3 SEM TDC PHYH (CBCS) C 5

2 0 2 2

(Nov/Dec)

PHYSICS

(Core)

Paper : C–5

(Mathematical Physics—II)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. Choose the correct answer : 1×5=5

   (a) The value of $erf(x) + erf_c(-x)$ is

   (i) 1

   (ii) 0

   (iii) –1

   (iv) None of the above

(b) The value of $\Gamma\left(\frac{1}{2}\right)$ is

    (i) $\sqrt{\pi}$

    (ii) $\frac{-\pi}{2}$

    (iii) $-2\sqrt{\pi}$

    (iv) 0

(c) The value of Legendre polynomial $P_{2m+1}(0)$ is

    (i) 0

    (ii) 1

    (iii) 2

    (iv) −1

(d) e^{2tx-t^2} is the generating function for

    (i) Bessel polynomial

    (ii) Laguerre polynomial

    (iii) Hermite polynomial

    (iv) None of the above

     (Continued)

(e) The Fourier series representation of an even function

    (i) consists of both sine and cosine terms

    (ii) consists of sine terms only

    (iii) consists of cosine terms only

    (iv) None of the above

2. (a) Describe the complex form of Fourier series.   2

(b) Expand the function $f(x) = x + x^2$ in a Fourier series in the interval $-\pi \leq x \leq \pi$. Hence, show that

$$\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$$

     4+2=6

(c) Represent $f(x)$ in a Fourier series, if

$$f(x) = 1, \quad 0 < x < \frac{1}{2}$$
$$= 0, \quad \frac{1}{2} < x < 1$$

     3

3. (a) Determine whether $x = 0$ is an ordinary point or singular point of the following differential equation :   1+2=3

$$2x^2 y'' + 7x(x+1)y' - 3y = 0$$

     (Turn Over)

(b) Solve the following using Frobenius method (any *one*) : 5

   (i) $x^2 y'' + (x + x^2)y' + (x - 9)y = 0$

   (ii) $4xy'' + 2y' + y = 0$

(c) Show that $P_n'(1) = \frac{1}{2}n(n+1)$. 3

(d) Show that

$$P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n}(x^2 - 1)^n$$ 4

Or

Show that

$$\left[J_{\frac{1}{2}}(x)\right]^2 + \left[J_{-\frac{1}{2}}(x)\right]^2 = \frac{2}{\pi x}$$

4. Evaluate : 3

$$\int_0^\infty \sqrt[4]{x}\, e^{-\sqrt{x}}\, dx$$

Or

Prove that

$$\beta(l, m) = \frac{\Gamma(l)\Gamma(m)}{\Gamma(l+m)}$$

5. Answer any *two* of the following : 3×2=6

(a) What are truncation error and rounding off error? Illustrate with examples. 1½×2=3

(b) Find the maximum error in magnitude in the approximation $f(x, y) = x^2 - xy + \frac{1}{2}y^2 + 3$ over the rectangle $R : |x - 3| < 0\cdot01$ and $|y - 2| < 0\cdot01$. 3

(c) What is standard deviation of a data? Calculate the standard deviation of the series $a, a+d, a+2d, \cdots, a+nd$. 3

6. (a) Solve any *two* of the following partial differential equations by method of separation of variables : 4×2=8

   (i) $16\dfrac{\partial^2 z}{\partial x^2} = \dfrac{\partial^2 z}{\partial t^2}$ under the condition $u(x, 0) = x^2(5 - x)$

   (ii) $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} = 2(x+y)u$

   (iii) $\dfrac{\partial u}{\partial x} - 2\dfrac{\partial u}{\partial y} = u$ under the condition $u(x, 0) = 3e^{-5x} + 2e^{-3x}$

(b) Find the solution of 2-D Laplace's equation in spherical polar coordinates. 5

Or

Find the solution of 1-D wave equation by D'Alembert's method.

★ ★ ★

3 SEM TDC PHYH (CBCS) C 6

2 0 2 2

(Nov/Dec)

PHYSICS

(Core)

Paper : C–6

(Thermal Physics)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. Choose the correct option :   1×5=5

    (a) In an isochoric process, the first law of
         thermodynamics is

        (i) $dU = dQ - dW$

        (ii) $dU = dQ$

        (iii) $dU = dW$

        (iv) $dW = dQ$

(Turn Over)

(2)

(b) In a Carnot engine, if the temperature of the source and sink is increased by the same amount, the efficiency of the engine will

    (i) increase

    (ii) decrease

    (iii) remain same

    (iv) None of the above

(c) In which of the following processes entropy remains constant?

    (i) Isothermal process

    (ii) Adiabatic process

    (iii) Isochoric process

    (iv) Isolated process

(d) Which of the following expressions defines Gibbs' free energy?

    (i) $G = PV + TS$

    (ii) $G = U - TS + PV$

    (iii) $G = U + TS + PV$

    (iv) $G = PV - TS$

(e) For an ideal gas, Joule-Kelvin coefficient μ is

    (i) 1

    (ii) −1

    (iii) 0

    (iv) None of the above

(Continued)

(3)

2. (a) What do you mean by thermodynamic equilibrium?   2

(b) What is the basic difference between reversible and irreversible processes?   2

(c) State Kelvin-Planck statement of second law of thermodynamics.   2

(d) Draw the temperature-entropy diagram for Carnot's cycle.   2

(e) What do you mean by adiabatic demagnetization?   2

3. (a) Show that entropy of the universe is increasing.   3

(b) Derive Clausius-Clapeyron equation.   3

(c) State Charles' law. Deduce the Charles' law from kinetic theory.   1+2=3

(d) Deduce most probable velocity from Maxwell's velocity distribution function.   3

4. (a) Derive an expression for work done during an adiabatic process.   4

(b) Describe the working of refrigerator. Find an expression for its coefficient of performance.   4

Or

State and prove Carnot's theorem.

(Turn Over)

(c) State and explain the law of equipartition of energy.   4

Or

Derive an expression of coefficient of viscosity using kinetic theory.

(d) Show that Joule-Thomson coefficient

$$\mu = \frac{1}{C_P}\left[T\left(\frac{\partial V}{\partial T}\right)_P - V\right]$$

     4

5. *(a)* Using Maxwell's thermodynamic relation, show that $C_P - C_V = R$.   5

(b) Discuss the results of Andrews' experiment.   5

Or

Derive Boyle's temperature from van der Waals' equation.

