DELHI PUBLIC SCHOOL

STEEL TOWNSHIP, ROURKELA

HOLIDAY HOME ASSIGNMENT

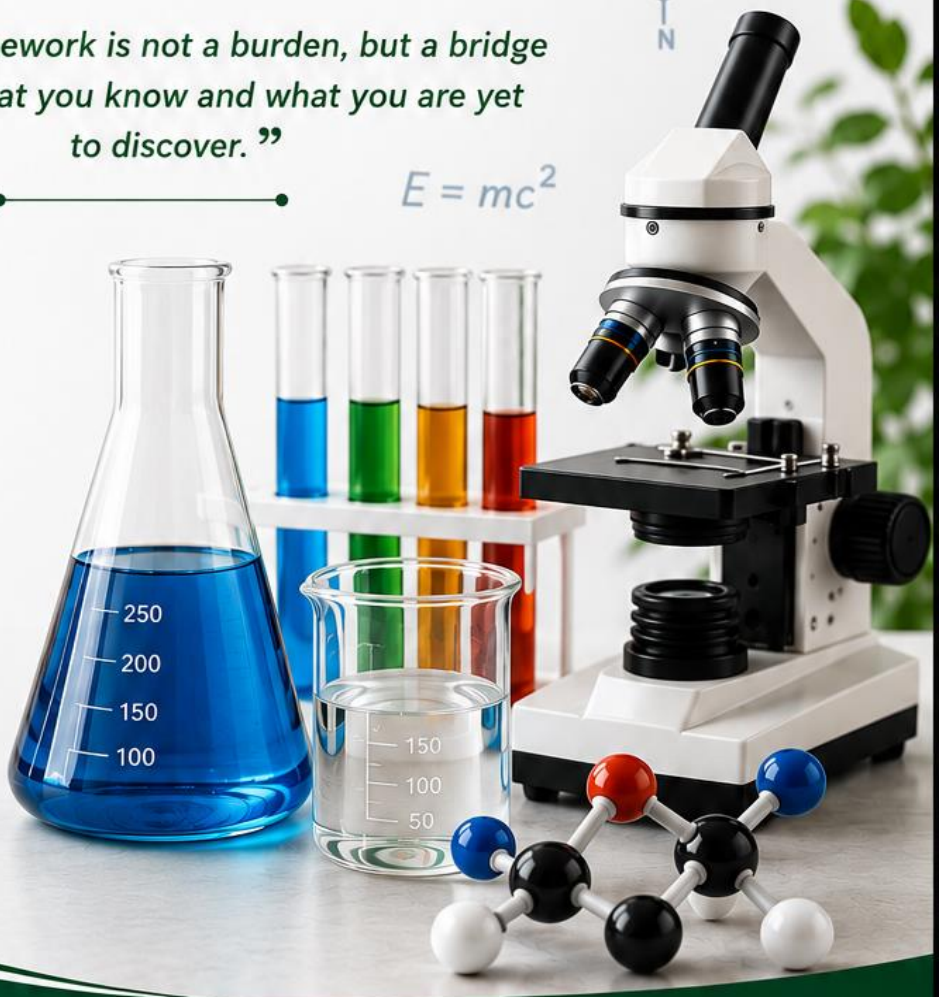
STREAM – SCIENCE

GRADE – XII

ACADEMIC SESSION – 2026-27

"Holiday homework is not a burden, but a bridge between what you know and what you are yet to discover."

- ENGLISH CORE
- PHYSICS
- CHEMISTRY
- BIOLOGY
- AI
- COMPUTER SCIENCE
- MATHEMATICS



SERVICE BEFORE SELF

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SUBJECT : ENGLISH

Dear Students,
As part of your holiday assignment, you are required to prepare an innovative project on the chapter The Tiger King from your NCERT textbook. The project is designed as per CBSE guidelines to enhance your analytical, creative, and critical thinking skills.

Project Topic: Power, Prophecy and Irony: A Psychological and Political Exploration of 'The Tiger King"
NOTE: Project Guidelines (15 Pages)
1. Cover Page
●School's Name
●Title of the Project
●Student's Name, Class, Section, Roll Number

2. Acknowledgement
Express gratitude to the principal, teachers, parents, and the school
3. Index
List of contents with page numbers

4. Main Content
a) A Brief Summary of the Chapter
b) Character Sketch of the Tiger King
●Personality traits
●Strengths and flaws
c) Theme analysis
Satire on authority
Fate vs free will
Irony
Symbolism in the story
d) Creative Section
Criticism of monarchy
OR
Blind exercise of power

5. Conclusion
Personal reflection and final thoughts
6. Bibliography NCERT textbook Other references (if used)
Important Instructions:
●The project must be handwritten on project papers
●Maintain neatness and proper presentation
●Paste relevant pictures/images to enhance the content

●Use proper headings, margins, and creativity
NOTE: Submission Date: Reopening day after Summer break

DELHI PUBLIC SCHOOL
SEC-14, ROURKELA

ENGLISH PROJECT

TOPIC:

NAME:

CLASS:

SECTION:

ROLL NO:

Literature Questions (Answers to be written in a separate notebook)

PART-1

A. Read the following extracts and answer the questions given below.

"My children, this is the last lesson I shall give you. The order has come from Berlin to teach only German in the schools of Alsace and Lorraine. The new master comes tomorrow. This is your last French lesson."

(a) Why is this the "last lesson" for the children?

(b) What does M. Hamel's tone reveal about his feelings?

(c) How does this announcement change Franz's attitude towards school and French?

B. Answer the following questions.

Q1. Why was Franz afraid to go to school that morning?

Q2. What tempted Franz to stay away from school instead of going to class?

Q3. Why were the village elders sitting in the classroom on the last day?

Q4. What impression do you form of M. Hamel from his last lesson?

Q5. How does the order from Berlin affect the villagers emotionally?

Q6. How does Franz react when he realises it is the last French lesson?

Q7. Why does Franz consider his books "old friends" by the end of the lesson?

Q8. What does the line "Vive la France!" symbolise in the story?

Q9. Why does the story end with M. Hamel standing motionless at the window?

Q10. How does Daudet use the classroom setting to highlight the theme of loss?

C. Long Answer type questions.

Q1. Describe how the people in the story suddenly realise the value of their language. Why does this realisation come only when it is on the verge of being taken away?

Q2. Sketch the character of Franz, highlighting how his attitude changes from the beginning to the end of the story. What message does this transformation convey to the reader?

PART-2

A. Read the following extract and answer the questions given below

"Driving from my parents' home to Cochin last Friday morning, I saw my mother, beside me, doze, open-mouthed, her face ashen like that of a corpse and felt that old familiar ache, my childhood's fear…"

(a) Why is the poet's mother described as "as white as a corpse"?

(b) What "old familiar ache" does the poet refer to?

(c) How does this opening image set the mood of the poem?

B. Answer the questions given below.

Q1. Why does the poet compare her mother's face to that of a corpse?

Q2. What contrasting images does the poet use in the poem?

Q3. What does the reference to "young trees sprinting" symbolise?

Q4. Why does the poet say she is smiling and smiling at the time of parting?

Q5. How does the poem present the theme of ageing and mortality?

Q6. What train of thought disturbed the poet during the car journey?

Q7. Why does the poet feel "familiar ache" at the sight of her mother?

Q8. How does the poem shift from a personal emotional moment to a universal fear of death?

Q9. What does the line "see you soon, Amma" reveal about the poet's feelings?

Q10. How does Kamala Das portray the conflict between love and fear in the poem?

C. Answer the following questions.

Q1. Discuss how Kamala Das, in the poem My Mother at Sixty-six, effectively uses contrasting images to express her inner conflict between fear and affection.

Q2. Bring out the poet's emotional journey from beginning to end, and comment on how the poem reflects the universal fear of losing a parent.

PART-3

Read the following passage carefully and answer the questions that follow:

The Balancing Act: Technology and Life

Modern life is deeply intertwined with technology. From the moment we wake up to the moment we go to sleep,

we are surrounded by devices that make our lives faster and easier. Smartphones connect us instantly to friends and family across the world. Computers store and process vast amounts of information, while the internet provides answers to almost any question within seconds.

Technology has also transformed education. Online classes, e-books, and educational apps allow students to learn at their own pace, anytime and anywhere. Doctors use advanced machines and software to diagnose illnesses more accurately and quickly. In business, digital tools have made communication and collaboration global and almost instant.

However, this dependence on technology has its drawbacks. Many young people spend more time on social media and video games than on their studies or physical activity. Long hours in front of screens can cause eye strain, poor posture, and sleep problems. Some people feel anxious if they are without their phones for even a short time, a condition often called “nomophobia”.

Another major concern is the decline in face-to-face interaction. While people may have hundreds of online friends, they often lack deep, real-life relationships. Misinformation spreads rapidly online, and privacy is sometimes compromised as personal data is shared across platforms. Cyberbullying and online harassment are also growing problems, especially among teenagers.

Experts agree that the key is balance. Technology in itself is not harmful; it is our use of it that matters. Parents and teachers should guide students to use screens wisely—limiting unnecessary scrolling, encouraging outdoor play, and teaching digital literacy. When used responsibly, technology can open doors to learning, creativity, and connection. Otherwise, it can become a source of distraction, addiction, and isolation.

Answer the following questions.

Q1. What does the passage mainly discuss?
(a) The history of technology
(b) The benefits of smartphones
(c) The impact of technology on modern life and the need for balance
(d) The dangers of cyberbullying only

Q2. According to the passage, how does technology help education?
(a) It makes studying longer and harder
(b) It does not affect learning
(c) It offers online classes, e-books, and apps for self-paced learning
(d) It replaces teachers completely

Q3. What does “nomophobia” refer to in the passage?
(a) Fear of nature
(b) Fear of technology
(c) Fear of being without a mobile phone
(d) Fear of using the internet

Q4. Which health problem is mentioned as a result of long screen time?
(a) Tooth decay
(b) Eye strain
(c) Hearing loss
(d) Weight gain only

Q5. How does the passage describe online relationships?
(a) Always deeper than real-life relationships
(b) Often more meaningful than real-life friendships
(c) Frequently lacking depth despite large numbers of online friends
(d) Completely useless

Q6. What is one negative effect of the rapid spread of information online?
(a) Faster academic progress

(b) Growth in misinformation
(c) Better sleep
(d) Decreased screen time

Q7. Why is privacy a concern on digital platforms?
(a) Because people never share personal data
(b) Because personal data is often shared and may be misused
(c) Because technology cannot store data
(d) Because the internet is not advanced

Q8. What role do parents and teachers play in managing technology use?
(a) They should ban all devices
(b) They should encourage unlimited screen time
(c) They should guide students to use screens wisely and teach digital literacy
(d) They should ignore the problem

Q9. According to the passage, which of these is a benefit of technology in medicine?
(a) Longer waiting times
(b) More accurate and quicker diagnosis
(c) No need for doctors
(d) Removal of all diseases

Q10. What does the passage say about outdoor activities?
(a) They are outdated and unnecessary
(b) They should be encouraged, along with limited screen time
(c) They are only for children
(d) They are more harmful than technology

Q11. Which behaviour on social media is linked to anxiety in the passage?
(a) Using phones occasionally
(b) Being without a phone for a short time
(c) Avoiding the internet
(d) Sleeping early

Q12. What term is used to describe the balance needed in technology use?
(a) Overuse
(b) Dependence
(c) Balance
(d) Addiction

Q13. How does the passage describe the effect of technology on business?
(a) It has slowed down communication
(b) It has made global communication faster and easier
(c) It has stopped collaboration
(d) It has made business irrelevant

Q14. Which group is particularly mentioned as facing cyberbullying and online harassment?
(a) Elderly people only
(b) Teenagers
(c) Scientists
(d) Animals

Q15. What is the central message of the passage?
(a) Technology should be completely avoided
(b) Technology is always harmful

(c) Technology is neutral; its impact depends on how humans use it
(d) Only children should use technology

PHYSICS

CHAPTER:- 1 (ELECTRIC CHARGE AND FIELD)

LONG QUESTIONS:

1. State coulomb's law, write its vector form.
2. Write the similarities and difference between gravitational force and coulomb's force.
3. Define electric field at a point, write its SI unit and dimension. Also write its significance.
4. Obtain electric field at a distance 'r' due to a point charge Q.
5. Derive an expression for electric field at a point on the axial line of an electric dipole.
6. Derive an expression for electric field at a point on the equilateral bisector of an electric dipole.
7. Derive an expression for electric field at the midpoint of an electric dipole.
8. Prove that the net translational force on an electric dipole in a uniform electric field is zero, hence obtained the torque acting on it.
9. A system consisting two point charges q_1 and q_2 having position vectors $\mathbf{r}_1$ and $\mathbf{r}_2$ respectively, find the net electric field at a point whose position vector is **'r'.**
10. State and prove Gauss's law.
11. Using gauss's law obtain electric field :

(i) Due to an infinite long line charge of density 'λ'.
(ii) Due to uniformly charged thin sheet.
(iii) Due to a uniformly charged thick sheet.
(iv) Due to a uniformly charged shell, inside and outside the shell. Draw a graph how electric field varies with distance from the centre of the shell.

Numerical:-

1. The force between two charges situated in air is F. The force between the same charges if the distance between them is reduced to half and they are situated in a medium having dielectric constant 4 is:
   (a) F/4 (b) 4F (c) 16F (d) F

2. A charge Q is divided into two parts q and Q-q and separated by a distance R. The force of repulsion between them will be maximum when:
   (a) q=Q/4 (b) q=Q/2 (c) q=Q (d) none of these

3. Three charges +4q, Q and q are placed in a straight line of length l at distance 0, (l/2) and l respectively. What should be Q in order to make the net force on q to be zero?
   (a) -q (b) -2q (c) -q/2 (d) 4q

4. Three equal charges, each of charge +q, are placed on the three corners of a square of side a. Then the magnitude of the electric field at the fourth corner is about:
   (a) Kq/a^2 (b) $Kq/2a^2$ (c) $1.9Kq/a^2$ (d) $2\sqrt{2}\,Kq/a^2$

5. The dielectric constant K of an insulator can be:
   (a) -1 (b) zero (c) 0.5 (d) 5

6. Three point charges, each +q, are placed at the corners of an equilateral triangle. The electric field at the center will be ($k=1/4\pi\omega_0$):
   (a) $3Kq/r^2$ (b) Kq/r^2 (c) $3\,Kq/2r^2$ (d) zero.

