

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5036

H

Unique Paper Code : 235666

Name of the Paper : MAPT-606: Mechanics and Discrete Mathematics

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

Semester : VI

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 any two parts from each question.
3. All questions are compulsory.
4. Marks are indicated.

1. (a) Two beads of weights w and w' can slide on a smooth circular wire in a vertical plane.

They are connected by a light string which subtends an angle 2β at the centre of the circle when the beads are in equilibrium on the upper half of the wire. Prove that the inclination α of the string to the horizontal is given

by

$$\tan \alpha = \frac{w - w'}{w + w'} \tan \beta \quad (8)$$

P.T.O.

- (b) Two light rings can slide on a rough horizontal rod. The rings are connected by a light inextensible string of length a , to the mid point of which is attached a weight w . Show that the greatest distance between the rings,

consistent with the equilibrium of the system is $\frac{\mu a}{\sqrt{1+\mu^2}}$,

where m is the coefficients of friction between either ring and the rod. (8)

- (c) Find the mass centre of a cubical box with no lid, the sides and bottom being made of the same thin material. (8)

2. (a) The velocities of a particle along and perpendicular to the radius vector from a fixed origin are λr and $\mu \theta$. Find the path and show that the accelerations along and perpendicular to radius vector are

$$\lambda^2 r - \frac{\mu^2 \theta^2}{r} \quad \text{and} \quad \mu \theta \left(\lambda + \frac{\mu}{r} \right). \quad (8)$$

- (b) A particle travels along a straight line with constant acceleration 'a'.

Prove that $v = u + at$, $s = ut + \frac{1}{2}at^2$ and $v^2 = u^2 + 2as$,

where s is the distance covered from the instant $t = 0$, u is the initial velocity and v is the final velocity.

- (c) (i) A particle is moving with S.H.M. of amplitude 'a' and periodic time 'T'.

$$\text{Prove that } \int_0^T v^2 dt = \frac{2\pi^2 a^2}{T} \quad (4)$$

- (ii) If 'R' is the horizontal range of a projectile, and 'h' is its greatest height, prove that the initial speed

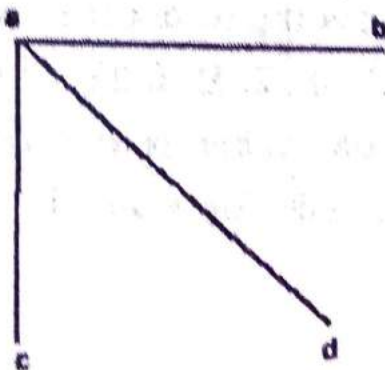
$$\text{is } \left[2g \left(h + \frac{R^2}{16h} \right) \right]^{1/2} \quad (4)$$

3. (a) (i) Define degree of a vertex in an undirected graph. Show that an undirected graph has even number of odd degree vertices. (4)

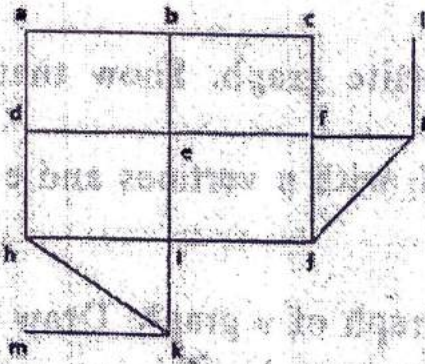
- (ii) Define a complete graph. Draw the graph K_6 . (3)

- (b) Define bipartite graph. Show that if G is a bipartite simple graph with n vertices and e edges, then $e \leq \frac{n^2}{4}$. (7)

- (c) Define subgraph of a graph. Draw all the subgraphs of the following graph (7)



4. (a) Find an adjacency matrix for W_n . (7)
- (b) Find the number of paths of length n between two different vertices in K_4 if n is
 (i) 2 (ii) 3 (iii) 4 (7)
- (c) For which value of m and n does the complete bipartite graph $K_{m,n}$ have an
 (i) Euler Circuit (ii) Euler path (7)
5. (a) Show that a graph with n vertices is a tree if and only if it has $n-1$ edges. (7½)
- (b) Use breadth first search to find a spanning tree for graph shown below (7½)



- (c) Use Huffman coding to encode their symbols with given frequencies A: 0.12, B: 0.23, C: 0.05, D: 0.15, E: 0.30, F: 0.07, G: 0.08. What is the average number of bits required to encode the symbol. (7½)

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[This question paper contains 10 printed pages.]