★ ★ ★

3 SEM TDC PHYH (CBCS) C 7

2022

(Nov/Dec)

PHYSICS

(Core)

Paper : C–7

(Digital Systems and Applications)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct answer (any *five*) :   1×5=5

   (a) The shift of spot of light on the screen per unit change in voltage across the deflection plate is called

      (i) current sensitivity

      (ii) voltage sensitivity

      (iii) deflection sensitivity

      (iv) None of the above

   (b) Linear ICs are used in

      (i) calculators

      (ii) computers

      (iii) TV and radio receivers

      (iv) counting circuits

(*Turn Over*)

(2)

(c) The expression $\overline{ABC}$ can be simplified to

  (i) $\overline{A} \cdot \overline{B} \cdot \overline{C}$

  (ii) $AB + BC + CA$

  (iii) $AB + \overline{C}$

  (iv) $\overline{A} + \overline{B} + \overline{C}$

(d) A half adder is constructed from

  (i) two XOR gates

  (ii) one XOR gate and an OR gate with their inputs connected in parallel

  (iii) one XOR gate and one AND gate with their inputs connected in parallel

  (iv) one XOR gate and one NAND gate

(e) A flip-flop is used to store

  (i) two bits of data

  (ii) one bit of data

  (iii) three bits of data

  (iv) None of the above

(f) Microprocessor 8085 has

  (i) 8-bit

  (ii) 16-bit

  (iii) 32-bit

  (iv) None of the above

(3)

2. Deduce an expression for deflection sensitivity of CRT.   3

Or

What is integrated circuit? How can transistor be fabricated in an IC?   3

3. Convert hexadecimal number 4 DFA into binary numbers.   2

4. Draw a circuit diagram for an AND gate using only NAND gates.   2

Or

How will you assemble an inverter by using NAND gate or NOR gate?   2

5. State and prove De Morgan's theorems.   3

6. What is Karnaugh map? Enter the following function on a Karnaugh map :   1+2=3

$$F = ABC + A\overline{B}C + AB\overline{C}$$

Or

Prove the following expression, using laws of Boolean algebra :   3

$$(AB + C)\,(AB + D) = AB + CD$$

7. Explain the circuit diagram of a full adder with truth table.   4

Or

What is the difference between adder and subtractor? Explain the circuit diagram of a half-subtractor.   1+3=4

8. What is a flip-flop? What is its importance in digital system? Explain the operation of *J-K* flip-flop. 1+1+3=5

9. *(a)* What is multivibrator? Distinguish between astable and monostable multivibrators. 1+1=2

   (b) Draw the logic diagram of 4-bit parallel in-parallel out shift register. 2

10. What is a counter? What is the difference between decade counter and synchronous counter? 1+3=4

11. *(a)* Distinguish between volatile memory and non-volatile memory. Draw the block diagram of an 8×8 memory chip. How is information written in memory cell? 2+3+1=6

    (b) Define primary and secondary memories. 2

12. *(a)* Explain with necessary diagram, the functions of different pins of 8085 microprocessor. 5

    (b) What is data bus? Is it unidirectional? 1+1=2

    (c) Define assembler. What is the basic difference between arithmetic instruction and logical instruction? 1+2=3

★ ★ ★

3 SEM TDC CHMH (CBCS) C 5

2 0 2 2

(Nov/Dec)

CHEMISTRY

(Core)

Paper : C-5

(Inorganic Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct answer from the following : 1×5=5

   (a) Which of the following acids results from better hard-hard combination?
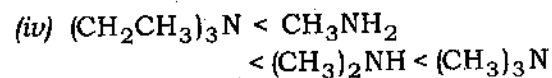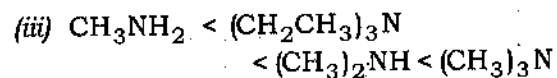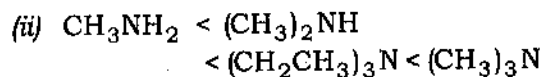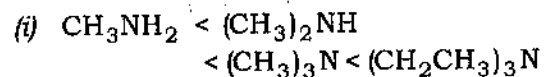
     (i) HCN

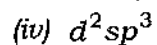   (ii) HI

     (iii) HCl

     (iv) HNO_2

                     (Turn Over)

(b) Which one of the following is the correct order of increasing basicity?

(i) $CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N < (CH_2CH_3)_3N$

(ii) $CH_3NH_2 < (CH_3)_2NH < (CH_2CH_3)_3N < (CH_3)_3N$

(iii) $CH_3NH_2 < (CH_2CH_3)_3N < (CH_3)_2NH < (CH_3)_3N$

(iv) $(CH_2CH_3)_3N < CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N$

(c) The type of hybridization for IF_5 is

(i) sp^3d

(ii) sp^3d^3

(iii) sp^3d^2

(iv) d^2sp^3
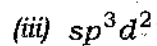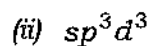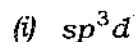
(d) The shape of $XeOF_4$ molecule with sp^3d^2 hybridization is

(i) pentagonal bipyramidal

(ii) octahedral

(iii) trigonal bipyramidal

(iv) square pyramidal

(e) In clathrates, the host-guest interaction is also known as

(i) covalent interaction

(ii) ionic interaction

(iii) coordination interaction

(iv) non-covalent interaction

2. Answer any six questions of the following : 2×6=12

(a) What are interhalogen compounds? Give examples.

(b) Compare the acid strength of $[Fe(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$.

(c) Give two reactions to show resemblance of lithium with magnesium.

(d) Draw the structure of boric acid.

(e) Write a short note on hydrometallurgy.

(f) Why helium and neon do not form clathrates?

(g) XeF_6 cannot be stored in glass vessel. Explain with chemical reaction.

(h) Discuss the effect of dielectric constant of solvents in relative strength of acids and bases.

3. Answer any *four* questions of the following :

$3 \times 4 = 12$

(a) What are *closo-*, *nido-* and *arachno-* boranes? Give one example of each.

(b) What are polyhalides? Among the halogens, iodine has the maximum tendency to form polyhalide anion. Explain the statement.

(c) What are silicones? Give the preparation of cross-linked silicones.

(d) Why is borazine called inorganic benzene? How is it prepared from diborane? Give a reaction to distinguish borazine from benzene.

(e) What are hydrides? Classify different types of hydrides with one example of each.

(f) Discuss the formation of $3c-2e$ bonds in diborane from molecular orbital theory. (Give the required MO diagrams)

4. Answer any *three* questions of the following :

$4 \times 3 = 12$

(a) Mention the Wade's rules for determining the skeletal structure of boranes. Applying these rules, predict the structure of B_5H_{11} and $C_2B_4H_8$.

$2 + 2 = 4$

(b) Define acids and bases from solvent system theory. Discuss the acid-base behaviour of NH_4Cl and KNH_2 in liquid ammonia.

