

[This question paper contains 4 printed pages.]

Your Roll No.



Sr. No. of Question Paper : 6829B

Unique Paper Code : 42357501

Name of the Paper : Differential Equations

Name of the Course : B.Sc. (Math Sci)-II / B.Sc. (Phy Sci)-II / B.Sc. (Life Sci)-II, Applied Sciences-II : DSE

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All the questions are compulsory.
3. Attempt any two parts from each question.
4. Marks of each part are indicated.
5. Use of non-programmable scientific calculator is allowed.

1. (a) Solve the initial value problem

$$(2x \cos y + 3x^2y)dx + (x^3 - x^2 \sin y - y)dy = 0, y(0) = 2. \quad (6.5)$$

(b) Solve $\frac{dy}{dx} + y = xy^3$. (6.5)

(c) Solve $y = 2px + x^2p^4$. (6.5)

2. (a) Solve the initial value problem

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 2e^x - 10\sin x, \quad y(0) = 2, \quad y'(0) = 4. \quad (6)$$

(b) Solve $x^3 \frac{d^3y}{dx^3} - 4x^2 \frac{d^2y}{dx^2} + 8x \frac{dy}{dx} - 8y = 4\ln x$. (6)

(c) Consider the differential equation :

$$x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} + 2y = 0$$

(i) Show that x and x^2 are linearly independent solutions of the given differential equation over the interval $0 < x < \infty$.

(ii) Write the general solution of the given equation.

(iii) Find the solution that satisfies the conditions $y(1) = 3, y'(1) = 2$. Explain why this solution is unique. (6)

3. (a) Using the method of variation of parameters, solve the differential equation

$$\frac{d^2y}{dx^2} + y = \sec x. \quad (6.5)$$

(b) Given that $y = x$ is a solution of

$$x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 4y = 0,$$

find a linearly independent solution by reducing the order. Write the general solution. (6.5)

(c) To check the condition or integrability condition integrability and then solve the give differential equation :

$$y(y+z)dx + x(x-z)dy + x(x+y)dz = 0. \quad (6.5)$$

4. (a) Solve

$$\frac{dx}{dt} + 4x + 3y = t,$$

$$\frac{dy}{dt} + 2x + 5y = e^t. \quad (6)$$

(b) Solve

$$\frac{dx}{x(y^2 - z^2)} = \frac{dy}{-y(z^2 + x^2)} = \frac{dz}{z(x^2 + y^2)} \quad (6)$$

(c) Solve $(2x^2 + 2xy + 2xz^2 + 1)dx + dy + 2zdz = 0$. (6)

5. (a) Define the order and degree of a partial differential equation. Form a partial differential equation corresponding to the complete integral given by $z = x + y + f(xy)$, where f is an arbitrary function.

(6.5)

- (b) Form a partial differential equation corresponding to the complete integral given by $ax^2 + by^2 + z^2 = 1$, where a and b are arbitrary constants.

(6.5)

- (c) Reduce the following partial differential equation into canonical form.

$$\frac{\partial^2 z}{\partial x^2} = k \frac{\partial^2 z}{\partial y^2}, \text{ where } k \text{ is a fixed constant.} \quad (6.5)$$

6. (a) Find the complete integral of the partial differential equation $p^2y(1 + x^2) = qx^2$, by using Charpit's method.

(6)

- (b) Use Lagrange's method to find the general solution of the partial differential equation

$$(mz - ny)p + (nx - lz)q = ly - mx. \quad (6)$$

- (c) Find the complete integral of the partial differential equation $p^2 + q^2 = 1$, by using Charpit's method.

(6)

2

[This question paper contains 4 printed pages.]

Your Roll No.



Sr. No. of Question Paper : 8440

Unique Paper Code : 32177906

Name of the Paper : Polymer Chemistry

Name of the Course : B.Sc. (Applied Physical Science)
Industrial Chemistry : DSE

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all.
3. Question No. 1 is compulsory.

1. (a) Differentiate between the following types of polymer
(Any two) : (2×3)

- (i) Linear and cross-linked polymer
- (ii) Homopolymer and copolymer
- (iii) Novolac and Bakelite

P.T.O.

(b) Define the following terms (Any two) : (2×2)

- (i) Functionality in case of a polymer
- (ii) Pendant group
- (iii) Poly Dispersity Index (PDI)

(c) Fill in the following blanks : (1×5)

- (i) Starch is a polymer of (monomer).
- (ii) Fibers are long chain polymers characterized by highly regions.
- (iii) Benzoyl peroxide is used to initiate the polymerization of olefinic monomers.
- (iv) Natural rubber is a polymer of (monomer).
- (v) Precursors for the synthesis of organic polymers come from industry.

2. (a) Describe the preparation and applications of polycarbonates. (2,3)

(b) What are polysulphones? And what are their important applications. (1,3)

(c) What are plasticizers? Give examples. (2,1)

3. (a) What are number average (M_n) and weight average (M_w) molecular weight of a polymer? Give the mathematical expressions for each. How molecular weight of a polymer can be determined using osmometric method? (2,1,6)

(b) What do you understand by the word, natural polymer? How cellulose is converted to more suitable and useful fiber? (1,2)

4. (a) How electricity is conducted in case of some polymers (conducting polymers)? What is polyaniline? Give its important usages. (3,1,2)

(b) How Nylon-6 is prepared? Give its main industrial applications. (2,2)

(c) Describe the difference between syndiotactic and isotactic polymers. (2)

5. (a) Give the preparation and uses of Teflon. (2,2)

(b) What are elastomers? Explain their typical properties with respective structure. (2,2)

- (c) How will you synthesize polystyrene? Give its main industrial applications. (2,2)
6. (a) Describe the method of preparation, properties and applications of polyacrylo nitrile (PAN). (2,1,2)
- (b) What do you understand by crystalline melting point (T_m) of a polymer? Discuss the factors affecting crystalline melting point. (1,4)
- (c) What is Free volume theory? (2)
7. Write short notes on any **three** of the followings :
- (i) Polyurethanes
- (ii) Polyvinyl acetate (PVA)
- (iii) Polypyrrole (PPy)
- (iv) Silicon polymers (3×4)

3



[This question paper contains 8 printed pages.]

Your Roll No.

Sr. No. of Question Paper : 8653

HC

Unique Paper Code : 42177925

Name of the Paper : Chemistry of d-Block Elements and
Quantum Chemistry & Spectroscopy

Name of the Course : B.Sc. (Physical Science / Life
Science) : DSE

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

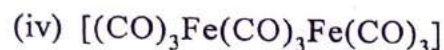
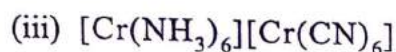
1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **three** questions from **Section A** and **three** questions from **Section B**.
3. Sections **A** and **B** are to be attempted in separate portions of the same answer sheet.
4. Please indicate the section you are attempting at the appropriate place and do not intermix the sections. The questions should be numbered in accordance to the number in the question paper.
5. Calculators and log tables may be used.

P.T.O.

SECTION - A

Attempt any three questions.

1. (a) Give the IUPAC names of any three of the following :



(b) What are stereoisomers? Give all the possible stereoisomers of the complex of type $[\text{Ma}_2\text{b}_2\text{c}_2]$.

(c) Sc^{3+} is colourless but Ti^{3+} is coloured. Explain.

(6,3,3½)

2. (a) Calculate CFSE (in kJ/mol) for d^6 ion in an octahedral field for both, high spin as well as low spin. Given $\Delta_o = 25000 \text{ cm}^{-1}$ and pairing energy, $P = 15000 \text{ cm}^{-1}$. In which of the two states is the complex likely to exist?

(b) Write the formulae of any two of the following :

(i) μ -Amido- μ -hydroxobis(bis(ethylenediamine)chromium(III)) ion

(ii) Tetraammineplatinum(II) tetrachloroplatinate(II)

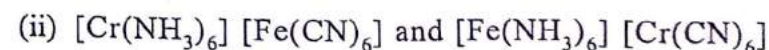
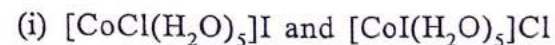
(iii) Amidochlorobis(ethylenediamine)cobalt(III) chloride

(c) Explain why $\text{La}(\text{OH})_3$ is most basic and $\text{Lu}(\text{OH})_3$ is least basic among the hydroxide of lanthanide elements.

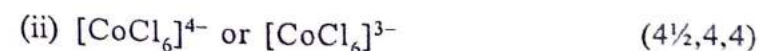
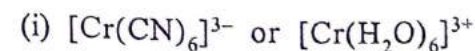
(d) Silver and gold are found in the nature in free state. Explain. (4,3,3,2½)

3. (a) The magnetic moment (μ) for $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is found to be 5.91 B.M while that of $[\text{Fe}(\text{CN})_6]^{3-}$, μ , is 1.9 B.M. Account for the above observation on the basis of valence bond theory.

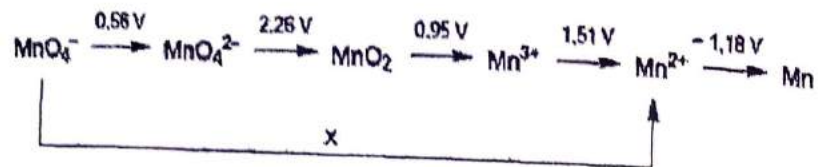
(b) Explain the type of isomerism in the following pairs :



(c) Which of the two complexes will have greater value of Δ_o and why?



4. (a) Given below is the Latimer diagram of Mn in acidic medium :

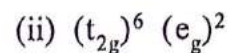
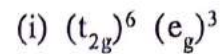


- (i) Calculate the skip step potential as represented by 'x' in the Latimer diagram of Mn.
- (ii) Giving suitable reason explain that MnO_4^{2-} tends to disproportionate in acidic medium.

OR

Write short note on any **two** of the following :

- (i) Separation of lanthanides by ion exchange method.
- (ii) Catalytic properties of transition elements and their compounds.
- (iii) Drawbacks of Valence Bond Theory.
- (b) What is Jahn Teller Theorem? Giving suitable reason explain, which of the following complexes will be distorted :



- (c) Magnetic properties of the lanthanides are fundamentally different from those of transition elements. Explain.
- (d) Tetrahedral complexes in Low spin state are not known. Explain. (4,3,3,2½)

SECTION B

Attempt any three questions.

Physical Constants

Planck's Constant 6.626×10^{-34} Js

Velocity of light 3×10^8 ms⁻¹

Avogadro's Number 6.023×10^{23}

Atomic mass unit 1.661×10^{-27} kg

Mass of electron 9.109×10^{-31} kg

5. (a) Attempt any **three** of the following :

- (i) Zero point energy need not be equal to zero. Comment.
- (ii) Give characteristics of a well behaved wave function.

(iii) When do reactions show a high quantum yield?
Give an example of a photochemical reaction with a very high quantum yield.

(iv) State two laws of photochemistry.

(b) How would rotational spectrum of HCl be affected if bond length, r , was to be 12.74 \AA instead of actual value 1.274 \AA ?
(9,3½)

6. (a) Find whether the momentum operator p_x and position operator x commute with each other. Interpret your result.

(b) Roughly sketch fundamental vibrations of H_2O molecule. Which of them will be IR active?

(c) Which of the following are the eigen functions of the operators $\frac{d^2}{dx^2}$

(i) $5 \cos bx$ (ii) e^{ikx}

Give the eigen values wherever appropriate.

(d) Write the Hamiltonian operator for particle in a one dimensional box.
(4½,3,3,2)

7. (a) Calculate the energy required for first excitation (from $n=1$ level) of a particle of mass 10^{-31} kg in a one dimensional box of length 1 \AA .

(b) On what factors does the vibrational frequency of a molecule depend? Arrange the following functional groups in the order of their increasing vibrational frequency: C-Cl, C-I, C-F, C-Br, C-H

(c) Which of the following molecules are rotationally active and why?

$\text{CO}_2, \text{HCl}, \text{CH}_4, \text{H}_2\text{O}$ (4½,4,4)

8. (a) Write short notes on any **three** of the following :

(i) Fluorescence

(ii) Primary and secondary photochemical process

(iii) Born Oppenheimer approximation

(iv) Franck Condon Principle

(b) A monochromatic radiation is incident on a solution of 0.05 molar concentration of an absorbing substance.

The intensity of radiation is reduced to $1/4$ of initial value after passing through 10 cm length of solution. Calculate the molar extinction coefficient of substance.

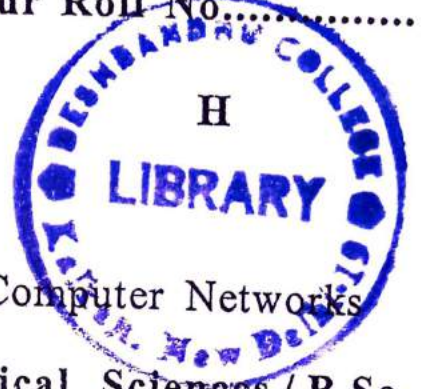
(9,3½)

17

[This question paper contains 4 printed pages.]

30/11/17

Your Roll No.....



Sr. No. of Question Paper : 5016

Unique Paper Code : 234561

Name of the Paper : CSPT-505 Computer Networks

Name of the Course : B.Sc. Physical Sciences / B.Sc. Math. Sciences

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt any **five** from remaining **seven** questions.
4. In all **six** questions are to be attempted.
5. Marks are indicated against each question.
6. All parts of a question must be done together.

1. (i) Identify the characteristics of an effective Data Communication System. (2)
(ii) What do you understand by Burst Error? Illustrate through an example. (2)
(iii) Differentiate between an amplifier and a repeater. (2)

P.T.O.

