course V

IC 1571 : INDUSTRIAL CHEMISTRY – III

(2014, 2016 and 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in **one** word to maximum of **two** sentences. Each question carries **1** mark.

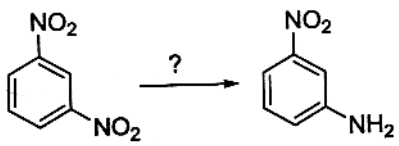
1. How could you convert benzene to benzene sulphonic acid in the laboratory?

2. Mention an aromatic electrophilic substituition reaction which is reversible.

3. What is Zeigler Natta catalyst?

4. Why does an amine act as a base?

5. Which reagent can be used for the following selective reduction?



P.T.O.

6. What is Gattermann Koch reaction?

7. Write down the synthesis of benzene sulphonamide.

8. What is vulcanization? What element is used to vulcanize rubber?

9. Predict the product of Perkin reaction.

10. Arrange the following three in the decreasing order of basicity.

$R-CH=NH$, $R-C\equiv N$, $R-CH_2-NH_2$.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type (Not to exceed one paragraph). Answer **any eight** questions from the following. Each question carries **2** marks.

11. What are sulphadrugs? Name two sulphadrugs.

12. Explain what is meant by (a) copolymer (b) homolpolymer.

13. What is natural rubber? Discuss the structure.

14. What is the directing ability of sulphonic acid group in electrophilic substitution reaction. Give an example.

15. Why does phenolphthalein show colour change during acid-base titration?

16. How do number average and weight average molecular weight differ?

17. How will you separate a mixture containing ethyl amine and dimethyl amine?

18. What is a phosphorous ylide? Mention its significance in synthetic organic chemistry.

19. Suggest a reaction for converting methyl phenyl ketoxime to N-phenyl acetamide.

20. Compare the structures of Buna-S and Buna-N?

21. What is Sandmeyer reaction? Explain the role of cuprous halides in the reaction.

22. Write one method of preparation of primary amines.

(8 × 2 = 16 Marks)

SECTION – C

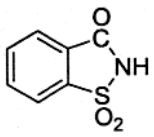
Short Essay (Not to exceed **120** words)

Answer **any six** questions from the following.

Each question carries **4** marks.

23. Write the mechanism of desulphonation of benzene sulphonic acid. Adopting the above reaction, how will you synthesi *o*- bromophenol?

24. How is saccharin (structure provided below) can be synthesized from toluene?



Saccharin

25. What is bakelite? Show the mechanism of polymerization.

26. What are arene diazonium salts? How are they prepared ? Discuss any two synthetic importance of benzene diazonium chloride.

27. Write a short note on Meerwin-Pondrof-Verly reduction.

28. Give method of preparation of methyl orange? Explain the reason for its colour change in acid-base titrations?

29. What does happen when completely substituted 1,2-diols ((eg. 2,3-dimethy 1-2,3-butanediol) are exposed to acidic reaction conditions? Discuss the mechanism.

30. Write down the sequence of reactions for the conversion of methyl amine to ethyl amine.

31. Explain Claisen condensation with the mechanism.

(6 × 4 = 24 Marks)

SECTION – D

Long essay

Answer **any two** questions from the following.

Each question carries **15** marks.

32. What is addition polymerization? Explain in detail the different types of addition polymerization mechanisms.

33. (a) Describe the reduction of nitrobenzene in acid, base, and neutral medium.

    (b) Explain Hoffmann's method of separation of primary, secondary, and tertiary amines.

34. Discuss the mechanism of :
    (a) Wittig reaction
    (b) Reimer Tiemann reaction
    (c) Beckmann rearrangement
    (d) Canizzaro reaction.

35. Write a note on classification of dyes on the basis of structure. Explain the synthesis of Congo red, alizarin, malachite green.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 1817**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021.

Career Related First Degree Programme under CBCSS

Group 2(a) – Chemistry and Industrial Chemistry

Vocational Course VI

IC 1572 – INDUSTRIAL CHEMISTRY IV

(2014, 2016 – 2017 Admission)

Time : 3 Hours Max. Marks : 80

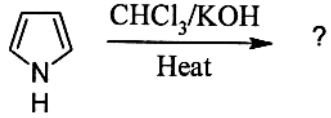
SECTION – A

Answer **all** questions. Each question carries **1** mark.

Answer in one word to maximum of two sentences

1. Give the structure of purine.

2. Explain why the resonance energy of thiophene is greater than that of pyrrole.

3. 

4. What are auxochromes? Give one example.

5. What is TMS in NMR spectroscopy? What is its importance?

6. What are antibiotics? Give one example.

7. What is the significance of the coupling constant?

8. Give the structure of aspirin.

9. What is the common type of electronic transitions one can seen in conjugated dienes?

10. What is meant by base peak in mass spectrometry?

(10 × 1 = 10 Marks)

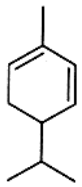
SECTION – B

Short answer type (Not to exceed one paragraph)
Answer **any eight** questions. Each question carries **2** marks.

11. What is Hofmann exhaustive methylation? How it is useful in the structure elucidation of heterocyclic compounds?

12. Explain why quinoline does not give Friedel crafts reaction?

13. Calculate the λ_{max} for the compound



14. How will you distinguish free OH and hydrogen bonded OH by IR spectroscopy?

15. Discuss the shielding and deshielding effect in NMR spectroscopy.

16. Explain why the 2-position of pyrrole is preferred for electrophilic substitution?

17. Whether C^{12} will give NMR spectra? Justify.

18. What are the important peaks found in the IR spectrum of acetanilide? Give its frequency range.

19. Explain Mclafferty rearrangement with an example.

20. What are green solvents? Give two examples.

21. Explain atom economy with an example.

22. Electrophilic substitution reaction in pyridine takes place at 3-position. Justify the statement.

(8 × 2 = 16 Marks)

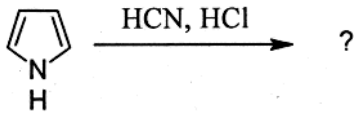
SECTION – C

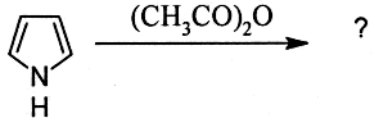
Short essay (Not to exceed **120** words)

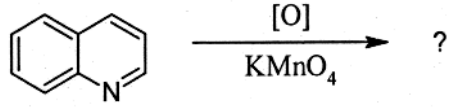
Answer **any six** questions. Each question carries **4** marks.

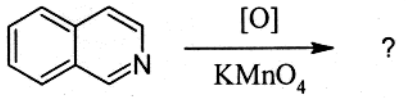
23. Explain Skraup quinoline synthesis with brief mechanism.

24. Predict the products of the following reactions

(a) 

(b) 

(c) 

(d) 

25. Write short notes on rational drug design and synthesis.

26. Discuss the effect of conjugation on absorption in UV spectroscopy with suitable examples.

27. What is coupling constant? How it can be calculated?

28. Discuss the twelve principles of Green Chemistry.

29. Give one method of preparation of thiophene. Discuss its electrophilic substitution reactions.

30. Discuss the basic principle of mass spectrometry.

31. What are the factors affecting the vibrational frequencies?

(6 × 4 = 24 Marks)

SECTION – D

Long essay

Answer **any two** questions. Each question carries **15** marks.