Your Roll No.....

Sr. No. of Question Paper : 5039

Unique Paper Code : 234661

Name of the Paper : Database Management Systems

Name of the Course : **B.Sc. (Prog.) / B.Sc. Math. Sc.**

Semester : VI

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 1 is compulsory in **Section A**.
3. Attempt any **five** questions from **Section B**.
4. Parts of a question should be attempted together.

SECTION A

1. (a) What is data redundancy? What are the disadvantages of having redundancy within a database? (4)
- (b) Consider the following relations for a database that keeps track of business trips of salespersons in a sales office:

P.T.O.

SALESPERSON (Ssn, Name, Account#, Dept_no)
 TRIP (Ssn, From_city, To_city, Departure_date, Return_date, Trip_id)
 EXPENSE (Trip_id, Ssn, Amount)

Specify the primary keys and foreign keys in this schema, stating any assumptions you make. (5)

(c) Differentiate between the following : (4)

- (i) Composite attribute and multivalued attribute.
- (ii) Logical and Physical data independence.

(d) Consider the following relation : (4)

BOOK (BookId, AuthorName, Title, PublisherName, BranchId, No_of_Copies)

Write the relational algebra expressions for the following queries :

- (i) Retrieve the number of copies of the book titled 'The Lost Tribe' in the library.
- (ii) For each book authored by 'Amitav Ghosh', retrieve the title and the publisher name.

(e) Consider the following table EMP_DETAIL :

ID	Name	Dept_Number	Address	Salary
1	Raman	10	Pashchim Vihar	5000.00
2	Sohan	20	South Delhi	3500.00
3	Siman	10	Vikas puri	4000.00
4	Alisa	10	Preet Vihar	4000.00
5	Geeta	30	Pashchim Vihar	5000.00
6	Jaggi	20	Ashok Nagar	6000.00
7	Meeta	30	South Vihar	6500.00

Formulate the SQL queries for the following :

- (i) Insert a tuple <8, Savita, 20, Vikas Puri, 7000>. (2)
- (ii) Delete the tuple where the address is 'Ashok Nagar'. (2)
- (iii) Modify the salary of an employee having ID = 1, to 6000. (2)
- (iv) Display the names and address of employees having salary greater than 5000.00 and are working in Department Number = 30. (2)

SECTION B

2. (a) Consider a MAIL_ORDER database in which employees take orders for parts sold by the company from the customers. The data requirements are summarized as follows :

- The mail order company has employees, each identified by a unique employee number, first and last name, and the PIN code.
- Each customer of the company is identified by a unique customer number, first and last name, and PIN code.
- Each part sold by the company is identified by a unique part number, a part name, price, and quantity in stock.
- Each order placed by a customer is taken by an employee and is given a unique order number. Each order contains specified quantities of one or more parts. Each order has a date of receipt as well as an expected ship date. The actual shipping date is also recorded.

Design an Entity-Relationship diagram for the MAIL_ORDER database. Make and state any necessary assumptions, if needed. (8)

- (b) For the following entities and relationships, depict the cardinality ratios : (2)

Entity1	Relationship	Entity2
(i) Employee	HAS	Dependent
(ii) Student	STUDIES_IN	School
(iii) Company	INTERVIEWS	Job_Applicant
(iv) Bank_Branch	GIVES_LOANS	Customer

3. (a) Draw the three-tier architecture of DBMS. (6)
- (b) Consider the following relational schema : (4)

EMPLOYEE (Name, Ssn, BirthDate, Address, Salary, Super_Ssn, Dept_No)

DEPARTMENT (Dname, Dnumber, Mgr_ssn, Mgr_start_date)

Where Ssn = Social Security Number, Super_Ssn = Supervisor of employee Ssn,

Dept_No = Department number of employee

Dname = Department name, Dnumber = Department number, Mgr_ssn = Manager of department, Mgr_start_date = date of manager joining department

Write answers for the following :

- (i) Give the primary keys and the foreign keys (if any) in the above schema.
- (ii) Give example of relational tuples, for which an attempt to insert in the database would lead to violation of entity integrity constraint.