- (iv) Differentiate between Flow Control and Error Control in context of Data Link Layer. (2)
- (v) Show how the following data 000111111110011111001 would change when bit stuffing is applied on it. (2)
- (vi) Categorize the following as (Fully Qualified Domain Name) FQDN or (Partially Qualified Domain Name) PQDN.
- abc
 - abc.xyz.
 - abc.xyz.net
 - abc.xyz.net.edu. (2)
- (vii) Identify the different ways of addressing used in Virtual Circuit Networks. (2)
- (viii) Define Uniform Resource Locator (URL). What is the significance of URL on internet? (2)
- (ix) Explain the terms '*Message Nonrepudiation*' and '*Entity Authentication*'. (2)
- (x) Find the class of the following IP addresses :
- 129.14.6.8
 - 208.54.12.8 (2)
- (xi) Define Vulnerable Time in Carrier Sense Multiple Access (CSMA). (2)

- (xii) Define Service-point addressing in Transport Layer of OSI Model. (1)
- (xiii) Name the connector used in Coaxial Cable. (1)
- (xiv) What do you mean by Jamming Signal in Carrier Sense Multiple Access with Collision Detection (CSMA/CD)? (1)
- Define Protocol. Discuss the key elements of a protocol. Explain any two protocols used by Internetworking Protocol (IP) in TCP/IP protocol suite. (1+2+2=5)
 - Explain any five characteristics of Transport Layer in the OSI model. (5)
 - What you understand by "Unguided Media" communication? Give advantages of Optical Fiber cable over Twisted pair Cable. (2+3=5)
 - What do you understand by a Transparent Bridge? List the criteria that must be met by a system equipped with Transparent Bridges. (2+3=5)
 - Write the algorithm for Stop-and-Wait Protocol. Draw its flow diagram. (2+2+1=5)
 - Draw the flow diagram for Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). (5)

5. (a) What is Classless Addressing? List the restrictions imposed by the internet authorities on classless address blocks. (2+3=5)
- (b) An Organization is granted the block 205.16.37.39/28.
- (i) Find the number of addresses in the block.
 - (ii) Find the first and last address in the block.
 - (iii) Explain the components of address 205.16.37.29/28. (1+2+2=5)
6. (a) What are the three FTP transmission modes? List two TCP ports used by FTP. What is the significance of anonymous FTP? (5)
- (b) Define firewall. Explain the functioning of Packet-Filter Firewall. (5)
7. Differentiate between the followings :
- (a) Recursive and Iterative Resolution (5)
 - (b) Persistent and Non-persistent Connection (5)
8. Write Short notes on the followings **Any Two** : (5×2)
- (a) Virtual Private Network
 - (b) TELNET
 - (c) Circuit Switched Networks
 - (d) Cookies

[This question paper contains 4 printed pages.]

18



Your Roll No.....

Sr. No. of Question Paper : 5017

H

Unique Paper Code : 235566

Name of the Paper : MAPT-505, Mathematics-V, Real Analysis

Name of the Course : B.Sc. (Prog.) / Mathematical Sciences

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All questions are compulsory.
3. Attempt any two parts from each question.

1. (a) Define supremum of a bounded set. For any set $S \subseteq \mathbb{R}$ and $a \in \mathbb{R}$, show that

$$\sup(S + a) = \sup S + a$$

where $S + a = \{s + a : s \in S\}$.

Find supremum and infimum of the set

$$S = \left\{ 1 + \frac{(-1)^n}{n} : n \in \mathbb{N} \right\}$$

P.T.O.

(b) Show that the set \mathbb{Q} of rational numbers is not order complete.

(c) State and prove Archimedean property of real numbers. Hence or otherwise, prove that

$$\inf \left\{ \frac{1}{n} : n \in \mathbb{N} \right\} = 0. \quad (6+6)$$

2. (a) Define limit point of a set. Show that 0 is the only limit point of the set $\left\{ \frac{1}{n} : n \in \mathbb{N} \right\}$.

(b) Define a countable set. Prove that $\mathbb{N} \times \mathbb{N}$ is countable set.

(c) Prove that $\lim_{n \rightarrow \infty} (n^{1/n}) = 1$. (6+6)

3. (a) If $\{a_n\}$ and $\{b_n\}$ are sequences of real numbers such that $\lim a_n = a$ and $\lim b_n = b$, then show that $\lim(a_n b_n) = ab$.

(b) Define a Cauchy sequence. Show that every Cauchy sequence is bounded. Is the converse true? Justify your answer.

(c) Show that the sequence $\{a_n\}$ defined by

$$a_1 = 1, a_{n+1} = \sqrt{2 + a_n} \quad \forall n \geq 1$$

converges. Find $\lim a_n$. (6+6)

4. (a) If $\sum u_n$ is a positive term series such that $\lim_{n \rightarrow \infty} \frac{u_n}{u_{n+1}} = l$, where $l < 1$, then show that $\sum u_n$ diverges. Does the result hold for $l = 1$ also? Justify your answer. "

(b) Test the convergence of the following series

$$(i) \sum (\sqrt{n^2 + 1} - n)$$

$$(ii) \sum \frac{n^{n^2}}{(n+1)^{n^2}}$$

$$(iii) \frac{1}{3} + \frac{1.2}{3.5} + \frac{1.2.3}{3.5.7} + \frac{1.2.3.4}{3.5.7.9} + \dots$$

(c) Show that the series $\sum \frac{1}{n^p}$ diverges for $p \leq 1$.

(7+7)

5. (a) Define absolute convergence and conditional convergence of a series. Show that every absolutely convergent series is convergent. Is the converse true? Justify your answer.

(b) Define radius of convergence of a power series. Find radius of convergence and exact interval of convergence

$$\text{for the power series } \sum \frac{(x-1)^n}{n^2}.$$

(c) Define Exponential function, Sine function and Cosine function in terms of power series. Specify their domains of definition. (6+6)

6. (a) If $\{f_n\}$ is a sequence of functions continuous on $[a, b]$ and converging uniformly to a function f on $[a, b]$, then show that f is continuous on $[a, b]$.

(b) Test the sequence $\{f_n\}$, where

$$f_n(x) = \frac{nx}{1+n^3x^2}$$

for uniform convergence on $[0, 1]$.

(c) Show that the series $\sum \frac{1}{n^4 + n^2x^2}$ converges uniformly for all real values of x . Can the series be integrated term by term on any interval $[a, b]$. (6½, 6½)

19
This question paper contains 6 printed pages.

Your Roll No.



Sl. No. of Ques. Paper : 5071
Unique Paper Code : 217561
Name of Paper : CHPT-505 : Chemistry – V
Chemistry of d Block Elements,
Quantum Chemistry and
Spectroscopy
Name of Course : B.Sc. Programme Life Science /
Physical Science / Applied Life
Science (Agrochemical & Pest
Management) / Applied Physical
Science (Analytical Chemistry /
Industrial Chemistry)
Semester : V
Duration : 3 hours
Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt **three** questions from Section A and **three** questions
from Section B. Sections A and B are to be attempted
in separate portions of the same answer sheet.
Please indicate the Section you are attempting at the
appropriate place and do not intermix the Sections. The
questions should be numbered in accordance to the number
in the question paper.

Calculators and log tables may be used.

SECTION A

Attempt any **three** questions.

Turn over

1. (a) Give brief reasons for any *three* of the following:
- Cu(II) compounds are coloured while Cu(I) compounds are colourless.
 - Zinc, cadmium and mercury are softer than the transition metals.
 - Octahedral complexes of Co(III) may be of inner and outer orbital types but those of Cr(III) are only inner orbital.
 - Many transition metals and their compounds act as catalysts.
 - The atomic radii of zirconium and hafnium are very similar.

(b) Define, using *two* examples, an ambidentate ligand. What specific type of isomerism is displayed in complexes containing such ligands? How does an ambidentate ligand differ from a bidentate ligand? 9,3½

2. (a) Explain why a d^9 octahedral complex with six identical ligands is not expected to have identical bond lengths. Give the appropriate splitting diagram of such a case where the axial bonds are longer than the equatorial bonds.

(b) Give the IUPAC names of any *three* of the following:

- $K_2[OsCl_4N]$
- $[Pt(NH_3)_4][PtCl_3(NH_3)_3]_2$
- $Na[Mn(CO)_5]$
- $[(en)_2Co(NH_3)(OH)Co(en)_2](SO_4)_2$

(c) The magnetic moments of $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ are 5.9 BM and 1.8 BM respectively. Explain on basis of

VBT. Indicate which of these is an inner orbital complex and which is an outer orbital complex. 5,4½,3

3. (a) Write the formulae of any *three* of the following:

- Barium tetrafluorobromate(III)
- Diamminesilver(I) tetraacetatoaurate(III)
- Aquatris (triphenylphosphine) palladium(0)
- Bis (ethylenediamine) copper(II) tetrahydroxocuprate(II)

(b) Calculate the CFSE in terms of Δ_t of the Co^{2+} ion placed in a tetrahedral field. Draw the splitting diagram and explain why the splitting pattern differs in tetrahedral and octahedral fields.

(c) Indicate the type of isomerism and one test to distinguish between the following:

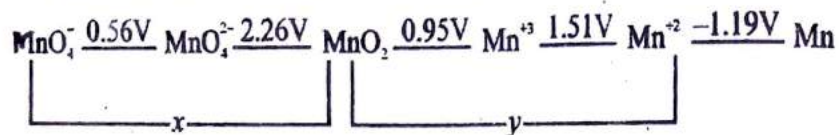
- $[CoI(NH_3)_5]SO_4$ and $[CoSO_4(NH_3)_5]I$
- $[CrCl(H_2O)_5]Cl_2$ and $[CrCl_2(H_2O)_4]Cl \cdot H_2O$ 4½,4,4

4. (a) Explain using CFT why an octahedral complex may be high spin or low spin but a tetrahedral complex is generally high spin.

(b) Indicate the appropriate choice and give brief reasons:

- Greater value of Δ_o $[Co(H_2O)_6]^{2+}$ or $[Co(H_2O)_6]^{3+}$
- Good reducing agent $Sm(II)$ or $Ce(IV)$
- Optically active cis or $trans$ $[CrCl_2(en)_2]^+$

(c) The Latimer diagram of manganese is given below:



Calculate x and y and indicate by showing necessary calculations which species will be disproportionate.

Or

(c) Write short notes on any two of the following:

- (i) Separation of lanthanides by ion exchange
- (ii) Spectrochemical series
- (iii) Variable oxidation states of $3d$ elements. 3,4½,5

SECTION B

Attempt any three questions.

Physical Constants

Planck's constant = 6.626×10^{-34} J s

Velocity of light = 3×10^8 m s⁻¹

Avogadro's number = 6.023×10^{23} mol⁻¹

Atomic mass unit = 1.661×10^{-27} kg

Mass of electron = 9.109×10^{-31} kg

$\pi = 3.142$

5. (a) Write the mathematical expressions for the position operator x and the linear momentum operator p_x .
- (b) Prove that the momentum and position operators do not commute with each other.
- (c) Examine which of the following are acceptable wave functions:
 - (i) $\psi = x^2$
 - (ii) $\psi = e^x$
 - (iii) $\psi = e^{-x}$
 - (iv) $\psi = A \sin x$

(d) Prove that the wave functions of a particle in one-dimensional box are normalized. 2,2½,4,4

6. (a) The fundamental vibration frequency of $\text{N}^{14}\text{O}^{16}$ is observed at 1870 cm^{-1} . Evaluate the zero point energy and the force constant of the molecule.
 - (b) A molecule AB is undergoing rotational motion under the rigid rotator approximation. What is this approximation? Write the mathematical expression for the Hamiltonian, Schrodinger's equation and the rotational energy E_{rot} associated with this system.
 - (c) Which of the following molecules can exhibit a pure microwave spectrum: Cl_2 , NH_3 , CO , C_2H_2 ? Explain briefly. 4,4½,4
7. (a) Explain the terms degeneracy and node using the particle in a box problem as an example.
 - (b) Predict the wave number of the lowest energy absorption band in the conjugated octatetraene molecule given that the average carbon-carbon bond distance is 0.141 nm .
 - (c) For a photochemical reaction, $\text{A} \rightarrow \text{B}$, 1.08×10^{-5} moles of B are formed on absorption of 5.89 J at 360 nm . Calculate the quantum efficiency of the reaction. Explain why the quantum yield is quite high for certain reactions. 4,4,4½

8. (a) Write a short notes on any *three* of the following:

(i) Fluorescence and Phosphorescence

(ii) Beer-Lambert's Law

(iii) Bathochromic and Hypsochromic shift

(iv) Bohr's correspondence principle.

(b) Define eigenfunction and eigenvalue.

3½,3,2

20

This question paper contains 3 printed pages.

Your Roll No



Sl. No. of Ques. Paper: 5075

Unique Paper Code : 217563

Name of Paper : Industrial Chemistry V :
ICPT 505

Name of Course : B.Sc. Applied Physical Sciences

Semester : V

Duration : 3 hours

Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt six questions in all.

Question No. 1 carries 15 marks.

1. Answer any five parts:

- (a) Differentiate between natural and synthetic polymers.
- (b) Differentiate between terms LDPHE and HDPHE.
- (c) What is vulcanization of rubber?
- (d) How can you distinguish linear and cross linked polymers?
- (e) Define copolymerization.
- (f) What are polysulphones?

3×5

P. T. O.

2. (a) How is Nylon-6 synthesised? Write any *two* of its applications.
- (b) Give the industrial preparation and uses of methyl orange.
- (c) Give the structure of Buna-S and Rayon. 5,5,2
3. (a) Explain the following with examples:
- (i) Mordant Dyes
- (ii) Vat Dyes.
- (b) What are thermosetting and thermoplastic polymers? Illustrate with examples.
- (c) Describe the manufacture and uses of Alkyds Resins. 4×3
4. Write short notes on the following: (any *three*)
- (a) Phosphorous based polymers
- (b) Classification of dyes
- (c) Polycarbonates
- (d) Biopolymers. 4×3
5. (a) What are Silicones? Give its uses.
- (b) Write a short note on edible dyes.
- (c) Give the synthesis and uses of Malachite Green. 4×3

6. (a) Describe preparation and uses of Alizarin.
- (b) Give the synthesis of Polystyrene and its applications.
- (c) Explain the terms moulding and compounding. 4×3
7. (a) Differentiate between Addition and Condensation polymerization.
- (b) Write the preparation of phosphonitrilic chlorides.
- (c) Write the characteristic features of dyes. 4×3
8. (a) Write the preparation of boron containing polymers.
- (b) What are Inorganic Polymers? Discuss how they are different from organic polymers.
- (c) Give the preparation and uses of Indigo. 4×3



(2)

This question paper contains 4 printed pages] ^{20/12/17}

Your Roll No. :

Sl. No. of Q. Paper : **5078** **H**

Unique Paper Code : 217582

Name of the Course : **B.Sc. (Programme)**
B.Sc. Math. Science
(Credit Course)

Name of the Paper : EL 310 (I) : Green
Chemistry

Semester : V

Time : 3 Hours **Maximum Marks : 75**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Attempt six questions in **all**, including Question No. **1** is compulsory and carries **15** marks. Remaining Questions are of **12** marks each.

1. (a) Fill in the blanks with appropriate words.
1×5=5

- (i) Atom economy involves the maximum conversion of reactants to
- (ii) DMC stands for

P.T.O.