7. There is a solid sphere of radius R having uniformly distributed charge throughout it. What is the relation between electric field E and distance r from the center (r<R)?

(a) $E \alpha r^{-2}$ (b) $E \alpha r^{-1}$ (c) $E \alpha r$ (d) $E \alpha r^{2}$

8. There is a solid sphere of radius R having uniformly distributed charge throughout it. What is the relation between electric field E and distance r from the center (r<R)?

(a) $E \alpha r^{-2}$ (b) $E \alpha r^{-1}$ (c) $E \alpha r$ (d) $E \alpha r^{2}$

9. The electric field at a point at a distance r from an electric dipole is proportional to:
(a) 1/r (b) $1/r^2$ (c) $1/r^3$ (d) r^2

10. Two point charges +3 μC and +8 μC repel each other with a force of 40 N. If a charge of -5 μC is added to each of them, then the force between them will become:
(a) +10N (b) +20 N (c) -20 N (d) -10 N

11. A cube has point charge of magnitude -q at all its vertices. Electric field at the centre of the cube is:
(a) $\frac{6q}{4\pi\varepsilon_o 3a^2}$ (b) $\frac{8q}{4\pi\varepsilon_o a^2}$ (c) zero (d) $4\pi\varepsilon_0$ $(-8q/a^2)$

12. The electric flux entering and leaving an enclosed surface is ϕ_1 and ϕ_2 respectively, the electric charge inside the enclosed surface will be:
(a) $(\phi_1+\phi_2)\varepsilon_0$ (b) $(\phi_1+\phi_2)/\varepsilon_0$ (c) $(\phi_2-\phi_1)\varepsilon_0$ (d) $(\phi_2-\phi_1)/\varepsilon_0$

13. Two spherical conductors B and C having equal radii and carrying equal charges in them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that of B but unchanged is brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion between B and C is:
(a) F/4 (b) 3F/4 (c) F/8 (d) 3F/8

14. Four charges equal to -Q are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium, the value of q is:
(a) $-\frac{Q}{4}(1+2\sqrt{2})$ (b). $\frac{Q}{4}(1+2\sqrt{2})$ (c) $-\frac{Q}{2}(1+2\sqrt{2})$ (d) $\frac{Q}{2}(1+2\sqrt{2})$

15. Two point charges +8q and -2q are located at x=0 and x=L respectively. The location of a point on the x-axis at which net electric field due to these two point charges is zero, is:

(a) 8L (b) 4L (c) 2L (d) L/4

16. A charge q is placed at the point of intersection of body diagonals of a cube. The electric flux passing through any one of its face is:
(a) $\frac{q}{6\varepsilon_o}$ (b) $\frac{3q}{\varepsilon_o}$ (c) $\frac{6q}{\varepsilon_o}$ (d) $\frac{q}{3\varepsilon_o}$

17. A rectangular coil of area A is kept in a uniform magnetic field $\vec{B}$ such that the plane of the coil makes an angle α with $\vec{B}$. The magnetic flux linked with the coil is:
(a) B A sin α (b) BA cos α (c) BA (d) zero

18. The electric flux through a closed Gaussian surface depends upon:
(a)net charge enclosed and permittivity of the medium.
(b) Net charge enclosed permittivity of the medium and the size of the Gaussian surface.
(c) Net charge enclosed only.
(d) Permittivity of the medium only.

19. A cylinder of radius r and length *l* is placed in a uniform electric field parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by:
(a) Zero (b) πr^2 (c) $E\pi r^2$ (d) $2E\pi r^2$

20. The magnitude of electric field due to a point charge 2q at distance r is E. then the magnitude of electric field due to uniformly charged thin sphere shell of radius R with total charge q at a $\frac{r}{2}(r >> R)$ will be:

(a) $\frac{E}{4}$ (b) 0 (c) 2E (d)4E

****

Answer: **1.d 2.b 3.a 4.c 5.c 6.d 7.d 8.c 9.c 10.d 11.c 12.c 13.d 14.b 15.c 16.a 17. A 18.a 19.a 20.c**

CHAPTER-2:

ELECTROSTATIC POTENTIAL AND CAPACITANCE:

LONG QUESTIONS:

1. Define electric potential at a point; obtain an expression for it at a distance r from a point charge Q.
2. Derive an expression for electric potential at any point on the axial line of an electric dipole. Hence find its value on the axial line and equatorial bisector.
3. Define equipotential surface and write its properties.
4. (i) Derive an expression for electric potential energy of an electric dipole in a uniform electric field; hence write the condition of stable and unstable equilibrium condition.

   (ii) Calculate the work to be done in rotating the dipole from stable to unstable equilibrium position.
5. Prove that,
   (i) Two equipotential surfaces do not intersect each other.
   (ii) Electric field is normal to the equipotential surface.
   (iii) Electric field is stronger where the equipotential surfaces are closer.
   (iv) The work done to displace a point charge from one point to other on an equipotential surface is zero.
6. Obtain electrostatic potential energy of a system consisting two point charges and three point charges.
7. Derive an expression for electrostatic potential energy of two point charges placed at a distance r in an external electric field.
8. Explain the following questions:
   (i) Electric field inside a conductor is zero.
   (ii) Any excess charge resides on the outer surface of a conductor.
   (iii) Electric field is perpendicular to the surface of a conductor.
   (iv) Electric field on the surface of a conductor is: $\overrightarrow{E} = \frac{\sigma}{\varepsilon_o}\hat{n}$.
   (v) Electric potential is constant throughout the body of a conductor.
9. Obtain capacitance of a spherical conductor.
10. Obtain capacitance of a parallel plate air capacitor.
11. Obtain capacitance of a parallel plate capacitor partially filled with dielectric.
12. Derive an expression for energy and energy density of a parallel plate capacitor.
13. Obtain equivalent capacitance of capacitors connected in (i) series and (ii) parallel.

NUMERICALS: (MCQ)

1. Two conducting spheres of radii r_1 and r_2 are at the same potential. The ratio of their charge density is:
   (a) (r_1^2 / r_2^2). (b) (r_2^2 / r_1^2) (c) (r_1 / r_2) (d) (r_2 / r_1).

2. A proton has a mass of 1.67×10^{-27} kg and charge 1.6×10^{-19} coulomb. If the proton is to be accelerated through a potential difference of one million volts, then the KE is:
(a) 1.6×10^{-15} J . (b) 1.6×10^{-13} J (c) 1.6×10^{-25} J (d) 3.2×10^{-13} J.

3. Work done in carrying a charge Q once round a circle of radius r with a charge Q at the center is:
(a) $1/4\pi\varepsilon_0$ Q/r. (b) $QQ'/4\pi\varepsilon_0$ r (c) zero (d) QQ'/2r.

4. The electric potential difference between two parallel plates is 2000 volts. If the plates are separated by 2 mm, what is the magnitude of electrostatic force (in Newton) on charge of 4×10^{-6} C located midway between the plates?
(a) 4 N. (b) 6 N (c) 8 N (d) 1.5×10^{-6} N.

5. Two spheres of radii R_1 and R_2 respectively are charged and joined by a wire. The ratio of electric field of the spheres is:
(a) $\frac{R_2^2}{R_1^2}$ (b) . $\frac{R_1^2}{R_2^2}$ (c) $\frac{R_2}{R_1}$ (d) $\frac{R_1}{R_2}$.

6. Identical charges (-q) are placed at each corner of a cube of side b; then the electrostatic potential energy of charge (+q) placed at the centre of the cube will be:
(a) $-4\sqrt{2}\, q^2/\pi\varepsilon_0$ (b) $8\sqrt{2}\, q^2/\pi\varepsilon_0 b$ (c) $-4q^2/\sqrt{3}\ \pi\varepsilon_0 b$ (d) $8\sqrt{2}\, q^2/4\pi\varepsilon_0 b$.

7. Electric potential at any point is: $V=-5x+3y+\sqrt{15}\, z$; then the magnitude of electric field is:
(a) $3\sqrt{2}$ (b) $4\sqrt{2}$ (c) $5\sqrt{2}$ (d) 7

8. A thin spherical conducting shell of radius R has charge q. Another charge Q is placed at the centre of the shell. The electrostatic potential at a point P at a distance R/2 from the centre of the shell is:
(a) $2Q / 4\pi\varepsilon_0 R$ (b) $(q+Q)2 / 4\pi\varepsilon_0 R$
(c) $(2Q / 4\pi\varepsilon_0 R) - (2q/4\pi\varepsilon_0 R)$ (d) $(2Q / 4\pi\varepsilon_0 R) + (q/4\pi\varepsilon_0 R)$.

9. Two thin wire rings each having a radius R is placed at a distance d apart with their axes coinciding. The charges on the two rings are +Q and -Q. The potential difference between the centres of the two rings is:
(a) Zero (b) $Q/4\pi\ \varepsilon_0 [(1/R) - (1/\sqrt{R^2 + d^2}\ )]$
(c) $QR / 4\pi\varepsilon_0 d^2$ (d) $Q/ 2\pi\ \varepsilon_0 [(1/R) - (1/\sqrt{R^2 + d^2}\ )]$

10. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference of 1 kV, its kinetic energy will be:
(a) 1840 keV. (b) 1/1840 keV (c) 1 keV (d) 920 keV.

11. A solid sphere of radius r and charge q placed at the center of a shell of charge Q and radius R. what will happen if both of them will be connected by a conducing wire.
(a) Charge will flow from shell to sphere. (b) Charge will flow from sphere to shell.
(c) Charge will be equally distributed between two. (d) None of these.

(Answer: 1. d 2.b 3.c 4.a 5.c 6.c 7.d 8.d 9.d 10.c 11.b)

CHEMISTRY

CHAPTER: SOLUTIONS

SECTION A - Multiple Choice Questions

1.Which of the following is NOT a colligative property?
a) Osmotic pressure b) Elevation in boiling point
c) Surface tension d) Depression in freezing point

2.The molarity of a solution containing 5.85 g of NaCl in 500 mL of solution is:
a) 0.1 M b) 0.2 M c) 0.5 M d) 1.0 M

3.According to Raoult's Law, the relative lowering of vapor pressure is equal to:
a) Mole fraction of solvent b) Mole fraction of solute
c) Molarity of solution d) Molality of solution

4.The Van't Hoff factor for completely dissociated $CaCl_2$ is:
a) 1 b) 2 c) 3 d) 4

5.Osmotic pressure is directly proportional to:
a) Temperature only b) Concentration only
c) Both temperature and concentration d) Neither temperature nor concentration

6.The elevation in boiling point is given by the formula:
a) $\Delta Tb = Kb \times m$ b) $\Delta Tb = Kb \times m \times i$
c) $\Delta Tb = Kb / m$ d) $\Delta Tb = m / Kb$

7.Which solution will have the highest boiling point?
a) 0.1 M glucose b) 0.1 M NaCl c) 0.1 M $CaCl_2$ d) 0.1 M $Al_2(SO_4)_3$

8.The molecular mass of a non-volatile solute can be determined using:
a) Elevation in boiling point only b) Depression in freezing point only
c) Osmotic pressure only d) All colligative properties

9.An ideal solution is one which obeys:
a) Henry's Law b) Raoult's Law c) Dalton's Law d) Graham's Law

10. The unit of ebullioscopic constant is:
a) K kg mol^{-1} b) K mol kg^{-1} c) kg K mol^{-1} d) mol K kg^{-1}

11. Reverse osmosis is used for:
a) Desalination of sea water b) Purification of water
c) Concentration of solutions d) All of the above

12. Which of the following shows maximum deviation from Raoult's Law?
a) Ethanol + Water b) Benzene + Toluene
c) n-Hexane + n-Heptane d) $CHCl_3 + CCl_4$

Questions 13-16: Assertion-Reason Questions

- a) Both assertion and reason are correct, and reason is the correct explanation of assertion
- b) Both assertion and reason are correct, but reason is not the correct explanation of assertion
- c) Assertion is correct but reason is incorrect
- d) Assertion is incorrect but reason is correct

13. **Assertion:** Colligative properties depend on the number of particles in solution.
    Reason: Colligative properties are independent of the nature of solute particles.
14. **Assertion:** 0.1 M NaCl solution has higher osmotic pressure than 0.1 M glucose solution.
    Reason: NaCl dissociates into Na^+ and Cl^- ions in solution.
15. **Assertion:** Ethylene glycol is used as antifreeze in car radiators.
    Reason: Ethylene glycol lowers the freezing point of water.
16. **Assertion:** Abnormal molecular mass is observed in solutions of electrolytes.
    Reason: Van't Hoff factor for electrolytes is always greater than 1.

SECTION B - Short Answer Questions

17. Define molality and molarity. Why is molality preferred over molarity in studying colligative properties?
18. State Raoult's Law for volatile liquids. Give one limitation of Raoult's Law.
19. What is meant by abnormal molecular mass? Give two examples where abnormal molecular mass is observed.
20. Calculate the mole fraction of benzene in a solution containing 30 g benzene and 42 g toluene.
21. Explain why NaCl is used to clear snow on roads during winter.

SECTION C - Short Answer Questions

22. Derive the relationship between relative lowering of vapor pressure and mole fraction of solute for a dilute solution.
23. A solution containing 12.0 g of non-volatile solute in 100 g of water has a vapor pressure of 750 mm Hg at 100°C. Calculate the molecular mass of the solute. (Vapor pressure of pure water at 100°C = 760 mm Hg)
24. Explain the principle of osmosis. Distinguish between osmosis and reverse osmosis with one application each.
25. Calculate the freezing point of a solution containing 8.1 g of HNO_3 in 1000 g of water. Assume HNO_3 is completely ionized. (K_f for water = 1.86 K kg mol^{-1})
26. What is Van't Hoff factor? How does it help in calculating the degree of dissociation of an electrolyte?
27. A 0.01 M solution of $K_3[Fe(CN)_6]$ is 50% dissociated. Calculate the osmotic pressure of solution at 25°C.
28. Explain why colligative properties are called colligative properties. List four colligative properties with their mathematical expressions.