32. Explain the basic principle and applications of IR spectroscopy.

33. What are drugs? Discuss the synthesis and medicinal importance of salicylic acid and ibuprofen derivatives.

34. Write short notes on the following

    (a) Fischer indole synthesis with brief mechanism. **5**

    (b) Important reactions of indole. **6**

    (c) Structure of indole based on MO theory. **4**

35. Write short notes on the following.

    (a) Basic principle of NMR spectroscopy. **5**

    (b) Factors influencing the chemical shift. **5**

    (c) Isotopic effect in mass spectrometry. **5**

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 1818**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Group 2(a) – Chemistry and Industrial Chemistry

Core Course – XI

IC 1541 : ORGANIC CHEMISTRY – II

(2018 and 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

(Answer **all** questions. Each question carries **1** mark)

1. What is the number of optical isomers possible for glucose?
2. Give the name of a non-reducing disaccharide.
3. Give the Zwitter ion structure of glycine.
4. What type of linkages are responsible for the formation of α-helix?
5. What do you understand by the term resolution?
6. Define chirality.
7. Give an example of anionic detergent?
8. Give the structure of nicotine.

P.T.O.

9. Write the structure of Vitamin B2.

10. Heating a mixture of sodium benzoate and soda lime gives

(10 × 1 = 10 Marks)

SECTION – B

(Answer **any eight** questions. Each question carries **2** marks)

11. Classify the carbohydrates on the basis of behavior towards hydrolysis.

12. Define epimers.

13. What happens when glucose is treated with excess of phenyl hydrazine?

14. How is biuret formed? What is biuret test?

15. Outline a synthesis of phenyl alanine.

16. What are basic amino acids? Give two examples.

17. What are enantiomers?

18. What conformational changes occur as the temperature rises?

19. Are enantiomers possible in molecules that do not have chiral carbon atom.

20. What is saponification?

21. What is the difference between geraniol and nerol?

22. Name an alkaloid and outline the method of its extraction.

23. Name four vitamin deficiency diseases.

24. Give the classification of enzymes.

25. Which is more acidic: benzoic acid or o-methylbenzoic acid? Rationalise your answer.

26. What are epoxides?

(8 × 2 = 16 Marks)

SECTION – C

(Answer **any six** questions. Each question carries **4** marks)

27. What is Kiliani synthesis? Give an example.

28. Discuss the pyranoside structure of fructose.

29. Write the different steps involved in the synthesis of a tripeptide having three different amino acid groups.

30. What is meant by the primary structure of protein? What are the important methods used for the elucidation of the primary structure of protein?

31. Explain why the chair conformation of cyclohexane is more stable than boat conformation of cyclohexane.

32. Explain the requirements for a compound showing optical activity. Explain your answer with examples.

33. Explain iodine value of an oil.

34. Describe the isolation and properties of coniine.

35. Discuss the synthetic applications of acetoacetic ester.

36. Write a note on male sex hormones.

37. Discuss the Zeisels method for the estimation of alky groups.

38. Discuss the preparation and importance of acetic anhydride.

(6 × 4 = 24 Marks)

SECTION – D

(Answer **any two** questions. Each question carries **15** marks)

39. How is the ring structure of glucose established?

40. Explain the part played by DNA in protein synthesis. Explain genetic code.

41. What methods are available for resolution of racemic mixture?

42. What are synthetic detergents? Give the classification with examples. What are the advantages of synthetic detergents over soaps?

43. What are vitamins? What are the sources, structures and functions of Vitamin A, B_{12} and C.

44. (a) Explain the effect of substituents on the acidity of aromatic carboxylic acids.

    (b) Give two methods of preparation and properties with equations of the following compounds:

        (i) Oxalic acid

        (ii) Acrylic acid

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 1819**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme Under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Vocational Course V

IC 1571 : INDUSTRIAL CHEMISTRY III

(2018 and 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Which intermediate carbocation is more stable in pinacole-pinacolone rearrangement?

2. m-chlorobenzaldehyde on reaction with conc. KOH at room temperature gives ————————.

3. On the basis of mode of formation polymers can be classified :

4. The polymer in which steric placements of the substituent are arranged in such a way to give alternate d and l configurations, is known as ————————.

5. Nylon 6, 6 is obtained by condensation polymerisation of ————————.

6. Acetamide can be converted to methenamine by which of the following reactions?

P.T.O.

7. An aldehyde on reaction with primary amine forms

8. Benzene-diazonium chloride on reaction with phenol in weakly basic medium gives ——————.

9. C_3H_9N can have how many structural isomers?

10. Give any pharmaceutical application of sulphathiazole.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Write two tests to distinguish between aldehydes and ketones.

12. Give an example of Claisen condensation.

13. Write the structure of phosphorous ylids.

14. What is Fries rearrangement?

15. Are enantiomers possible in molecules that do not have chiral carbon atom?

16. Write a note on elastomers.

17. What are chromophores? Give two examples of chromophores.

18. What do you understand by the terms bathochromic and hypsochromic shifts?

19. What are sulpha drugs?

20. Give the applications of benzene sulphonic acid.

21. Give the structure of sulphadiazine.

22. Discuss the preparation of sulphanilic acid.

23. Discuss the mode of action of quarternary ammonium salts as phase transfer catalysts.

24. How will you distinguish primary and secondary nitrocompounds?

25. Give the products of electrolytic reduction of aromatic nitro compounds under strongly and weakly acidic conditions.

26. Pyridine is less basic than piperidine. Why?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. What is Gattermann-Koch reaction? Write a mechanism for the reaction.

28. Explain Sandmeyer reaction? Write a mechanism for the reaction.

29. What is Knoevenangel reaction? Write a mechanism for the reaction.

30. Discuss about addition and condensation polymerization with examples.

31. Discuss about number average molecular weight determination of polymers.

32. Explain colour and constitution in terms of modern theory.

33. Draw the structure of sulphanilamide. What are its main uses?

34. Write the mechanism of action of sulphathiazole.

35. Discuss the mechanism of Riemer-Tiemann reaction and Witting reaction.

36. Discuss Gabriel's phtalimide synthesis of primary amines.

37. Write the method of preparation of diazomethane. What are the applications?

38. What are the synthetic applications of benzene diazonium chloride?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Discuss the mechanism of following rearrangement reactions :

    (a) Claisen rearrangements

    (b) Benzidine rearrangement

    (c) Beckmann rearrangement **5 + 5 + 5**

40. Discuss the preparation, structure and applications of the following industrially important polymers.

    (a) PVC

    (b) Nylon 6, 6

    (c) PMMA **5 + 5 + 5**

41. Discuss the synthesis and applications of following compounds :

    (a) Benzene sulphonic acid

    (b) Toluene sulphonyl chloride

    (c) Sulphadiazine. **5 + 5 + 5**

42. What are the reduction products of nitrobenzene under different conditions? **15**

43. Discuss the Hinsberg method to distinguish primary, secondary and tertiary amines. **15**

44. (a) Discuss Gattermann aldehyde synthesis with mechanism.

    (b) Discuss the mechanism of Meervin-Pondorf-Verley reduction.