4. (a) Consider the following relational database schema: (6)

WORKS_FOR (Pname, Cname, Salary)

LIVES (Pname, Street, City)

LOCATED_IN (Cname, City)

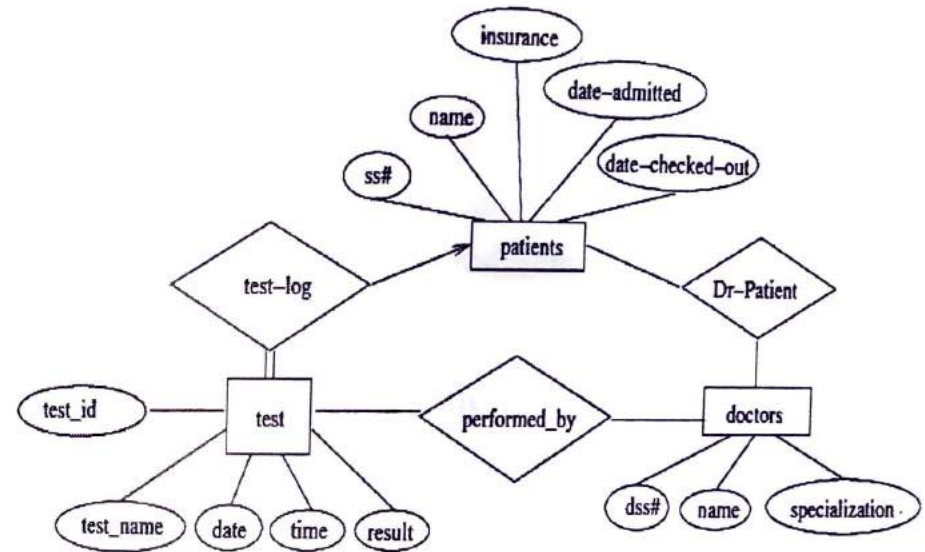
MANAGER (Pname, Mgrname)

Where Pname = Person name, Cname = Company name, and Mgrname = Manager name.

Write the SQL queries for the following :

- (i) List the names of the people who work for the company 'Wipro' along with the cities they live in.
 - (ii) Find the people who work for the company 'Infosys' with a salary more than Rs. 50000/-.
 - (iii) Find the names of the persons who live and work in the same city.
- (b) Give reasons that lead to the occurrence of NULL values in relations. (4)

5. Consider the following ER diagram of a hospital:



E-R diagram for a hospital.

- (i) Identify the relations and relationships from the diagram. (2)
 - (ii) Give the schema for each of them. (4)
 - (iii) Give the primary and foreign keys of each relation. (4)
6. (a) Consider the following relation for published books : (6)
- BOOK (Book_title, Author_name, Book_type, List_price, Author_affiliation, Publisher)

The following are the functional dependencies that hold on this relation :

Book_title → Publisher, Book_type

Book_type → List_price

Author_name → Author_affiliation

- (i) What normal form is the relation in? Justify your answer.
- (ii) Apply normalization until you cannot decompose the relations further.
- (b) Given below are two sets of FDS for a relation R (A, B, C, D, E, F). Are they equivalent?
- G = { A → C, AC → D, E → AD, E → F }
- H = { A → CD, E → AF }
- (4)

7. (a) Consider the following table BANK_INFO :

Bank ID	Bank Name	Bank Address
001	UBI	New Delhi
002	SBI	Mumbai
003	AXIS	Chennai
004	HDFC	Kolkata

- (i) Write SQL command to create the above table. (2)

- (ii) Write SQL command to add one more column 'Total_No_of_Accounts' to the above table. (2)
- (iii) Write SQL command to remove the above table from the database. (2)

- (b) Give short answers for the following : (4)

(i) What is a subclass?

(ii) What are different types of end users of database?

8. (a) Consider the following table Student :

RollNo	Name	Marks	Attendance
2401	Reema	63	89
2402	Raja	52	56
2403	Pankaj	55	87
2404	Sohan	49	78

Give the SQL queries for the following : (2×2=4)

- (i) Find the total number of students in the class.
- (ii) Find the Name of the student having maximum marks.

(b) Differentiate between :

(2×3=6)

- (i) Specialization and Generalization
- (ii) Database Schema and Database Instance
- (iii) Strong entity and weak entity

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[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5127

Unique Paper Code : 217661

Name of the Paper : CHPT-606 CHEMISTRY – VI
(Organometallics, Bio-inorganic
Chemistry, Proteins and UV-IR
Spectroscopy)

Name of the Course : B.Sc. (Programme)

Semester : VI

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 answer-sheet.
4. The question should be numbered in accordance to the number in the question paper.