SECTION D - Case-Based Questions

Question 29

Case Study 1: A pharmaceutical company needs to determine the molecular mass of a newly synthesized drug compound. The laboratory has the following data: A solution was prepared by dissolving 2.5 g of the compound in 100 g of chloroform. This solution showed a boiling point elevation of 0.323°C. The boiling point elevation constant (Kb) for chloroform is 3.63 K kg mol^{-1}.

Based on this information, answer the following:

a)i. Calculate the molality of the solution. (1 mark)

ii. Determine the molecular mass of the compound. (1 mark)

c) If the compound has empirical formula $C_8H_8O_2$, determine if this is also the molecular formula. (1 mark)

d) Suggest two other colligative properties that could be used for this determination. (1 mark)

Question 30

Case Study 2: A student is studying the effect of different solutes on the freezing point of water. She prepares three solutions:

- Solution A: 0.1 M glucose
- Solution B: 0.1 M NaCl
- Solution C: 0.1 M $CaCl_2$

The Kf for water is 1.86 K kg mol^{-1}.
Based on this scenario, answer the following:
a) i. Which solution will have the maximum depression in freezing point? Justify your answer. (1 mark)
ii. Calculate the freezing point of solution B assuming complete dissociation. (1 mark)
c) If solution C shows a freezing point depression of 0.52°C, calculate its Van't Hoff factor. (1 mark)
d) Explain why the observed Van't Hoff factor is often less than the theoretical value. (1 mark)

SECTION E - Long Answer Questions
Question 31 (5 marks)
a) Derive the mathematical expression for osmotic pressure using thermodynamic principles. (2 marks)
b) A semipermeable membrane separates two aqueous solutions. Solution A contains 1.75 g of substance X in 100 mL, and solution B contains 1.5 g of substance Y in 100 mL. If the molecular mass of X is 60 and Y is 40, determine the direction of osmosis. Calculate the osmotic pressure difference at 27°C. (3 marks)
Question 32 (5 marks)
a) Explain the concept of ideal and non-ideal solutions. What causes positive and negative deviations from Raoult's Law? (3 marks)
b) Two liquids A and B form an ideal solution. At 25°C, the vapor pressure of pure A is 80 mm Hg and that of pure B is 120 mm Hg. Calculate the vapor pressure of a solution containing 2 moles of A and 3 moles of B. Also find the composition of vapor phase. (2 marks)
Question 33 (5 marks)
a) How are colligative properties used to determine the molecular mass of substances? Explain with the help of any two colligative properties. (3 marks)
b) A solution of a polymer in toluene has an osmotic pressure of 0.0312 atm at 27°C. The density of the solution is 0.95 g mL^{-1} and contains 6% by mass of polymer. Calculate the molecular mass of the polymer. (2 marks)

CHAPTER: ELECTROCHEMISTRY

SECTION A - Multiple Choice Questions

Instructions: Choose the correct option for each question.

Q1. The EMF of Daniel cell at 298K is E_1. When the concentration of $ZnSO_4$ is changed from 1M to 0.1M and that of $CuSO_4$ from 1M to 0.01M, the EMF changes to E_2. Which relation is correct?*)*

(a) $E_2 > E_1$ (b) $E_2 < E_1$ (c) $E_2 = E_1$ (d) $E_2 = 0$

Q2. Which of the following statements is correct regarding assertion and reason?

Assertion (A): In electrolytic cells, electrical energy is converted into chemical energy.
Reason (R): Electrolysis involves non-spontaneous redox reactions.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q3. The unit of molar conductivity is:
(a) S m^2mol^{-1} (b) S cm^2mol^{-1} (c) Ω^{-1} m^2mol^{-1} (d) Both (a) and (c)
Q4. Which of the following is NOT a secondary cell?

(a) Lead acid battery (b) Nickel-cadmium battery
(c) Dry cell (d) Fuel cell

Q5. Assertion (A): Kohlrausch's law helps in determining Λ°_m for weak electrolytes.
Reason (R): Weak electrolytes dissociate completely at infinite dilution.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q6. The relationship between ΔG° and E°_{cell} is:
(a) $\Delta G^\circ = nFE^\circ_{cell}$ (b) $\Delta G^\circ = -nFE^\circ_{cell}$
(c) $\Delta G^\circ = nF/E^\circ_{cell}$ (d) $\Delta G^\circ = -nF/E^\circ_{cell}$
Q7. In the electrochemical series, which metal is placed at the top?
(a) Gold (b) Silver (c) Lithium (d) Copper
Q8. Assertion (A): Conductivity of an electrolytic solution decreases with dilution.
Reason (R): Number of ions per unit volume decreases on dilution.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
Q9. The Nernst equation for a cell reaction is:
(a) $E_{cell} = E^\circ_{cell} - (RT/nF)\ln Q$ (b) $E_{cell} = E^\circ_{cell} + (RT/nF)\ln Q$
(c) $E_{cell} = E^\circ_{cell} - (nF/RT)\ln Q$ (d) $E_{cell} = E^\circ_{cell} + (nF/RT)\ln Q$
Q10. Which of the following represents corrosion?
(a) $2Fe + O_2 \rightarrow 2FeO$ (b) $4Fe + 3O_2 \rightarrow 2Fe_2O_3$
(c) $Fe \rightarrow Fe^{2+} + 2e^-$ (d) All of the above
Q11. Assertion (A): Salt bridge maintains electrical neutrality in electrochemical cells.
Reason (R): Salt bridge prevents mixing of electrolytes of two half cells.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
Q12. At 298 K, the value of 2.303 RT/F is approximately:
(a) 0.025 V (b) 0.059 V (c) 0.0257 V (d) 0.0591 V
Q13. Which electrode acts as anode in Daniel cell?
(a) Cu electrode (b) Zn electrode (c) Both can act as anode (d) None of these
Q14. Assertion (A): Fuel cells are more efficient than conventional methods of electricity generation.
Reason (R): Fuel cells directly convert chemical energy into electrical energy.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
Q15. The number of electrons involved in the reduction of permanganate ion in acidic medium is:
(a) 3 (b) 5 (c) 7 (d) 1
Q16. Assertion (A): Copper cannot displace zinc from zinc sulphate solution.
Reason (R): Standard reduction potential of Cu^{2+}/Cu (0.34V) is higher than Zn^{2+}/Zn (-0.76V).
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

SECTION B - Short Answer Questions

Q17. Define standard electrode potential. How is it measured experimentally?
Q18. Write the electrode reactions for the electrolysis of aqueous sodium chloride using platinum electrodes.

Q19. Calculate the emf of the cell: $Mg|Mg^{2+}(0.01M)||Ag^{+}(0.01M)|Ag$ at 298K.
[Given: $E°(Mg^{2+}/Mg) = -2.37V$, $E°(Ag^{+}/Ag) = +0.80V$]

Q20. What is the relationship between molar conductivity and degree of dissociation for a weak electrolyte?
Q21. Distinguish between galvanic cells and electrolytic cells based on any two points.

SECTION C - Short Answer Questions

Q22. Derive the relationship between Gibbs free energy change and EMF of an electrochemical cell. Under what condition will the cell reaction be spontaneous?

Q23. Explain the construction and working of H_2-O_2 fuel cell. Write the electrode reactions involved.
Q24. State and explain Kohlrausch's law of independent migration of ions. How is this law helpful in determining molar conductivity of weak electrolytes?
Q25. The resistance of 0.01M NaCl solution at 25°C is 200 ohm. If the cell constant is 1.0 cm^{-1}, calculate: (a) Specific conductance
(b) Molar conductance
Q26. Explain the electrochemical theory of corrosion. How can corrosion be prevented by cathodic protection?
Q27. Calculate the standard free energy change for the reaction:
$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$
Given: $E°(Zn^{2+}/Zn) = -0.76V$, $E°(Cu^{2+}/Cu) = +0.34V$
Q28. Describe the construction and working of lead storage battery. Write the overall cell reaction during discharge.

SECTION D - Case-Based Questions

Q29. Electroplating and Industrial Applications

Electroplating is widely used in industry for coating objects with thin layers of metals. A factory uses electroplating to coat steel objects with chromium using chromic acid solution (H_2CrO_4).
In the electroplating setup:

- Steel object acts as cathode
- Pure chromium rod acts as anode
- Current of 5A is passed for 2 hours
- Atomic mass of Cr = 52 g/mol

Based on this information, answer the following:
(a) Write the electrode reactions occurring at anode and cathode. (1) (b) Calculate the mass of chromium deposited on the steel object. (1) (c) Why is the steel object made cathode in this process? (1) (d) What would happen if the polarity is reversed? (1)

Q30. Conductometry and Quality Control

A pharmaceutical company uses conductometric measurements to check the purity of distilled water used in drug manufacturing. The company has the following data:

- Pure water conductivity at 25°C = 5.5×10^{-6} S/m
- Sample A conductivity = 8.2×10^{-6} S/m
- Sample B conductivity = 2.1×10^{-4} S/m
- Acceptable limit for pharmaceutical use = 1.0×10^{-5} S/m

Based on this case, answer:
(a) Which samples are suitable for pharmaceutical use? Justify your answer. (1) (b) What could be the probable impurities causing high conductivity in rejected samples? (1) (c) How does temperature affect the conductivity of electrolytic solutions? (1) (d) Suggest a method to improve the quality of water that doesn't meet the standards. (1)

SECTION E - Long Answer Questions

Q31. (a) State Faraday's laws of electrolysis. Derive the mathematical expression for Faraday's second law. (b) During electrolysis of copper sulfate solution using copper electrodes, 0.635g of copper was deposited at cathode. Calculate: (i) Quantity of electricity passed
(ii) Amount of $CuSO_4$ electrolyzed

(iii) Amount of H_2SO_4 formed
[Atomic mass of Cu = 63.5]

Q32. (a) Explain the construction, working, and applications of dry cell. Why is it called a primary cell?
(b) Compare dry cell with lead storage battery on the basis of:
(i) Type of cell
(ii) Cell reactions

(iii) Voltage output
(iv) Applications
Q33. (a) How much charge is required to reduce 1 mole of Al^{3+} to Al?
(b) The EMF of the cell $Zn|ZnSO_4(0.01M)||CuSO_4(0.1M)|Cu$ at 298K is 1.15V. Calculate: (i) EMF of the cell when concentration of $ZnSO_4$ is 0.1M and $CuSO_4$ is 0.01M
(ii) Ratio of $[Zn^{2+}]/[Cu^{2+}]$ when EMF becomes zero

CHAPTER: CHEMICAL KINETICS

SECTION A - Multiple Choice Questions

Instructions: Choose the correct option for each question.

Questions 1-12: Multiple Choice Questions

1. For a first-order reaction, the rate constant is $2.0 \times 10^{-3}\ s^{-1}$. What is the half-life of the reaction?
   a. 346.5 s b. 693 s c. 34.65 s d. 173.25 s
2. The rate law for a reaction A + B → C is Rate = $k[A]^2[B]$. If the concentration of A is doubled and B is kept constant, the rate will:
   a. Double b. Quadruple c. Remain the same d. Increase by eight times
3. The unit of rate constant for a zero-order reaction is:
   a. $mol\ L^{-1}\ s^{-1}$ b. s^{-} c. $mol^{-1}\ L\ s^{-1}$ d. $mol^{-2}\ L^2\ s^{-1}$
4. According to the Arrhenius equation, the slope of the plot of log k versus 1/T gives:
   a. $-E_a/2.303R$ b. $E_a/2.303R$ c. $-E_a/R$ d. log A
5. Which of the following statements about catalyst is correct?
   a. It increases the activation energy b. It decreases the activation energy
   c. It changes the equilibrium d. It shifts the equilibrium position
6. For a reaction with molecularity 3, which statement is true?
   a. The order must be 3
   b. The order may or may not be 3
   c. The reaction cannot be an elementary step
   d. The reaction must be multi-step
7. The time required for 75% completion of a first-order reaction is related to its half-life ($t_{1/2}$) as:
   a. $t_{75\%} = 2 \times t_{1/2}$
   b. $t_{75\%} = 3 \times t_{1/2}$
   c. $t_{75\%} = 1.5 \times t_{1/2}$
   d. $t_{75\%} = 4 \times t_{1/2}$
8. The rate of a gaseous reaction is given by the expression k[A][B]. If the volume of the reaction vessel is suddenly reduced to 1/4th of the initial volume, the reaction rate relative to the original rate will be:
   a. 1/16 b. ¼ times c. 8 times d.16 times
9. The integrated rate equation for zero-order reaction is:
   a. $[A] = [A]_0 - kt$ b. $\ln[A] = \ln[A]_0 - kt$ c. $1/[A] = 1/[A]_0 + kt$ d. $[A]^2 = [A]_0^2 - kt$
10. The average rate of reaction is defined as:
    a. Change in concentration over a finite time interval b. Change in concentration at a specific instant
    c. The derivative of concentration with respect to time c. The rate at t = 0
11. According to collision theory, which factor does NOT affect the rate of reaction?
    a. Number of collisions per unit time

b. Fraction of molecules with energy greater than E_a
c. Proper orientation of colliding molecules
d. Molecular mass of reactants

12. The rate constant of a reaction at 300K is found to be 2.54×10^{-3} s^{-1}. If the activation energy is 50 kJ mol^{-1}, what is the approximate value of the Arrhenius factor A?
a. 2.23×10^6 s^{-1} b. 4.46×10^6 s^{-1} c. 1.12×10^6 s^{-1} d. 6.68×10^6 s^{-1}

Questions 13-16: Assertion-Reason Questions

- a) Both assertion and reason are correct, and reason is the correct explanation of assertion
- b) Both assertion and reason are correct, but reason is not the correct explanation of assertion
- c) Assertion is correct but reason is incorrect
- d) Assertion is incorrect but reason is correct

13. Assertion (A): The rate of a reaction always increases with increase in temperature.
Reason (R): With increase in temperature, the fraction of molecules having energy equal to or greater than activation energy increases.

14. Assertion (A): For a first-order reaction, the half-life is independent of initial concentration.
Reason (R): The half-life of a first-order reaction is inversely proportional to the rate constant.

15. Assertion (A): Order of a reaction can be zero or fractional.
Reason (R): Order of a reaction is determined experimentally and is not related to stoichiometry.

16. Assertion (A): A catalyst does not alter the equilibrium constant of a reaction.
Reason (R): A catalyst increases the rate of both forward and backward reactions equally.