$2 + 2 = 4$

(c) Complete the following reactions : $1 \times 4 = 4$

(i) $H_3BO_3 + NaOH + H_2O \longrightarrow ?$

(ii) $BCl_3 + LiAlH_4 \longrightarrow ?$

(iii) $XeF_6 + SiO_2 \longrightarrow ?$

(iv) $NaNO_3 + H_2SO_4 \xrightarrow{150\,°C-200\,°C} ?$

(d) What is meant by diagonal relationship of elements in the periodic table? Discuss the diagonal relationship between lithium and magnesium. $1 + 3 = 4$

5. Answer any *three* questions of the following :

$3 \times 3 = 9$

(a) What are phosphazines? Discuss the structure of hexachlorocyclotri-phosphazine. $1+2=3$

(b) State the HSAB principle. Explain why $[CoF_6]^{3-}$ is more stable than $[CoI_6]^{3-}$.

$1+2=3$

(c) What are the reasons for the anomalous behaviour of fluorine with its group members? Compare the variation of oxidation states of group 17 elements.

$2+1=3$

(d) Give the names of oxo-acids of chlorine. Compare the acid strength of oxo-acids of chlorine. $2+1=3$

6. Answer *either (a) or (b)* from the following : 3

(a) Give the structures of—

(i) P_2O_5

(ii) $H_2S_2O_8$

(iii) $HClO_4$ $1+1+1=3$

(Continued)

(b) Write short notes on any *two* of the following : $1\frac{1}{2} \times 2 = 3$

(i) Zone refining

(ii) Fullerenes

(iii) Carbon reduction

★ ★ ★

3 SEM TDC CHMH (CBCS) C 6

2 0 2 2

(Nov/Dec)

CHEMISTRY

(Core)

Paper : C-6

(Organic Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct answer from the
   following :   1×5=5

   (a) Addition of HBr to 2-methylpropene in
        the presence of benzoyl peroxide mainly
        forms

        (i)   1-bromobutane

        (ii) 2-bromopropane

        (iii) 2-bromo-2-methylpropane

        (iv) 1-bromo-2-methylpropane

(Turn Over)

(b) The intermediate in the acid-catalyzed dehydration of alcohol is

   (i) carbene

   (ii) carbanion

   (iii) carbocation

   (iv) free radical

(c) The electrophile involved in the Reimer-Tiemann reaction is

   (i) $:CCl_2$

   (ii) $\overset{\oplus}{C}HCl_2$

   (iii) $\overset{\oplus}{C}HO$

   (iv) $\overset{\ominus}{C}Cl_3$

(d) Malaprade reagent used to detect vicinal diol is

   (i) OsO_4

   (ii) H_5IO_6

   (iii) $Pb(OAc)_4$

   (iv) peracetic acid

(e) Which of the following compounds has the highest acid strength?

   (i) C_6H_5OH

   (ii) HCOOH

   (iii) CH_3COOH

   (iv) $ClCH_2COOH$

UNIT—I

2. Answer any *five* of the following questions :

$$2 \times 5 = 10$$

(a) What is S_Ni mechanism? Explain with the help of an example.

(b) Discuss the benzyne mechanism for nucleophilic aromatic substitution reaction. Give evidences in support of the proposed mechanism.

(c) Synthesize the following : $1 \times 2 = 2$

   (i) Ethyl bromide by Hunsdiecker reaction

   (ii) Fluorobenzene through diazonium salt

(d) Using organometallic compound, how would you prepare a 3°-alcohol from an ethyl ester?

(e) Why are the aryl halides less reactive towards nucleophilic substitution reactions than alkyl halides?

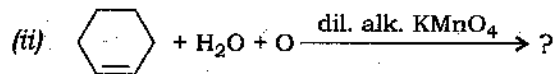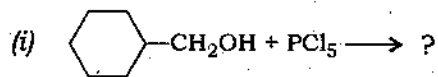(f) Discuss the relative reactivity of alkyl, allyl and aryl halides towards nucleophilic substitution reactions.

UNIT—II

3. Answer any *three* of the following questions :

$2 \times 3 = 6$

(a) How will you distinguish between 1°-, 2°- and 3°-alcohols by Victor-Meyer method?

(b) Complete the following reactions :

(i) —CH$_2$OH + PCl$_5$ ⟶ ?

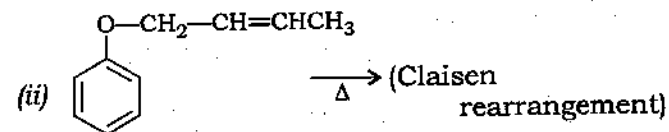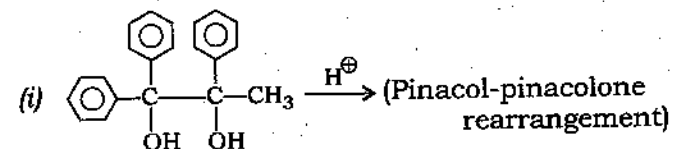(ii) + H$_2$O + O $\xrightarrow{\text{dil. alk. KMnO}_4}$?

(*Continued*)

(c) How would you synthesize α,β-unsaturated alcohol and aldehyde from glycerol?

(d) Prepare acrolein from glycerol.

4. Answer any *two* of the following questions :

$3 \times 2 = 6$

(a) Complete the following reactions with mechanisms :

(i) $\xrightarrow{\text{H}^\oplus}$ (Pinacol-pinacolone rearrangement)

(ii) $\xrightarrow{\Delta}$ (Claisen rearrangement)

(b) (i) How can you prepare phenol from cumene? Give mechanism.

(ii) Give the mechanism of the following reaction :

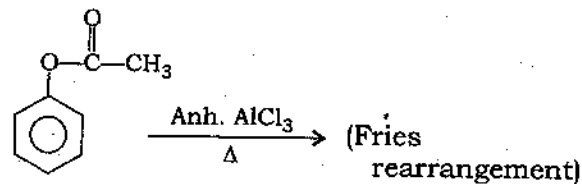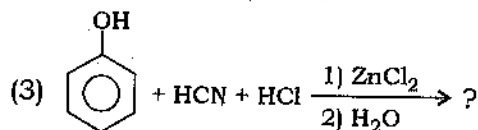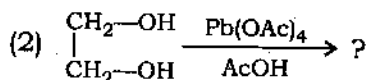 $\xrightarrow[\text{70 °C}]{\text{CHCl}_3 + \text{NaOH}}$
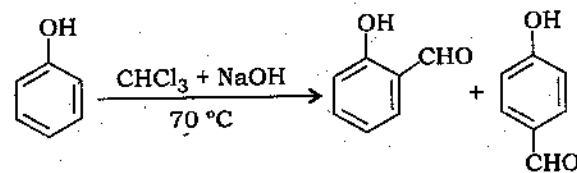
(*Turn Over*)

(c) (i) Complete the following rearrangement and suggest the mechanism :

$\xrightarrow[\Delta]{\text{Anh. AlCl}_3}$ (Fries rearrangement)

(ii) Complete the following reactions :

(1) + HCN $\longrightarrow$?

(2) $\begin{array}{l} CH_2\text{--}OH \\ | \\ CH_2\text{--}OH \end{array}$ $\xrightarrow[\text{AcOH}]{\text{Pb(OAc)}_4}$?