P.T.O.

SECTION - A

Attempt any three questions.

1. (a) A black coloured compound of Manganese (A), when fused with KOH in the presence of atmospheric Oxygen gives a green coloured compound (B). On treatment with Chlorine in alkaline medium, compound (B) is oxidized to the purple coloured solution of compound (C). When treated with concentrated H_2SO_4 , compound (C) gave another compound (D), which further decomposed explosively on heating to give compound (A). Compound (A) was also obtained along with benzoic acid when compound (C) reacted with Toluene in alkaline medium. Identify (A) to (D) and also give chemical reactions involved.

(b) What happens when (Give balanced chemical equation) ?

(i) Acidic solution of $K_2Cr_2O_7$ is made to react with H_2O_2 in ether solution.

(ii) $K_4 [Fe(CN)_6]$ is added in to copper sulphate solution.

(iii) $CoCl_2$ is treated with KNO_2 in acetic acid.

(iv) $CoCl_2$ is treated with NH_3 and NH_4Cl in the presence of oxygen and activated charcoal.

(v) $KMnO_4$ reacts with oxalic acid in acidic medium. (7.5,5)

2. (a) The V_{C-O} values in $[Fe(CO)_4]^{2-}$, $[Co(CO)_4]^-$ and $[Ni(CO)_4]$ are 1788, 1918, and 2121 cm^{-1} respectively while the V_{C-O} for $CO(g)$ is 2143 cm^{-1} . Explain the trend.

(b) With reference to the M.O. diagram of CO, explain why the bonding in metal carbonyls is through carbon and not through oxygen.

(c) Write down one method for the preparation of $Co_2(CO)_8$. Draw its structure in hexane in the solid state.

(d) Using VBT explain the structure of $Ni(CO)_4$. (4,3.5,3,2)

3. (a) What are organometallic compounds? Give their classifications on the basis of nature of bonding with examples.

(b) What is meant by Synergic effect? How does it account for the formation of carbonyl complexes of transition metals in low oxidation state?

(c) Using the $18e^-$ rule as a guide, find (any two) :

(i) The number of Fe-Fe bonds in $Fe_3(CO)_{12}$

(ii) The value of x in $Fe_2(CO)_x$

(iii) The 3d metal in $M(CO)_5$

(d) Draw the structure of methyl lithium. (4,3.5,3,2)

4. (a) Explain with the help of a diagram the mechanism of Na-K pump in human body. What is the source of energy for the functioning of this pump?

(b) What do you understand by essential and non-essential metal ions in bio-systems? Give suitable example.

(c) What is the mechanism of blood clotting in human body? Which metal is responsible for it?

(d) What is the role of Mg^{2+} ions present in chlorophyll for energy production? (4,3.5,3,2)

SECTION B

Attempt any three questions.

5. (a) (i) Using Gabriel phthalimide synthesis, how will you prepare Glycine?

(ii) Discuss the carboxypeptidase enzyme method for the C-terminal analysis of peptides.

(b) Draw the resonating structures of naphthalene and explain why the C_1-C_2 bond length in naphthalene is shorter than the C_2-C_3 bond length?

(c) Give one example each of the following :

(i) Acidic amino acid

(ii) Essential amino acid

(d) Explain the effect of salt formation on λ_{max} taking suitable example. (6, 2,1,3.5)

6. (a) Explain, why conjugated dienes absorb at higher wavelength in comparison to dienes with isolated double bonds.

(b) $\nu(C=O)$ stretching frequency in amides occurs at lower frequency than in the corresponding acids. Why?

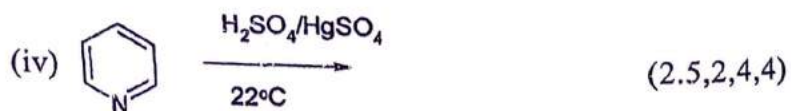
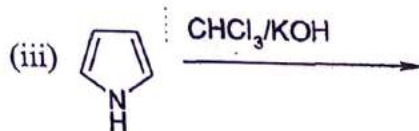
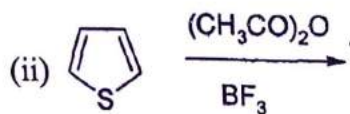
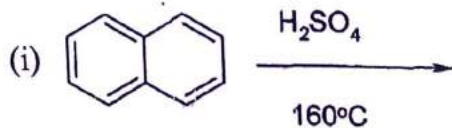
(c) Write a short note on : (any two)

(i) Electrophoresis

(ii) Ninhydrin test

(iii) Secondary structure of proteins

(d) Complete the following reactions :



7. (a) (i) What happens when anthracene is treated with Br_2 in CCl_4 ?