SECTION B - Short Answer Questions

17. Distinguish between average rate and instantaneous rate of a reaction.

18. A first-order reaction takes 40 minutes for 30% decomposition. Calculate its half-life period.

OR

For a first-order reaction, show that time required for 99% completion is twice the time required for 90% completion.

19. What do you understand by the order of a reaction? Can it be zero or fractional? Give one example of each.

20. Explain how temperature affects the rate of a reaction with reference to activation energy.

OR

Define activation energy. How is the rate constant of a reaction related to its activation energy?

21. Define molecularity of a reaction. Why can molecularity not be zero, negative or fractional?

SECTION C - Short Answer Questions

22. For the reaction: $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$
The rate of formation of NO_2 is 0.004 mol L^{-1} s^{-1}. Calculate:
(i) Rate of disappearance of N_2O_5
(ii) Rate of formation of O_2

23. The decomposition of NH_3 on platinum surface is a zero-order reaction. What are the rates of production of N_2 and H_2 if $k = 2.5 \times 10^{-4}$ mol L^{-1} s^{-1} for the reaction:
$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$

24. Derive the integrated rate equation for a first-order reaction. Show that the half-life of a first-order reaction is independent of initial concentration.

OR

The rate constant for a first-order reaction is 60 s^{-1}. How much time will it take to reduce the initial concentration of the reactant to 1/16th of its value?

25. The rate constant of a reaction is 1.5×10^{-2} s^{-1} at 300K and 3.0×10^{-2} s^{-1} at 310K. Calculate the activation energy of the reaction. (R = 8.314 J K^{-1} mol^{-1})

26. Explain the collision theory of reaction rates. What are the two main requirements for an effective collision?

OR

Why do all collisions not lead to a chemical reaction? Explain with reference to collision theory.

27. For a reaction A + B → Products, the following data were obtained:
Experiment 1: [A] = 0.1M, [B] = 0.1M, Rate = 0.05 mol L^{-1} s^{-1}
Experiment 2: [A] = 0.2M, [B] = 0.1M, Rate = 0.10 mol L^{-1} s^{-1}
Experiment 3: [A] = 0.1M, [B] = 0.2M, Rate = 0.20 mol L^{-1} s^{-1}
Determine the order with respect to A and B, and calculate the rate constant.

28. A substance decomposes following first-order kinetics. If 50% of the compound decomposes in 120 minutes, how long will it take for 90% of the compound to decompose?

SECTION D - Case-Based Questions

29. **Case Study 1:**
The thermal decomposition of hydrogen iodide is an important reaction in chemical kinetics. The reaction is: $2HI(g) \rightarrow H_2(g) + I_2(g)$. This reaction has been studied extensively to understand reaction mechanisms. At 443°C, the rate constant is 30×10^{-5} L mol^{-1} s^{-1} and at 393°C, it is 0.69×10^{-5} L mol^{-1} s^{-1}. The reaction follows second-order kinetics.

(i) Calculate the activation energy for this reaction. (2 marks)

(ii) What will be the half-life of the reaction if the initial concentration of HI is 0.2 mol L^{-1} at 443°C? (2 marks)

OR

(ii) Calculate the rate constant at 500°C. (2 marks)

30. **Case Study 2:**
The decomposition of N_2O_5 in CCl_4 solution at 318K has been studied: $2N_2O_5 \rightarrow 4NO_2 + O_2$. The concentration of N_2O_5 at different times was measured and the following data was obtained:

At t = 0 s: $[N_2O_5]$ = 2.0 M
At t = 600 s: $[N_2O_5]$ = 1.0 M
At t = 1200 s: $[N_2O_5]$ = 0.5 M

(i) Show that the reaction is first-order. (2 marks)

(ii) Calculate the rate constant and the time required for 80% completion of the reaction. (2 marks)

OR

(ii) Calculate the half-life of the reaction and predict the concentration of N_2O_5 after 1800 s. (2 marks)

SECTION E - Long Answer Questions

31. (a) Derive the integrated rate equation for a zero-order reaction. Show graphically how you can determine the rate constant from this equation. (3 marks)

(b) A zero-order reaction has a rate constant of 0.02 mol L^{-1} s^{-1}. If the initial concentration is 0.5 M, how long will it take for the reaction to be 100% complete? (2 marks)

OR

Discuss the factors that affect the rate of a chemical reaction. Explain with suitable examples how concentration and temperature influence reaction rate.

32. (a) State and explain the Arrhenius equation. Derive the logarithmic form and explain how it can be used to calculate activation energy. (3 marks)

(b) The rate constant of a reaction increases by a factor of 4 when the temperature is raised from 300K to 320K. Calculate the activation energy of the reaction. (R = 8.314 J K^{-1} mol^{-1}) (2 marks)

OR

Derive an expression to show the relationship between the rate constants at two different temperatures using the Arrhenius equation. If the rate constant doubles when temperature is increased from 300K to 310K, calculate the activation energy.

33. (a) Explain the effect of catalyst on the rate of a chemical reaction using energy profile diagrams. Why does a catalyst not affect the equilibrium constant? (3 marks)

(b) For the reaction: $2A + B \rightarrow C + D$, the rate law is given as Rate = $k[A][B]^2$. What is the order of the reaction? If the concentration of both A and B are doubled, by what factor will the rate increase? (2 marks)

OR

Distinguish between order and molecularity of a reaction. For the reaction: $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$, the rate law is Rate = $k[NO]^2[O_2]$. What is the order and molecularity? Explain why they may differ.

BIOLOGY

1.The C.W. for the chapters: 'Sexual Reproduction in Flowering Plants', 'Organisms and Populations' and 'The Ecosystem' must be completed in the class work notebook.

2.The Question Bank attached at the last must be worked out.

3. The Intext Exercise questions must be worked out for the following chapters:

i) Sexual Reproduction in Flowering Plants

ii) Organisms and Populations

iii) The Ecosystem

4.The practical record work must be completed (in all aspects) for the following experiments:

Expt. 1: To study various stages of *meiosis* from the prepared slides.

Expt. 2:To demonstrate the process of *pollen germination* on a nutrient medium.

Expt. 3:To study *pollen germination* on the *stigma* from the prepared slides.

Expt.4:To study T.S. of *Testis* and T.S. of *Ovary* for different stages of gamete development from prepared slides.

Expt. 5: To study T.S. of *Blastula*.

Expt.6: To study various *flowers* adapted for different *modes of pollination*: - *wind*, *insects* and *birds*.

Expt.7: To study the steps of *controlled pollination*.

5. To prepare the investigatory projects on the following topics: - (In the project file)

For CLASS XII – C

A.Three major Ramsar sites of Odisha and their ecological importance (Roll no. – 01 to 05)
B.Different types of Mangoes grown at different parts of India as an example of genetic biodiversity. (Roll no. – 06 to 10)
C. Aquarium as an example of man-made ecosystem. (Roll no. – 11 to 15)
D. Probiotics – A boon or bane for food industry and its' impact on human health. (Roll no. – 16 to 20)
E. Golden rice: - Method of production and its' importance. (Roll no. – 21 to 25)

F. Methods of pollination of the following flowers:Yucca, Anthocephalus, Rafflesia, Lotus and Rice (Roll no. – 26 to 30)
G. Diabetes as a lifestyle disorder – Awareness and Prevention. (Roll no. – 31 to 35)

H. Mechanism of RT-PCR and its' application as a diagnostic tool. (Roll no. – 36 to 40)
I. Monoclonal antibodies and their therapeutic applications. (Roll no. – 41 to 45)

J. Epistasis (Dominant / Recessive): Complementary and supplementary genes as an example of deviation of Mendelism.(Roll no. – 46 to 50)
K. Application of Stem Cell Technology. (Roll no. – 51 to 55)
L. El Nino and its' effect on Agronomy and climate of India. (Roll no. – 56 to last)

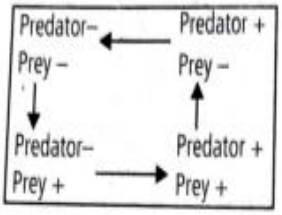
For CLASS XII – D

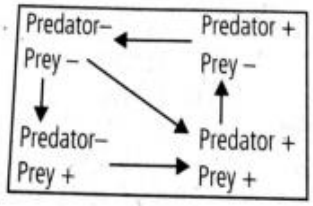
M. Micro RNA and its' application in treatment of Cancer.

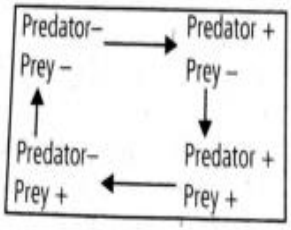
QUESTION BANK for Chapter: Organisms and Populations

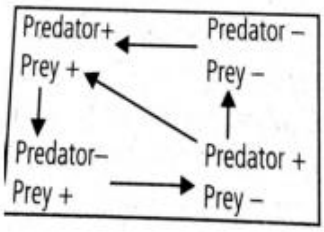
SECTION – A

Q.1) Which of the following figures *correctly* depicts *predator – prey relationship observed in nature*?

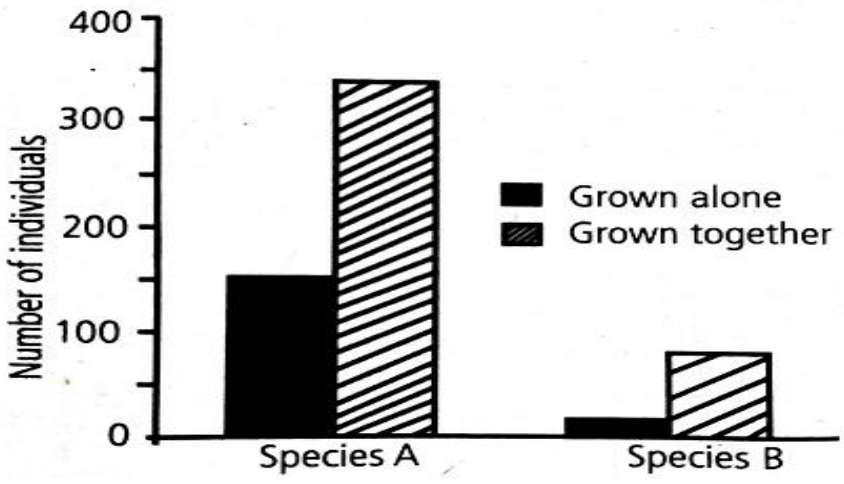
(a)


c)


b)


d)


Q.2) *Two insect species* were used in the laboratory experiment. For one treatment both species were grown by themselves (in separate chambers) on a suitable food source. For the second treatment, the two species were grown together (in the same chamber) on the same type and amount of food as in the first treatment. The given figure shows the results (the number of individuals of each species in the two treatments) at the end of the experiment. Based on these results the two species should be classified as:



a) *Competitors* b) *Mutualists* c) *Predators* or *Pathogens* d) *Commensalists*

Q.3) If a pond had 20 *lotus* plants last year and 8 new plants are added through reproduction, then the *birth rate* is:
a) 0.8 offspring per *lotus* per year b) 0.2 offspring per *lotus* per year

c) 0.4 offspring per *lotus* per year d) 0.6 offspring per *lotus* per year

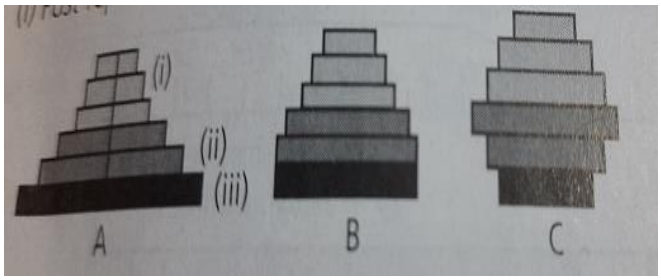
Q.4) In the following figures of *age pyramid*, identify the *growth status* of the population as marked A, B and C given that: i) *Post - reproductive*, ii) *Reproductive*, iii)*Pre – reproductive*

a) A – expanding population, B – declining population, C – stable population

b) A – stable population, B – expanding population, C – declining population

c) A – expanding population, B – stable population, C – declining population

d) A – declining population, B – expanding population, C – stable population



Q.5) What would be the reason for extinction of *Abingdon tortoise* from Galapagos islands?

a) Intraspecific competition b) Predation c) Interspecific competition d) Parasitism

Q.6) Identify A, B and C from the given equation. $dN / dt = rN \{(K – N) / K\}$

A – *population density* at time t, B – *Intrinsic rate of natural increase*, C – *Carrying capacity*

	A	B	C
a)	N	K	r
b)	N	r	K
c)	K	N	r
d)	K	r	N

Q.7) Following figure refers to the density of a population in a given habitat during a given period. Due to changes in four basic processes, it fluctuates, Fill up A and B boxes in the diagram given below with *correct* options.

a) A = Natality + Emigaration B = Mortality + Immigaration

b) A = Birth rate + Death rate B = Migration + Emigaration

c) A = Natality + Mortality B = Immigartaion + Emigration

d) A = Natality + Immigration B = Mortality + Emigration

Q.8) In a community/habitat *interspecific interaction* occurs, which may be beneficial (+), harmful (-) or neutral, i.e., neither harmful nor beneficial (0). Select the *incorrect* match of *type of interaction*.

	Species A	Species B	Type of Interaction
a)	+	-	*Parasitism / predation*
b)	+	-	*Commensalism*
c)	-	-	*Competition*
d)	-	0	*Amensalism*

Q.9) Gause's principle of competitive exclusion states that:

a) less abundant species will exclude the more abundant species through competition.

b) competition for the same resources excludes species having different food preferences.

c) no two species can occupy the same niche indefinitely for the same limiting resources.

d) larger organisms exclude smaller ones through competition.

Q.10) Read the following statements and select the *correct* option.

Statement I: In rN {(K –N) / K}, 'r' represents the intrinsic rate of natural increase.

Statement II: Growth is limited by the value of 'K' in an environment.

a) Both statements I and II are correct.

b) Both statements I and II are incorrect.

c) Statement I is correct but statement II is incorrect.

d) Statement I is incorrect but statement II is correct.