    (c) Write a note on biodegradable polymers. **5 + 5 + 5**

(2 × 15 = 30 Marks)

———————

(Pages : 4) **M – 1820**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2021

Career Related First Degree Programme under CBCSS

Group 2 (a) : Chemistry & Industrial Chemistry

Vocational Course – VI

IC 1572 : INDUSTRIAL CHEMISTRY – IV

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

(Answer **all** questions. Each question carries **1** mark.

1. On which factors the vibrational stretching frequency of diatomic molecule depend?

2. The frequency of vibration of a bond is a function of which factor?

3. What is the correct increasing order of stretching frequencies for $C \equiv C$, $C = C$ and $C - C$?

4. Which isotope of carbon is NMR active?

5. Which chemical structure is responsible for the antibacterial activity of penicillin?

6. Analgin is the trade name for ————————.

7. How many methyl peaks would you expect to observe in the ^{1}H NMR spectrum of *cis*-1,4-dimethylcyclohexane?

8. What was the first antibiotic discovered?

9. Name a heterocyclic compound which undergoes Diels-Alder reaction.

10. Which pyridine monocarboxylic acid is associated with vitamin-B group?

(10 × 1 = 10 Marks)

SECTION – B

(Answer **any eight** questions from the following. Each question carries **2** marks)

11. Why $CDCl_3$ is used as a solvent to record NMR spectrum?

12. How can you distinguish cyclohexanone from cyclohexenone by IR spectroscopy?

13. Calculate the reduced mass of CO [At. mass of C = 12 amu; O = 16 amu].

14. Write the resonance structure of furan.

15. Suppose you have two NMR spectra, one of benzene and the other of phenol. How would you identify which is which?

16. What is the meaning of “finger print region” in IR spectroscopy?

17. What is referred to as electron–ionization mass spectrometry? What are antibiotics? Give two examples.

18. Define a normal mode of vibration.

19. What is green chemistry?

20. What is indophenin reaction?

21. How are drugs classified? Give examples of each class.

22. Write a reaction to show the diene activity of furan.

23. Pyrrole is not stable in acid media. Suggest a reason.

24. Give a simple method of preparation of thiophene.

25. How is the magnitude of the nuclear magnetic moment of a nucleus related to its spin quantum number?

26. Write the relationship between wavelength, frequency and wavenumber.

($8 \times 2 = 16$ Marks)

SECTION – C

Short Essay

(Answer **any six** questions from the following. Each question carries **4** marks)

27. Which is more basic? Pyridine or piperidine. Rationalise your answer.

28. Discuss the electrophilic substitution mechanism of indole.

29. Given that the fundamental vibrational frequency for HI is 2192.5 cm^{-1}, calculate the force constant of the H – I bond. [H = 1.008; I = 126.9].

30. Discuss the applications of lR spectroscopy in organic chemistry.

31. Explain the term chemical shift in NMR spectroscopy.

32. Explain one common method of effective ionization of molecules in mass spectrometry.

33. Draw the schematic sketches of NMR spectra of

    (a) ultrapure ethanol and

    (b) acidified ethanol and highlight the difference between two.

34. Write a short note on ^{13}C NMR.

35. What are the different factors governing drug-design?

36. What is Ibuprofen? Discuss its medicinal applications.

37. Discuss the medicinal applications of salicylic acid.

38. How can you convert indole to quinoline?

($6 \times 4 = 24$ Marks)

SECTION – D

Long Essay

(Answer **any two** questions from the following. Each question carries **15** marks)

39. What are the twelve principles of green chemistry? Explain.

40. (a) Discuss the basic principles of NMR spectroscopy. **10**

    (b) Propose a structure for the following compound.

    ^{1}H NMR spectrum of $C_5H_6Br_2$: δ 1.90 (quintet, 2H) δ 2.28 (triplet, 4H) **5**

41. (a) How can *cis* and *trans* alkenes be distinguished using UV-Vis spectroscopy?

    (b) Propose a structure for the following compound : **8**

    ^{1}H NMR spectrum of $C_5H_8O_2$: δ 1.90 (multiplet, 4H), δ 2.40 (triplet, 2H), δ 4.26 (triplet, 2H) **7**

42. Discuss the importance of Franck-Condon principle in electronic spectroscopy.

43. Discuss the importance of heterocyclic compounds in medicine.

44. What is rational approach to drug design?

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **P – 2864**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme Under CBCSS

Chemistry and Industrial Chemistry

Vocational Course V

IC 1571 : INDUSTRIAL CHEMISTRY III

(2013-2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Cyclohexanone is converted in to caprolactum using ———— rearrangement.

2. For Fries rearrangement, a low reaction temperature favors ———— substitution.

3. ———— ylides are used in Wittig reaction.

4. Buna-N is copolymer of ———— and acrylonitrile.

5. Nylon 6,6 is manufactured from ———— and ————

6. Eryzole is an example of a ————

7. The pink colour of phenolphthalein is due to ———— structure.

P.T.O.

8. ‘Crystal violet gives ———————— colour in weakly acidic solution.

9. Aniline is ———————— basic than 2-nitoaniline.

10. TNT is prepared from toluene using ———————— and ————————

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. **Each** question carries **2** marks.

11. What is the stereochemistry of MPV reduction?

12. What is Reimer-Tiemann reaction?

13. What is pinacole - pinacolone rearrangement?

14. What are the methods used to determine number average molecular weight of a polymer?

15. What is Ziegler — Natta catalyst?

16. What are the advantages of synthetic resins over natural resins?

17. What is the most common side effect of sulfa drugs?

18. How will you prepare 1,3-dinitrobenzene?

19. How will you distinguish between secondary and tertiary amines?

20. What are the importances of quaternary ammonium compounds?

21. What is the main text of identification of primary amines?

22. What is Hoffmann elimination?

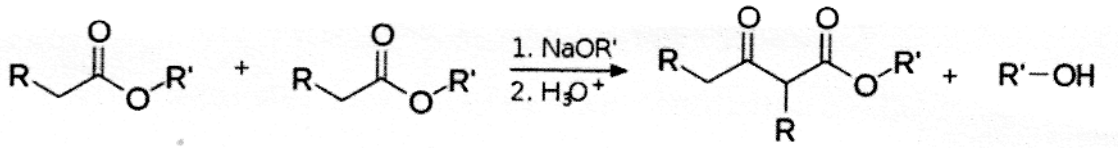
(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

23. What is the difference between Gattermann reaction and Gattermann Koch reaction?

24. Discuss the mechanism of the following reaction:



25. What is Perkin reaction? Discuss its mechanism

26. Discuss the synthesis and applications of Buna — N rubber.

27. Briefly explain the synthesis and uses of malachite green.

28. Discuss a method of preparation of benzene sulfonic acid.

29. Discuss the preparation and use of sulfanilic acid.

30. Discuss the effect of substituents on the basicity of aliphatic amines

31. Briefly explain the preparation and uses of diazonium compounds

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. **Each** question carries **15** marks.

32. Explain the mechanism and stereochemistry of

    (i) Beckmann rearrangement and

    (ii) Fries rearrangement

33. Explain the synthesis and applications of

    (i) urea formaldehyde resin and

    (ii) Bakelite.

34. Explain the preparation and use of

    (i) benzene sulfonyl chloride and

    (ii) sulfathiazole.

35. Explain the general method of preparation and main reactions of aniline. What are the uses of aniline?

(2 × 15 = 30 Marks)

———————

(Pages : 3) **P – 2865**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme Under CBCSS

Chemistry and Industrial Chemistry

Vocational Course VI

IC 1572 : INDUSTRIAL CHEMISTRY IV

(2013-2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Pyrrole is ———————— basic than pyridine.