(3) + HCN + HCl $\xrightarrow[\text{2) H}_2\text{O}]{\text{1) ZnCl}_2}$?
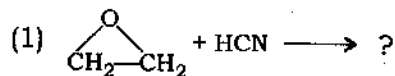
UNIT—III

Answer *either* Q. No. **5** *or* Q. No. **6**

5. (a) Complete the following reactions and write down the mechanisms : 3×2=6

(i) $\xrightarrow[\Delta]{\text{KOH}}$
(Benzil-benzilic acid rearrangement)

(ii) + Ac$_2$O $\xrightarrow{\text{AcONa}}$ (Perkin reaction)
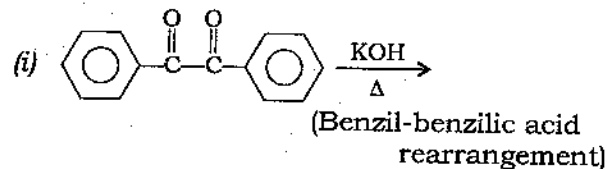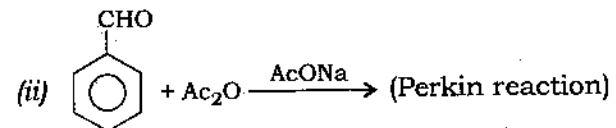
(b) Trichloroacetaldehyde is more reactive towards the nucleophilic addition reaction than acetaldehyde. Explain. 2

6. (a) Explain with example the mechanism involved in Wittig reaction. 3

(b) Write one synthetic application of each of the following reagents (any *three*) : 1×3=3

(i) LiAlH$_4$

(ii) Pb(OAc)$_4$

(iii) NaBH$_4$

(iv) PCC

(c) Write the Rosenmund's reaction for synthesis of acid chlorides. 2

7. Answer any *two* of the following questions :

$2 \times 2 = 4$

(a) Synthesize the following (any *one*) : 2

(i) Methylvinyl ketone from acetone

(ii) Crotonaldehyde from acetaldehyde

(b) Write a short note on keto-enol tautomerism. 2

(c) What is Michael reaction? Explain with a suitable reaction. 2

8. How is barbituric acid prepared using malonic ester? 1

Or

Write any one preparation method of acetoacetic ester.

UNIT—IV

Answer *either* Q. No. **9** *or* Q. No. **10**

9. (a) "Acetic acid is much weaker acid than formic acid." Explain. 2

(Continued)

(b) Identify *A, B* and *C* in the following reaction : 3

$$\underset{\text{conc. } H_2SO_4}{\overset{\text{conc. } HNO_3}{\longrightarrow}} A \xrightarrow{\text{SOCl}_2} B \underset{H_3O^+}{\overset{NaBH_4}{\longrightarrow}} C$$
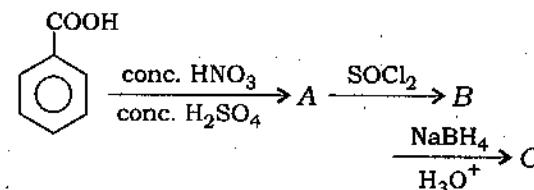
(c) Synthesize the following : $2 \times 2 = 4$

(i) Propanoic acid to ethanoic acid by Hoffmann degradation

(ii) Butanoyl chloride to propanoic acid by Curtius rearrangement

10. (a) Arrange the following acids in increasing order of their relative acid strength with proper explanation : 2

(i) $CH_3—CH_2—CH(Br)COOH$

(ii) $CH_3—CH(Br)—CH_2—COOH$

(iii) $CH_2(Br)—CH_2—CH_2—COOH$

(iv) $CH_3—CH_2—CH_2—COOH$

(Turn Over)

(b) Show the mechanistic steps of the following reaction : 3

$$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-OC_2H_5 + H_2O \underset{\longleftarrow}{\overset{H^+}{\rightleftharpoons}}$$

$$CH_3COOH + C_2H_5OH$$
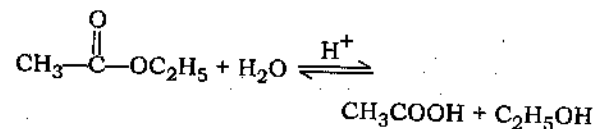
(c) Complete the following reactions (any *two*) : 1×2=2

(i)

$+ 2CaO \xrightarrow{\Delta} ?$

(ii)

$$\begin{matrix} CH_2COOH \\ | \\ CH_2COOH \end{matrix} + SOCl_2 \longrightarrow ?$$

(iii)

$$\begin{matrix} CH_2-COOH \\ | \\ C(OH)-COOH \\ | \\ CH_2-COOH \end{matrix} \xrightarrow[\Delta]{H_2SO_4} ?$$
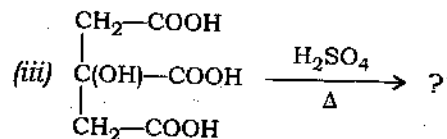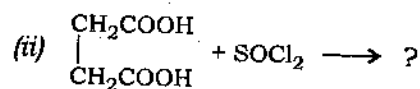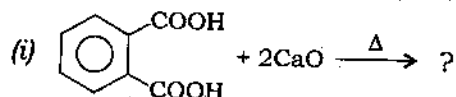
(d) Account for the fact that maleic acid is a stronger acid than fumeric acid but maleate monoanion is a weaker acid than fumarate monoanion. 2

UNIT—V

Answer the following questions : 2×2=4

11. What are mercaptans? How will you prepare ethyl mercaptan from ethyl halide? 1+1=2

12. Give one method of preparation of thio-ether. What happens when a thiol reacts with an aldehyde in the presence of HCl? 1+1=2

★ ★ ★

3 SEM TDC CHMH (CBCS) C 7

2 0 2 2

(Nov/Dec)

CHEMISTRY

(Core)

Paper : C-7

(Physical Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×5=5

   (a) At a particular concentration, the $t_{1/2}$ of a reaction is 100 min. When the concentration of reactant becomes double half-life period becomes 25 min. The order of the reaction is

   (i) 1

   (ii) 2

   (iii) 0

   (iv) 3

(Turn Over)

(b) Number of components, number of phases and degrees of freedom of the system

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g), \quad P_{NH_3} \neq P_{HCl}$$
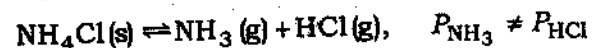
are

(i) 2, 2, 2

(ii) 2, 1, 1

(iii) 2, 1, 0

(iv) 1, 1, 1

(c) If two liquids A and B form minimum boiling azeotrope at some specific composition, then

(i) $A–B$ interactions are stronger than those between $A–A$ or $B–B$

(ii) vapour pressure of solution increases because more number of molecules of liquids A and B can escape from the solution

(iii) vapour pressure of solution decreases because less number of molecules of only one of the liquids escape from the solution

(iv) $A–B$ interactions are weaker than those between $A–A$ or $B–B$

(Continued)

(d) The condition which is not a favourable condition of physical adsorption is

(i) high pressure

(ii) negative ΔH

(iii) high critical temperature of adsorbate

(iv) high temperature

(e) A first-order reaction has a specific reaction rate of 10^{-2} s^{-1}. How much time will it take for 20 g of the reactant to reduce to 5 g?