Q.11) Which growth model is considered a more realistic one?

a) Logistic model b) Exponential model c) Geometric model d) J-shaped model

Q.12) Connel's field experiment on the rocky sea coast of Scotland showed that larger barnacle *Balanus* dominates the intertidal area and removes the smaller barnacle *Chthalamus*. This happened due to:

a) *Parasitism* b) *Predation* c) *Mutualism* d) *Competition*

Q.13) Select the *incorrect* statement.

a) In nature *predators* are imprudent.

b) Some species of insects and frogs are cryptically coloured to avoid predators.

c) For plants, *herbivores* are the *predators*.

d) *Calotropis* produces highly poisonous *cardiac glycosides* to protect itself from *herbivores*.

Q.14) Choose the *correct* option with respect to *orchids*.

I. The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get asexual reproduction done.

II. In *Ophrys*, pollination can be done by a species of bee.

III. Both *bee* and *flower* show *co-evolution*.

IV. The female bee is attracted to what it perceives as a male and '*pseudocopulates*' with the flower.

a) Statements I is true and Statements II, III and IV are false.

b) Statement I and IV are false whereas Statements II and III are true.

c) Statements I, II and III are true but Statement IV is false.

d) Statements II and IV are true but Statements I and III are false.

Q.15) Match the following and chose the *correct* option.

	Column I		Column II
A.	*Monarch butterfly*	I.	Camouflage
B.	*Frog*	II.	Defence
C.	*Calotropis*	III.	Highly distasteful to bird
D.	*Thorns*	IV.	Cardiac glycosides

a) A – III, B – I, C – IV, D – II b) A – II, B – I, C – IV, D – III

c) A – I, B – III, C – IV, D – II d) A – IV, B – II, C – III, D – I

Q.16) Few interactions are given below. How many of them are *not* examples of *mutualism*?

A. *Fungus* and roots of higher plants and *Micorhiza*

B. *Clown fish* and *Sea anemone* C. *Cuckoo* and *Crow*

D. *Cattle egret* and Grazing *cattle* E. *Cuscuta* and *Hedge plants*

a) 3 b) 5 c) 4 d) 2

Q.17) A *Cuckoo* laying eggs in the nest of other species of birds is an example of:

a) *Commensalism* b) *Broad parasitism*

c) *Ectoparasitism* d) *Hyperparasitism*

Q.18) "Cryptically-coloured' (camouflage) is a technique through which prey can:

a) feed abundantly b) lessen the impact of predator

c) increase their number d) increase their reproductive fitness

SECTION - B

Q.1) If 8 individuals in a laboratory population of 80 *Lotus* plants died in a week. What is the death-rate of this population for the above period? (2)

Q.2) Why was *prickly pear cactus* problematic? Name the biological principle used to control it. (2)

Q.3) Give 2 examples where population estimation of an *organism* is done indirectly without counting. (2)

Q.4) Name the kind of interaction in the following & assign the signs correctly to each: (2)

i) *Balanus* & *Chathamalus* ii) *Cuckoo* & *Crow*

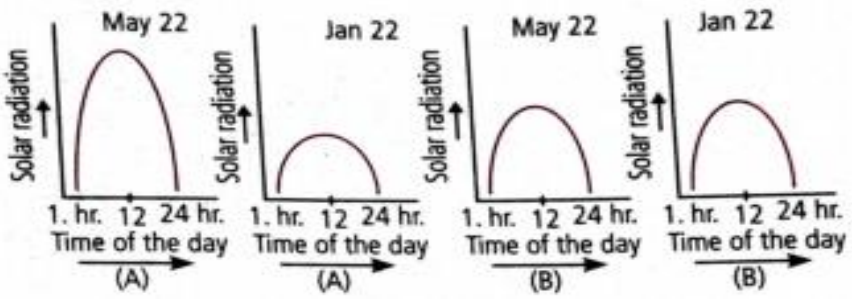
iii) *Cattle egrets* & *Cattle* iv) *Birds* feeding on *Guava*

Q.5) What do you mean by *phytophagous insects*? Provide suitable example. (2)

Q.6) Name the principle that states that two closely related species competing for the same resources cannot coexist indefinitely & the competitively inferior species will be eliminated eventually. (2)

Q.7) Differentiate between: *J – shaped* and *S – shaped growth curve*. (Any *4* points (2)

Q.8) The graphs 'A' and 'B' below depict the *diurnal variations* in the *solar radiations* in the month of May



(*summer*) and in January (*winter*).(2)-

a) Which of the two graphs depicts *tropical region* and *temperate region* respectively?

b) Which of the two regions A or B will show *high biological diversity* and why?

SECTION – C

Q.1) Draw & explain a logistic curve for population density (N) at time (T) whose intrinsic rate of natural increase is (r) for carrying capacity (K). (3)

Q.2) Name the *specific interaction* and *assign corresponding signs* to the following set of organisms. (3)

i) *Parrot* feeding on *Guava*

ii) *Chthamalus* and *Balanus*

iii) *Mango plant* and *Orchid*

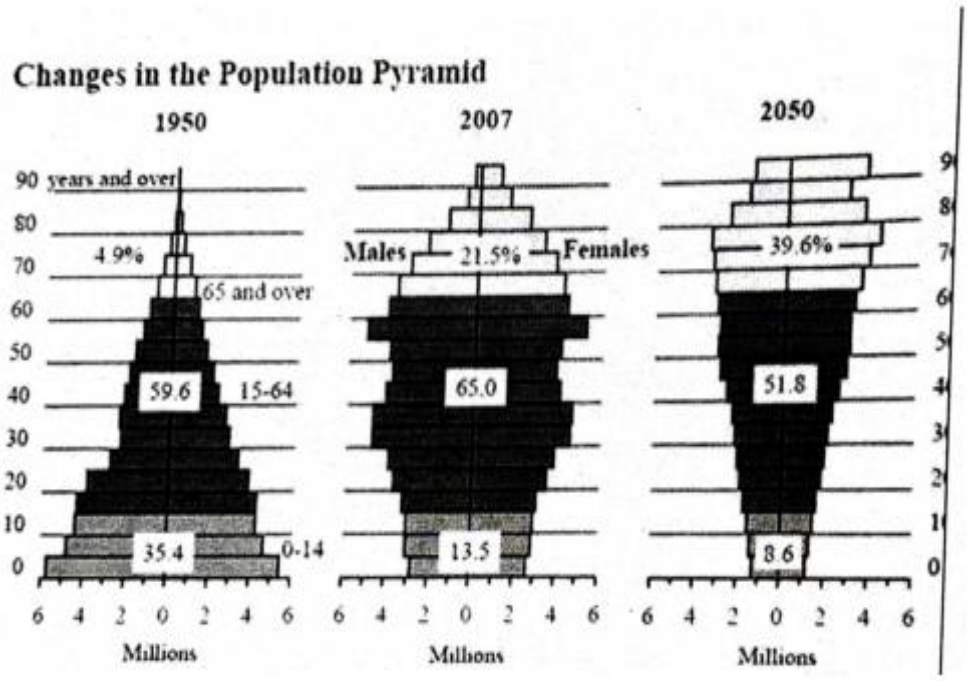
iv) *Cattle egret* and *Cattle*

v) *Chlorophyceae* and *Fungal filament*

vi) *Crow* and *Cuckoo*

SECTION – D

Q.1) The *population pyramids* of a country 'X' for the years 1945, 2020 and on estimation basis for 2050 are provided below. Based on the figure given below, answer the following questions. (4)



a) What is the *rate of growth* status of the population on the basis of the *shape of Age pyramids*?

b) The population of the county is supposed to decrease/increase by 2070? Answer by choosing the *correct* option with proper justification.

SECTION – E

Q.1) i) A population of bacteria growing on a medium is showing signs of ove population. Draw suitable growth curve for them. (2)

ii) On the corresponding graph, specify 'K'. (1)

iii) Write suitable equation. 2)

OR

i) Give Verhaulst-Pearl growth curve equation. (2)

ii) A population growing in size doubles in 2 years. What is the 'r' for this? (Value of 'e' = 2.718) (3)

Q.2) Provide the examples and explain to justify the following:

a) Unrelated species can compete for the same resource. (1)

b) '*r*' *value* of *one species* can be *negatively* affected in presence of *another species*. (1)

c) *Competitive exclusion* occurs in nature. (1)

d) *Competition* can be result of *competitive release*. (1)

e) *Parasites* have to be in *long-term* association with their *respective hosts*. (1)

OR

a) Enlist any *3* ways in which *plants protect themselves* against *herbivores* and any *1* way *animals protect themselves* from their *respective predators*. (2)

b) Explain the *4 major roles played by predators' in nature*. (2)

c) Justify 'why *predators' in nature are prudent*'. (1)

ARTIFICIAL INTELLIGENCE

Guidelines for submitting the Holiday HW.

Prepare a stick file comprising of all these questions with answers. For Question no 2 and 3, use MS-Excel for creating the visualizations. The answers should be handwritten. The MS-Excel outputs should be stuck in the stick file. Use of ChatGPT or any other AI tool is strictly prohibited. Use your creativity.

1. Draw the diagram of Foundational Methodology of Data Science and Explain the steps in brief.
2. Design an effective Data Storytelling from this scenario.
   Impact of Digital Classrooms Initiative
   Background

Year	Enrolled Students	Average Attendance (%)	Dropout Students	Dropout Rate (%)
2014	2,950,000	68	182,000	6.2
2015	3,020,000	70	171,000	5.7
2016	3,180,000	73	150,000	4.7
2017	3,350,000	76	130,000	3.9
2018	3,520,000	79	115,000	3.3
2019	3,680,000	82	102,000	2.8
2020	3,600,000	75	140,000	3.9

2021	3,750,000	78	120,000	3.2
2022	3,920,000	83	98,000	2.5

In 2016, a state government launched the **Digital Classrooms Initiative (DCI)** to improve learning outcomes by introducing smart boards, internet access, and multimedia teaching in government schools. The goal was to increase student engagement, improve attendance, and reduce dropout rates.
Using the dataset above, create a compelling **data story** that explores the impact of the **Digital Classrooms Initiative (DCI)** on student attendance and dropout rates.
Your analysis should include:

1. **Trend Analysis**
   - Examine how enrolment, attendance, and dropout rates have changed over time.
   - Identify any noticeable patterns before and after 2016 (when DCI was introduced).
2. **Correlation Exploration**
   - Analyse the relationship between:
     - Attendance and dropout rates
     - Enrolment and dropout rates
   - Does higher attendance appear to reduce dropout rates?
3. **Visualization**
   Create at least **3 visualizations** in MS-EXCEL such as:
   - Line graph (Dropout Rate over Years)
   - Bar chart (Enrolment vs Dropout Students)
   - Dual-axis graph (combo chart) (Attendance vs Dropout Rate)
4. **Impact Evaluation**
   - Based on the data, discuss whether DCI had a **positive, negative, or mixed impact**.
   - Support your claims with evidence from the dataset.
5. **External Factors Analysis**
   - Identify and explain any external events that may have influenced trends (e.g., **COVID-19 pandemic in 2020**, policy changes, economic factors).
6. **Conclusion**
   - Summarize your findings in a **clear narrative** –(Maximum 2 lines)

3. Choose the correct visualisation for these scenarios.
   A school wants to analyse **student performance, attendance, and engagement** to improve learning outcomes. You are hired as a **Data Analyst** to study the data and present meaningful insights using **data storytelling and visualization techniques**.

Student_ID	Study_Hours	Attendance (%)	Marks (%)	Participation_Level	Stream
S1	2	65	58	Low	Arts
S2	4	72	64	Medium	Commerce
S3	6	85	78	High	Science
S4	3	70	60	Medium	Arts

Student_ID	Study_Hours	Attendance (%)	Marks (%)	Participation_Level	Stream
S5	7	90	88	High	Science
S6	5	80	75	Medium	Commerce
S7	8	92	91	High	Science
S8	2	60	55	Low	Arts
S9	6	88	82	High	Commerce
S10	4	75	68	Medium	Arts

Create a **compelling data story** using the dataset above. Your work should include **analysis, visualizations, and conclusions**.**Visualization Requirements**

You must include **at least 5 different types of visualizations** from the list below:

Numeric Data Visualizations

- Line Graph → Show trend between **Study Hours and Marks**
- Bar Chart → Compare **Marks across Streams**
- Histogram → Show distribution of **Marks**
- Scatter Plot → Relationship between **Attendance and Marks**
- Pie Chart → Proportion of students in each **Participation Level. (Hint: Take the count of each participation level in a separate column and then plot the Pie Chart).**

4. Observe this and explain the Design Thinking framework.

The image shows the evolution of a **wheelchair from 1760 to 2020**, highlighting advancements in design, comfort, and technology.

Using the **Design Thinking Framework**, analyse how such innovations might have been developed over time.

Task:

Write a detailed answer (at least 2 lines for each) covering all five phases:

1. **Empathize**
   - What challenges did people with mobility issues face in earlier times?
   - How might designers have understood user needs?
2. **Define**
   - Clearly state the core problem(s) in early wheelchair designs.
3. **Ideate**
   - Suggest possible ideas that could improve mobility, comfort, and independence.

4. **Prototype**
   - Describe what kind of prototype could be created (materials, features, structure).
5. **Test**
   - How would you test the wheelchair with real users?
   - What improvements might come after testing?

5. This is the latest news related to AI. Share your opinion in about 100 -200 words maximum.

Delta Air Lines CEO Ed Bastian said he prefers not to use the term **"artificial intelligence."** He argued that it creates unnecessary fear among employees about job losses. In an interview with Fortune at Great Place to Work's For All Summit in Las Vegas, Bastian said Delta refers to the technology as **"augmented intelligence"** because it is intended to help employees perform their jobs more effectively rather than replace them. His comments come as companies across industries continue to evaluate how AI could reshape operations, customer service, and workforce roles.

What Delta CEO Ed Bastian said about AI

"I think it's a mistake to call anything artificial. You want to scare people? Tell them that artificial intelligence is coming for you," Bastian told Fortune.

He added that Delta wants employees to see the technology as support rather than a threat. **"I want our employees to see it as a tool to enable them to do their jobs better, not to replace them, but to enhance them,"** the executive explained.

Bastian said Delta does not plan to use AI to reduce headcount. Instead, employees whose tasks are automated could be reassigned to customer-facing roles. **"To the extent there's less need for more people at a gate or more people on a phone, we'll redeploy those people to better serve customers even more,"** he said.