- (iii) Elimination reaction are % atom economical.
- (iv) Ionic liquids are solvents.
- (v) The twelve principles of green chemistry were put forth by
- (b) Explain the need of green Chemistry in day to day life. 3
- (c) What is piezoelectric effect ? 2
- (d) Write any two important goals of Green Chemistry. 2
- (e) What types of reaction vessels are used in microwave reactions ? 2
- (f) Give the short form to denote ultrasound reactions. 1
2. (a) Give different techniques of minimizing hazardous waste. 4
- (b) Describe the role of "Clayan" as a non-metallic oxidative reagent in various reactions. 4
- (c) Write the names of any two substances generally used as adsorbents in solid phase microwave reaction. 2
- (d) Define % atom economy. 2

3. Write short notes on any **three** : 3×4=12
- (i) Role of Green chemistry in pharmaceutical industry
- (ii) Role of Green Chemistry in Sustainable development
- (iii) Green Catalyst
- (iv) Use of protecting groups
4. Give the Green Synthesis of following compounds : 4×3=12
- (i) Catechol
- (ii) Adipic Acid
- (iii) Citral
- (iv) Methyl acrylate
5. Discuss the following reactions under sonication taking suitable example. 4×3=12
- (i) Saponification reaction
- (ii) Cannizzaro reaction
- (iii) Strecker reaction
- (iv) Oxidation reaction

6. (a) What is Biocatalysis ? What are the advantages of biocatalytic conversions. 6
- (b) How does Sc-CO_2 can be viable green alternative ? 4
- (c) What is green house effect ? 2
7. (a) Give the greener route for the synthesis of Ibuprofen and compare with its conventional route. 6
- (b) Give the advantages of using water as solvent over organic solvent. 4
- (c) Define ionic liquids. 2
8. (a) Explain the twelve principles of green chemistry in detail. 8
- (b) What is PTC ? Give any two examples of PTC. 4

92



This question paper contains 3 printed pages.

Your Roll No.

Sl. No. of Ques. Paper: 5084
Unique Paper Code : 222565
Name of Paper : Physics— Electricity, Magnetism
and E.M. Theory
Name of Course : B.Sc. (Prog.) (PHPT-404)
Semester : V
Duration : 3 hours
Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt five questions in all.
Question No. 1 is compulsory.*

1. Attempt any five:—

- (a) Explain concept of electric field lines and their significance.
- (b) Write a brief note on conservative nature of electric field.
- (c) Find an expression for potential energy of system of charges.
- (d) What is magnetic flux? State Biot-Savart's Law.
- (e) Find expression for force on a point charge placed in a magnetic field.
- (f) State the properties of Curl B and Divergence B.

P. T. O.

- (g) Write the integral form of Ampere's law. What are its applications?
- (h) What is Brewster's angle? 3×5
2. (a) State and prove Gauss law in electrostatics. 9
- (b) Use Gauss law to find the electric field at a point (due to a uniformly charged solid conducting sphere) lying (i) inside and (ii) outside the sphere. What do you mean by Gaussian surface? 6
3. (a) State Ampere's circuital law and find field due to a current carrying solenoid. 9
- (b) A current of 5 Amperes is passed through a coil of self-inductance L . Find expression for energy stored in the magnetic field of the coil. 6
4. (a) Using Biot-Savart's law, calculate magnetic field near an infinitely long straight conductor carrying current. 8
- (b) Calculate the magnetic field intensity at a distance of 10 cm from a long straight conductor carrying 3 A current. 2
- (c) Prove $\text{curl } \mathbf{B} = \mu_0 \mathbf{J}$. 5
5. (a) Describe the construction of a moving coil B.G. 9
- (b) Find expression for charge sensitivity and critical damping resistance. 6

6. What is continuity equation? State and prove Maxwell's equations for free space. 5+10
7. (a) What is displacement current?
- (b) Find expression for plane wave equation and prove transverse nature of E.M. wave. 3+12
8. Write short notes on any two:
- (a) Energy stored in electric field
- (b) Magnetic energy in terms of current and inductance
- (c) Faraday's laws of induction and their significance. 7.5×2

23

This question paper contains 4 printed pages.

Your Roll No.



Sl. No. of Ques. Paper: 5085

Unique Paper Code : 223551

Name of Paper : Biochemistry and Immunology
(LSPT-510)

Name of Course : B.Sc. (Life Sciences)

Semester : V

Duration : 3 hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt six questions in all.

*In Section A answer three questions including Question
No. 1 which is compulsory.*

*In Section B answer three questions including Question
No. 5 which is compulsory.*

1. (a) Define:

(i) Anabolic Pathways

(ii) Holoenzyme

(iii) Transamination.

3

(b) Differentiate between the following:

(i) Transaldolase and Transketolase

(ii) Ammonotelic and Ureotelic organisms

(iii) Competitive and Uncompetitive Inhibition. 6

P. T. O.

(c) Give one function of the following:

- (i) Ubiquinone
(ii) Thiolase.

2

(d) Match the following:—

- | | |
|--------------------------|-------------------------------|
| (i) Lactic Acid | (A) Citric acid cycle |
| (ii) NADPH | (B) Oxidative phosphorylation |
| (iii) Aconitase | (C) Michaelis constant |
| (iv) Chemiosmotic Model | (D) Fatty acid synthase |
| (v) 4-phosphopantetheine | (E) Pentose phosphate pathway |
| (vi) K_m | (F) Anaerobic respiration |

3

2. Describe the Glycolysis pathway with structural formulae. 12

3. (a) Discuss the sequence of reactions in the Urea cycle. 8

(b) Briefly explain the Induced Fit Theory of enzyme action. 4

4. Write short notes on any *three* of the following:

- (a) Allosteric enzymes
(b) Role of carnitine shuttle

(c) ATP synthase

(d) Glycogenesis.

4+4+4

SECTION B (IMMUNOLOGY)

5. (a) Define the following:

- (i) Innate immunity
(ii) Hapten.

2

(b) Differentiate between the following terms:

- (i) Natural and Artificial Immunity
(ii) Primary and Secondary Lymphoid Organs. 4

(c) Write the full forms of the following:

- (i) TCR
(ii) ADCC
(iii) CTL
(iv) Fab
(v) TLR

5

(d) Write the contribution of the following scientists:

- (i) Karl Landsteiner
(ii) E. Metchnikoff.

2

6. What are the attributes of adaptive immunity? Explain the role of B cell and T cell in eliciting immune response. 12

7. (a) Illustrate with the help of diagram how exogenous antigen is processed and presented.

(b) Describe the structure and function of IgM. 8,4

8. Write short notes on any *three* of the following:

(a) Lymph node

(b) Subunit vaccine

(c) MHC II.

(d) Hybridoma technology. 4+4+4

(24)

This question paper contains 4 printed pages.

Your Roll No. LIB/12/11



Sl. No. of Ques. Paper: 5086

Unique Paper Code : 222563

*Name of Paper : Physics-V [Quantum Mechanics
& Atomic Physics] (PHPT-505)*

Name of Course : B.Sc. (Physical Sciences)

Semester : V

Duration : 3 hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt any five questions.
All questions carry equal marks.*

1. (a) Discuss how Classical Physics failed to explain the spectral distribution of radiant energy emitted by a black body. 6
- (b) What are phase velocity and group velocity of a wave packet? Derive the relation between them. 3,3
- (c) The work function of a metal is 3.45 eV . What is the maximum wavelength of a photon that can eject an electron from the metal? 3
2. (a) What is Compton effect? Give the explanation of this effect with the help of quantum theory and obtain an expression of the Compton shift. 2,6

P. T. O.

- (b) Explain de Broglie's hypothesis. 4
- (c) Find the kinetic energy of a neutron if its de Broglie wavelength is 1.0 \AA . 3
3. (a) State Heisenberg's uncertainty relation. Illustrate the uncertainty principle by Heisenberg's Gamma-ray microscope. 2,6
- (b) Derive Schrodinger's time independent form of wave equation. 7
4. (a) Solve Schrodinger equation for a particle in one dimensional box. Obtain the expression for normalized wave function and energy eigenvalues. 9
- (b) A particle limited to the x -axis has the wave function $\Psi = ax$ between $x=0$ and $x=1$. Find the expectation value of the particle's position. 3
- (c) What is tunnel effect? 3
5. (a) Explain space quantization of orbital angular momentum. 5
- (b) Derive an equation for the deviation produced by an atomic dipole moving in a non-uniform magnetic field. Describe Stern-Gerlach experiment. What is the conclusion of this experiment? 5,3,2
6. (a) What is Anomalous Zeeman Effect? Explain in detail how this effect arises. 2,8

- (b) Calculate the Lande g -factor for the following states:
- (i) ${}^2P_{3/2}$
- (ii) ${}^2D_{3/2}$ 5
7. (a) State Pauli's exclusion principle. What are symmetric and anti-symmetric wave functions? Explain how anti-symmetry of the two electron wave function leads to the Pauli exclusion principle. 2,3,4
- (b) What do you understand by spin-orbit coupling? What is its significance? 4,2
8. (a) Explain j - j coupling. 4
- (b) Find the possible spectral terms in j - j coupling of two atomic electrons having orbital quantum numbers $l_1=1$ and $l_2=2$. 5
- (c) Explain the spectral line arising in the transition $3d \rightarrow 2p$ of the Balmer series in hydrogen atom due to spin-orbit coupling. Write down the selection rules involved in the given transition. 5,1

Physical Constants:

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

$$m_n = 1.675 \times 10^{-27} \text{ kg}$$

25
This question paper contains 4 printed pages.

Your Roll No. _____



Sl. No. of Ques. Paper: 5087

Unique Paper Code : 216553

Name of Paper : Developmental Biology and
Physiology : Plants
(LSPT-511)

Name of Course : B.Sc. (Prog.) Life Sciences

Semester : V

Duration : 3 hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt any five questions.

All parts of a question must be answered together.

All questions carry equal marks.

Draw well labelled diagrams wherever necessary.

1. (a) Describe the role of gibberellins in mobilization of food reserves in plants. 5
- (b) What are the salient features of Dixon's cohesion-tension hypothesis? 5
- (c) Distinguish between apoplast and symplast. 5
2. (a) Blue light and potassium ions are important for stomatal opening. Justify. 5

- (b) Explain briefly the mechanism of translocation of photoassimilates in plants by mass flow hypothesis. 5
- (c) Define (any five):
- Cavitation
 - Enhancement effect
 - Antitranspirants
 - Photorespiration
 - Bioassay
 - Photoperiodism. 5
3. (a) Outline the major deficiency symptoms associated with zinc and molybdenum. 5
- (b) Explain why auxins are important in agriculture and horticulture. 5
- (c) Rubisco behaves as dual-functional enzyme. Comment. 5
4. Write explanatory notes on (any three):
- Biological clock
 - CAM plants
 - Water potential and its components
 - Discovery and biological significance of vernalization. $3 \times 5 = 15$

5. (a) Differentiate between (any two):
- Amoeboid and Secretory tapetum
 - Crassinucellate and Tenuinucellate ovule
 - Gametophytic and Sporophytic incompatibility. $2 \times 5 = 10$
- (b) Define (any five):
- Ubisch bodies
 - Hypostase
 - Perisperm
 - Haustorium
 - Exostome
 - Funiculus. $5 \times 1 = 5$
6. (a) Incompatibility leads to poor seed set. Give two methods to overcome incompatibility in plants. 5
- (b) Double fertilization is an important feature of angiosperms. Justify. How does it take place? 5
- (c) Discuss in detail the ultrastructure of synergids. 5
7. (a) Write short notes on the following (any two):
- Male Germ Unit
 - Pollen kit material and its importance
 - Light reaction in photosynthesis
 - Factors affecting transpiration. $2 \times 5 = 10$
- P. T. O.

(b) Write a detailed account of role of callose in microsporogenesis. 5

Or

Why are ethylene traps important for fruit-sellers?
Name some substances used as ethylene traps.
Mention the name of the precursor of ethylene. 15

26

This question paper contains 4 printed pages.

Your Roll No.



Sl. No. of Ques. Paper : 5088
Unique Paper Code : 234563
Name of Paper : Database and Visual Basics
Name of Course : B.Sc. (Prog.) Physical Sciences
Semester : V
Duration : 3 hours
Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Part A is of 25 marks and is compulsory.
Attempt any five questions from Part B.

PART A

1. (a) What is Entity integrity? How is it different from Referential integrity? 3
- (b) What is the storage requirement for Byte and Single data type? 1
- (c) How can you create a different lower bound for the array? 1
2. (a) Explain Masked Text Box with example. 3
- (b) What is Normalization? What anomaly arises in non-normalized relation? 3

Turn over

(c) Explain the significance of the statements "Option Infer On" and "Option Explicit Off". 2

3. (a) Write short notes on any two:

(i) Weak relationship

(ii) Strong relationship

(iii) Derived attribute

(iv) Cardinality of a relation. 3

(b) Differentiate between OR Else and OR operators. 2

4. (a) Differentiate between List Box and Combo Box. 2

(b) What is "ME" in Visual Basic? Where can it be used? 2

(c) Differentiate between Data and Information. 1

(d) What is Null value? Mention two different interpretations of null value in a database giving suitable example for each. 2

PART B

5. (a) Differentiate between following:

(i) Network and Hierarchical database models

(ii) Primary key and Foreign key

(iii) Chen's notation and Crow's Foot notation for ER diagram. 6

(b) Discuss For-Next statement. Write a program to find factorial of a number n taken from user. 4

6. (a) What is the difference between function call-by-value and call-by-reference? Give an example of each. 4

(b) Explain the following relational operators giving suitable examples of each:

(i) SELECT

(ii) INTERSECT

(iii) NATURAL JOIN 6

7. (a) Write a function procedure max (a, b, c) which will return maximum of three numbers. 4

(b) Consider the following relational database schema:

Emp (Emp_Num, Emp_Name, Job_Code, Dept_No, Salary)

Emp_Num	Emp_Name	Job_Code	Dept_No	Salary
101	John	502	01	10,000
102	David	501	02	20,000
103	Alice	500	03	20,000
104	Maria	501	04	30,000
105	Larry	502	05	40,000
106	Smith	500	06	50,000

Write SQL statements for the following:

(i) Display names of all the employees having Job_Code 500, working in Dept_No 03.

(ii) Listing of all rows for which salary is not 20,000.