(ii) Explain why pyrrole is a weaker base than pyridine?

(b) Explain Merrifield solid phase polypeptide synthesis.

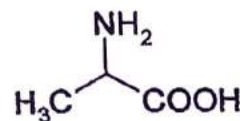
(c) Write the structure of the complex formed when an aqueous solution of glycine is treated with cupric oxide.

(d) How will you distinguish between the following pairs of compounds using IR spectroscopy?

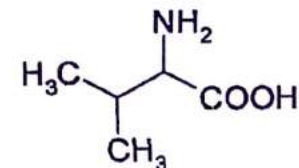
(i) $\text{CH}_3\text{CH}_2\text{COOCH}_3$ and CH_3COCH_3

(ii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
(4,3,1.5,4)

8. (a) Outline the stepwise synthesis of the dipeptide Ala-Val from alanine and valine.



Alanine



Valine

(b) Explain why :

(i) Pyridine undergoes nucleophilic substitution in addition to electrophilic substitution reaction.

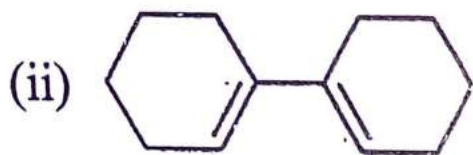
(ii) Furan undergoes electrophilic substitution at 2-position.

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(c) Calculate the λ_{\max} for the following :

(i) $\text{CH}_3\text{-CH=CH-CH=CH-CH}_3$ Basic Value = 217nm



Basic Value = 215nm

(4.5,4,4)

(19)



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(This question paper contains 2 printed pages)

Roll No.

Sl-no. of Q.P. : 5129
Unique Paper Code : 217683

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Name of the Paper : Polymer Science: Industrial Chemistry-VI

Name of the Course : B.Sc. (Prog.) Applied Physical Science

Semester : VI

Duration: 3 hours

Maximum Marks: 75

(Please write your exam Roll No. on the top immediately on receipt of this question paper.)

Attempt any five questions in all. All questions carry equal marks.

- Define polymer and polymerization with suitable examples.
 - Define functionality and its significance in polymerization.
 - Classify the polymers based on their preparation methods.
- Discuss the molecular weight of polymers.
 - Calculate degree of polymerization (DP) for polystyrene polymer having 10400 gm/mol of molecular weight.
 - Discuss glass transition temperature (T_g) and its affecting factors.
- Discuss the free radical polymerization mechanism of polystyrene using benzoyl peroxide as initiator.
 - Illustrate the condensation polymerization of Nylon 6,6.
 - Describe the preparation and applications of urea-formaldehyde resin.
- What is the importance of stoichiometric ratio of the reactants in condensation polymerization? Illustrate with examples.

(b) Write short note on Zeigler-Natta catalyst.

(c) What are the factors which affect the electrical conductivity of organic polymers.

5. Write short notes on any three of the following.

(a) Viscosity method for polymer molecular weight determination.

(b) Osmotic pressure method for polymer molecular weight determination.

(c) Vulcanization of natural rubber.

(d) Describe the synthesis of polystyrene from benzene.

(e) Define tacticity in polymers.

6. Write the structure of any five of the following.

(1) Polystyrene, (2) Poly (Methyl Methacrylate), (3) Bakelite, (4) Nylon-6,

(5) Polyurethane, (6) Poly (vinyl acetate), (7) Polycarbonate, (8) Kevlar.

7. Differentiate any three pairs of the following

(a) Thermoplastics and thermosets.

(b) Bulk and solution polymerization.

(c) Homopolymers and copolymers.

(d) Addition and condensation polymerization.

[This question paper contains 4 printed pages]



Your Roll No.....

Sr. No. of Question Paper : 5140

Unique Paper Code : 222663

Name of the Paper : Solid State and Nuclear Physics
(PHPT 606)

Name of the Course : B.Sc. (Prog.)