(i) 238·6 seconds

(ii) 138·6 seconds

(iii) 346·5 seconds

(iv) 693·0 seconds

2. Answer any *five* questions from the following : 2×5=10

(a) The possibility of 4-phase equilibria in the sulphur system is ruled out. Explain.

(b) Describe the half-life method for determining the order of a reaction.

(Turn Over)

(c) "Azeotropes are mixtures." Comment on the statement with proper explanation.
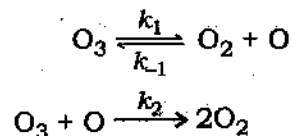
(d) For the reaction $A(g) + 3B(g) \rightarrow 2C(g)$, the rate of the reaction $\left\{\dfrac{-d[A]}{dt}\right\}$ is 3×10^{-3} mol L^{-1} min^{-1}. What is the value of $\dfrac{-d[B]}{dt}$ in mol L^{-1} min^{-1}?

(e) Explain any two factors upon which adsorption depends.

(f) What is shape-selective catalysis? Give one example of it.

3. Answer any *two* questions from the following :   6×2=12

    (a)   (i) Explain the effect of pressure on the transition temperature of rhombic sulphur and on the melting point of monoclinic sulphur with the help of Clapeyron equation.   2+2=4

         (ii) What is the maximum number of phases that can coexist for a two-component system? Give reason.   2

       (Continued)

(b)   (i) Draw and explain the phase diagram of water system.   4

       (ii) Explain why the fusion curve of ice has a negative slope whereas the sublimation curve has a positive slope in the phase diagram of water.   2

(c)   (i) State Nernst distribution law. How is the law helpful in ascertaining the molecular complexity of the dissolved solute?   1+2=3

       (ii) Prove that multi-step extraction is more economical than the single-step extraction.   3

4. Answer any *two* questions from the following :   6×2=12

    (a)   (i) Show that for a first-order reaction, the time required for 99·9% completion of the reaction is 10 times that required for 50% completion.   2

       (ii) What are pseudounimolecular reaction? Give one example of this type of reaction.   2

       (iii) Explain the effect of temperature on the rate of a chemical reaction.   2

       (Turn Over)

(b) The following mechanism has been suggested for the decomposition of O_3 :

$$O_3 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} O_2 + O$$
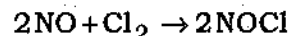
$$O_3 + O \xrightarrow{k_2} 2O_2$$

Assuming $k_{-1}[O_2] \geq k_2[O_3]$, show that the rate of the overall reaction is

$$\frac{-d[O_3]}{dt} = \frac{k[O_3]^2}{[O_2]}$$

What could be concluded from the appearance of $\dfrac{1}{[O_2]}$ in the rate equation? 5+1=6

(c) (i) For the reaction between gaseous chlorine and nitric oxide

$$2NO + Cl_2 \rightarrow 2NOCl$$

it is found that doubling the concentration of both reactants increases the rate 8 times but doubling the chlorine concentration alone doubles the rate. What is the order of the reaction with respect to nitric oxide and chlorine? Write the rate law of the reaction. 3+1=4

(ii) Show that for a second-order reaction, half-life period is inversely proportional to the initial concentration of the reactant. 2

(Continued)

5. Answer any *two* questions from the following : 4½×2=9

(a) What are enzyme-catalyzed reactions? Discuss the effects of concentration, temperature and pH on the rate of enzyme-catalyzed reaction. 1+3½=4½

(b) (i) Discuss any one mechanism of heterogeneous catalysis. 2½

(ii) What is autocatalysis? Give one example. 2

(c) (i) Discuss the use of nanoparticles as catalyst giving three examples. 3

(ii) What are catalytic poisons? Give one example. 1+½=1½

6. Answer any *one* question from the following : 5

(a) What are adsorption isotherms? Derive Langmuir adsorption isotherm and show that Freundlich isotherm is a special case of this isotherm. 1+3+1=5

(b) (i) Mention any four differences between physical adsorption and chemical adsorption. 2

(Turn Over)

(ii) Give reason why a finely divided substance is more effective as an adsorbent. 2

(iii) Write two important applications of adsorption in industry. 1

★ ★ ★

3 SEM TDC ZOOH (CBCS) C 5

2 0 2 2

(Nov/Dec)

ZOOLOGY

(Core)

Paper : C–5

(Diversity of Chordata)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Fill in the blanks : 1×5=5

   (a) Amphioxus belongs to the subphylum

   _____.

   (b) Osteichthyes are commonly known as

   _____.

   (c) _____ forwarded the Continental Drift
   theory.

(Turn Over)

(d) Sphenodon is endemic to _____.

(e) Vertebrates with four limbs are known as _____.

2. Write short notes on the following :   4×3=12

(a) Dipleurula concept or Echinoderm theory of chordate

(b) General characters of Agnatha

(c) General characters of chordate

3. Describe the general characteristics of Hemichordata.   6

Or

Give an account on retrogressive metamorphosis in urochordate.

4. Define Continental Drift theory. Describe the theories pertaining to the distribution of animals.   4+6=10

5. Describe the principle of aerodynamics of flight in birds.   10

Or

What is parental care? Describe various processes of parental care in Amphibia.
                                      2+8=10

(Continued)

6. Write the general characteristics of Chondrichthyes and Osteichthyes.   5+5=10

Or

Explain about the structure and functional mechanism of poison apparatus in snakes.
                                      5+5=10

★ ★ ★

3 SEM TDC ZOOH (CBCS) C 6

2 0 2 2

(Nov/Dec)

ZOOLOGY

(Core)

Paper : C–6

(Animal Physiology : Controlling and Coordinating Systems)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Fill in the blanks :   1×5=5

    (a) The cell body of a neuron is called _____.

    (b) Ovulation is induced by a hormone called _____.

    (c) In a muscle fibre, Ca^{2+} is stored in _____.

    (d) _____ is a hyperglycemic hormone.

    (e) Bone is a type of _____ tissue.