(iii) Listing of all employees whose names do not start with 'Smith'. 6

8. (a) What is functional dependency? List all fully functional dependencies in Emp relation given in Q. No. 7 (b). 4

(b) Write a program for Button click event, to find whether a number is even or not. Display the output (T/F) in a message box. 6

9. (a) Create an ER diagram using the following requirements:
- (i) College has several schools: School of Business, School of Arts & Sciences, School of Education and School of Applied Sciences. Each school is administered by a Dean, who is a professor. Each dean can administer only one school.
 - (ii) Each school is composed of several departments.
 - (iii) Each department may offer courses.
 - (iv) Each department may have many professors assigned to it. Each professor may take up to 4 courses. 6

(b) Explain two ways of reading a text file, giving example of each. 4

10. (a) What are the main components of database system? Explain in detail. 7

(b) Explain how a user defined data type can be created using the structure statement. Give suitable example. 3

11. (a) Define 3NF (Third Normal Form) of a relation. 2

(b) What are multivalued attributes and how can they be handled within the database design? 2

(c) Which function is used to convert a number to a string? 2

(d) Explain the procedure of adding multiple forms to a project with an example. 4

(27)

This question paper contains 4 printed pages.

Your Roll No.



Sl. No. of Ques. Paper : 5090

H

Unique Paper Code : 216555

Name of Paper : Genetics and Genomics (LSPT-512)

Name of Course : B.Sc. (Prog.) Life Sciences

Semester : V

Duration : 3 hours

Maximum Marks : 75

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt five questions in all, including
Question No. 1 which is compulsory.
All questions carry equal marks.*

1. (a) Define (any five):

- (i) Barr body
- (ii) Pseudodominance
- (iii) Missense mutation
- (iv) Proteomics
- (v) Dicentric chromosome
- (vi) Conditional lethal mutation.

1×5=5

(b) Give one contribution of (any five):

- (i) Barbara McClintock
- (ii) W. Sutton and T. Boveri

Turn over

- (iii) Calvin Bridges
- (iv) Craig Venter
- (v) Alfred Sturtevant
- (vi) Mary Lyon.

1×5=5

(c) Fill in the blanks:

- (i) Linkage between the genes can be detected as a deviation from the Mendel's principle of
- (ii). Allele for color-blindness is located on chromosome.
- (iii) The phenomenon of bringing about equality in the products synthesized under the control of the genes carried on X-chromosomes is called as
- (iv) The X and Y chromosomes in *Melandrium album* have a common segment.
- (v) When a gene affects many aspects of phenotype, it is said to be

1×5=5

2. Write short notes on (any three):

- (a) Lyon hypothesis
- (b) Inheritance pattern of white eye color in *Drosophila*
- (c) Allopolypoidy
- (d) Shot gun sequencing
- (e) Chi Square Analysis.

5×3=15

3. Differentiate between (any five):

- (a) Inversion and Translocation
- (b) Complete and Incomplete linkage
- (c) Codominance and Incomplete dominance

(d) Penetrance and Expressivity

(e) Dominance and Epistasis

(f) Test cross and Reciprocal cross.

3×5=15

4. (a) A pure dextral female snail is crossed with a pure sinistral male snail. Give the genotype and phenotype of F_1 , F_2 and F_3 progeny with reasons. 10
- (b) Write down the common features of model organisms. Discuss *Arabidopsis thaliana* as a model organism in genetic study. 5
5. (a) In sweetpea the dominant allele R causes purple flower and recessive allele r causes red flower in homozygous condition. The dominant allele L causes long pollen grain, and recessive allele l causes round pollen grain in homozygous condition. In F_2 generation from a cross between double heterozygous purple flowered plant with long pollen grains and a red flowered plant with round pollen grain, the following results were obtained:

Purple flower, long pollen grain	296
Purple flower, round pollen grain	19
Red flower, long pollen grain	27
Red flower, round pollen grain	85

Give the genotypes of parents and progenies. Calculate recombination frequency. 8

- (b) Give the cause and symptoms for Klinefelter syndrome. 5
- (c) What is the phenotype of a person who has:
- (i) XY with SRY genes deleted
 - (ii) XXV with SRY genes deleted? 2

6. (a) What are physical mutagens? Discuss the role of ionizing and non-ionizing radiations in inducing mutation. 8
- (b) Explain the Celera genomics project and the sequencing methodology used in the project. 7
7. (a) What is Pedigree Analysis? Explain the inheritance of X-linked recessive inheritance with the help of a suitable example. 8
- (b) Explain why the recombination frequency never exceeds 50%. 5
- (c) Give the number of barr bodies present in an individual with chromosomal constitution XXXXYY and XXYY. 2

28

This question paper contains 7 printed pages]

2/12/17

Roll No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

S. No. of Question Paper : 6779

Unique Paper Code : 42347901

HC

Name of the Paper : Programming in Java

Name of the Course : Computer Science : DSE

Semester : V

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Section A is compulsory.

Attempt any five questions from Section B.

SECTION A

1. (a) Explain the output of the following java code :

```
class VarargsExample1
{
    static void display(String... values)
    {
        System.out.println("display method invoked ");
    }

    public static void main(String args[])
    {
        display();//zero argument
        display("my","name","is","varargs");//four arguments
    }
}
```



4

(b) Give output of the following code :

i. class A

```
{  
    public static void main(String[] st)  
    {  
        int n1 = 4;  
        int n2 = 5;  
        String s1 = "7";  
        System.out.println(s1+n1+n2);  
        System.out.println(n1+n2);  
    }  
}
```

ii. class A

```
{  
    public static void main(String[] args)  
    {  
        String a = "TEST STRING";  
        a = a.substring(5,7);  
        char b = a.charAt(1);  
        a = a + b;  
        System.out.println(a);  
    }  
}
```

iii. class Inherit_Single

```
{  
    protected int s;  
    Inherit_Single()  
    {s = 10;}  
}
```

```
}  
  
class SubClass extends Inherit_Single  
{  
    SubClass()  
    {s = 11;}  
    void display()  
    {System.out.println(s);}  
}  
class MainClass  
{  
    public static void main (String args[])  
    {  
        SubClass obj = new SubClass();  
        obj.display();  
    }  
}
```

(c) What is the purpose of *final* keyword in context of variable, method and class. 4

(d) What is the purpose of the following method : 2

```
protected void finalize(){...}
```

(e) What do you understand by this keyword ? Explain with the help of an example. 4

- (f) When will we declare a member of a class static ? 2
- (g) What is the output of the following code : 3

```
public class Test
{
    public static void main(String[] args)
    {
        int[] x = { 1, 2, 3, 4 };
        int[] y = x;
        x = new int[2];
        for (int i = 0; i < x.length; i++)
            System.out.print(y[i] + " ");
    }
}
```

SECTION B

2. (a) Write a java program to perform the arithmetic operations using the concept of method overloading, define a method add that accepts as input two int values and return their sum as an int. Overload this method by a method that accepts two float values and return float. 6
- (b) Write a java code to calculate factorial of a number where number is accepted from the command line. 4
3. (a) Write a Java program to input two integers a and b. Print a/b and handle an appropriate Exception that may occur in the code. 2
- (b) Define a class Person having name as a data member. Inherit two more classes Student and Employee from Person. To the class Student, add data members course, marks and year, and to the class employee add data members department and salary. Write display method in all the three classes to display the relevant details of the corresponding class. Provide the necessary methods to show dynamic method dispatch. 8

4. (a) Create a user defined exception, which is generated whenever the user inputs the string "Hello". 4
- (b) Consider the following files file 1. java and file2. java : 6

//file1.java

```
package P1;
```

```
public class A
```

```
{
```

```
    int a;
```

```
    private int b;
```

```
    protected int c;
```

```
    public int d;
```

```
    :
```

```
}
```

```
class B
```

```
{
```

```
    :
```

```
}
```

```
class C extends A
```

```
{
```

```
    :
```

```
}
```

//file2.java

```
package P2;
```

```
import P1.*;
```



```

class D
{
    :
}
class E extends A
{
    :
}

```

Which variables of class A are accessible in classes B, C, D and E ? Why ?

5. (a) State the purpose of the following methods of an Applet class with example : 4

- public void init(){...}
- public void start(){...}

(b) Write code to create an applet that displays a message HELLO WORLD. 3

(c) Write java code to replace a substring in a string by another one. Make use of indexOf() and substring() methods. 3

6. (a) Write a java program to copy the contents of file A.txt to file B.txt. 6

(b) What is the output of the following code : 4

```

class Test
{
    public static void main(String args[])
    {

```

```
int x = -4;
System.out.println(x>>1);
System.out.println(x<<1);
int y = 4;
System.out.println(y>>1);
System.out.println(y<<1);
}
}
```

7. (a) What is an interface ? How is it different from abstract class ? Can we create an instance of an interface ? Is it possible to declare variables in that ? Give suitable example. 6
- (b) Write a program to accept 10 integers in an array and print the same using for.. each syntax. 4
8. (a) Differentiate between the following : 4
- (i) Byte Stream and Character Stream
- (ii) == and equals methods when applied over objects.
- (b) Write a method in java to swap two numbers. Make use of it in the main method to read the values of two int variables a, b, invoke the method swap and display the modified values of the variables a, b. 6

2

18/12/17

This question paper contains 4 printed pages]

Roll No.

--	--	--	--	--	--	--	--	--	--

S. No. of Question Paper : 6792

Unique Paper Code : 42227929

Name of the Paper : Elements of Modern Physics

Name of the Course : Physics : DSE

Semester : V

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt five questions in all.

Question No. 1 is compulsory.

1. Attempt any five of the following : 5×3=15

(a) If the average time duration between the excitation and the emission of the radiation from the atom is 1.0×10^{-8} s, find the inherent uncertainty in the frequency of the emitted photon using energy-time uncertainty relation.

(b) The half-life of a thorium isotope is 14×10^{10} years. Calculate the time required for 10% of a sample of thorium to disintegrate.

P.T.O.

- (c) Show that the group velocity of the de Broglie waves associated with a moving particle is equal to the velocity of the particle.
- (d) The maximum wavelength for photoelectric emission in Tungsten is 230 nm. What wavelength of light must be used in order for electrons with maximum energy of 1.5 eV to be ejected ?
- (e) In a Compton scattering experiment, the X-ray photon is scattered at an angle of 180° and the electron recoils with an energy of 4 keV. Calculate the wavelength of the incident photon.
- (f) The shortest wavelength of the Balmer series in Hydrogen spectrum is 3646\AA . Calculate the Rydberg constant.
- (g) An electron at rest is accelerated through a potential difference of 1500 V. Find the de Broglie wavelength for this electron.
2. (a) Establish the time-dependent Schrodinger equation for a non-relativistic particle. 5
- (b) Determine the energy levels and the corresponding normalized wave function of a particle of energy 'E' bound in a one-dimensional square well of infinite height, having a length "L". 10

3. Write the time independent Schrodinger equation for a particle of energy E tunnelling across a rectangular potential barrier of height V_0 ($V_0 > E$) and width "l". Find the expression for the transmission probability. 5,10
4. (a) Discuss the Liquid Drop model of the nucleus and hence derive the Semi-Empirical Mass formula. 3,10
- (b) Draw the Binding Energy per Nucleon Vs Atomic Mass graph. 2
5. (a) What are the laws of radioactive decay ? Derive the expression for the half-life in terms of decay constant. 5
- (b) Illustrate with a graph, the variation in the number of neutrons (N) Vs number of protons (Z) for stable nuclides. Also show the $N = Z$ line in the graph. 3
- (c) What is beta-decay ? Discuss the arguments that led Pauli to predict the existence of neutrinos. 7
6. (a) What are the Bohr's quantization rules ? 3
- (b) Derive an expression for the energy associated with the quantum states for hydrogen like atoms. 12

7. (a) Discuss the aim, apparatus and the results of the Davisson-Germer experiment. 10
- (b) What is the Heisenberg's Uncertainty principle ? 2
- (c) Using uncertainty principle, estimate the minimum energy of an electron confined to region of 1 \AA . 3
8. (a) Deduce the expression for Compton scattering :
 $\Delta\lambda = (h/m_e c) (1 - \cos \theta)$. 10
- (b) X-rays of wavelength 0.01 nm are scattered from a target. Find the wavelength of X-ray scattered through 45° . Also find the maximum wavelength present in the scattered X-rays. 5

PHYSICAL CONSTANTS

$$c = 3 \times 10^8 \text{ m/s} \qquad m_e = 9.1 \times 10^{-31} \text{ kg}$$

$$e = 1.6 \times 10^{-19} \text{ C} \qquad m_n = 1.00866 \text{ u}$$

$$h = 6.6 \times 10^{-34} \text{ Js} \qquad m_p = 1.00728 \text{ u}$$

3

This question paper contains 4 printed pages.

Your Roll No.



Sl. No. of Ques. Paper: 8284

Unique Paper Code : 32497903

Name of Paper : Molecular Basis of Non-Infectious Diseases

Name of Course : Biochemistry : Discipline Specific Elective for Hons.

Semester : V

Duration : 3 hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt five questions in all including Q. No. 1 which is compulsory.

Use of scientific calculator / log tables may be allowed.

1. (a) Comment on the following:

- (i) Glycosylated haemoglobin is considered a good marker for tracing long term therapy in established diabetics.
- (ii) An elevated level of homocysteine is a major risk factor of atherosclerosis.
- (iii) Huntington's chorea disease results due to accumulation of misfolded proteins.
- (iv) Diabetic patients often show signs of polydipsia.

P. T. O.

(v) Cancer is a multifactorial and polygenic disease.

(vi) Oedema is one symptom that distinguishes between Marasmus and Kwashiorkor.

(b) Expand the following:

(i) PCOS

(ii) CFTR

(iii) ALS

(iv) DOPA

(v) PEM

(vi) IBD

(vii) RDA.

12,7

2. (a) Differentiate between the following:

(i) Benign tumor and Malignant tumor

(ii) Oncogenes and Tumor suppressor genes

(iii) Anorexia nervosa and Bulimia

(iv) Wet beriberi and Dry beriberi

(v) Osteoporosis and Osteomalacia

(vi) Xerophthalmia and Night-Blindness.

(b) What are monogenic disorders? Mention *two* examples.

10,4

3. (a) Explain the mechanism of action of following drugs (*any five*):

(i) β -Blockers

(ii) Statins

(iii) Tamoxifen

(iv) Herceptin

(v) Gleevac

(vi) Sulfonureas

(vii) Warfarin.

(b) What dietary interventions should be done in the following diseases?

(i) Beri-Beri

(ii) Alkaptonuria.

10,4

4. Elaborate on the following:

(a) The 4Ds of Pellagra

(b) The etiology of Maple syrup urine disease

(c) Bleeding gums in scurvy

(d) Ras is an oncogene.