2. The major compound obtained when furan is nitrated at with acetyl nitrate is ————————

3. Indole undergoes electrophilic substitution at ———————— position.

4. Sedatives come under the class of ————————drugs.

5. For organic reactions ————————are considered as the best green chemistry solvent.

6. Benzophenone gives ————————absorption peaks in its UV spectrum.

7. In IR spectrum. stretching vibration bands have ————————values than bending vibration bands.

P.T.O.

8. The number of peaks for ethyl alcohol in ^{1}H-NMR spectrum is ————————

9. ———————— is used as a standard for NMR

10. Highest m/z peak in mass spectrum is called as ————————

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. **Each** question carries **2** marks.

11. Compare the aromaticity of furan and thiophene.

12. Write a method for the preparation of furan.

13. What is the reduction product of quinoline?

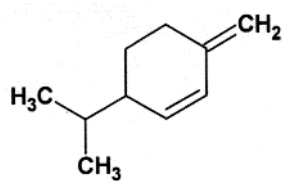
14. What is the first step of rational drug design?

15. What is the structure of aspirin?

16. What are the main IR spectral bands in phenol?

17. What are chromophores?

18. Calculate the λmax for the following compound:



19. What is the importance of finger print region in IR spectrum?

20. What is shielding effect in NMR?

21. What is coupling constant?

22. What is McLafferty rearrangement?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

23. Discuss a method of preparation of indole. What are its properties?

24. Discuss the importances of heterocyclic compounds in biochemistry

25. Discuss the mechanism of electrophilic substitution in quinoline

26. Discuss the effect of conjugation on the on UV absorption spectrum

27. Discuss the effect of hydrogen bonding on IR frequency values

28. Draw the IR spectrum of benzaldehyde and indicate the IR bands

29. Discuss the various factors affecting chemical shift in NMR

30. Draw the proton NMR spectrum of ethyibromide and indicate the peaks

31. Draw the mass spectrum of 2-methyl acetophenone and indicate the fragmentation pattern

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. **Each** question carries **15** marks.

32. Explain the methods of preparation and properties of furan and pyrrole.

33. Explain the principles of green chemistry.

34. Explain the Infrared spectroscopy and its applications.

35. Explain the various types of fragmentation in Mass spectrometry.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **P – 2866**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme under CBCSS

Chemistry & Industrial Chemistry

Core Course – XI

IC 1541 : ORGANIC CHEMISTRY – II

(2018 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. Define saponification value of an oil.
2. Draw the structure of 18-crown-6.
3. Give the name of an aldopentos.
4. Which vitamin is known as antihemorrhagic vitamin?
5. Draw the structure of L-glyceraldehyde.
6. Which hormone is used in obstetrics to induce labor in pregnant women?
7. What is a symmetry element?
8. Among tryptophan, alanine, glycine, which is a heterocyclic amino acid?
9. What are the building blocks of proteins?
10. What is role of trifluoro acetic acid (TFA) in peptide synthesis?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions. Each question carries **2** marks

11. What are metalloenzymes?

12. Write the chemical equation for the reaction between an α-amino acid and $LiAlH_4$.

13. Explain the chemistry of any one colour tests for the identification of proteins.

14. Give a laboratory test to illustrate reducing nature of glucose.

15. How methylmagnesiuin bromide is prepared?

16. What are the industrial applications of cellulose?

17. What are anomers?

18. Explain the cofactor of an enzyme.

19. Suggest a suitable method for the preparation of aliphatic carboxylic acids. Illustrate with an example.

20. How will you convert chlorobenzene to benzoic acid?

21. What are diterpenes? Give its general formula.

22. Draw the structure of the compound (*E*)-1-chloro-2-methylbut-1-ene.

23. What is meant by a prosthetic group in enzymes?

24. What is anthranilic acid? Give any two uses of anthranilic acid.

25. Draw the Fischer projection formula for D-glyceraldehyde and L-glyceraldehyde.

26. What are alkaloids?

(8 $\times$ 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Each question carries **4** marks.

27. Write a note on sequence rules.

28. Write a note on the classification of enzymes.

29. Discuss β-pleated structure of proteins.

30. Explain the effect of substituents on the acidity of aliphatic and aromatic carboxylic acids.

31. How carbohydrates are classifieds? Explain.

32. Explain the reactions involved in Ruff degradation.

33. Give the structure and chemical name of vitamin C? What are its major sources? Name the disease caused by its deficiency.

34. Write a note on replication of DNA.

35. Explain Gabriel's phthalimide synthesis of amino acids.

36. Discuss the structure elucidation of glucose.

37. Explain Biuret test for proteins.

38. Write a note on organozinc reagents.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each question carries **15** marks.

39. Write an essay on the extraction and structural elucidation of nicotine.

40. Explain :
    (a) Optical activity of allenes and biphenyls.
    (b) Geometrical isomerism and E-Z systems of nomenclature.

41. Discuss :

    (a) Ascent and descent series in aliphatic carboxylic acids.

    (b) Crown ethers.

42. Explain :

    (a) Structure of nucleic acids.

    (b) Genetic code.

43. Discuss about :

    (a) Salient features of enzymes.

    (b) Preparation and synthetic applications of Grignard reagents.

44. Write a note on :

    (a) Interconversion of glucose and fructose.

    (b) Mutarotation.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **P – 2867**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme under CBCSS

Chemistry & Industrial Chemistry

Vocational Course – V

IC 1571 : INDUSTRIAL CHEMISTRY – III

(2018 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. What is Claisen condensation reaction?
2. Explain Wittig reaction with an example.
3. Give the mechanism of Fries rearrangement.
4. What is PMMA?
5. What is the monomer of natural rubber?
6. Give the structure of phenolphthalein.
7. Give one method of preparation of toluene sulphonic acid.
8. Depict the tautomeric forms of nitroalkane.
9. Compare the basicity of aliphatic and aromatic amines.
10. Mention the medicinal importance of sulphapyridine.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Short answer type.

Answer **any eight** questions. Each question carries **2** marks.

11. Explain Gattermann aldehyde synthesis with an example.
12. Describe the mechanism of Reimer-Tiemann reaction.
13. What is addition polymerization?
14. Explain benzidine rearrangement with possible mechanism.
15. Give the method of preparation and uses of Buna-S.
16. Define number average molecular weight of a polymer.
17. How does benzene sulphonyl chloride react with aniline?
18. Give the method of preparation of sulphaguanidine from nitrobenzene.
19. Draw the structure of sulphathiazole.
20. Explain carbylamine reaction and its applications.
21. Give any two reduction reactions of nitrobenzene.
22. What are quaternary ammonium salts? Give its one method of preparation.
23. Give the preparation of methyl orange.
24. Explain the effect of substituents on the basicity of aniline.
25. What are composites? Mention their advantages.
26. How will you prepare cinnamic acid from benzaldehyde?

($8 \times 2 = 16$ Marks)

SECTION – C

Short essay

Answer **any six** questions. Each question carries **4** marks.