He also pointed to broader challenges facing the airline industry, including rising fuel prices and geopolitical uncertainty. He said fuel prices recently doubled in a single month, while global conflicts and trade issues continue to affect demand and operating costs.

"Carriers are going to have to reorganise in order to survive," Bastian noted, referring to airlines that rely heavily on low-cost pricing models.

He also said Delta is focused on maintaining financial stability, describing the airline's approach as building a **"fortress balance sheet"** to prepare for future disruptions. Bastian highlighted Delta's workplace culture as another focus area.

He also referenced Delta's employee profit-sharing programme, which distributes around 15% of the airline's profits to frontline staff. This year, Delta paid $1.3 billion through the programme.

On AI in aviation, Bastian made it clear that some roles will remain human-led. **"I'm never getting on an airplane without two Delta pilots on it commercially, and I don't think that's going to change anytime soon,"** he added.

COMPUTER SCIENCE

NOTE : Write the all the programs using python language

1. Write a Python program using Python language with a function from function to add 'ing' at the end of a given string. If the given string already ends with 'ing' then add 'ly' instead. If the string length is less than 3, leave it unchanged.
Example:
Input: string
Output: stringly

2. Write a Python program using a suitable function to find the roots of a quadratic equation.
A quadratic equation is represented as $ax^2 + bx + c = 0$ here a, b and c are numbers where $a \neq 0$, and x is to be calculated.

The root of any quadratic equation are given by the formula.
Use the formula:
$x = (-b \pm \sqrt{(b^2 - 4ac} / 2a$
Make use of a sqrt function and find the roots based on the discriminate $b^2 - 4ac$.

3. Write a Python function to capitalize first and last letters of each word of a given string.

4. Write a program using a function swap_case_string(str) to swap each character of a given string from lowercase to uppercase and vice versa.

5. Write a function Left Shift (lst, n) in Python which accepts numbers in a list and all the elements of the list

should be shifted to left according to the value of x.
Sample Input = [20, 40, 60, 80, 10, 50, 30, 90, 45, 29],where x = 3
Output list = [30, 10, 50, 90, 80, 45, 29, 20, 40, 60]

Case Based / Source Based Questions

1. Traffic accidents occur due to various reasons. While problems with roads or inadequate safety facilities lead to some accidents, majority of the accidents are caused by drivers' carelessness and their failure to abide by traffic rules.

ITS Roadwork is a company that deals with manufacturing and installation of traffic lights so as to minimize the risk of accidents. Keeping in view the requirements, traffic simulation is to be done. Write a program in Python that simulates a traffic light. The program should perform the following:

(a) A user-defined function trafficLight() that accepts input from the user, displays an error message if the user enters anything other than RED, YELLOW and GREEN. Function light() is called and the following is displayed depending upon return value from light():

(i) "STOP. Life is more important than speed" if the value returned by light() is 0.

(ii) "PLEASE GO SLOW." if the value returned by light() is 1.

(iii) "You may go now." if the value returned by light() is 2.

(b) A user-defined function light() that accepts a string as input and returns 0 when the input is RED, 1 when the input is YELLOW and 2 when the input is GREEN. The input should be passed as an argument.

2. Kids Elementary is a playway school focusing on "Play and Learn "strategy that helps toddlers understand concepts in a fun way. being a senior programmer, you have taken responsibility to develop a program using-defined functions to help children differentiate between upper case and lower case letters/ English alphabet in a given sentence. Make sure that you perform a careful analysis of the type of alphabets and sentences that can be

included as per age and curriculam.
Write a Python program that accepts a string and calculates the number of uppercase letters and lowercase letters.

Assertion and Reasoning Based Questions

The following questions contain two statements: Assertion and Reasoning. Each question has four choices—(i), (ii), (iii), (iv) – only one of which is correct. In the light of these statements, choose the most appropriate option.

(i) Both A and R are true and R is the correct explanation of A.

(ii) Both A and R are true but R is not the correct explanation of A.

(iii) A is true but R is false.

(iv) A is false but R is true.

1. Assertion (A): Function can take input values as parameters, execute them and return output (if required) to the calling function with a return statement.

Reasoning (R): A function in Python can return multiple values.

2. Assertion (A): If the arguments in a function call statement match the number and order of arguments as defined in the function definition, such arguments are called positional arguments.

Reasoning (R): During a function call, the argument list first contains default argument(s) followed by positional argument(s).

3. Assertion (A): Local Variables are accessible only within a function or block in which they are declared.

Reasoning (R): Global variables are accessible in the whole program.

4. Assertion (A): The local and global variables declared with the same name in the function are treated in the same manner by the Python interpreter.

Reasoning (R): The variable declared within the function block is treated as local, whereas the variable declared outside the function block will be referred to as a global variable.

5. Assertion (A): The functions developed and defined by language programmers and provided within framework of the language are termed as built-in functions

Reasoning (R): Each and every built-in function contains a set of statements to perform a specific task. They are independent entities and, hence, not included within any module or object.

6. Assertion (A): To use positional arguments, the arguments need to be passed in the same order as the respective parameters in the function definition.

Reasoning (R): If three positional arguments are to be passed to the function, the first argument will be assigned to the first parameter, second argument to the second parameter and the third argument to the third parameter.

MATHEMATICS

RELATIONS & FUNCTIONS

1) If $R = \{(a,b): |a-b| \ is \ divisible \ by \ 3, a,b \in A\}$ where $A = \{1,2,3,\ldots,12\}$ is an equivalence relation on A then find $[1]$.
2) For the set $A = \{1,2,3\}$, define a relation R on the set A as follows $R = \{(1,1),(2,2),(3,3),(1,3)\}$. Write the ordered pairs to be added to R to make the smallest equivalence relation.
3) State the reason of the relation R in the set $\{1,2,3\}$ given by $R = \{(1,2),(2,1)\}$ not to be transitive.
4) Show that the union of two equivalence relations on a set may not be an equivalence relation on that set.
5) Check whether the following relation R is reflexive , symmetric or transitive

(a) $\boldsymbol{R = \{(a,b): a \leq b^3, a,b \in R\}}$
(b) $\boldsymbol{R = \{(a,b): a \leq b^2, a,b \in R\}}$
(c) $\boldsymbol{R = \{(a,b): a \leq b, a,b \in R\}}$
(d) $\boldsymbol{R = \{(a,b): a \ divides \ b, a,b \in N\}}$
(e) $\boldsymbol{R = \{(a,b): a \ is \ perpendicular \ to \ b, a, b \ are \ lines \ in \ a \ plane\}}$

6) Prove that the inverse of an equivalence relation is also an equivalence relation.
7) Prove that the intersection of two equivalence relations is also an equivalence relation.
8) Let Z be the set of all integers. A relation R is defined on Z by $R = \{(x,y): x-y \ is \ divisible \ by \ 5\}$. Show that R is an equivalence relation on Z. Also find the equivalence classes of 0 and 1.
9) Show that the relation $R = \{(a,b): a+b \ is \ even, a,b \in Z\}$ is an equivalence relation on Z.
10) Show that the relation R on a set $A = \{1,2,3,4,5\}$ given by $R = \{(a,b): |a-b| \ is \ even\}$ is an equivalence relation.
11) Let T be the set of triangles in a plane and R be the relation in T defined as
12) $R = \{(T_1,T_2): T_1 \ is \ similar \ to \ T_2, \ T_1,T_2 \in T\}$. Show that R is equivalence relation. Consider three right angle triangles T_1 with sides 3, 4, 5, T_2 with sides 5, 12, 13 and T_3 with sides 6, 8, 10. Which triangles among T_1 , T_2 and T_3 are related?
13) Let L be the set of lines in a plane and R be the relation in L defined as

14) $R = \{(L_1,L_2): L_1 \ is \ parallel \ to \ L_2, L_1,L_2 \in L\}$. Show that R is an equivalence relation. Find the set of all lines related to the line $y = 2x + 4$.
15) Show that the relation R defined by $(a,b) \ R \ (c,d)$ when $a + d = b + c$ on the set of $N \times N$ is an equivalence relation.
16) Let the function $f: N \to N$ defined by $f(x) = \begin{cases} \frac{x+1}{2} \ if \ x \ is \ odd \\ \frac{x}{2} \ if \ x \ is \ even \end{cases}$

State whether the function f is bijective or not

17) Show that the function $f: R - \{2\} \to R - \{1\}$ given by $f(x) = \frac{x-1}{x-2}$ is a bijective function.

18) Show that the function $f: R \to (-1,1)$ defined by $f(x) = \frac{x}{1+|x|}$ is one-one and onto function.

INVERSE TRIGONOMETRIC FUNCTIONS

1) Find the principal value of the following

(i) $\text{cosec}^{-1}\left(\frac{-2}{\sqrt{3}}\right)$ (ii) $\sec^{-1}(-1)$ (iii) $\cos^{-1}\left(\frac{-1}{2}\right)$

(iv) $\cot^{-1}\left(\frac{-1}{\sqrt{3}}\right)$ (v) $\text{cosec}^{-1}(-\sqrt{2})$ (vi) $\sin^{-1}\left(\frac{-1}{2}\right)$

(vii) $\sec^{-1}(-2)$ (viii) $tan^{-1}(\frac{-1}{\sqrt{3}})$ (ix) $\sin^{-1}\left(\frac{1}{2}\right)$

(x) $\tan^{-1}(-\sqrt{3})$ (xi) $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (xii) $\cos^{-1}\left(\frac{-\sqrt{3}}{2}\right)$

2) Find the principal value of the following

(i) $\sin^{-1}\left(sin\frac{\pi}{5}\right)$ (ii) $\sin^{-1}\left(sin\frac{3\pi}{5}\right)$ (iii) $\sin^{-1}\left(sin\frac{7\pi}{6}\right)$

(iv) $\sin^{-1}\left(sin\frac{-3\pi}{4}\right)$ (v) $\sin^{-1}\left(sin\frac{-17\pi}{8}\right)$ (vi) $\sin^{-1}\left(sin\frac{13\pi}{7}\right)$

(vii) $\cos^{-1}\left(cos\frac{5\pi}{3}\right)$ (viii) $\cos^{-1}\left(cos\frac{7\pi}{6}\right)$ (ix) $\cos^{-1}\left(cos\frac{13\pi}{5}\right)$

(x) $\cos^{-1}\left(cos\frac{-7\pi}{3}\right)$ (xi) $\cos^{-1}\left(cos\frac{15\pi}{8}\right)$ (xii) $\cos^{-1}\left(cos\frac{5\pi}{6}\right)$

3) Find the domain of the following

(i) $f(x) = \sin^{-1} x + \sin x$ (ii) $f(x) = \sin^{-1}(x^2)$

(iii) $f(x) = \sin^{-1}\sqrt{x^2-1}$ (iv) $f(x) = \sin^{-1}(2x-3)$

(v) $f(x) = \sin^{-1}\sqrt{x-1}$ (vi) $f(x) = \cos^{-1}(2x-5)$

DETERMINANTS & MATRICES

4) Write the number of all possible matrices of order (2×3) with each entry 1 or 2.

5) Write the number of all possible matrices of order (3×3) with each entry 1 or 0.

6) Construct a (3×4) matrix whose elements are given by

(i) $a_{ij} = 3i - 4j$ (ii) $a_{ij} = 3i + j$

7) If $\begin{bmatrix} x+y & y-z \\ z-2x & y-x \end{bmatrix} = \begin{bmatrix} 3 & -1 \\ 1 & 1 \end{bmatrix}$ then find x, y, z.

8) If $\begin{bmatrix} x+2y & 3y \\ 4x & 2 \end{bmatrix} = \begin{bmatrix} 0 & -3 \\ 8 & 2 \end{bmatrix}$ then find the value of $(x-y)$.

9) If $\begin{bmatrix} x-y & z \\ 2x-y & w \end{bmatrix} = \begin{bmatrix} -1 & 4 \\ 0 & 5 \end{bmatrix}$ then find the value of $(x+y)$.

10) Find the value of a & b if $\begin{bmatrix} a+b & 2 \\ 5 & ab \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$.

11) Find the value of x, y, z if $\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$.

12) Find the value of a, b, c, d if $\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$.

13) If $A=\begin{pmatrix}1&0&2\\0&2&1\\2&0&3\end{pmatrix}$ then prove that $A^3-6A^2+7A+2I=O$.

14) If $A=\begin{bmatrix}2&0&1\\2&1&3\\1&-1&0\end{bmatrix}$ then find the value of $A^2-3A+2I$.

15) If $A=\begin{bmatrix}3&1\\-1&2\end{bmatrix}$ then show that $A^2-5A+7I=O$.

CONTINUITY & DIFFERENTIABILITY

1) Find the value of k so that the following functions are continuous

2) (i) $f(x)=\begin{cases}2x+1\,;x<2\\k\quad\;;x=2\\3x-1\,;x>2\end{cases}$ (ii) $f(x)=\begin{cases}\frac{1-cos4x}{x^2}\;;x<0\\k\quad\;;x=0\\\frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}\;;x>0\end{cases}$

3) (iii) $f(x)=\begin{cases}\frac{\sqrt{1+kx}-\sqrt{1-kx}}{x}\;;-1\le x<0\\\frac{2x+1}{x-1}\quad;0\le x<1\end{cases}$ (iv) $f(x)=\begin{cases}\frac{kcosx}{\pi-2x}\;;x\neq\pi/2\\3\quad\;;x=\pi/2\end{cases}$

4) Show that the function $f(x)=|x-1|+|x+1|$ is not differentiable at $x=-1$ and $x=1$.

5) Show that the function $f(x)=\begin{cases}3x-2\quad;0<x\le1\\2x^2-x\quad;1<x\le2\\5x-4\quad;x>2\end{cases}$ is not differentiable at $x=2$.

6) If the function $f(x)=\begin{cases}x^2+3x+a\,;x\le1\\bx+2\quad;x>1\end{cases}$ is differentiable at $x=1$ then find a & b.