(Turn Over)

2. Distinguish between any *two* of the following : 3×2=6

   (a) Skeletal muscle and Cardiac muscle

   (b) Blood and Lymph

   (c) Adenohypophysis and Neurohypophysis

3. Write short notes on any *two* of the following : 3×2=6

   (a) Role of parathormone

   (b) Cartilage

   (c) Functions of epithelial tissue

4. Write illustrative notes on any *two* of the following : 4½×2=9

   (a) Spermatogenesis

   (b) Anatomical structure of adrenal gland

   (c) Hormones of pancreas

5. What is synapse? Give an account on the synaptic transmission with suitable diagram. 1+8=9

Or

Describe the structure of cochlea. Give an account on the physiology of hearing in human with suitable diagram. 3+6=9

(*Continued*)

6. What is sarcomere? Describe the mechanism involved in muscle contraction with diagram. 2+7=9

Or

What is puberty? Describe the histology of ovary with suitable diagram. 2+7=9

7. Name the hormones of thyroid gland and mention their functions. 3+6=9

Or

Why is hypothalamus called neuroendocrine gland? Discuss the principal nuclei involved in neuroendocrine control of anterior pituitary. 2+7=9

★ ★ ★

3 SEM TDC ZOOH (CBCS) C 7

2 0 2 2

(Nov/Dec)

ZOOLOGY

(Core)

Paper : C–7

(Fundamentals of Biochemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. Fill in the blanks :   1×5=5

   (a) Working combination of apoenzyme and co-enzyme is called _____.

   (b) The chemical linkage between glycerol and fatty acid is called _____.

   (c) The general formula of monosaccharide is _____.

(Turn Over)

(d) The immunoglobulin which can cross placenta is _____.

(e) Nucleic acids are polymers of _____.

2. Distinguish between (any *two*) : 4×2=8

(a) Purines and Pyrimidines

(b) Essential and Non-essential amino acids

(c) Monosaccharides and Disaccharides

3. Write short notes on any *two* of the following : 4×2=8

(a) Types of RNA

(b) Glycoconjugates

(c) Hyperchromaticity of DNA

4. Write an explanatory note on levels of organization in protein with suitable diagram. 10

Or

What is meant by denaturation of DNA? Describe Watson and Crick model of DNA with suitable diagram. 2+8=10

5. What are saturated and unsaturated fatty acids? Add a note on importance of phospholipids. 2½+2½+5=10

Or

Define immunoglobulin. Describe the typical structure of immunoglobulin with diagram. 2+5+3=10

6. What are cofactors? Write accounts on allosteric enzyme and isoenzymes. 2+5+5=12

Or

What is Lineweaver-Burk plot? Discuss about the different methods of enzyme inhibition.

3+9=12

★ ★ ★

3 SEM TDC MTMH (CBCS) C 5

2 0 2 2

(Nov/Dec)

MATHEMATICS

(Core)

Paper : C–5

(Theory of Real Functions)

Full Marks : 80
Pass Marks : 32

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. _(a)_ State the divergence criteria of a limit of a function.   1+1=2

   _(b)_ Define cluster point of a set with an example.   1+1=2

   _(c)_ Use ε-δ definition to establish that

   $$\lim_{x \to c} x^2 = c^2$$
       2

(d) Let $f : A \to \mathbb{R}$ where $A \subseteq \mathbb{R}$ and $c \in \mathbb{R}$, a cluster point of A. Show that if f has a limit, when $x \to c$, then f is bounded.   3

(e) Let $f : A \to \mathbb{R}$ where $A \subseteq \mathbb{R}$ and $c \in \mathbb{R}$, a cluster point of A. If $a \le f(x) \le b$, $\forall\ x \in A$ and $x \ne c$, and $\lim\limits_{x \to c} f(x)$ exists, then show that

$$a \le \lim_{x \to c} f(x) \le b$$ 3

(f) State and prove squeeze theorem.   1+3=4

(g) Show by using definition that

$$\lim_{x \to 0} \frac{1}{x^2} = \infty$$ 3

(h) Let $f : A \to \mathbb{R}$ where $A \subseteq \mathbb{R}$ and $c \in A$. Then establish any *one* of the following :   3

    (i) If f is continuous at $c \in A$, then given any ε-neighbourhood $V_\varepsilon\,(f(c))$ of $f(c)$, $\exists$ a δ-neighbourhood $V_\delta(c)$ of c, such that if $x \in A \cap V_\delta(c)$, then

$$f(x) \in V_\varepsilon(f(c)).$$

    (ii) Let given any ε-neighbourhood $V_\varepsilon\,(f(c))$ of $f(c)$, $\exists$ a δ-neighbourhood $V_\delta(c)$ of c, such that if $x \in A \cap V_\delta(c)$, then $f(x) \in V_\varepsilon(f(c))$. Then f is continuous at $c \in A$.

(i) Let $f : A \to \mathbb{R}$ where $A \subseteq \mathbb{R}$ and define $|f|$ by $(|f|)(x) = |f(x)|$, $\forall\ x \in A$. Show that if f is continuous at $c \in A$, then $|f|$ is also continuous at $c \in A$.   4

Or

Let $f : A \to \mathbb{R}$ where $A \subseteq \mathbb{R}$ and $f(x) \ge 0$, $\forall\ x \in A$. Defined $\sqrt{f}$ by $(\sqrt{f})(x) = \sqrt{f(x)}$, $\forall\ x \in A$. Show that if f is continuous at $c \in A$, then $\sqrt{f}$ is continuous at c.

(j) State and prove location roots theorem.   1+3=4

Or

Let I be a closed and bounded interval, and $f : I \to \mathbb{R}$ is continuous on I. Then show that $f : I \to \mathbb{R}$ is uniformly continuous.   4

2. (a) Define relative maximum of a real-valued function at a point. 1

   (b) State the first derivative test for the relative maximum at a point of a real-valued function. 1

   (c) Show that if $f : I \to \mathbb{R}$ is differentiable and $f(x) \geq 0$, $\forall x \in I$, then f is increasing on I. 2

   (d) Using first derivative test, show that $f(x) = x^2$ has a minima at $x = 0$. 2

   (e) State and prove the interior extremum theorem. 3

   Or

   Let $f : I \to \mathbb{R}$ be differentiable at c. If $f'(c) < 0$, then show that
   $$f(x) > f(c), \quad \forall x \in (c - \delta, c)$$

   (f) State and prove Caratheodory's theorem. 4

   (g) Use mean value theorem to show that if $f(x) = \sin x$ which is differentiable, $\forall x \in \mathbb{R}$, then
   $$|\sin x - \sin y| \leq |x - y| \quad \forall x, y \in \mathbb{R}$$ 4

   Or

   Use mean value theorem to show that
   $$-x \leq \sin x \leq x \quad \forall x \geq 0$$

   (h) State and prove the mean value theorem. 4

   (i) State and prove Darboux's theorem. 4

   Or

   Use mean value theorem to show that
   $$e^x \geq 1 + x \quad \forall x \in \mathbb{R}$$
   and hence show that $e^{\pi} > \pi^e$.