27. How primary, secondary and tertiary amines are separated from a mixture?
28. Give one method of preparation of nitro alkanes and nitro arenes.
29. Explain the mechanism of Knovenagel condensation.
30. What is Perkin reaction? Mention its importance.
31. Describe the mechanism of pinacol-pinacolone rearrangement.
32. Give the preparation and uses of urea-formaldehyde resins.
33. Explain coordination polymerization reaction with an example.
34. Give the synthesis and uses of crystal violet.
35. Discuss the classification of dyes based on application.
36. Give the preparation and uses of PS and PVC.
37. Discuss the preparation and synthetic applications of diazo compounds.
38. Draw the structure of sulfacetamide. Give its preparation and uses.

($6 \times 4 = 24$ Marks)

SECTION – D

Long essay

Answer **any two** questions. Each question carries **15** marks.

39. Discuss the mechanism of the reactions.
    (a) MPV reaction
    (b) Beckmann rearrangement
    (c) Cannizzaro reaction

40. Discuss the theories of colour and constitution of dyes.

41. (a) Explain the preparation and uses of bakelite and nylone-6,6 **10**

    (b) Write short note on biodegradable polymers. **5**

42. Discuss the preparation, structure and synthetic applications of diazonium salts.

43. Write short note on the following :

    (a) Preparation and synthetic applications of sulphanilic acid

    (b) Preparation and uses of fluorescein

    (c) Give the resonance structures of nitrobenzene and aniline.

44. Discuss the different methods to distinguish primary, secondary and tertiary amines.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **P – 2868**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

Vocational Course VI

IC 1572 – INDUSTRIAL CHEMISTRY IV

(2018 Admission onwards)

Time : 3 Hours Max. Marks : 80

SECTION A

(Very short answer questions)

Answer **all** questions. Each question carries **1** mark.

1. Draw the structure of indole and isoquinoline.

2. Name a purine derivative found in both DNA and RNA.

3. Draw the structure of Indole.

4. Draw the structure of salol.

5. Give any one example for a chromophore.

6. How many signals are observed in the low resolution ^{1}H NMR spectrum of pure ethanol.

7. Name the spectroscopic method used to find the exact molecular mass of volatile organic compounds.

8. Which isotope of carbon is NMR active?

9. Predict the m/z value of base peak in the mass spectrum of acetone.

10. Name the spectroscopic method most suitable to detect the presence of chlorine in an organic compound.

(10 × 1 = 10 Marks)

SECTION B

(Short answer questions)

Answer any **eight**. Each question carries **2** marks.

11. Explain the aromatic character of furan.

12. Give any two examples for electrophilic substitution reactions of pyridine.

13. Outline any one method of synthesis of thiophene.

14. What is the product obtained when pyrrole is completely hydrogenated using H_2 and Pt?

15. Draw the structure of ibuprofen.

16. Name any two six membered fused ring nitrogen heterocyclic compounds and their structural formula.

17. Name any two nucleophilic substitution reactions given by pyridine.

18. Name any two drugs that are derived from salicylic acid. Point out their uses.

19. What is meant by n - π^* and $\pi - \pi^*$ transitions? Illustrate with an example.

20. Point out any two applications of UV-VIS spectroscopy.

21. What are the major peaks in the IR spectrum of acetone?

22. Which spectroscopic method is most suitable to distinguish propionaldehyde from acetone?

23. What type of organic compounds absorb in the UV-VISIBLE region.

24. Give any one method of preparation of pyridine.

25. Sketch and explain the low resolution ^{1}H NMR spectrum of pure ethanol.

26. What is coupling constant in 'H NMR?

(8 × 2 = 16 Marks)

SECTION C

(Short essay questions)

Answer any **six**. Each question carries **4** marks.

27. What are chromophores and auxochromes in organic dyes? Illustrate with an example.

28. Discuss the classification of drugs on their molecular structure with examples.

29. What is the difference between base peak and molecular ion peak in mass spectroscopy?

30. What is McLafferty rearrangement? Illustrate with an example.

31. What is the finger print region in IR spectra?

32. Explain the synthesis of isoquinoline. Give the chemical equations.

33. What is meant by isotope effect in mass spectroscopy?

34. What are bathochromic shift and hypsochromic shift?

35. What is major difference between the ^{1}H NMR spectrum of pure ethanol and impure ethanol (containing acidic impurities)?

36. Explain spin-spin spliting in ^{1}H NMR.

37. Compare the basicity of five membered heterocyclics pyrrole, furan and thiopene.

38. Explain one method of synthesis of quinolone.

(6 × 4 = 24 Marks)

SECTION D

(Long Essay Questions)

Answer any **two**. Each question carries **15** marks.

39. Discuss the mechanism of electrophilic substitution reactions of pyridine.

40. Explain the term chemical shift in NMR spectrum? What are the factors that can affect the chemical shift? Explain the shielding and desheilding effects in ^{1}H NMR.

41. Explain the various modes of vibration possible for CO_2, which of them are IR active? Discuss the applications of IR spectroscopy.

42. Write a note on the principles of green chemistry.

43. Discuss the theory of mass spectrum and explain different type of fragmentations.

44. Explain the synthesis of furan. How does furan reacts with following reagents? Give chemical equations.
    (a) Br_2/Dioxane ; 0°C
    (b) HNO_3/Acetic anhydride ; 10°C
    (c) SO_3/Pyridine ; 100°C
    (d) Acetic anhydride/BF_3
    (e) Maleic anhydride/100°C

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 1608**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Group 2(a) – Chemistry and Industrial Chemistry

Core Course

IC 1641: PHYSICAL CHEMISTRY III

(2014 & 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

(Answer **all** questions **each** question carries **1** mark)

1. Give an example for fractional order reactions.

2. What is the unit of k in zero order reaction?

3. What is reduced phase rule?

4. Define efflorescence.

5. If the standard reduction potentials of Zn/Zn^{2+} and Ag/Ag^{+} are –0.76 V and +0.80 V respectively, for the cell obtained by coupling these electrodes, calculate the standard EMF of the cell.

6. Give one example for photosensitization reaction.

7. The unit for specific conductance is

P.T.O.

8. Represent a galvanic cell.

9. Define instantaneous rate of reaction

10. Define Grotthuss-Draper law.

($10 \times 1 = 10$ Marks)

SECTION – B

(Answer any **eight** questions **each** question carries **2** marks)

11. What are called non-radiative transitions?

12. At $25^{\circ}C$ the molar conductance of dilute solution of acetic acid is $15.0\,S\,m^2\,mol^{-1}$ and the molar conductance at infinite dilution (is $390.0\ S\,m^2\,mol^{-1}$). The degree dissociation of the acetic acid is?

13. The mole fraction of a volatile solvent is 0.8. The relative vapour pressure lowering of a non-volatile solute dissolved in it is?

14. Define lower critical solution temperature.

15. Define meta stable equilibrium.

16. Define deliquescence

17. Calculate the time required for the completion of 99% of the first order chemical reaction with half life of 6.93 minutes.

18. What is liquid junction potential and how it can be eliminated?

19. Explain Pattinson's process.

20. If 50% of a reaction occurs in 100 seconds and 75% of the reaction occurs in 200 seconds, the order of this reaction is ?

21. Define Debye-Falkenhagen effect.

22. Define Nerst distribution law.

($8 \times 2 = 16$ Marks)

SECTION – C

(Answer any **six** questions **each** question carries **4** marks)

23. Calculate the liquid junction potential associated with the following cell.

    $Ag(s)\,|\,AgCl(s)\,|\,HCl(=1.0,\ ::HCl((=0.05\,|\,AgCl(s)\,|\,Ag(s)$. If the transport number of H^+ is 0.83.