7) Find the values of a & b for which the following functions are continuous

8) (i) $f(x)=\begin{cases}3ax+b\ if\ x>1\\11\ if\ x=1\\5ax-2b\ if\ x<1\end{cases}$ (ii) $f(x)=\begin{cases}5\quad if\ x\le2\\ax+b\quad if\ 2<x<10\\21\quad if\ x\ge10\end{cases}$

(iii) $f(x)=\begin{cases}x^2+ax+b\,;0\le x<2\\3x+2\quad;\ 2\le x\le4\\2ax+5b\quad;4<x\le8\end{cases}$ (iv) $f(x)=\begin{cases}x+2\quad;x\le2\\ax+b\quad;2<x<5\\3x-2\quad;x\ge5\end{cases}$

DIFFERENTIATION

1) Find $\frac{dy}{dx}$ for the following

(i) $yx=\sec(x+y)$ (ii) $y=\sin^{-1}\left(\frac{a+b\,cosx}{b+a\,cosx}\right)$ (iii) $x=y\log(xy)$ (iv) $sin^2y+\cos(xy)=\pi$ (v) $\sin(xy)-\cos(x-y)=y^2$ (vi) $xy+y^2=y+tanx$ (vii) $(x^2+y^2)^2=xy$ (viii) $log\sqrt{x^2+y^2}=\tan^{-1}\left(\frac{y}{x}\right)$ (ix) $\tan^{-1}(x^2+y^2)=a$

2) If $x\sqrt{y+1}+y\sqrt{x+1}=0\ then\ show\ that\ (1+x)^2\frac{dy}{dx}+1=0$.

3) If $y=\sqrt{\frac{1-x}{1+x}}$ then show that $(1-x^2)\frac{dy}{dx}+y=0$.

4) If $y=x\sin(a+y)$ then prove that $\frac{dy}{dx}=\frac{sin^2(a+y)}{\sin(a+y)-y\cos(a+y)}$

5) If $\log(x^2+y^2)=2\tan^{-1}\left(\frac{y}{x}\right)$ then show that $\frac{dy}{dx}=\frac{x+y}{x-y}$.

6) If $y\sqrt{x^2+1}=\log\left(\sqrt{x^2+1}-x\right)\ then\ show\ that\ (x^2+1)\frac{dy}{dx}+xy+1=0$.

7) Find $\frac{dy}{dx}$ for the following (i) $y = x^{\sin x}$

(ii) $y = (\sin x)^{\cos x}$

(iii) $y = (\log x)^{\sin x}$

(iv) $y = (x+2)^2(x+4)^3(x+5)^4$

(v) $y = \sqrt{\frac{(x-3)(x-4)(x+1)}{(x^2+2)(x^3+5)}}$

(*vi*) $y = (x^3+3)^2(x-5)^{7/2}\sqrt{x^2+1}$

(vii) $y = (x)^x + (sinx)^x$

(viii) $y = (logx)^x + x^{logx}$

(ix) $y = (sinx)^x + \sin^{-1}\sqrt{x}$

8) If $x^m y^n = (x+y)^{m+n}$ then prove that $\frac{dy}{dx} = \frac{y}{x}$.

9) If $x = e^{x/y}$ then show that $\frac{dy}{dx} = \frac{x-y}{x\log x}$.

10) If $x^y = e^{x-y}$ then show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$

11) Find $\frac{dy}{dx}$ for the following functions

(i) $x = a\sin\theta, y = b\cos\theta$ (ii) $x = 2at^2, y = a\,t^4$

(iii) $x = a\sec\theta, y = b\,tan\,\theta$ (iv) $x = a\,cos^3\theta, y = a\,sin^3\theta$

(v) $x = a(cost + t\,sint), y = a(sint - t\,cost)$ (vi) $x = a\left(cost + \log\left(tan\frac{t}{2}\right)\right), y = a\,sint$

12) If $x = e^{cos2t}$ & $y = e^{sin2t}$ then prove that $\frac{dy}{dx} = \frac{-y\,logx}{x\,logy}$.

13) If $x = \sqrt{a^{\sin^{-1}t}}$ & $y = \sqrt{a^{\cos^{-1}t}}$ then prove that $\frac{dy}{dx} = \frac{-y}{x}$.

14) Differentiate the following

15) (i) x^4 w.r.t x^2 (ii) $\sin x$ w.r.t $\log(\cos x)$

16) (iii) $\sin^{-1}x$ w.r.t $\cos^{-1}\sqrt{1-x^2}$ (iv) $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ w.r.t $\tan^{-1}x$

(v) $\log(sinx)$ w.r.t $\sqrt{cosx}$ (vi) sin^2x w.r.t $(log\,x)^2$

17) If $y = Ae^{mx} + Be^{nx}$ then show that $y_2 - (m+n)y_1 + mny = 0$.

18) If $y = ae^{2x} + be^{-x}$ then show that $y_2 - y_1 - 2y = 0$.

19) If $y = 5e^{3x} + 4e^{2x}$ then show that $y_2 - 5y_1 + 6y = 0$.

20) If $y = \cos^{-1}x$ then find $\frac{d^2y}{dx^2}$ in terms of y alone.

Dear Students,

You are all instructed to prepare a separate notebook and solve all previous years' questions (2015 to 2026) from the chapters Matrices and Determinants, Inverse Trigonometric functions along with the questions of practice sets given below Please ensure the following:

- **Write the questions in black pen.**
- **Write the answers in blue pen.**
- **Make sure your work is neat and complete**

DATE OF SUBMISSION :- REOPENING DAY

PRACTICE SET -1

CHAPTER NAME- Matrices & Determinants

1	If A = $\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$ ($i^2 = -1$) and B = $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$, then AB is equal to a) $\begin{bmatrix} 0 & 0 \\ i & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ c) $\begin{bmatrix} i & -i \\ 0 & 1 \end{bmatrix}$ d) $\begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$	**[1]**
2	If $\begin{bmatrix} x+y & x+2 \\ 2x-y & 16 \end{bmatrix} = \begin{bmatrix} 8 & 5 \\ 1 & 3y+1 \end{bmatrix}$, then the value of x and y are: a) x = 3, y = 5 b) x = 7, y = 2 c) x = 5, y = 3 d) x = 2, y = 7	**[1]**
3	If matrix A = [a_{ij}] , where $a_{ij} = \begin{cases} 1, if i \neq j \\ 0, if i = j \end{cases}$,then A^3 is equal to: a) I b) A c) J d) O	**[1]**
4	If A is a square matrix such that A^2 = I, then (A - I)^3 + (A + I)^3 - 7A is equal to: a) I + A b) 3A c) I - A d) A	**[1]**
5	If A = $\begin{bmatrix} 2 & 0 & -3 \\ 4 & 3 & 1 \\ -5 & 7 & 2 \end{bmatrix}$ is expressed as the sum of a symmetric and skew - symmetric matrix, then the symmetric matrix is a) $\begin{bmatrix} 2 & 2 & -4 \\ 2 & 3 & 4 \\ -4 & 4 & 2 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ c) $\begin{bmatrix} 2 & 4 & -5 \\ 0 & 3 & 7 \\ -3 & 1 & 2 \end{bmatrix}$ d) $\begin{bmatrix} 4 & 4 & -8 \\ 4 & 6 & 8 \\ -8 & 8 & 4 \end{bmatrix}$	**[1]**
6	Which of the given values of x and y make the pair of matrices equal? $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}, \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$ a) x = $\frac{-1}{3}$,y = 7 b) y = 7, x = $\frac{-2}{3}$ c) Not possible to find d) $x = \frac{-1}{3}, y = \frac{-2}{3}$	**[1]**
7	If the order of matrix A is m× p and the order of B is p × n. Then the order of matrix AB is? a) m× p b) m× n c) n× m d) n× p	**[1]**
8	If $\begin{bmatrix} 1 & 3 & 9 \\ 1 & x & x^2 \\ 4 & 6 & 9 \end{bmatrix}$ is singular matrix, then x = a) 3 or 6 b) 3 or $\frac{3}{2}$ c) 3 d) - 3, $\frac{3}{2}$	**[1]**
9	If a matrix A is such that $3A^3 + 2A^2 + 5A + I = 0$, then A^{-1} is equal to a) - $(3A^2 + 2A + 5)$ b) $3A^2 + 2A + 5$ c) $3A^2$ - 2A - 5	**[1]**

	d) none of these	
10	If A = $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is such that A ^{2} = I, then: a) 1 - $\alpha^2 + \beta\gamma = 0$ b) 1 - $\alpha^2 - \beta\gamma = 0$ c) 1 +$\alpha^2 - \beta\gamma = 0$ d) 1 +$\alpha^2 + \beta\gamma = 0$	**[1]**
11	If A = $\begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$, then det (adj (adj A)) is a) 14^2 b) 14 c) 14^3 d) 14^4	**[1]**
12	For what value of k inverse does not exist for the matrix $\begin{bmatrix} 1 & 2 \\ k & 6 \end{bmatrix}$? a) 2 b) 0 c) 3 d) 6	**[1]**
13	If A is a non - singular matrix, then a) $\|AA'\| \neq \|A^2\|$ b) $\|A\| + \|A'\| \neq 0$ c) $\|A^{-1}\| \neq \|A\|^{-1}$ d) $\|A\| \neq \|A'\|$	**[1]**
14	If the points (1, 3) (x, 5) and (2, 7) are collinear, then the value of x is a) $\frac{3}{4}$ b) $\frac{3}{2}$ c) 2 d) 1	**[1]**
15	If A = $\begin{bmatrix} 2 & \lambda & -3 \\ 0 & 2 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, then A $^{-1}$ exists if a) $\lambda = 2$ b) $\lambda \neq 2$ c) $\lambda \neq -2$ d) none of these	**[1]**
16	If A is an invertible matrix, then which of the following is not true? a) $\|A\| \neq 0$ b) $\|A^{-1}\| = \|A\|^{-1}$ c) $(A^2)^{-1} = (A^{-1})^2$ d) $(A')^{-1} = (A^{-1})'$	**[1]**
17	If A and B are square matrices of the same order, then (A + B) (A - B) is equal to: a) $A^2 - B^2$ b) $A^2 - BA + B^2 + AB$ c) $A^2 - BA - AB - B^2$ d) $A^2 - B^2 + BA - AB$	**[1]**
18	If A and B are two matrices such that AB = A and BA = B, then B^2 is equal to: a) A b) B c) O d) I	**[1]**
19	For any 2× 2 matrix, if A (Adj A) = $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then |A| is equal to a) 0 b) 100 c) 10 d) 20	**[1]**
20	The matrix A = $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$,then A ^{6} is equal to: a) I^2 b) zero matrix c) I d) A	**[1]**
21	What is x if $\begin{bmatrix} 1 & 4 \\ 2 & x \end{bmatrix}$ is a singular matrix? a) 5 b) 6 c) 8 d) 7	**[1]**
22	If [x 1] $\begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix}$ = 0, then x equals: a) - 2 b) - 1 c) 2 d) 0	**[1]**

23	If B is a non - singular matrix and A is a square matrix, then det (B^{-1} AB) is equal to a) Det (B^{-1}) b) Det (A^{-1}) c) Det (B) d) Det (A)	
24	If A is a non - singular square matrix of order 3 such that A^2 = 3A, then the value of |A | is a) 27 b) - 3 c) 3 d) 9	**[1]**
25	If $\begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix}$ A = $\begin{bmatrix} g & hi \\ j & kl \\ m & no \end{bmatrix}$ then order of matrix A is: a) 2× 3 b) 3× 3 c) 3× 2 d) 2× 2	**[1]**
26	Out of the following matrices, choose that matrix which is a scalar matrix: a) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$	**[1]**
27	If A =$\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that A $^{-1}$ = kA, then k equals a) - 19 b) $\frac{1}{19}$ c) 19 d) $-\frac{1}{19}$	**[1]**
28	Adjoint of matrix$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ is: a) $\begin{vmatrix} 4 & 2 \\ 3 & 1 \end{vmatrix}$ b) $\begin{vmatrix} 4 & -2 \\ -3 & 1 \end{vmatrix}$ c) $\begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$ d) $\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix}$	**[1]**
29	If A =$\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$,then A ^{2} - 5A - 7I is: a) a zero matrix b) an unique matrix c) diagonal matrix d) an identity matrix	**[1]**
30	If A^2 - A + I = O, then the inverse of A is a) I - A b) A + I c) A^{-2} d) A - I	**[1]**
31	If$A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then a) α = 2ab, β = a ^{2} + b ^{2} b) α = a ^{2} + b ^{2} , β = 2ab c) α = a ^{2} + b ^{2} , β = a ^{2} - b ^{2} d) α = a ^{2} + b ^{2} , β = ab	**[1]**
32	If matrix A is of order m× n, and formatrix B, AB and BA both are defined, then order of matrix B is: a) m× m b) m× n c) n× m d) n× n	**[1]**
33	If A is a square matrix of order 3 such that A (adj A)$\begin{bmatrix} -3 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -3 \end{bmatrix}$, then |A| is equal to a) - 6 b) - 3 c) 9 d) 3	**[1]**
34	A and B are square matrices each of order 3 such that |A| = - 1 and |B| = 3. What is the value of |3AB|? a) - 9 b) - 27 c) - 18 d) - 81	**[1]**