3. (a) Define a convex function on an interval and give its geometrical interpretation. 1+1=2

(b) Show that the function $f(x) = x^3$ has no relative extremum at $x = 0$.   2

(c) Show that

$$f(x) = x + \frac{1}{x}; \quad x > 0$$

is a convex function.   3

(d) Determine relative extrema of the function

$$f(x) = x^4 + 2x^3 - k$$

where k is a constant.   3

(e) State and prove Cauchy's mean value theorem.   5

(f) State and prove Taylor's theorem with Lagrange's form of remainder.   5

(g) Define Taylor's and Maclaurin's series. Obtain Maclaurin's series for the function $\sin x$.   2+3=5

Or

Show that

$$\cos x = \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{\lfloor 2n} \quad \forall \ x \in \mathbb{R} \qquad 5$$

★★★

(Continued)

3 SEM TDC MTMH (CBCS) C 6

2 0 2 2

(Nov/Dec)

MATHEMATICS

(Core)

Paper : C–6

(Group Theory—I)

Full Marks : 80

Pass Marks : 32

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. *(a)* Write each symmetry in D_3 (the set of symmetries of an equilateral triangle).   1

   (b) What is the inverse of $n-1$ in $U(n)$, $n > 2$?   1

   (c) The set $\{5, 15, 25, 35\}$ is a group under multiplication modulo 40. What is the identity element of this group?   1

   (d) Let a and b belong to a group G. Find an x in G such that $xabx^{-1} = ba$.   2

   (e) Show that identity element in a group is unique.   2

   (f) Find the order of each element of the group $(\{0, 1, 2, 3, 4\}, +_5)$.   3

     (Turn Over)

(2)

(g) Show that the four permutations I, (ab), (cd), $(ab)(cd)$ on four symbols a, b, c, d form a finite Abelian group with respect to the permutation multiplication. 5

2. (a) In Z_{10}, write all the elements of $<2>$. 1

(b) With the help of an example, show that union of two subgroups of a group G is not necessarily a subgroup of G. 2

(c) Define centre of an element of a group and centre of a group. 2

(d) Let G be a group and $a \in G$. Then prove that the set $H = \{a^n \mid n \in Z\}$ is a subgroup of G. 2

(e) Prove that the centre of a group G is normal subgroup of G. 4

(f) Let H and K be two subgroups of a group G. Then prove that HK is a subgroup of G if and only if $HK = KH$. 4

3. (a) If $|a| = 30$, find $<a^{26}>$. 1

(b) List the elements of the subgroup $<20>$ in Z_{30}. 1

(c) Find all generators of Z_6. 2

(d) Express the permutation
$$f = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 6 & 5 & 3 & 4 & 2 \end{pmatrix}$$
as a product of disjoint cycles. 2

(3)

(e) Find $O(f)$ where
$$f = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 5 & 3 & 1 \end{pmatrix}$$
  2

(f) Let a be an element of order n in a group and let k be a positive integer. Then prove that
$$<a^k> = <a^{\gcd(n,\, k)}> \text{ and } |a^k| = \frac{n}{\gcd(n,\, k)}$$
  4

Or

Prove that any two right cosets are either identical or disjoint.

(g) Prove that a group of prime order is cyclic. 3

(h) State and prove Lagrange's theorem. 5

4. (a) Define external direct product. 1

(b) Compute $U(8) \oplus U(10)$. Also find the product $(3, 7)(7, 9)$. 2

(c) Prove that quotient group of a cyclic group is cyclic. 3

(d) If H is a normal subgroup of a finite group G, then prove that for each $a \in G$, $O(Ha) \mid O(a)$. 4

(e) Let G be a finite Abelian group such that its order $O(G)$ is divisible by a prime p. Then prove that G has at least one element of order p. 5

Or

Let H be a subgroup of a group G such that $x^2 \in G$, $\forall x \in G$. Then prove that H is normal subgroup of G. Also prove that $\dfrac{G}{H}$ is Abelian.

5. *(a)* Let $(Z, +)$ and $(E, +)$ be the group of integers and even integers respectively. Show that $f : Z \to E$ defined by $f(x) = 2x$, $\forall x \in Z$ is a homomorphism.　　2

(b) Prove that a homomorphic image $f : G \to G'$ is one-one if and only if $\ker f = \{e\}$, where e is the identity of G.　　3

(c) Prove that every group G is isomorphic to a permutation group.　　5

(d) Prove that every homomorphic image of a group G is isomorphic to some quotient group of G.　　5

Or

Let H be a normal subgroup of G and K be a subgroup of G. Then prove that

$$\frac{HK}{H} \cong \frac{K}{H \cap K}$$

★ ★ ★

3 SEM TDC MTMH (CBCS) C 7

2 0 2 2

(Nov/Dec)

MATHEMATICS

(Core)

Paper : C–7

(PDE and Systems of ODE)

Full Marks : 60

Pass Marks : 24

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. (a) Find the degree of the equation:

$$x\frac{\partial^2 z}{\partial x^2} + y\left(\frac{\partial z}{\partial y}\right)^{1/3} + Kz = 0 \qquad 1$$

(b) Define linear partial differential equation.   1

(c) Write the general form of Lagrange's equation.   1

(d) Form the PDE by eliminating the arbitrary functions f and ϕ from   5

$$z = yf(x) + x\phi(y)$$

Or

Solve :

$$(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$$

(e) Find the integral surface of the equation $(x-y)y^2 p + (y-x)x^2 q = (x^2 + y^2)z$ which passes through the curve $xz = a^3, y = 0$. 5

Or

Solve :

$$\sqrt{p} + \sqrt{q} = 1$$

2. (a) Write the Jacobi's subsidiary equations. 2

(b) Find the complete integral of any *one* of the following : 4

(i) $(p^2 + q^2)y = qz$

(ii) $pxy + pq + qy = yz$

(iii) $p = (z + qy)^2$

(c) Find the complete integral of

$$p_3 x_3 (p_1 + p_2) + x_1 + x_2 = 0$$ 6

Or

Solve the boundary value problem $\dfrac{\partial u}{\partial x} - 2\dfrac{\partial u}{\partial y} = u$ with $u(x, 0) = 6e^{-3x}$ by the method of separation of variables.

3. (a) Write the Laplace equation. 1

(b) Classify the following equations :

(i) $(1 - x^2)\dfrac{\partial^2 z}{\partial x^2} - 2xy\dfrac{\partial^2 z}{\partial x \partial y} + (1 - y^2)\dfrac{\partial^2 z}{\partial y^2}$

$$+ 2x\dfrac{\partial z}{\partial x} + 6x^2 y\dfrac{\partial z}{\partial y} - 6z = 0$$ 2

(ii) $u_{xx} + u_{yy} + u_{zz} + u_{yz} + u_{zy} = 0$ 2

(Continued)

(c) Reduce the equation

$$y(x + y)(r - s) - xp - yq - z = 0$$

to canonical form. 7

Or

Derive the one-dimensional wave equation.