Semester : VI

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 any five questions.
3. All questions carry equal marks.

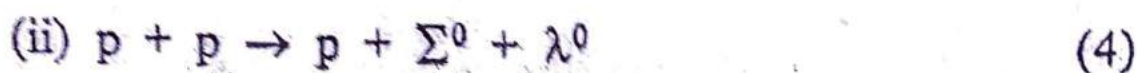
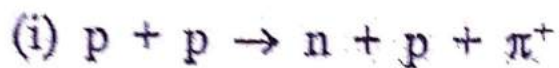
1. (a) Define reciprocal lattice. Find the primitive vectors of a reciprocal lattice. (8)

(b) State Bragg's law for X-ray diffraction. Calculate interplanar spacing for (321) plane in simple cubic lattice whose lattice constant is 4.2×10^{-8} cm. (7)

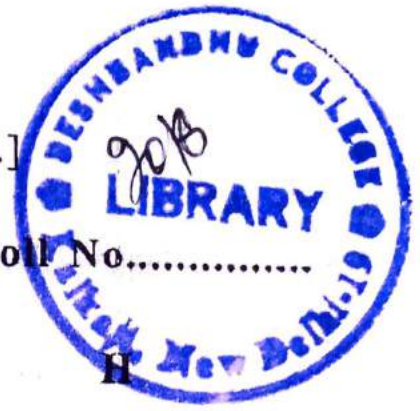
2. (a) Derive Claussius-Mossoti relation between polarizability and dielectric constant of a solid. (8)
- (b) What are the sources of polarizability? Prove that $D = \epsilon_0 E + P$, symbols have their usual meanings. (7)
3. (a) Derive Curie's law for paramagnetism. (8)
- (b) Explain hysteresis curve for ferromagnetic materials. Also show that the energy loss per cycle is equal to the area under the B-H curve. (7)
4. (a) What is Meissner's effect? Define type I and type II superconductors. (7)
- (b) Using Kronnig- Penney model, discuss the formation of allowed and forbidden energy bands. (8)
5. (a) Derive radioactive decay law. Deduce a relation between half life (T) of radioactive substance and disintegration constant (λ). (7)
- (b) Explain : (8)
- (i) Nuclear isomerism
 - (ii) Internal conversion

6. (a) What is binding energy? Draw its curve showing variation of binding energy per nucleon vs. mass number and explain the process of nuclear fission and fusion on basis of this curve. (9)
- (b) Calculate the binding energy per nucleon of alpha particle in MeV. The mass of alpha particle, proton and neutron are 4.00150 amu, 1.00728 amu, 1.00867 amu respectively. (3)
- (c) How long it takes for 60% of a radon sample to decay. Half life of radon = 3.88 days. (3)
7. (a) Derive semiempirical mass formula of binding energy for liquid drop model. (10)
- (b) Write the following reactions by putting appropriate particles on the arrows : (5)
- $${}_{92}^{238}\text{U} \rightarrow {}_{90}^{234}\text{Th} \rightarrow {}_{91}^{234}\text{Pa} \rightarrow {}_{92}^{234}\text{U} \rightarrow {}_{90}^{230}\text{Th} \rightarrow {}_{88}^{226}\text{Ra}$$
8. (a) Write the four types of fundamental interactions. (4)
- (b) Discuss the classification of Elementary particles on the basis of spin. (7)

(c) Which of the following reactions are allowed or forbidden? Also state the conservation laws.



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Your Roll No.....

Sr. No. of Question Paper : 5146

Unique Paper Code : 234663

Name of the Paper : Multimedia Systems & Applications

Name of the Course : B.Sc. (Prog.)

Semester : VI

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. The paper has two sections. All questions in 'Section A' are compulsory.
3. Attempt any five questions from 'Section B'.
4. Parts of a question must be answered together.

SECTION A

1. (a) Define multimedia and list its any two applications.

(2)

(b) Fill in the blanks :

(i) MIDI stands for

P.T.O.