35	. Let A bea square matrix of order 2× 2, then |KA| is equal to: a) K^3 |A| b) K^2 |A| c) K |A |d) 2K|A|	**[1]**
36	If A is a square matrix of order 3 and |A| = 2, then the value of | - AA'| is a) 4 b) 2 c) - 4 d) - 2	**[1]**
37	If A is any square matrix of order 3× 3 such that |A| = 3, then the value of |adj A| is a) 27 b) $\frac{1}{3}$ c) 9 d) 3	**[1]**
38	Total number of possible matrices of order 2× 3 with each entry 1 or 0 is: a) 6 b) 64 c) 36 d) 32	**[1]**
39	If Ais a square matrix of order3 such that A(adjA) = $\begin{bmatrix} -2 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -2 \end{bmatrix}$, then |adjA| is equal to a) 4 b) - 2c) - 8 d) - 4	**[1]**
40	If$A = \begin{bmatrix} 2 & -1 & 3 \\ 4 & 5 & -6 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & -6 \end{bmatrix}$, then a) only BA is defined b) AB and BA both are not defined c) onlyAB is defined d) AB and BA are both defined	**[1]**
41	If A = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 1 \\ a & b & 2 \end{bmatrix}$, then aI + bA + 2$A^2$ equals a) ab A b) - A c) none of these d) A	**[1]**
42	If A and B are two matrices of order 3× m and 3 × n respectively and m = n, then the order of 5A - 2B is: a) m× n b) 3× 3 c) m× 3 d) 3× n	**[1]**
43	If A, B are two non - singular matrices of same order, then a) AB is non - singular b) $(AB)^{-1} = A^{-1} B^{-1}$ c) AB is singular d) AB is not invertible	**[1]**
44	If A, B are square matrices of order 3, A is non - singular and AB = O, then B is a: a) non - singular matrix b) singular matrix c) null matrix d) unit matrix	**[1]**
45	If$A = \begin{bmatrix} \frac{1}{3} & 2 \\ 0 & 2x-3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$ and AB = I_2 , then the value of x is	**[1]**

	a) 0 b) 1 c) - 1 d) 2	
46	The matrix A = $\begin{bmatrix} 0 & 0 & 4 \\ 0 & 4 & 0 \\ 4 & 0 & 0 \end{bmatrix}$ is a a) unit matrix b) diagonal matrix c) none of these d) square matrix	**[1]**
47	The system of linear equations $2x + ky = 7$ $3x + 2y = 7$ will be consistent, if: a) $k = \frac{4}{3}$ b) $k = \frac{3}{4}$ c) $k \neq \frac{4}{3}$ d) $k \neq \frac{3}{4}$	**[1]**
48	The number of all possible matrices of order 3× 3 with each entry 0 or 1 is: a) 512 b) 27 c) 81 d) 18	**[1]**
49	If A satisfies the equation $x^3 - 5x^2 + 4x + \lambda = 0$, then A^{-1} exists it a) $\lambda \neq -1$ b) $\lambda \neq 1$ c) $\lambda \neq 0$ d) $\lambda \neq 2$	**[1]**
50	If $\begin{vmatrix} 3x & 4 \\ 5 & x \end{vmatrix} = \begin{vmatrix} 4 & -3 \\ 5 & -2 \end{vmatrix}$, then x = a) $3x^2 - 20 = -8 + 15$ $\Rightarrow 3x^2 = 27 \Rightarrow x^2 = 9 \Rightarrow x = \pm 3$. b) 3 only c) 3 or - 3 d) - 3 only	**[1]**
51	If A = [a_{ij}] \$_{ 2\$ where $a_{ij} = \begin{cases} 1, & if i \neq j \\ 0, & if i = j \end{cases}$, then A^2 is equal to a) J b) A c) I d) O	**[1]**
52	The matrix $\begin{bmatrix} 2 & -1 & 3 \\ \lambda & 0 & 7 \\ -1 & 1 & 4 \end{bmatrix}$ is not invertible for a) $\lambda = 0$ b) $\lambda = 1$ c) $\lambda \in R - \{1\}$ d) $\lambda = -1$	**[1]**
53	If A = $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$,then A^2 is equal to a) a unit matrix b) - A c) a null matrix d) A	**[1]**
54	The value of the determinant $\begin{vmatrix} 1 & 2 & 4 \\ -1 & 3 & 0 \\ 4 & 1 & 0 \end{vmatrix}$ is a) 52 b) - 13 c) 13 d) - 52	**[1]**
55	If A = $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$, then A^5 = a) 10A b) 32A c) 16A d) 5A	**[1]**
56	If Ais a square matrix of order 3 and |A| = 5, then the value of |2A'| is	**[1]**

	a) 40 b) - 10 c) 10 d) - 40	
57	The area of a triangle with vertices (- 3, 0), (3, 0) and (0, k) is 9 sq. units. Then, the value of k will be a) - 9 b) 6 c) 3 d) 9	**[1]**
58	If A, B are two n× n non - singular matrices, then a) AB is singular b) $(AB)^{-1} = A^{-1} B^{-1}$ c) $(AB)^{-1}$ does not exist d) AB is non - singular	**[1]**
59	If A and B are matrices of the same order, then $AB^T = B^T A$ is a: a) unit matrix b) skew - symmetric matrix c) null matrix d) symmetric matrix	**[1]**
60	If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then the value of x is a) 3 b) 6 c) ± 3 d) ± 6	**[1]**
61	Suppose A, B and C are three square matrices of the same order such that A B is invertible. **Assertion (A):** If AB = AC, then B = C **Reason (R):** A is invertible. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
62	**Assertion (A):** Matrix $A = \begin{bmatrix} 0 & -6 & 7 \\ 6 & 5 & -1 \\ -7 & 1 & 0 \end{bmatrix}$ is a skew - symmetric matrix. **Reason (R):** A matrix A is skew - symmetric if $A' = -A$. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
63	For the matrices A' = $\begin{bmatrix} 3 & 4 \\ -1 & 2 \\ 0 & 1 \end{bmatrix}$ and B = $\begin{bmatrix} -1 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, consider the following statements. **Assertion (A):** (A + B)' = A' - B' **Reason (R):** (A - B)' = A' - B'	**[1]**

	a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	
64	**Assertion (A):** Scalar matrix A = $[a_{ij}] = \begin{cases} k, & i = j \\ 0, & i \neq j \end{cases}$, where k is a scalar, is an identity matrix when k = 1. **Reason (R):** Every identity matrix is not a scalar matrix. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
65	Let A be a square matrix. **Assertion (A):** Every square matrix can be expressed as the sum of symmetric and skewsymmetric matrices. **Reason (R):** (A + A') is symmetric matrix and (A - A') is skew - symmetric matrix. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
66	**Assertion (A):** If $\begin{vmatrix} x^2 - 4x & x^2 \\ x^2 & x^3 \end{vmatrix} = \begin{vmatrix} -3 & 1 \\ -x + 2 & 1 \end{vmatrix}$, then the value of x = 1. **Reason (R):** Two matrices A = [a $_{ij}$] $_{ m$ and B = [b $_{ij}$] $_{ m$ of same order m × n are equal, if a $_{ij}$ = b $_{ij}$ for all i = 1, 2, 3, ... m and j = 1, 2, 3, ... n. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
67	**Assertion (A):** If A = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$, then |3A| = 27|A| **Reason (R):** If A is a square matrix of order n, then |kA| = k ^{n} |A|. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**

68	**Assertion (A):** If A = $\begin{bmatrix}2 & 3 & -1\\1 & 4 & 2\end{bmatrix}$ and B = $\begin{bmatrix}2 & 3\\4 & 5\\2 & 1\end{bmatrix}$, then AB and BA both are defined. **Reason (R):** For the two matrices A and B, the product AB is defined, if number of columns in A is equal to the number of rows in B. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
69	**Assertion (A):** If $\begin{bmatrix}xy & 4\\z+5 & x+y\end{bmatrix} = \begin{bmatrix}4 & w\\0 & 4\end{bmatrix}$, then x = 2, y = 2, z = - 5 and w = 4. **Reason (R):** Two matrices are equal, if their orders are same and their corresponding elements are equal. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	**[1]**
70	**Assertion (A):** If A is a square matrix of order 3 such that |adj A| = 144, then the value of |A| is $\pm$ 12. **Reason (R):** If A is an invertible matrix of order n, then |adj A| = $\|A\|^{n-1}$. a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). b) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A). c) Assertion (A) is true but Reason (R) is false. d) Assertion (A) is false but Reason (R) is true.	**[1]**

PRACTICE SET - 2

CHAPTER NAME- Matrices & Determinants

1	For the matrices A = $\begin{bmatrix}2 & 1\\5 & 3\end{bmatrix}$ and B = $\begin{bmatrix}4 & 5\\3 & 4\end{bmatrix}$ verify that $(AB)^{-1} = B^{-1} A^{-1}$.	**[2]**
2	If A = $\begin{bmatrix}3 & -2\\4 & -2\end{bmatrix}$, find the value of λ so that $A^2 = \lambda A - 2I$. Hence, find A^{-1} .	**[2]**
3	If A = $\begin{bmatrix}\alpha & \beta\\\gamma & -\alpha\end{bmatrix}$ and $A^2 = I$, find the value of $\alpha^2 + \beta\gamma$.	**[2]**
4	If $\begin{vmatrix}x-2 & -3\\3x & 2x\end{vmatrix} = 3$, find the integral value(s) of x.	**[2]**
5	Given A = $\begin{bmatrix}2 & -3\\-4 & 7\end{bmatrix}$, compute A^{-1} and show that $2A^{-1} = 9I - A$.	**[2]**

6	If A, B are square matrices of equal order and B is symmetric, then show that A'BA is also symmetric.	**[2]**
7	If A = $\begin{bmatrix}1 & 1\\1 & 1\end{bmatrix}$,satisfies $A^4 = \lambda A$, then write the value of λ .	**[2]**
8	Find the value(s) of k if the area of the triangle with vertices (- 2, 0), (0, 4) and (0, k) is 4 square units.	**[2]**
9	Show that the matrix B^T AB is symmetric or skew - symmetric according to as A is symmetric or skew - symmetric.	**[2]**
10	If A = $\begin{bmatrix}3 & -2\\4 & -2\end{bmatrix}$,find k such that $A^2 = kA - 2I_2$.	**[2]**
11	Find the value of x: $\begin{bmatrix}2x-y & 5\\3 & y\end{bmatrix} = \begin{bmatrix}6 & 5\\3 & -2\end{bmatrix}$	**[2]**
12	Using matrix method, solve the following system of equations: x + y + z = 9 2x + 5y + 7z = 52 2x + y - z = 0	**[2]**
13	If A = $\begin{bmatrix}2 & -3 & -5\\-1 & 4 & 5\\1 & -3 & -4\end{bmatrix}$ and B = $\begin{bmatrix}2 & -2 & -4\\-1 & 3 & 4\\1 & -2 & -3\end{bmatrix}$,show that AB = Aand BA = B.	**[2]**
14	Compute the products AB and BA if exists in the case: A =[1 - 1 2 3] and B = $\begin{bmatrix}0\\1\\3\\2\end{bmatrix}$	**[2]**
15	A is a matrix of the type 3× 5 and R is a row of A, then what is the type of R as a matrix?	**[2]**
16	Write the minors and cofactors of each element of the first column of the given matrix and hence evaluate the determinant: $A = \begin{bmatrix}5 & 20\\0 & -1\end{bmatrix}$	**[2]**
17	Show that amatrix that is both symmetric, as well as skew - symmetric, is a null matrix.	**[2]**
18	Prove that the points P(a, b + c), Q(b, c + a) and R(c, a + b) are collinear.	**[2]**
19	For the matrix A = $\begin{bmatrix}3 & 2\\1 & 1\end{bmatrix}$, find the numbers a and b such that $A^2 + aA + bI = O$. Hence, find A^{-1} .	**[2]**
20	If A is a square matrix such that $A^2 = A$, show that $(I + A)^3 = 7A + I$.	**[2]**
21	Find the matrix X for which $\begin{bmatrix}1 & -4\\3 & -2\end{bmatrix}$ X = $\begin{bmatrix}-16 & -6\\7 & 2\end{bmatrix}$.	**[2]**
22	If A is any square matrix, prove that AA' is symmetric.	**[2]**
23	If A is a skew - symmetric matrix and n is an even natural number, write whether A^n is symmetric or skew - symmetric or neither of these two.	**[2]**
24	Using determinants, find the area of the triangle with vertices (- 3, 5), (3, - 6) and (7, 2).	**[2]**
25	Solve: 3(2u + v) = 7 uv; 3(u + 3v) = 11 uv	**[2]**
26	If $\begin{bmatrix}x+3 & 4\\y-4 & x+y\end{bmatrix} = \begin{bmatrix}5 & 4\\3 & 9\end{bmatrix}$,find x and y.	**[2]**
27	Following equations are consistent? If consistent, solve the: 4x - 2y + 6z = 8 2x - y + 3z = 4 2x - y + 3z = 13	**[2]**

28	If A =[a_{ij}] = $\begin{bmatrix} 2 & 3 & -5 \\ 1 & 4 & 9 \\ 0 & 7 & -2 \end{bmatrix}$ and B =[b_{ij}] = $\begin{bmatrix} 2 & -1 \\ -3 & 4 \\ 1 & 2 \end{bmatrix}$ then find $a_{22} + b_{21}$.	**[2]**
29	If A = $\begin{bmatrix} 4 & 3 \\ 2 & 5 \end{bmatrix}$, find x and y such that $A^2 - xA + yI = O$. Hence, evaluate A^{-1} .	**[2]**
30	If A = $\begin{bmatrix} 3 & 5 \\ -2 & 3 \end{bmatrix}$, find A^{-1} and use it to solve the system of equations: 3x - 2y = 7, 5x + 3y = 1	**[2]**
31	Use matrix method to solve the following system of equations: 5x + 2y = 4 7x + 3y = 5	**[2]**
32	If A = $\begin{bmatrix} 3 & \sqrt{3} & 2 \\ 4 & 2 & 0 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & -1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$, then verify that (A')' = A.	**[2]**
33	If for any 2× 2 square matrix A, A(adj A) = $\begin{bmatrix} 8 & 0 \\ 0 & 8 \end{bmatrix}$, find the value of |A|.	**[2]**
34	Write the value of x + y + z if $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$	**[2]**
35	If A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, B = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find adj(AB).	**[2]**
36	If2 $\begin{bmatrix} 3 & 4 \\ 5 & x \end{bmatrix} + \begin{bmatrix} 1 & y \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 7 & 0 \\ 10 & 5 \end{bmatrix}$,find x and y.	**[2]**
37	If A = $\begin{bmatrix} 1 & -3 & 2 \\ 2 & 0 & 2 \end{bmatrix}$, B = $\begin{bmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$,find the matrix C such that A + B + C is zero matrix.	**[2]**
38	Using matrix method, solve the following system of equations: 2x - 3y + 5z = 11 3x + 2y - 4z = - 5 x + y - 2z = - 3	**[2]**
39	If $\begin{bmatrix} 1 & 0 \\ y & 5 \end{bmatrix} + 2 \begin{bmatrix} x & 0 \\ 1 & -2 \end{bmatrix}$ = I,where I is 2 × 2 unit matrix. Find x and y.	**[2]**
40	Solve: 2(3u - v) = 5uv 2(u + 3v) = 5uv	**[2]**