4. (a) Fill in the blank :

The PDE in case of vibrating string problem is formulated from the law of _____. 1

(b) Write one-dimensional heat equation. 1

(c) Solve

$$\dfrac{\partial^2 u}{\partial x^2} - 2\dfrac{\partial u}{\partial x} - \dfrac{\partial u}{\partial y} = 0$$

using the method of separation of variables. 6

Or

Find the solution of $\dfrac{\partial^2 y}{\partial t^2} = c^2 \dfrac{\partial^2 y}{\partial x^2}$ such that $y = p_0 \cos pt$ where p_0 is constant when $x = l$ and $y = 0$ when $x = 0$.

5. (a) Give an example of a linear system of ordinary differential equation with variable coefficient. 1

(Turn Over)

(b) Transform the linear differential equation $\dfrac{d^3x}{dt^3} + 2\dfrac{d^2x}{dt^2} - \dfrac{dx}{dt} - 2x = e^{3t}$ into system of first order differential equation.   2

(c) Prove that $x = 2e^t,\ y = -3e^{2t}$ is the solution of $\dfrac{dx}{dt} = 5x + 2y,\ \dfrac{dy}{dt} = 3x + 4y.$ 2

(d) Describe the method of successive approximation.   4

Or

Find first two approximations of the function that approximate the exact solution of the equation $\dfrac{dy}{dx} = x + y,\ y(0) = 1.$

(e) Find the general solution of the system :

$$\frac{dx}{dt} = x + 2y,\ \frac{dy}{dt} = 3x + 2y$$ 6

Or

Using operator method, find the general solution of

$$\frac{dx}{dt} + \frac{dy}{dt} - 2x - 4y = e^t,\ \frac{dx}{dt} + \frac{dy}{dt} - y = e^{4t}$$

★ ★ ★

3 SEM TDC BOTH (CBCS) C 5

2 0 2 2

(Nov/Dec)

BOTANY

(Core)

Paper : C–5

(Anatomy of Angiosperms)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Fill in the blanks of the following : 1×3=3

   (a) Companion cells are always associated
   with the _____.

   (b) Velamen tissue is found in the roots of
   _____.

   (c) Elongated tube-like dead cells with
   tapering end are known as _____.

(*Turn Over*)

2. Choose the correct answer from the following : 1×2=2

    (a) Histogen theory was proposed by Hanstein / Schmidt / Robert Hooke / Esau.

    (b) In a dicot stem, cork cambium originates from epidermis / pericycle / cortex / vascular bundles.

3. Explain any *four* of the following : 3×4=12

    (a) Importance of plant anatomy in systematics

    (b) Pits and plasmodesmata

    (c) Hydathodes

    (d) Tunica-Corpus theory

    (e) Bicollateral vascular bundles

    (f) Epicuticular waxes

4. Differentiate between any *three* of the following : 4×3=12

    (a) Shoot apex and Root apex

    (b) Fibrous and Sclereids

    (c) Open vascular bundle and Closed vascular bundle

    (d) Heartwood and Sapwood

(Continued)

5. What is stomatal apparatus? Explain the structure and functions of cells of stomatal apparatus. Give labelled diagrams. 2+8+2=12

Or

With suitable diagrams, discuss the anatomical structure of dicot stem. 4+8=12

6. With suitable sketches, discuss the anatomical adaptations of hydrophytes. 4+8=12

Or

Write explanatory notes on any *two* of the following : 6×2=12

    (a) Adcrustation and Incrustation

    (b) Lenticels

    (c) Glandular and Non-glandular trichomes

★ ★ ★

3 SEM TDC BOTH (CBCS) C 6

2 0 2 2

(Nov/Dec)

BOTANY

(Core)

Paper : C–6

(Economic Botany)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. Fill in the blanks of the following :   1×5=5

   (a) The fibre obtained from the husk of coconut is called _____.

   (b) The scientific name of soya bean is _____.

   (c) Teak belongs to the family _____.

   (d) The source of quinine is _____.

   (e) The full form of ICAR is _____.

2. Write short notes on any *four* of the following :   3×4=12

   (a) Heartwood

   (b) Domestication of crops

   (c) Textile fibres

   (d) Beverages

   (e) Indian IKS

3. Write the scientific names along with their family of the following plants and give short account on their economic importance of useful parts (any *three*) :   4×3=12

   (a) Pepper

   (b) Jute

   (c) Mustard

   (d) Teak

   (e) Chickpea

4. Write an account on cultivation along with processing and economic utilization of tea.
                                               5+5+2=12

5. Write the scientific names of the following and give short account on their economic importance :   4×3=12

   (a) Sugarcane

   (b) Aloe Vera

   (c) Pine

Or

Write explanatory notes on the following :
                                               6×2=12

(a) Vavilov's centres of origin

(b) Legumes are important to man and ecosystems

★ ★ ★

3 SEM TDC BOTH (CBCS) C 7

2 0 2 2

(Nov/Dec)

BOTANY

(Core)

Paper : C–7

(Genetics)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. *(a)* Choose the correct answer of the
   following :   1×3=3

   (i) The F2 ratio in duplicate epistasis
   is 15:1/3:1/9:7/9:3:4.

   (ii) Heterochromatin is the darkly
   stained part of cytoplasm/grana/
   nucleus/chromatin.

   (iii) The phenotypic dihybrid ratio is
   1:1:1:1/9:3:3:1/9:7/9:3:4.

(Turn Over)

(b) Fill in the blanks :   1×2=2

  (i) Point mutation involves changes in _____ base pair.

  (ii) _____ is the key to speciation of populations.

2. Write short notes on any *three* of the following :   4×3=12

  (a) Pleiotropy

  (b) Deletion

  (c) Turner Syndrome

  (d) Genetic Drift

3. What is sex-linked inheritance? Why is it also known as criss-cross pattern of inheritance? Describe it with suitable example.   2+2+8=12

Or

Write short notes on the following :   6+6=12

  (a) Polygenic Inheritance

  (b) Role of natural selection in speciation

(Continued)

4. Write the difference between the following :   3×4=12

  (a) Euploidy and Aneuploidy

  (b) Incomplete dominance and Codominance

  (c) Pericentric Inversion and Paracentric Inversion

  (d) Mendelian Inheritance and Extrachromosomal Inheritance

Or

What is crossing over? Describe the different types of crossing over. Write the significance of crossing over.   2+8+2=12

5. What do you mean by mutation? Write the characteristic features of mutation. How does the base analogue cause mutations? How are base analog mutations repaired?   2+2+4+4=12

Or

What do you mean by Hardy-Weinberg law? What are the assumptions of Hardy-Weinberg equilibrium? Write the application of Hardy-Weinberg law.   2+4+6=12

★ ★ ★