4,4,3,3

5. (a) Mention the two major conditions that cause excessive bleeding in human beings. Explain each briefly.

(b) What are protein misfolding diseases? Describe the molecular basis of Alzheimer's disease.

6. Write short notes on:—

P. T. O.

- (a) Cystic fibrosis
 - (b) Obesity
 - (c) Schizophrenia or Parkinson's disease. 5,5,4
7. (a) Describe the relationship of diabetes mellitus with hypertension, obesity, hypothyroidism and stress.
- (b) What is Atherosclerosis? Describe the stages of atherosclerosis development. 8,6
8. (a) What are major and minor components of nutrients in a balanced diet?
- (b) Explain:
- (i) Causes and stages of cancer
 - (ii) Molecular approaches to cancer treatment. 5,9

(4)

This question paper contains 3 printed pages.

Your Roll No.

7/12/17
HC

Sl. No. of Ques. Paper: 8288

Unique Paper Code : 32497908

Name of Paper : Basic Microbiology

Name of Course : Biochemistry : Discipline
Specific Elective for Hons.

Semester : V

Duration : 3 hours

Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt five questions in all including
Q. No. 1 which is compulsory.



1. (a) Briefly explain the following:

- (i) Bacterial spores
- (ii) Virulence
- (iii) Prions
- (iv) Heterothallism
- (v) Algal blooms
- (vi) Eyespot.

(b) Give the contribution of following:

1×6

- (i) Joseph Lister
- (ii) Elie Metchnikoff
- (iii) Carl Woese

P. T. O.

(iv) Walter Reed

(v) R.H. Whittaker.

1×5

(c) Comment on the following:

(i) Gram negative bacteria are usually much easier to disrupt by sonic oscillation.

(ii) Viruses are highly versatile with respect to the nature of their genetic material.

(iii) Disease causing fungi are usually dimorphic.

(iv) Agar-agar is used as a solidifying agent. 2×4

2. Differentiate between:

(a) Lysogeny and Lytic cycle

(b) Archaeobacteria and Eubacteria

(c) Rickettsia and Chlamydia

(d) Sexual and Asexual reproduction in algae. 3-5×4

3. (a) How did Pasteur and Tyndall settle the spontaneous generation controversy?

(b) Comment on distribution, occurrence and morphology of bacteria.

(c) What are Koch's postulates? What is their significance? 5,5,4

4. Explain the following with the help of diagram:

(a) Life cycle of Ascomycetes

(b) Life cycle of *Chlamydomonas*

(c) Structure of T4 Bacteriophage.

5,5,4

5. Explain the following:

(a) Feeding structures in Protozoa

(b) Holozoic and Saprozoic nutrition

(c) Encystment in amoeba

(d) Hyperparasitism.

3.5×4

6. (a) What are the major characteristics that are used to classify microorganisms?

(b) Give one word for the following:

(i) Primary storage product of Euglenophyta

(ii) A disease caused by *Rhizoctonia*

(iii) Fungus producing the toxin α -amanitin

(iv) Causative organism of Ergotism

(v) Causative organism of Protothecosis.

(c) Explain the following:

(i) Pyrenoids

(ii) Zygo spores.

5,5,4

7. Write short notes on the following:

(a) Applications of algae

(b) Economic importance of fungi

(c) Industrial applications of bacteria.

4,5,5

8. (a) Why are the Charophyta called stoneworts?

(b) Give one word for the following:

(i) Red body present near anterior end of motile algae.

(ii) Specialized flat hyphae formed when in contact with suitable host's plant cell.

(iii) Dense proteinaceous structure in algae.

(iv) Opening through which food is ingested in protozoa

(v) Species of algae responsible for the production of agar.

(c) Explain the various modes of nutrition in Fungi.

4,5,5

(S)

[This question paper contains 6 printed pages.]



Your Roll No.....

Sr. No. of Question Paper : 8294

H.C.

Unique Paper Code : 32167501

Name of the Paper : Analytical Techniques in Plant Sciences

Name of the Course : **Botany : Discipline Specific Elective for Honours**

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all including Question No. 1 which is compulsory.
3. All the parts of a question must be attempted together.

1. (a) Expand the following : (5)

(i) GFP

(ii) FRAP

(iii) HPLC

P.T.O.

(iv) VNTR

(v) SDS

(b) Fill in the blanks : (5)

(i) _____ lenses are used in electron microscope.

(ii) $1\text{\AA}^0 =$ _____ nm.

(iii) The marker enzyme for mitochondria is _____ .

(iv) A thermostable enzyme used in PCR is _____ .

(v) _____ blotting is used to separate and identify proteins.

(vi) The electrophoretic mobility for separation of nucleic acids depends upon _____ differences of the molecule.

(c) Give contribution of the following : (5)

(i) Marvin Minsky

(ii) Alec Jeffery

(iii) Knoll and Ruska

(iv) Mikhail Tsvet

(v) Sanger and Coulson

2. Write short notes on any **three** : (5×3=15)

(i) Role of fluorochromes

(ii) Technique of ultracentrifugation

(iii) Northern blotting

(iv) X-ray crystallography

(v) Confocal microscopy

3. Differentiate between any **three** : (5×3=15)

(i) Molecular sieving and ion exchange chromatography

(ii) Positive staining and negative staining

(iii) Paper chromatography and thin layer chromatography

(iv) Sucrose and cesium chloride centrifugation

(v) AGE and PAGE

4. (a) Compare the working of light and electron microscope with the help of ray diagram depicting the path taken by light rays in the formation of an image. (5)
- (b) Briefly discuss the pulse chase experiment. (5)
- (c) Calculate the chi-square value for the data given below. What does the value signify?

In corn, purple kernels are dominant over yellow kernels and full kernels are dominant over shrunken kernels. A corn plant having purple and full kernels is crossed with a plant having yellow and shrunken kernels, and the following progeny are obtained :

Purple, full	112	
Purple, shrunken	103	
Yellow, full	91	
Yellow, shrunken	94	(5)

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

- (a) Discuss the technique of PCR and write its applications. (5)
- (b) Explain in detail the technique of spectrophotometry. (5)
- (c) Write a brief account of the technique of phase contrast microscopy. (5)

- (d) Define the following : (1×5=5)

- (i) Chromosome painting
- (ii) Coefficient of variation
- (iii) Half life
- (iv) Absorption spectrum
- (v) Immunofluorescence

6. Answer any **three** of the following : (5×3=15)

- (a) Outline the principle of Freeze-fracture technique and its importance in the study of biological membranes
- (b) Briefly explain the preparation of sample for electron microscope.
- (c) Give a detailed account of technique of flow cytometry and its applications.
- (d) Attempt briefly :
- (i) Name the metals used in the technique of shadow casting.
- (ii) What is the unit of measuring radioactivity?

- (iii) Name two most commonly employed ion exchange resins.
- (iv) Define Svedberg unit and its relevance in cell fractionation studies.
- (v) Name any one vital stain.

6

[This question paper contains 6 printed pages]



Your Roll No.....

Sr. No. of Question Paper : 8296

Unique Paper Code : 32177902

Name of the Paper : Inorganic Materials of Industrial Importance

Name of the Course : Chemistry : DSE

Semester : III / V

Duration : 3 hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
 2. Attempt **five** questions in all.
 3. Question **1** is compulsory.
 4. Attempt any **four other** questions. **All** questions carry equal marks.
-
1. (a) Fill in the blanks or mark **True/False** as required :
 - (i) A battery cannot be recharged and has to be discarded after single use.
 - (ii) catalysts are substances that retard a reaction.

- (iii) are low refractive index materials, generally white in colour, which are added to a paint formulation to increase its volume.
- (iv) In chemical laboratories, glassware is preferred for apparatus which is graduated or needs to be strongly heated.
- (v) Optical fibres function on the principle of,
- (vi) Ammonium nitrate is an example of a Fertilizer.
- (vii) Synthetic zeolites are preferred over natural zeolites for commercial catalytic processes. T/F
- (viii) Vitrification is the process of crystallisation of glass. T/F

(b) Give one word/phrase for the following (any five) :

- (i) The special oven in which annealing of glass articles is carried out.
- (ii) Small hard balls produced by the sintering together of limestone and aluminosilicate materials in a cement kiln.

- (ii) Additives in an emulsion paint formulation which prevent excessive foam formation during manufacturing.
- (iv) Common impurity in urea fertiliser which is toxic to plants.
- (v) The process of applying a protective zinc coating to iron or steel.
- (vi) Failure of a paint film by peeling off from the surface.
- (vii) The special name given to the oxide $\text{YBa}_2\text{Cu}_3\text{O}_7$.
(10,5)

2. (a) Distinguish between the following (any two) :

- (i) Physical Vapour Deposition and Chemical Vapour Deposition
- (ii) Wet and dry process for the manufacture of cement
- (iii) Soda lime glass and borosilicate glass

(b) Explain with a diagram the working of Wilkinson's catalyst for the hydrogenation of alkenes. How can the process be made enantioselective in case only one enantiomer of the resulting chiral alkane is desired?

- (c) Write the discharging and charging reactions of a lead storage battery and explain how the battery works. Why is this battery still popular despite its bulk and weight? $(2\frac{1}{2} \times 2, 5, 5)$
3. (a) Classify the following as direct or indirect fertilizers :
- Calcium superphosphate
 - Calcium carbonate
 - Ammonium nitrate
 - Gypsum
- (b) How does urea function as an effective fertiliser for plants? Give one method for the manufacture of urea.
- (c) How does a flame-retardant paint work? Mention the functions of the following additives in a paint formulation.
- Emulsifying agent
 - Anti-skinning agent
 - Plasticiser
- (d) Why is it necessary to add a retardant to cement? Give an example of a retardant and explain with chemical reactions how it functions in retarding the setting of cement. $(2, 3, 5, 5)$

4. (a) The trend in the rate of hydrogenation of some alkenes by Wilkinson's catalyst follows the order cyclohexene > *cis*-4-methyl-2-pentene > 1-methylcyclohexene. Explain this trend and identify the step in the catalytic cycle that is most affected.
- (b) Explain the terms chemisorption and desorption with reference to heterogeneous catalysis.
- (c) What are the various steps involved in the manufacture of Portland cement by rotary kiln technology? Explain the reactions taking place in different parts of the kiln.
- (d) What is 'annealing'? What special type of oven is used for the annealing of glass articles? Do you agree that the longer the annealing duration the more durable the glass article? Justify. $(3, 2, 5, 5)$
5. (a) What do you understand by 'glazing' of ceramic ware? What is the importance of glazing? Explain liquid glazing of ceramics.
- (b) Discuss the characteristics and applications of (i) safety glass (ii) photochromic glass.
- (c) What is a battery? What are the different types of batteries? Give examples. $(5, 2\frac{1}{2} \times 2, 5)$

6. (a) Briefly describe the formation, characteristics and applications of the following forms of carbon (any **two**) :

- (i) fullerenes
- (ii) nanotubes
- (iii) carbon fibre

(b) What is the purpose of applying surface coatings to objects? Discuss the following methods of surface coating (any **two**) :

- (i) Anodisation
- (ii) Galvanisation
- (iii) Electroplating

(c) What is the composition of Ziegler-Natta catalyst? Is it an example of homogeneous catalysis or heterogeneous catalysis? Illustrate its working cycle diagrammatically.

(2½×2, 2½×2, 5)

(7)

[This question paper contains 4 printed pages.]

Your Roll No.
712117



Sr. No. of Question Paper : 8300
Unique Paper Code : 32177906
Name of the Paper : Polymer Chemistry
Name of the Course : **B.Sc. (Applied Physical Science)**
Industrial Chemistry : DSE
Semester : V
Duration : 3 Hours
Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all.
3. Question No. **1** is compulsory.

1. (a) Differentiate between the following types of polymer
(Any two) : (2×3)

- (i) Plastics and elastomers
- (ii) Thermosetting and thermoplastic
- (iii) Addition and condensation polymers

(b) Define the following terms (Any two) : (2×2)

- (i) Polydispersity index (PDI)
- (ii) Degree of polymerization (DP)
- (iii) Network Polymers

(c) Fill in the blanks : (1×5)

- (i) Cellulose is a polymer of (monomer).
- (ii) Chain termination agents are used to limit the of the polymer chains.
- (iii) Polyamides show rigid mechanical behavior due to interactions.
- (iv) Bakelite is a polymer of formaldehyde and
- (v) Vulcanization of natural rubber was discovered by in 1839.

2. (a) How polyethene is prepared? Distinguish between LDPE & HDPE. Also give their respective uses. (2,2,2)

(b) Define glass transition temperature (T_g) of a polymer. Describe various factors affecting the glass transition temperature. (2,4)

3. (a) What is copolymerization? Give preparation and application of copolymers of styrene. (2,4)

(b) What are condensation polymers? How Nylon 6, 6 can be synthesized? Give its important industrial applications. (2,2,2)

4. (a) What is number average and weight average molecular weight of a polymer? Give the mathematical expressions for each. Describe the measurement of molecular weight of a polymer using viscometric method. (2,1,6)

(b) What is poly vinyl chloride? Give its important applications. (1,2)

5. (a) What are polyurethanes and how it is prepared? How polyurethane foam is prepared? Describe how polyurethanes are industrially useful compounds. (1,2,1,2)

(b) What are conducting polymers? What is the mechanism of electrical conductivity in such polymer? (2,4)

6. (a) Give with examples, the mechanism of cationic and anionic polymerization of olefinic monomers. (2,2)

(b) How methyl methacrylate is prepared? Give the main applications of polymethyl methacrylate (PMMA). (2,2)

(c) Discuss the lower critical solution and the upper critical solution temperatures. (2,2)

7. Write short notes on any **three** of the followings :

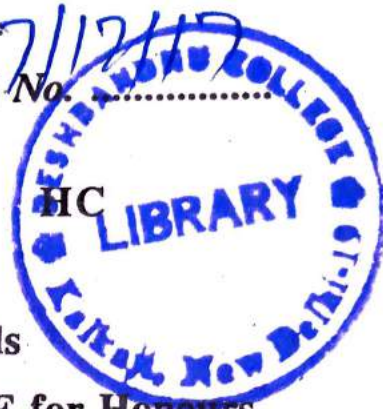
- (i) Free volume theory
- (ii) Polytetrafluoro ethylene (PTFE)
- (iii) Silicon polymers
- (iv) Plasticizers

(3×4)

8

This question paper contains 4 printed pages.