24. Explain the determination of transport number by moving boundary method.

25. Derive second order integrated rate expression.

26. Why phosphorescence in called delayed fluorescence?

27. Explain intermediate compound formation theory in catalysis.

28. Explain the phase diagram of solid gas system by taking $CaCO_3$ as an example.

29. How is pH of a solution determined using hydrogen electrode?

30. Explain distribution law to the study of association of molecules and dissociation of molecules.

31. Derive the rate expression for the H_2-Cl_2 photochemical reaction.

($6 \times 4 = 24$ Marks)

SECTION – D

(Answer any **two** questions. **Each** question carries **15** marks)

32. (a) Derive thermodynamically the law of mass action.

    (b) Explain enzyme catalysis and Michaelis Menten law.

33. (a) Derive equation for EMF of concentration cell with and without transference

    (b) Explain theory of absolute reaction rate or transition state theory

34. (a) Discuss Debye-Huckel-Onsager equation.

(b) Discuss the methods of determination of order of reactions.

35. (a) Derive Van't Hoff equation for temperature dependence of the equilibrium constant.

(b) The equilibrium constant of a reaction doubles on raising the temperature from 25 C to 35 C. Calculate for the reaction.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 1609**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

IC 1641 — PHYSICAL CHEMISTRY – III

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

(Answer **all** questions each carries **1** mark)

1. Give an example for fractional order reactions.
2. What is the unit of k in zero order reaction?
3. What is reduced phase rule?
4. Define efflorescence
5. If the standard reduction potentials of Zn/Zn^{2+} and Ag/Ag^{+} are –0.76 V and +0.80 V respectively, for the cell obtained by coupling these electrodes, calculate the standard EMF of the cell.
6. Give one example for photosensitization reaction.
7. The unit for specific conductance is.
8. Represent a galvanic cell.
9. Define instantaneous rate of reaction.
10. Define Grotthuss-Draper law.

(10× 1 = 10 Marks)

P.T.O.

SECTION – B

(Answer **any eight** questions each question carries **2** marks)

11. What are called non-radiative transitions?

12. At 25 C the molar conductance of dilute solution of acetic acid is 15.0 S m^2 mol^{-1} and the molar conductance at infinite dilution (is 390.0 S m^2 mol^{-1}. The degree dissociation) of the acetic acid is.

13. The mole fraction of a volatile solvent is 0.8. The relative vapour pressure lowering of a non-volatile solute dissolved in it is.

14. Define lower critical solution temperature.

15. Define meta stable equilibrium.

16. Define deliquescence.

17. Calculate the time required for the completion of 99%, of the first order chemical reaction with half life of 6.93 minutes.

18. What is liquid junction potential and how it can be eliminated?

19. Explain Pattinson's process.

20. If 50% of a reaction occurs in 100 seconds and 75% of the reaction occurs in 200 seconds, the order of this reaction is.

21. Define Debye-Falkenhagen effect.

22. Define Nerst distribution law.

(8 × 2 = 16 Marks)

SECTION – C

(Answer **any six** questions. **Each** question carries **4** marks)

23. Calculate the liquid junction potential associated with the following cell.

    Ag(s) | AgCl(s) | HCl (=1.0, :: HCl ((0.05 | AgCl(s) | Ag(s). If the transport number of H^- is 0.83.

24. Explain the determination of transport number by moving boundary method.

25. Derive second order integrated rate expression.

26. Why phosphorescence in called delayed fluorescence?

27. Explain intermediate compound formation theory in catalysis.

28. Explain the phase diagram of solid gas system by taking $CaCO_3$ as an example.

29. How is pH of a solution determined using hydrogen electrode?

30. Explain distribution law to the study of association of molecules and dissociation of molecules.

31. Derive the rate expression for the $H_2 - Cl_2$ photochemical reaction.

32. How to determine from emf data?

33. How to determine Arrhenius parameters?

34. What is electrochemical series? Briefly explain two of its uses.

35. Discuss Kohlrauss's law and its applications.

36. Derive second order rate equation by collision theory.

37. Explain Clausius-Claypeyron equation and its uses.

38. Explain Lindman theory of unimolecular reactions.

($6 \times 4 = 24$ Marks)

SECTION – D

(Answer any **two** questions. **Each** question carries **15** marks)

39. (a) Derive thermodynamically the law of mass action.

    (b) Explain enzyme catalysis and Michaelis Menten law.

40. Explain conductometric titrations of the following :

    (a) Weak acid strong base

    (b) Precipitation

    (c) Weak acid weak base

    (d) Strong acid weak base

    (e) Strong acid and strong base.

41. (a) Explain thermodynamic derivation of phase rule.

(b) Explain phase diagram of sulphur system.

42. (a) Derive equation for EMF of concentration cell with and without transference.

(b) Explain theory of absolute reaction rate or transition state theory.

43. (a) Discuss Debye-Huckel-Onsager equation.

(b) Discuss the methods of determination of order of reactions.

44. (a) Derive Van't Hoff equation for temperature dependence of the equilibrium constant.

(b) The equilibrium constant of a reaction doubles on raising the temperature from 25 C to 35 C. Calculate for the reaction.

($2 \times 15 = 30$ Marks)

(Pages : 3) **N – 1610**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Vocational Course

IC 1671 – INDUSTRIAL CHEMISTRY V

(2014 & 2017 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. question carries **1** mark

1. What is meant by Condensation procedure in Sulfonation?

2. Which is the coldest region of atmosphere?

3. Which isomer is formed as the result of aromatic bromination reaction catalyzed by the Lewis acid thalium acetate?

4. What are secondary pollutants? Give an example.

5. Suggest the product of the oxidation of aromatic hydrocarbons with potassium permanganate?

6. By international convention, which line marks the outermost boundary of the Earth's atmosphere?

7. Diolefins undergo catalytic hydrogenation to produce which type of hydrocarbon?

P.T.O.

8. Suggest the product formed when an alcohol refluxing with Cr_2O_7?

9. Name the product of Friedel-Crafts Acylation reactions.

10. When H_2SO_4 is used as a Sulfonating agent, what effect does formation of water has on the reaction?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions each question carries **2** marks

11. Give any four commercially important hydrogenation agents.

12. Discuss the manufacturing of acetaldehyde.

13. Discuss the effect of chloroflourocarbons in air quality parameters?

14. What are the health effects of oxides of sulpher?

15. Discuss the commercial sulphonation process of alkylbenzene.

16. Suggest the industrial manufacturing of monochloroacetic acid.

17. How CFCs affect the ozone layer?

18. Discuss the effect of dioxans in the air quality parameters?

19. Discuss the commercial manufacturing of benzoic acid.

20. Give the names and formula of any four sulphonation agents.

21. Explain the hydrogenation of vegetable oils.

22. Briefly describe about the soil environment.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions question carries **4** marks.

23. Write a note on catalytic reformation.

24. Elaborate aromatic halogenation reactions. Explain with mechanism.

25. Discuss the kinetics and detailed mechanism of halogenation of alkanes.

26. Discuss the mechanism of hydrogenation of acids to alcohols.

27. Explain the commercial preparation of the following compounds:

    (a) maleic anhydride and

    (b) acrolein.

28. Discuss about biosphere.

29. Discuss the kinetics and mechanism of liquid phase oxidation.

30. Briefly discuss different causes of air pollution

31. Discuss the industrial preparation of methanol from CO and H_2.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions carries **15** marks.

32. Discuss the commercial sulphonation of naphthalene and alkyl benzene. Discuss the mechanism also.

33. Give a detailed discussion on the structure and composition of atmosphere.

34. (a) Discuss about hydrogenation of vegetable oils.

    (b) Write a note on synthesis of

        (i) acetyl anhydride and

        (ii) phthalic anhydride. (8+7=15)

35. Discuss about different reasons of air pollution. What are the remedies to reduce air pollution? Explain.

(2 × 15 = 30 Marks)

———————

(Pages : 3) **N – 1611**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

IC 1671 : INDUSTRIAL CHEMISTRY – V

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark

1. What is meant by Condensation procedure in Sulfonation?
2. Which is the coldest region of atmosphere?
3. Which isomer is formed as the result of aromatic bromination reaction catalyzed by the Lewis acid thalium acetate?
4. What are secondary pollutants? Give an example.
5. Suggest the product of the oxidation of aromatic hydrocarbons with potassium permanganate?
6. By international convention, which line marks the outermost boundary of the Earth's atmosphere?
7. Diolefins undergo catalytic hydrogenation to produce which type of hydrocarbon?
8. Suggest the product formed when an alcohol refluxing with Cr_2O_7?
9. Name the product of Friedel-Crafts Acylation reactions.
10. When H_2SO_4 is used as a Sulfonating agent, what effect does formation of water has on the reaction?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions. **Each** question carries **2** marks.

11. Discuss the working of catalytic convertors in automobiles.
12. Give any four commercially important hydrogenation agents.
13. Discuss the manufacturing of acetaldehyde.
14. Discuss the effect of chloroflourocarbons in air quality parameters?
15. Discuss the Tyrer sulfonation process.
16. What are the health effects of oxides of sulpher?
17. Write a note on environmentally benign refrigents.
18. Write a note on catalytic hydrogenation.
19. Discuss the commercial sulphonation process of alkylbenzene.
20. Suggest the industrial manufacturing of monochloroacetic acid.
21. How CFCs affect the ozone layer?
22. Discuss the effect of dioxans in the air quality parameters.
23. Discuss the commercial manufacturing of benzoic acid.
24. Give the names and formula of any four sulphonation agents.
25. Explain the hydrogenation of vegetable oils.
26. Briefly describe about the soil environment.

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **4** marks.

27. Elaborate aromatic halogenation reactions. Explain with mechanism.
28. Write a note on catalytic reformation.
29. Discuss the kinetics and detailed mechanism of halogenation of alkanes.
30. Write a note on sulphonation of benzene.
31. Discuss the mechanism of hydrogenation of acids to alcohols.
32. Explain the commercial preparation of the following compounds
    (a) anhydride and
    (b) acrolein.

33. Discuss about biosphere.

34. Discuss different types of oxidation reactions.

35. Discuss the kinetics and mechanism of liquid phase oxidation.

36. Briefly discuss different causes of air pollution.

37. Discuss the industrial preparation of methanol from CO and H_2.

38. Discuss the importance of clean air.

($6 \times 4 = 24$ Marks)

SECTION – D

Answer **any two** questions. **Each** question carries **15** marks

39. Discuss in detail the kinetics and mechanism of liquid phase and vapour phase oxidation.

40. Discuss the commercial sulphonation of naphthalene and alkyl benzene. Discuss the mechanism also.

41. Give a detailed discussion on the structure and composition of atmosphere.

42. (a) Discuss about hydrogenation of vegetable oils.
    (b) Write a note on synthesis of
        (i) acetyl anhydride and
        (ii) phthalic anhydride.

(8+7=15)

43. (a) Write a note on the harmful effects of persistent organic pollutants and oxides of nitrogen in environment.
    (b) Discuss commercial synthesis of methanol from CO and H_2.

(10+5=15)

44. Discuss about different reasons of air pollution. What are the remedies to reduce air pollution? Explain.

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 1612**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Vocational Course

IC 1672 – INDUSTRIAL CHEMISTRY VI

(2014 & 2017 Admission)

Time : Three Hours Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in one word to maximum two sentences. **Each** question carries **one** mark.

1. What is green belt?

2. What are pesticides?

3. What is meant by cold trapping?

4. What causes radioactive pollution?

5. What are the major air pollutants?

6. Distinguish between anthropogenic and non-anthropogenic pollutants.

7. What are particulates?

8. What is water softening?

P.T.O.

9. Define noise pollution.

10. What is sewage?

(10 × 1 = 10 Marks)

SECTION – B

Short answer type. Answer any **eight** questions from the following. **Each** question carries **2** marks.

11. What are the effects of thermal pollution on aquatic environment?

12. Define BOD.

13. What are the different sampling methods for the particulate matter?

14. What are the major sources of water pollution?

15. What are the control measures for soil pollution?

16. Explain deep well injection.

17. What are the basic parameters which affect water quality?

18. What is reverse osmosis?

19. Explain dissolved oxygen meter method for the determination of BOD.

20. Explain the sampling method sedimentation for particulate analysis.

21. What are the safe disposal methods for radioactive pollutants?

22. What are the important methods to control water pollution?

(8 × 2 = 16 Marks)

SECTION – C

Short essay type. Answer any **six** *questions from the following.* ***Each*** *question carries* **4** *marks.*

23. Explain Eutrophication.

24. Distinguish between biomagnification and bioaccumulation.

25. Write a brief note on cyclone collectors.

26. Explain any one methods used for the determination of nitrate present in polluted water.

27. Give an account of oil spill and marine pollution.

28. Explain USAB technology used in wastewater treatment.

29. Discuss the various solid waste disposal methods.

30. Compare the advantages of aerobic and anaerobic treatment processes.

31. Why are two catalytic reactors necessary to control all major automotive exhaust pollutants? Explain.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** *questions.* ***Each*** *question carries* ***15*** *marks*

32. Write an essay on the three stages of waste water treatment.

33. Write an essay on the analytical methods for the determination of CO, SO_2, and H_2S.

34. Explain the principle and working of

(a) Cottrel electrostatic precipitator.

(b) Gravitational settling chamber.

35. Discuss about

(a) Self-purification capacity of water bodies.

(b) Anthropogenic impacts on environment.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 1613**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

IC 1672 : INDUSTRIAL CHEMISTRY VI

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions **each** carries **1** mark.

1. What is the difference between pollutant and contaminant?
2. What is the basic mechanism of removing particulate matter from gas stream?
3. What are fabric filters?
4. How to detect phosphate content in water?
5. What is called cold trapping in air pollution?
6. What are the causes of thermal pollutions?
7. Name two non anthropogenic pollutions.
8. How to reduce noise pollutions?

P.T.O.