Your Roll No. 7112117



Sl. No. of Ques. Paper : 8368
Unique Paper Code : 32357501
Name of Paper : Numerical Methods
Name of Course : Mathematics : DSE for Honours
Semester : V
Duration : 3 hours
Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Use of non-programmable scientific calculator is allowed.
Attempt all questions selecting two parts from each question.

- (a) Define fixed point of a function. Find the fixed point(s) of the function $g(x) = x(2 - ax)$, $a \neq 0$. Determine the order of convergence and asymptotic error constant of the iterative scheme $p_n = g(p_{n-1})$ for obtaining the non-zero fixed point.

(b) Verify that the equation $x^3 - 13 = 0$ has a root in the interval $(2, 3)$. Perform 3 iterations to approximate the zero of the same equation by the method of false position.

(c) Let g be a continuous function on the closed interval $[a, b]$ with $g : [a, b] \rightarrow [a, b]$. Show that g has a fixed point p in $[a, b]$. Furthermore, if g is differentiable on the open interval (a, b) and there exists a positive constant $k < 1$ such that $|g'(x)| \leq k < 1$ for all x belongs to (a, b) , then the fixed point in $[a, b]$ is unique.

2. (a) Give the geometrical construction of the secant method to approximate the zero of a function. Further, find the order of convergence of secant method.

(b) Find the root correct up to three decimal places of $f(x) = \tan(\pi x) - x - 6$, by Newton's method starting with $p_0 = 0.48$.

(c) For the recursive scheme: $x_{n+1} = \frac{1}{2} \left(x_n + \frac{9}{x_n} \right)$; $x_0 = 9$, for obtaining the square root of 9, perform four iterations. Hence, find out the absolute errors $|e_n|$ and the asymptotic constant λ given that the order of the scheme is 2. 13

3. (a) Show that the following matrix A has no LU decomposition,

$$A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

Rearrange the rows of A so that the resulting matrix has a LU decomposition.

(b) Use the Gauss-Seidel method to solve the following system of equations. Use $x^{(0)} = 0$ and perform three iterations,

$$4x_1 + 2x_2 - x_3 = 1,$$

$$2x_1 + 4x_2 + x_3 = -1,$$

$$-x_1 + x_2 + 4x_3 = 1.$$

(c) (i) Compute the iteration matrix T_{jac} of the Gauss-Jacobi method for obtaining the approximate solution of the system of equations $Ax=b$ where A is given as

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

(ii) Determine the spectral radius of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

13

4. (a) If $x_0, x_1, x_2, \dots, x_{n+2}$ are $n+1$ distinct points in $[a, b]$ and f is continuous on $[a, b]$ and has $n+1$ continuous derivatives on (a, b) , then prove that for each $x \in [a, b]$ there exists $\xi(x) \in [a, b]$ such that:

$$f(x) = P(x) + \frac{f^{(n+1)}(\xi)}{(n+1)!} (x-x_0)(x-x_1) \dots (x-x_n),$$

where $P(x)$ is the interpolating polynomial.

(b) The thermal conductivity of water as a function of pressure is given in the table below. Using the Newton form of interpolating polynomial, estimate the thermal conductivity of water when $P = 250$ Pa.

Pressure (Pa)	100	200	300	400	500	600
Thermal conductivity	9.4	18.4	26.2	33.3	39.7	45.7

(c) (i) Define an interpolating polynomial for a given set of data $(x_i, f(x_i))$, $i = 1, 2, \dots, n$. Construct the Lagrange polynomials passing through the points $(1, \ln 1)$, $(2, \ln 2)$ and $(3, \ln 3)$.

- (ii) Define the forward difference operator Δ and the average operator μ . Prove that:—

$$\mu = \left(1 + \frac{1}{2}\Delta\right) (1 + \Delta)^{-\frac{1}{2}}. \quad 12$$

5. (a) Derive second-order central difference approximation to the first order derivative of a function.
- (b) Verify $f'(x) \approx \frac{3f(x_0) - 4f(x_0 - h) + f(x_0 - 2h)}{2h}$, the difference approximation for the first derivative provides the exact value of the derivative regardless of h , for the functions $f(x) = 1$, $f(x) = x$ and $f(x) = x^2$, but not for the function $f(x) = x^3$.
- (c) Use the formula $f'(x) \approx \frac{f(x_0) - f(x_0 - h)}{h}$ to approximate the derivative of the function $f(x) = \sin x$ at $x_0 = \pi$, taking $h = 1, 0.1, 0.01$, and 0.001 . What is the order of approximation? 12
6. (a) Define the degree of precision for a quadrature rule $I_n(f)$. Verify that the Simpson's rule has the degree of precision as 4.
- (b) Derive the closed Newton-Cotes rule ($n = 2$) for the computation of the definite integral $\int_a^b f(x) dx$.
- (c) Apply Euler's method to approximate the solution of the given initial value problem $x' = \frac{t}{x}$, ($0 \leq t \leq 2$), $x(0) = 1$, $h = 0.5$. Further, it is given that the exact solution is $x(t) = \sqrt{t^2 + 1}$. Compute the absolute error at each step. 12

9

7/12/17

This question paper contains 4 printed pages.

Your Roll No.

Sl. No. of Ques. Paper: 8372

HC

Unique Paper Code : 32357505

Name of Paper : Discrete Mathematics

Name of Course : Mathematics : DSE for Hons.

Semester : V

Duration : 3 hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)



Attempt any two parts from each questions.

Section I

- 1 (a) Define 'covering relation' in an ordered set. Prove that if P and Q are two ordered sets, then (a_2, b_2) covers (a_1, b_1) in $P \times Q$ if and only if either $(a_1 = a_2$ and b_2 covers $b_1)$ or $(a_2$ covers a_1 and $b_1 = b_2)$. (6)
- (b) Let N_0 be the set of whole numbers equipped with the partial order \leq defined by $m \leq n$ if and only if m divides n . Draw a Hasse diagram and find out maximal and minimal elements, if they exist, for the subset $\{2, 3, 4, 6, 10, 12, 0\}$ of (N_0, \leq) . Does it have the smallest and the greatest elements? Justify your answer. (6)
- (c) Define an order isomorphism for ordered sets. Show that every order isomorphism is bijective but the converse is not true. (6)

2 (a) Let (L, \leq) be a lattice as an ordered set. Define two binary operations $+$ and \cdot on L by $x + y = x \vee y = \sup\{x, y\}$ and $x \cdot y = x \wedge y = \inf\{x, y\}$. Prove that $(L, +, \cdot)$ is an algebraic lattice.

(6.5)

P. T. O.

(b) Let L be a lattice and let $x, y, z \in L$. Prove that

(i) $y \leq z \Rightarrow x \wedge y \leq x \wedge z$ and $x \vee y \leq x \vee z$

(ii) $((x \wedge y) \vee (x \wedge z)) \wedge ((x \wedge y) \vee (y \wedge z)) = x \wedge y$,

(6.5)

(c) Let $f: L \rightarrow K$ be a lattice homomorphism. Show that

(i) If S is a sublattice of L , then $f(S)$ is a sublattice of K .

(ii) If T is a sublattice of K and $f^{-1}(T)$ is non-empty, then $f^{-1}(T)$ is a sublattice of L .

(6.5)

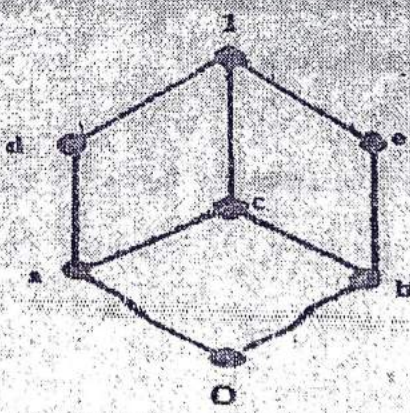
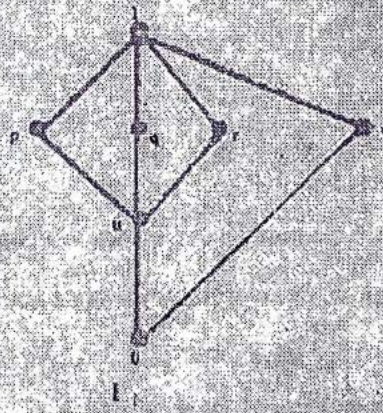
Section II

3 (a) Prove that a lattice L is distributive if and only if $\forall a, b, c \in L$ we have

$(a \vee b = c \vee b \text{ and } a \wedge b = c \wedge b) \Rightarrow a = c$.

(6)

(b) Use M_3-N_5 Theorem to find if the lattices L_1 and L_2 given below are modular or distributive:



L_3

(c) Find the Conjunctive Normal form of

$$(x_1 + x_2 + x_3)(x_1 x_2 + x_1' x_3) \tag{6}$$

4 (a) Define sectionally complemented lattice. Show that every Boolean Algebra is sectionally complemented. (6.5)

(b) Find all the prime implicants of $xy'z + x'yz' + xyz' + xyz$ and form the corresponding prime implicant table. (6.5)

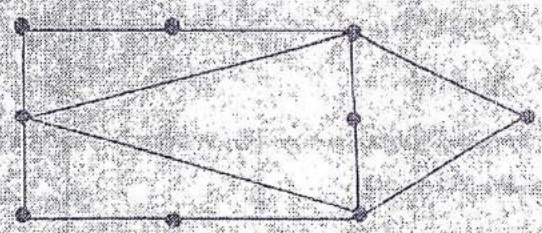
(c) Draw the contact diagram and give the symbolic representation of the circuit given by
$$p = (x_1 + x_2 + x_3)(x_1' + x_2)(x_1 x_3 + x_1' x_2)(x_2' + x_3) \tag{6.5}$$

Section III

5 (a) (i) Answer the Königsberg bridge problem and explain your answer with graph. (3, 3)
 (ii) Draw $K_{3,3}$ and $K_{4,4}$

(b) (i) Draw a graph with 5 vertices and as many edges as possible. How many edges does your graph contain. What is the name of this graph and how is it denoted?

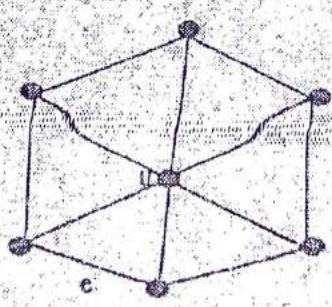
(ii) What is bipartite graph? Determine whether the graph given below is bipartite. Give the bipartition sets or explain why the graph is not bipartite.



(3, 3)

(c) (i) Draw a graph whose degree sequence is 1, 1, 1, 1, 1, 1.
 (ii) Does there exist a graph G with 28 edges and 12 vertices, each of degree 3 or 4. Justify your answer.

(iii) Draw pictures of the subgraphs $G \setminus \{e\}$ and $G \setminus \{u\}$ of the following graph G:

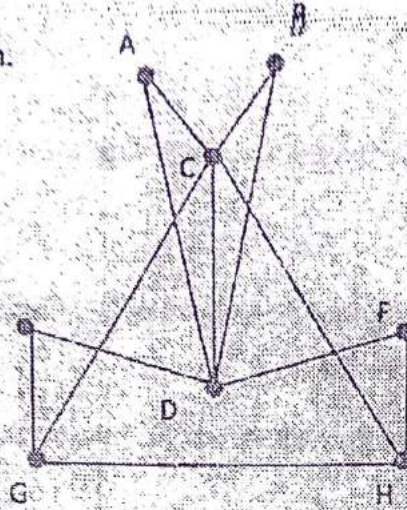


G

(2, 2, 2)

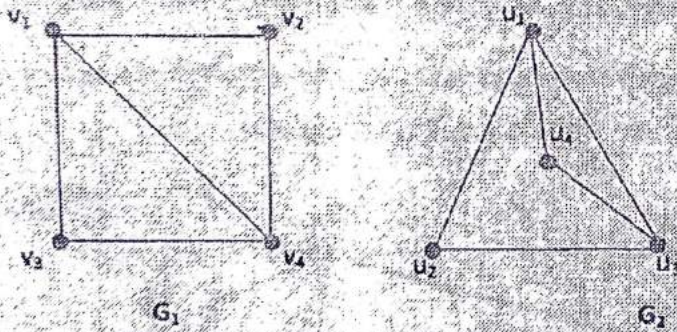
6 (a) (i) Consider the graph G given below. Is it Hamiltonian? If no, explain your answers, if yes find a Hamiltonian cycle.

(ii) Is it Eulerian? Explain.



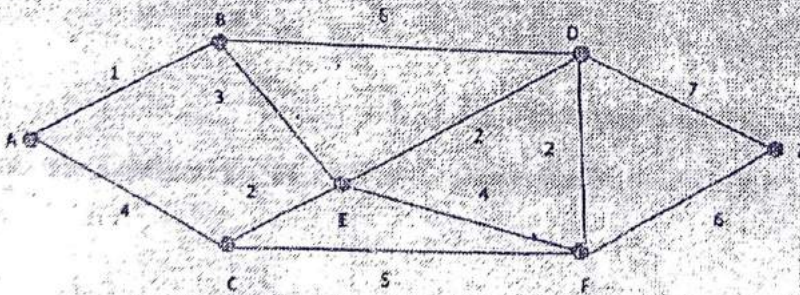
(4, 2.5)

(b) Find the adjacency matrices A_1 and A_2 of the graphs G_1 and G_2 shown below. Find a permutation matrix P such that $A_2 = PA_1P^T$.



(6.5)

(c) Apply the first form of Dijkstra's Algorithm to find a shortest path from A to Z in the graph shown. Label all vertices.



(6.5)

(10)

This question paper contains 3 printed pages.

7/12/17

Your Roll No.

Sl. No. of Ques. Paper: 8378

HC

Unique Paper Code : 32227501

Name of Paper : Experimental Techniques

Name of Course : Physics : DSE

Semester : V

Duration : 3 hours

Maximum Marks : 75



(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt five questions in all.
Question No. 1 is compulsory.

All questions carry equal marks.

1. Attempt any five questions of the following:

- Give three rules to find significant figures.
- What is the difference between accuracy and precision? Explain with one example of each case.
- What do you understand by systematic error? Give an example.
- What is 'signal to noise ratio'?
- What is a transducer? What are the three main bases of temperature transducers?
- Assuming the linear response of platinum at 1000°C , calculate the resistance of platinum at 900°C . Given that the resistance and temperature

P. T. O.

coefficient of platinum are 100Ω at 25°C and $3.664 \times 10^{-3} / ^\circ\text{C}$ respectively.

- (g) Define the three main flows of air in vacuum of chamber. 5×3=15
2. (a) Describe the uncertainties in product and additive functions. 10
- (b) Calculate the standard deviation of the data given in following table:
- | | | | | | | |
|--------------------|------|------|------|------|------|---|
| <i>Length (mm)</i> | 32.8 | 33.1 | 32.7 | 32.6 | 33.0 | 5 |
|--------------------|------|------|------|------|------|---|
3. (a) Describe the static characteristics of the measurement systems. 10
- (b) What is 1/f noise? 5
4. (a) What is the generalised mathematical model of the measuring systems? 12
- (b) Obtain the expression for the response of zero order system. 3
5. (a) What is signal conditioning? 5
- (b) How is the signal conditioning used for thermistors? 10
6. (a) What are Q-meter and LCR bridge? 10
- (b) Describe the resistance mode of LCR bridge. 5

7. (a) What are the various characteristics of a vacuum system? 10
- (b) What is throughput in a vacuum system? 5
8. With the help of relevant diagram / block diagram explain the working of following:
- (a) Penning gauge or Diffusion pump 7
- (b) Linear variable differential transformer (LVDT) or Temperature sensor AD 590 and LM 35. 8

11



7/12/17

[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **8405** **HC**

Unique Paper Code : 32237905

Name of the Course : **Zoology : OSE for Honours**

Name of the Paper : Computational Biology

Semester : V

Time : 3 Hours **Maximum Marks : 75**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Question **NO.1** is compulsory.
- (c) Attempt **all** question.

1. (a) Define the following : 1×5=5
- (i) Microarray
 - (ii) Curated database
 - (iii) Matagenomics
 - (iv) Annotation
 - (v) Codon

P.T.O.

(b) Expand the following : $0.5 \times 6 = 3$

- (i) BLAST
- (ii) PAM120
- (iii) QSAR
- (iv) DDBJ
- (v) ZINC
- (vi) ORF

(c) Differentiate between the following : $2 \times 5 = 10$

- (i) Functional & Structural genomics
- (ii) Homology & Similarity
- (iii) e- value & lod score
- (iv) Paired and unpaired t-test
- (v) PAM and BLOSUM

(d) Write the major contribution of the following scientists. $1 \times 4 = 4$

- (i) Needleman- Wunsch
- (ii) Smith- Waterman
- (iii) Ronald Aylmer Fisher
- (iv) Margaret Oakley Dayhoff

(e) Match the following : $1 \times 5 = 5$

- (i) A data base that deals with structure classification. BLAST

- (ii) A database of chemical molecules and their activities against biological assays. Clustal
- (iii) A tool to find regions of similarity between biological sequences . Pubchem
- (iv) A series of widely used computer programs used in Bioinformatics for multiple sequence alignment SAGEmap
- (v) Gene Expression database. SCOP

2. Write Short Notes on the following (Any **three**) : $5 \times 3 = 15$

- (a) z-test
- (b) Scoring Matrices
- (c) Swiss-Port
- (d) Metabolic pathway database

3. Describe the methods of DNA and Protein sequencing . 8

OR

Sequence similarity and sequence identity are synonymous for nucleotide sequences. But, for protein sequences, however, the two concepts are very different. Explain how ? 08

4. Explain the methods used for prediction of tertiary structures of proteins. 08

5. Explain the heuristic methods FASTA and BLAST for sequence alignment. What are the disadvantages of heuristic methods over other dynamic programming methods? 08

OR

Explain the importance of high-throughput techniques such as microarray and next genome sequencing in functional genomics.

6. (a) Compute the sample Standard Deviation of the following data. 03

24 23 25 23 30 29 28 26 33 29

24 37 25 23 22 27 28 25 31 29

- (b) The types of raw materials used to construct stone tools found at the archaeological site Casa del Rito are shown below. A random sample of 1486 stone tools was obtained from a current excavation site. 06

Raw Material	Regional Percent of Stone Tools	Observed Number of percent Tools at Current Excavation Site
Basalt	61.3%	906
Obsidian	10.6%	162
Welded tuff	11.4%	168
Pedernal	13.1%	197
chert		
other	3.6%	53

Use a 1% level of significance to test the claim that the regional distribution of raw materials fits the distribution at the current excavation site.

12

This question paper contains 4 printed pages.

Your Roll No. 12/12/17

Sl. No. of Ques. Paper : 8442 HC
Unique Paper Code : 32177908
Name of Paper : Green Chemistry
Name of Course : Chemistry : DSE
Semester : V
Duration : 3 hours
Maximum Marks : 75



(Write your Roll No. on the top immediately
on receipt of this question paper.)

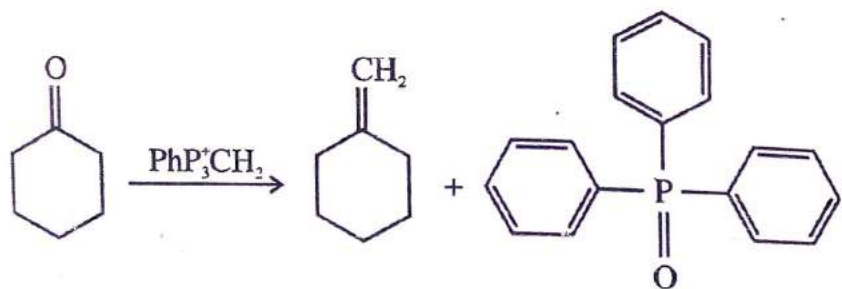
Attempt any *five* questions.

Attempt all parts of a question together.

Each question carries 15 marks.

SECTION A

1. (i) Provide green method of synthesis: (Any *three*)
- (a) Disodium imino diacetate (DSIDA)
 - (b) Adipic acid
 - (c) Catechol
 - (d) Polylactic acid from corn
 - (e) Phthalocyanine Copper complex 2×3
- (ii) Define "Atom Economy". Calculate the atom economy of the reaction given below. Comment on its atom economy and % yield. 5



(Atomic weights C = 12; O = 16; P = 31)

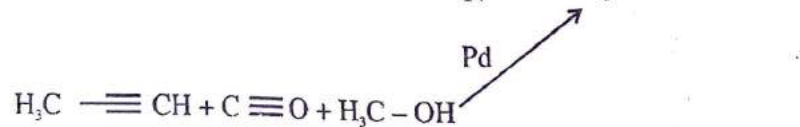
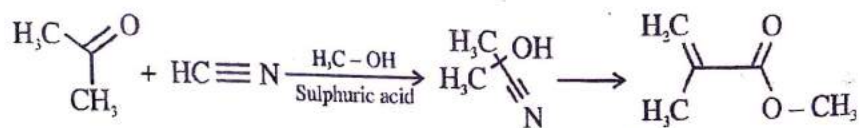
(iii) Give the importance of asymmetrical catalysis correlating the defects produced in babies when drug thalidoimide was given to pregnant women. 4

2. (i) Write short notes on any four:

- (a) Green solvents
- (b) Supercritical carbon dioxide
- (c) Importance of developing analytical techniques
- (d) Derivatization and protection groups
- (e) Photocatalysis. 2x4

(ii) Which is a greener route? Justify your answer. 6

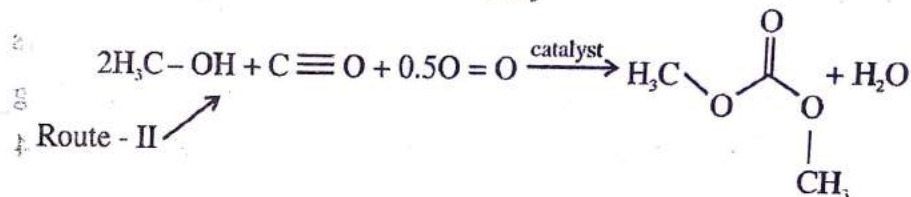
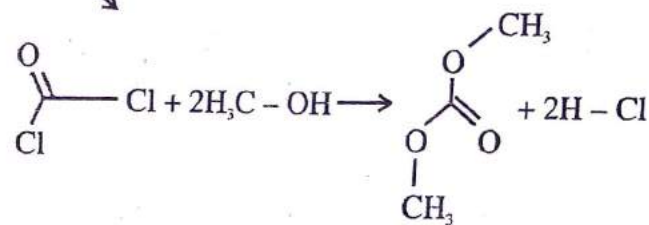
(a)
Route-I



Route-II

(b)

Route - I



(iii) Define green chemistry. 1

3. (i) Give brief account of the following (any four):

- (a) Solventless synthesis
- (b) Auxillary substances
- (c) Renewable feedstock
- (d) Prevention of chemical accidents
- (e) Microbial oxidation reaction
- (f) Aqueous phase reaction. 2x4

(ii) Write down twelve basic principles of green chemistry with their explanations. 7

4. (i) Give different techniques for minimizing hazardous waste. 2

(ii) Why do we need to focus on developing analytical techniques? 2

(iii) Discuss the difference between homogeneous and heterogenous catalysts. 4

- (iv) Briefly write about the "Goals of Green Chemistry". 3
 (v) Discuss the principle of ultrasound synthesis and its beneficial effect in Simmons-Smith reaction. 4

5. (i) Discuss the beneficial points with microwave assisted reaction in water:

* Hofmann elimination

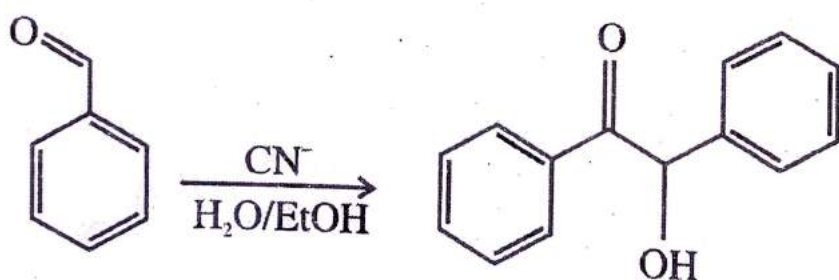
* Oxidation of toluene and alcohols 4

(ii) Explain the terms used in the Pollution Prevention act of 1990 by US Environmental Protection Agency, EPA
 $Risk = f(\text{hazard} \times \text{exposure})$ 3

(iii) Comment on sustainability and green chemistry. 4

(iv) What are VOCs? Comment on the properties of ionic liquids. 4

6. (i) Design greener route synthesis of benzoin from benzaldehyde. Discuss the drawbacks of the conventional route. 4



(2 moles of benzaldehyde)

(ii) Give the advantages and principles of phase transfer catalyst. 3

(iii) Why are biocatalysts considered as green catalyst? Discuss the application of biocatalyst in the industry. 5

(iv) Combinatorial Chemistry is future of Chemistry. Comment. 3

13

This question paper contains 6 printed pages.

Your Roll No. 12/12/17

Sl. No. of Ques. Paper : 8508 HC

Unique Paper Code : 32357501

Name of Paper : Numerical Methods

Name of Course : Mathematics : DSE for Honours

Semester : V

Duration : 3 hours

Maximum Marks : 75



(Write your Roll No. on the top immediately on receipt of this question paper.)

Use of non-programmable scientific calculator is allowed.

Attempt all questions, selecting two parts from each question.

- (a) Give the geometrical construction of the Newton's method to approximate a zero of a function. Write an algorithm to find a root of $f(x) = 0$ by Newton's method.
(b) Define order of convergence of an iterative scheme $\{x_n\}$. Determine the order of convergence for the recursive scheme:

$$x_{n+1} = \frac{1}{2} \left(x_n + \frac{a}{x_n} \right).$$

Turn over

(c) Define the rate of convergence of an iterative scheme $\{x_n\}$. Use the bisection method to determine the root of the equation $x^5 + 2x - 1 = 0$ on $(0, 1)$. Further, compute the theoretical error bound at the end of fifth iteration and the next enclosing (bracketing) interval. 13

2. (a) Differentiate between the method of false position and the secant method. Apply the method of false position to $\cos x - x = 0$ to determine an approximation to the root lying in the interval $(0, 1)$ until the absolute error is less than 10^{-3} ($p = 0.739085$).

(b) Let g be a continuous function on the closed interval $[a, b]$ with $g : [a, b] \rightarrow [a, b]$. Furthermore, suppose that g is differentiable on the open interval (a, b) and there exists a positive constant $k < 1$ such that $|g'(x)| \leq k < 1$ for all x belongs to (a, b) . Then:

(i) The sequence $\{p_n\}$ generated by $p_n = g(p_{n-1})$ converges to the fixed point p for any p_0 belonging to $[a, b]$;

(ii) $|p_n - p_{n-1}| \leq k^n \max(p_0 - a, b - p_0)$.

(c) Find the approximated root of $f(x) = x^3 + 2x^2 - 3x - 1$ by secant method, taking $p_0 = 2$ and $p_1 = 1$ until $|p_n - p_{n-1}| < 5 \times 10^{-3}$. 13

3. (a) Using scaled partial pivoting during the factor step, find matrices L, U and P such that $LU = PA$ where

$$A = \begin{bmatrix} 2 & 7 & 5 \\ 6 & 20 & 10 \\ 4 & 3 & 0 \end{bmatrix}.$$

Hence, solve the system $Ax = b$, given

$$b = \begin{bmatrix} 14 \\ 36 \\ 7 \end{bmatrix}.$$

(b) Use Jacobi method to solve the following system of linear equations. Use the initial approximation $x^{(0)} = 0$ and perform three iterations.

$$\begin{aligned} 4x_1 + 2x_2 - x_3 &= 1 \\ 2x_1 + 4x_2 + x_3 &= -1, \\ -x_1 + x_2 + 4x_3 &= 1. \end{aligned}$$

(c) (i) Consider the matrix:

$$A = \begin{bmatrix} 1 & 1 & 2 \\ -1 & 0 & 2 \\ 3 & 2 & -1 \end{bmatrix}.$$

Find a lower triangular matrix L and an upper triangular matrix U with ones along its diagonal such that $A = LU$.

(ii) Determine the spectral radius of the matrix:

$$A = \begin{bmatrix} 2 & -1 \\ -1 & 3 \end{bmatrix}.$$

13

4. (a) (i) If $x_0, x_1, x_2, \dots, x_{n+1}$ are $n + 1$ distinct points and f is defined at $x_0, x_1, x_2, \dots, x_n$, then prove that interpolating polynomial P , of degree at most n , is unique.