9. What are trickling filters?

10. What are impingers?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions **each** question carries **2** marks.

11. What is deep well injection?

12. What are the advantages of COD over BOD?

13. What is eutrophication?

14. Explain IPM.

15. How to determine acidity of water?

16. What are the sources of soil pollution?

17. Depict the fate of pollutants in aquatic systems.

18. Write a short note on power generation pollutions.

19. How green belt reduces air pollution?

20. How catalytic convectors reduce air pollutions?

21. Write a brief account on cyclone collectors.

22. Explain the basic principle of Cottrell electrostatic precipitator.

23. How thermal precipitators are used in air pollution?

24. Describe analytical method for the determination of particulate matter.

25. What are the consequence of oil pollution?

26. Other than bleaching powder name any two disinfectants used for water purification. Why bleaching powder preferred over other disinfectant for municipal supplies?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions **each** question carries **four** marks.

27. What is the main objective of the sewage treatment? Describe various process involved in primary treatment of sewage.

28. What are the sources of acidity and salinity of water body? Discuss briefly its control measures.

29. Why is the value of COD is always greater than the BOD.

30. Mention methods of safe disposal of nuclear wastes.

31. Give major after effects of water pollution.

32. Distinguish between primary and secondary air pollutions.

33. Give different method for sludge digestion and elaborate method.

34. Explain biomagnifications by taking DDT as an example.

35. Explain the extractor ventilator and zoning.

36. Explain the principle and procedure for the determination of BOD.

37. Explain the Winkler's method for the determination of dissolved oxygen.

38. Explain UASB process.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions **each** question carries **15** marks.

39. (a) Noise pollution

    (b) Radio active pollution

40. Write a brief notes on industrial waste water treatments.

41. Write detailed notes on solid waste management.

42. What do you understand by water quality parameters and water quality standards? Which is the organization responsible for setting water quality standards in India?

43. What are the analytical methods for the determination of CO, NO_x and SO_x.

44. What are the major air pollution control measures?

($2 \times 15 = 30$ Marks)

———————

(Pages : 4) **N – 1614**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Chemistry and Industrial Chemistry

IC 1661.1 : SUPRAMOLECULAR, NANO PARTICLES AND GREEN CHEMISTRY

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. What is the chemical responsible for the Bhopal gas tragedy?

2. Write the structure of Ibuprofen.

3. What are green catalysts?

4. One billionth of a meter is?

5. What is the famous statement by the scientist Richard Feynman?

6. Give any two scanning probe instruments used for nanoparticle characterization.

7. What is the dimension of quantum dots?

8. What are the synonyms for molecular recognition?

P.T.O.

9. Write any two examples of molecular receptors

10. What is oligocyclic crown ethers?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. What are SCFs? Give example.

12. Write a note on green solvents.

13. Explain ionic liquids.

14. Explain the basis of green chemistry.

15. What do you mean by nanofabrication?

16. Write a short note Sol-Gel synthesis.

17. Write chemical precipitation method for the synthesis of nanoparticles.

18. Mention any catalytic property of nanoparticle.

19. Briefly mention STM.

20. Write a short note on the mechanical properties of nanoparticles.

21. Explain hydrophobic interaction and its importance.

22. Write a short note on the significance of Hydrogen bonding in molecular recognition.

23. What are the different types of Vander Waal's force involved in molecular recognition?

24. Write a short note on Cyclophanes.

25. What are receptors? Explain using endoreceptors and exoreceptors.

26. Draw and explain the structural aspects of cyclodextrin

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Write a short note on Bhopal gas tragedy.

28. How do chemical environments pollute the environments?

29. What are microwave assisted organic synthesis?

30. What is atom economy? How can it be calculated?

31. Explain the statement using suitable examples. “Nanoparticles are not new but nanotechnology is new”.

32. Explain different methods of synthesis of nanoparticles.

33. Describe the optical and thermal properties of nanoparticles.

34. Write briefly about STM in the characterization of nanoparticles.

35. What is molecular recognition chemistry?

36. Write a short note on some of the host molecules.

37. Explain molecular recognition in biomolecules.

38. Discuss any application of supramolecules

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. Define green chemistry via green synthesis, solvents and auxiliaries.

40. Explain the principles of Green Chemistry.

41. State the features of carbon nanotubes and fullerenes.

42. Explain different applications of nanomaterials.

43. Describe the forces involved in Supramolecular recognition chemistry.

44. Write notes on Cryptands, Cyclodextrin and Calixarenes.

(2 × 15 = 30 Marks)

———————

(Pages : 4) **N – 1616**

Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2022

Career Related First Degree Programme under CBCSS

Group 2(a) Chemistry and Industrial Chemistry

Elective Course

IC 1661.3 : POLYMER CHEMISTRY

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

Answer in one word to maximum of two sentences.

1. Write the structure of Neoprene.
2. Name one polyester. Give any one uses of it.
3. What is a homo polymer?
4. What is the role of inhibitors in polymerisation? Give one example of an initiator.
5. State any one use of polycarbonates.
6. Write about the relationship between molecular weight and degree of polymerisation.
7. What is meant by film casting?

P.T.O.

8. What is vulcanisation?

9. Define the term Poly dispersity index.

10. Give the monomers used in the synthesis of ABS.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type (Not to exceed one paragraph)

Answer **any eight** questions. Each question carries **2** marks.

11. Explain with an example the term functionality.

12. State the difference between an elastomer and a fiber.

13. What is Bakelite?

14. What are the advantages of bulk polymerization?

15. Briefly discuss applications of melamine-formaldehyde resins.

16. What is CMC?

17. Why is polyvinyl acetate used as a adhesive?

18. What are the factors that affect crystalinity in polymers?

19. Write the carothers equation and explain the terms in it.

20. How is crystallinity of a polymer sample is expressed?

21. Give the importance of thermoforming in plastic industry.

22. What is photodegradation?

23. What is Ziegler Natta catalyst? Give its use.

24. What is a graft polymer?

25. Why is the processing of PTFE is difficult?

26. What is cross linked polymer? How does cross linking affect the properties of a polymer?

(8 × 2 = 16 Marks)

SECTION – C

Short Essay (Not to exceed **120** words)

Answer **any six** questions. Each question carries **4** marks.

27. Distinguish between thermosetting and thermoplastic materials.

28. Briefly discuss the mechanism of addition polymerisation.

29. Distinguish between a graft copolymer and block copolymer?

30. What are the factors affecting GTT of a polymer?

31. Write a short note on compression moulding.

32. What is polymer degradation? Discuss briefly about thermal degradation.

33. Give the synthesis and applications of polycarbonate.

34. Name one polyamide and give its method of preparation.

35. Explain the importance of Tg and its relationship with Molecular weight.

36. What is Rayon? Briefly discuss it's manufacturing method.

37. Write a short note on various grades of PVC and illustrate the advantages and disadvantages of PVC.

38. Briefly discuss the mechanism of addition polymerisation.

(6 × 4 = 24 Marks)

SECTION – D

Long essay

Answer **any two** questions. Each question carries **15** marks.

39. What are polymers? How are they classified?

40. Give the method, use and advantages of suspension polymerisation over bulk polymerisation and give the salient features of the above mentioned polymerisation technique.

41. Discuss the preparation, properties and uses of

    (a) HDPE

    (b) SBR

    (c) PVC

42. What are the different ways of expressing the molecular weight? Discuss each type in detail and also write short note on light scattering method of determination of Molecular weight of polymers.

43. Write about glass transition temperature. What are the factors affecting Tg? Give the relationship between Tg and Tm.

44. Give a brief account of various derivatives cellulose and it's importance.

(2 × 15 = 30 Marks)

———————