(ii) Define the shift operator E and central difference operator δ . Prove that:

$$E = 1 + \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{1}{4}\delta^2}.$$

(b) For the function $f(x) = e^x$, construct the Lagrange form of interpolating polynomial of f passing through the points $(-1, e^{-1})$, $(0, 1)$ and $(1, e)$. Estimate \sqrt{e} using the polynomial. What is the error in the approximation? Verify that theoretical error bound is satisfied.

(c) (i) Write the following data in the usual divided difference tabular form and determine the missing values:

$$x_0 = 0, x_1 = 1, x_2 = 2, x_3 = 3,$$

$$f[x_0] = 2, f[x_1] = 6, f[x_2] = 6,$$

$$f[x_0, x_1] = 4, f[x_2, x_3] = 0, f[x_1, x_2, x_3] = 0.$$

(ii) Prove that:

$$\sum_{k=0}^{n-1} \Delta^2 f_k = \Delta f_n - \Delta f_0.$$

12

5. (a) Use the formula:

$$f'(x) \approx \frac{f(x_0 + h) - f(x_0)}{h}$$

to approximate the derivative of the function $f(x) = 1 + x + x^3$ at $x_0 = 1$, taking $h = 1, 0.1, 0.01$, and 0.001 . What is the order of approximation?

(b) Verify:

$$f'(x) \approx \frac{-3f(x_0) + 4f(\pm h) - f(x_0 + 2h)}{2h},$$

the difference approximation for the first derivative provides the exact value of the derivative regardless of h , for the functions $f(x) = 1$, $f(x) = x$ and $f(x) = x^2$, but not for the function $f(x) = x^3$.

(c) Derive second-order forward difference approximation to the first order derivative of a function.

12

6. (a) Approximate the value of the integral $\int_1^2 \frac{1}{2} dx$ using Simpson rule. Further verify the theoretical error bound.

(b) Apply Euler's method to approximate the solution of the given initial value problem $x' + \frac{4}{t} = t^4$, $(1 \leq t \leq 3)$, $x(1) = 1$, $N = 5$. Further it is given that the exact solution is $x(t) = \frac{1}{9}(t^5 + 8t^{-4})$. Compute the absolute error at each step.

(c) Consider the initial value problem

$$x' = 1 + \frac{x}{t}, (1 \leq t \leq 3), x(1) = 1$$

whose exact solution is given by $x(t) = t(1 + \ln t)$. Using the step-size of 0.5, obtain the solution of the IVP and compare the absolute error with theoretical error bound, assuming the Lipschitz constant L equals 1.

12

14

[This question paper contains 8 printed pages.]



Your Roll No.....

Sr. No. of Question Paper : 8625

Unique Paper Code : 42177925

Name of the Paper : Chemistry of d-Block Elements and
Quantum Chemistry & Spectroscopy

Name of the Course : **B.Sc. (Physical Science / Life
Science) : DSE**

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

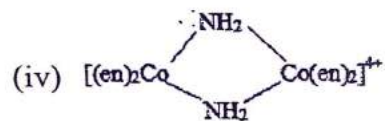
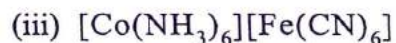
1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **three** questions from **Section A** and **three** questions from **Section B**.
3. Sections **A** and **B** are to be attempted in separate portions of the same answer sheet.
4. Please indicate the section you are attempting at the appropriate place and do not intermix the sections. The questions should be numbered in accordance to the number in the question paper.
5. Calculators and log tables may be used.

P.T.O.

SECTION : A

Attempt any three questions.

1. (a) Give the IUPAC names of any three of the following :



(b) What are stereoisomers? Give all the possible stereoisomers of the complex $[\text{M(AA)}_2\text{a}_2]$.

(c) Zn, Cd and Hg are d-Block elements but are not transition elements. Explain. (6,3,3½)

2. (a) Calculate CFSE (in kJ/mol) for d^4 ion in an octahedral field for both, high spin as well as low spin. Given $\Delta_o = 23500 \text{ cm}^{-1}$ and pairing energy, $P = 18000 \text{ cm}^{-1}$. In which of the two states is the complex likely to exist?

(b) Write the formulae of any two of the following :

(i) μ -Hydroxo- μ -superoxobis(tetraamminechromium(III)) ion

(ii) Amidochlorobis(ethylenediarnine)cobalt(III) chloride

(iii) Potassium tetracyanooxalatoferrate(II)

(c) MnO_4^- ion is intensely coloured. Explain.

(d) Explain why actinides have greater tendency to form complexes than lanthanides? (4,3,3,2½)

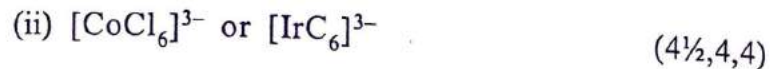
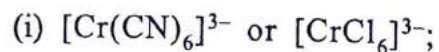
3. (a) $[\text{Ni(CO)}_4]$ is diamagnetic, while $[\text{NiCl}_4]^{2-}$ is paramagnetic. Explain on the basis of VBT.

(b) Explain the type of isomerism in the following pairs :

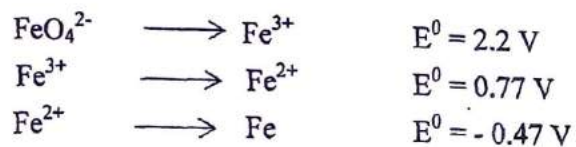
(i) $[\text{Co(H}_2\text{O)}_6]\text{Cl}_3$ and $[\text{CoCl(H}_2\text{O)}_5]\text{Cl}_2 \cdot \text{H}_2\text{O}$

(ii) $[\text{Co(NH}_3)_5(\text{NO}_2)]^{2+}$ and $[\text{Co(NH}_3)_5(\text{ONO})]^{2+}$

(c) Which of the two complexes will have greater value of Δ_o and why?



4. (a) Construct the Latimer diagram of iron in acidic medium from the following data :



- (i) Calculate E^0 for $\text{FeO}_4^{2-} | \text{Fe}^{2+}$.
- (ii) Giving suitable reason explain that Fe^{3+} is stable in acidic medium and does not undergoes disproportionation.

OR

Write short note on the following :

- (i) Lanthanide Contraction and one of its consequence.
- (ii) Ability of transition elements to form complexes.
- (b) An octahedral complex of $\text{Cu}(\text{II})$ is generally distorted and two bonds are longer than the other four. Explain and draw the splitting diagram.

- (c) Draw the splitting diagram for tetrahedral complexes. For tetrahedral complexes, $\Delta_t = (4/9 \Delta_o)$. Explain.
- (d) Crystal Field effect, which are so pronounced in transition elements are almost absent in lanthanides. Explain. (4,3,3,2½)

SECTION B

Attempt any three questions.

Physical Constants

Planck's Constant 6.626×10^{-34} Js

Velocity of light 3×10^8 ms⁻¹

Avogadro's Number 6.023×10^{23}

Atomic mass unit 1.661×10^{-27} kg

Mass of electron 9.109×10^{-31} kg

5. (a) Attempt any three of the following :
- (i) Why $n=0$ is not allowed in the equation
- $$E = \frac{n^2 h^2}{8ma^2}$$
- (ii) How many nodes are possible for translational quantum number $n = 5$ and vibrational quantum number $n = 5$ and vibrational quantum number $n = 5$.

number $v = 6$.

- (iii) Differentiate between thermal reactions and photochemical reactions.
- (iv) IR signal for stretching of C-C bond is at lower frequency than C=C bond. True or False. Give reasons.
- (b) How would isotopic substitution ^{16}O by ^{18}O alter the microwave spectrum of C^{16}O ? (9,3½)
6. (a) Electronic transitions are also called vertical transitions. Explain.
- (b) Roughly sketch fundamental vibrations of CO_2 molecule. Which of them will be IR active?
- (c) Find whether the following operators commute with each other :
- (i) $\left[x, \frac{d}{dx} \right]$
- (ii) $\left[3x^2, \frac{d}{dx} \right]$ (4½,4,4)
7. (a) Calculate the wavelength of a particle of mass 10^{-31} kg

in a one dimensional box of length 1 \AA during its transition from $n = 1$ level.

- (b) Show that e^{ax} is an eigen function of operator

$$\left(\frac{d^2}{dx^2} + 2\frac{d}{dx} + 3 \right). \text{ What is the eigen value?}$$

- (c) What is the effect of polar solvents on $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ electronic transitions?
- (d) State the conditions for a molecule to be rotationally and vibrationally active. (4½,3,3,2)
8. (a) Write short notes on any **three** of the following :
- (i) Reasons for low and high quantum yield
- (ii) Phosphorescence
- (iii) Bohr's Correspondence Principle
- (iv) Auxochromes and Chromophores
- (b) The molar extinction coefficient of $\text{Fe}(\text{phen})_3$ complex is $1200 \text{ dm}^3\text{mol}^{-1}\text{cm}^{-1}$ and minimum detectable

absorbance is 0.01. Calculate the minimum concentration of complex that can be detected in a Lambert-Beer's Law cell of path length 1.0 cm. (9,3½)

15

[This question paper contains 6 printed pages.]

Your Roll No.



Sr. No. of Question Paper : 8628

Unique Paper Code : 42167902

Name of the Paper : Cell and Molecular Biology

Name of the Course : **Botany : DSE for B.Sc. (Prog.)**

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt 5 questions in all.
3. Question No. 1 is compulsory.
4. All questions carry equal marks.
5. Answer all parts of a question together.

1. (a) Fill in the blanks (**any 5**) : (5)

(i) Existence of lysosomes was for the first time suggested by

P.T.O.

- (ii) In metaphase the centromeres of each chromosome are aligned midway across the spindle on a plane called the
- (iii) Extra nuclear DNA is found in by and
- (iv) Fluid mosaic model was given by and
- (v) is the semi fluid substance in which the organelles of the cytoplasm are suspended.
- (vi) Proteins responsible for unwinding of DNA are

(b) Match the following : (5)

- | | |
|----------------------------|--|
| (i) Facilitated movement | (a) Arrangement of individual atom within molecule |
| (ii) Microtome | (b) Division of nucleus |
| (iii) SEM | (c) Carrier protein |
| (iv) X-ray Crystallography | (d) 3 D Image/Topography |
| (v) Karyokinesis | (e) Microscopy sample preparation |

- (c) Define (any 5) (5)
- (i) Numerical aperture
- (ii) Pachytene
- (iii) Ribozymes
- (iv) Aminoacyl tRNA
- (v) Anticodon
- (vi) Inducible operon

2. Write short note on (any 3) : (5×3=15)

- (a) Replication as a semi conservative process
- (b) RNA polymerase
- (c) Discuss about the membrane Proteins and their functions.
- (d) Nucleosomes

3. Differentiate between (any 5) : (3×5=15)

- (i) Freeze fracture and Freeze etching

- (ii) Euchromatin and heterochromatin
 - (iii) Primary wall and secondary wall
 - (iv) LM and EM
 - (v) Mitosis and meiosis
 - (vi) SEM and TEM
4. (a) Write down the various functions of chloroplast. Name at least two marker enzymes of chloroplasts. (5)
- (b) Discuss the Theta mode of replication in prokaryotes. (5)
- (c) Write a short note on Phase contrast microscopy. (5)
5. (a) Discuss about the various types of RNA. (5)
- (b) Write about the Topoisomerases. (5)
- (c) Meiosis and sexual reproduction promote biological diversity. Explain. (5)
6. (a) Describe the Outer and inner mitochondrial membrane. (5)

- (b) Discuss the differences in Translation between prokaryotes and eukaryotes. (5)
- (c) State whether the following are True or False (any 5) (5)
- (i) AUG is the start codon during translation.
 - (ii) The first cell(s) were thought to have been prokaryotic and heterotrophic.
 - (iii) During electron microscopy source of electrons is Tungsten filament.
 - (iv) Mesosomes in bacteria are responsible for septum formation.
 - (v) Janus Green B stain is a vital stain.
 - (vi) The movement of water across a selectively permeable membrane from an area of higher concentration to an area of lower is osmosis.
7. (a) Discuss gene expression in Prokaryotes. (5)

8628

6

- (b) Differentiate between Active transport and passive transport. (5)
- (c) Describe the Endosymbiotic theory. (5)

16

This question paper contains 3 printed pages.

Your Roll No.

18/12/17

HC

Sl. No. of Ques. Paper: 8705
Unique Paper Code : 42227928
Name of Paper : Electricity and Magnetism
Name of Course : Physics : DSE for B.Sc. (Prog.)
Semester : V
Duration : 3 hours
Maximum Marks : 75



(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt five questions in all.
Question No. 1 is compulsory.

1. Attempt any five of the following:

- (a) Find the constant m for which the vector:
$$\mathbf{A} = (2x + 3y)\mathbf{i} + (my - 4z)\mathbf{j} + (x + mz)\mathbf{k}$$
is solenoidal.
- (b) State Gauss divergence and Stokes' theorems for vectors.
- (c) Define Poynting vector.
- (d) Write the expression for the magnetic field of a steady current using Biot-Savart's law.
- (e) Define magnetic susceptibility.
- (f) Define polarisation of an electromagnetic wave.
- (g) Show that the magnetic forces do no work.

P. T. O.

- (h) State the Ampere's Law and write its differential and integral form. $3 \times 5 = 15$
2. (a) Use Gauss's Law to find the electric field intensity due to two thin vertically parallel infinite sheets carrying equal but opposite surface charge densities $\pm\sigma$, in the regions (i) to the left of both sheets, (ii) in between both the sheets, (iii) to the right of both the sheets. 7.5
- (b) Find the potential due to uniformly charged spherical shell of radius R at a point (i) inside the sphere, (ii) outside the sphere. 7.5
3. (a) Find the electric field intensity at any point inside a non-conducting charged solid sphere having a uniform charge density ρ . 7
- (b) Find the electric field at a distance z above one end of straight line segment of length L , carrying a uniform line charge λ . 8
4. (a) State the Maxwell's modification to the Ampere's Law. Derive the expression for the displacement current. 10
- (b) Define relative permittivity for a linear dielectric material. 5
5. (a) Find the magnetic field at a distance r from a long straight wire carrying a steady current I using Ampere's law. 5

- (b) Find the divergence and curl of a magnetic field. 10
6. (a) Define mutual induction and calculate mutual induction for a closed circuit C_1 placed in the magnetic field of another closed circuit C_2 . 8
- (b) Distinguish between the dia, para and ferro-magnetic materials with examples. 7
7. Write the Maxwell's equations in an isotropic dielectric medium and derive the wave equation. Find the velocity of an electromagnetic wave in the isotropic dielectric medium and prove that electromagnetic wave is transverse in nature. 15