- (ii) ASCII character set uses bits.
- (iii) B in RGB represents colour.
- (iv) Series of frames in between the keyframes are drawn in a process called
- (v) Type of memory that is erased when power is shut off is called..... (1×5=5)
- (c) Define the terms: hypertext, hypermedia, links and anchor. (4)
- (d) What is the use of Color Palettes in Multimedia. (3)
- (e) Name any three file formats used for images. (3)
- (f) Discuss additive and subtractive color model. (4)
- (g) Describe the four primary stages in a multimedia project. (4)

SECTION B

2. (a) Explain the process involved in adding sound to multimedia project. (5)
- (b) Explain Bitmaps. How do they differ from vector drawn objects? (5)

3. (a) List the characteristics of following multimedia authoring tools : (6)
- (i) Page based tools
 - (ii) Icon based tools
 - (iii) Time based tools
- (b) Define Codec and list its example. (4)
4. (a) List any three features of a 3-D modelling tool. (3)
- (b) Write any three uses of Intelligent Multimedia system. (3)
- (c) Explain the storage device – Blu-ray disc. (4)
5. (a) What are the features of image editing tools? Give example of the same. (4)
- (b) Explain OCR software. (2)
- (c) Write short notes on : (4)
- (i) Flash Memory
 - (ii) MPEG
6. (a) Discuss advantages and disadvantages of MIDI over digital audio? (5)

- (b) What do you mean by the term dithering? (2)
- (c) Differentiate between lossy and lossless compression. (3)
7. (a) Differentiate between : (6)
- (i) Key frame and Frame
 - (ii) GIF and JPEG
- (b) Justify the statement 'Multimedia is bringing art to life'. (4)
8. Write short note on : (5×2=10)
- (i) Input and output devices for a multimedia application
 - (ii) Audio file formats

[This question paper contains 8 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 2309

Unique Paper Code : 42347903

Name of the Paper : Internet Technology

Name of the Course : **B.Sc. (P) / B.Sc. Math.
Sciences**

Semester : VI

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. **Section A** is compulsory.
3. Attempt any **five** questions from **Section B**.

SECTION – A

1. (a) Write the HTML code to create a link to a page '**showPage.html**'. The link text that appears should read '**Click Here for more information**'.

(2)

P.T.O.

(b) Write the **CSS** code to :

(i) set the **size of the text to 7** in element **H3**.

(ii) set the **color of the text** in element **P** to **blue**. (2)

(c) Write a function in **JavaScript** to accept a number as argument and return its **cube**. (2)

(d) What is the difference between **reset** and **submit** button? (2)

(e) When is '**onLoad**' event executed in **JavaScript**? Illustrate with an example. (2)

(f) What is the use of **abstract** class in Java? (2)

(g) Give one difference between **throw** and **throws** in Java. (2)

(h) Give the output for the following **JavaScript** code :

```
var day = "Sunday"
```

```
(day == "Sunday") ? "Weekend" : "Weekday";
```

```
document.write("<center>" + "day=" + day + "</center>"); (2)
```

(i) What is the use of **DriverManager.getConnection()** in **JDBC**? (2)

(j) Find the error and make correction in the following **JSP** code :

```
<%= int x = 15 %> (2)
```

(k) What is the use of **isErrorPage** attribute of page? What is its default value as per the following code :

```
<%@ pageisErrorPage = "true" %> (2)
```

(l) Give three advantages of using **JSP** over **Servlets**. (2)

SECTION - B

2. (a) Give the **output** for the following **HTML** code :

```
<html>
```

```
<body>
```

```
<table border=1>
```

```
<tr><td rowspan=2>Desination</td><td colspan=2>Time</td></tr>
```

```
<tr><td>Arrival</td><td>Departure</td></tr>
```

```

<tr><td>Mumbai</td><td>7:30</td><td>08:45</td></tr>
<tr><td>Delhi</td><td>13:00</td><td>23:45</td></tr>
</table>
</body>
</html>

```

(5)

(b) Give one advantage of using **CSS** with **HTML**. How do you create **external CSS** file? Give example. (5)

3. (a) List any two **properties** and **methods** of the **textbox** element in **Javascript**. What will be value stored in "a" in the following code :

```

var myStr = "Hello I am here";
var a=myStr.substring(2,8);

```

(5)

(b) Explain the three types of **dialog** boxes (pop-up windows) available in **JavaScript**? (5)

4. (a) Explain **Exception Handling** in **Java**. Give the output of the following code :

```

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

```

```

    { try{
    int d[ ]={1};
        d[22]=45;
        System.out.println("This is in try block");
        }
        catch(ArrayIndexOutOfBoundsException e)
        { System.out.println("This is in Catch
        block"); }
        System.out.println("This is after catch block");
        }
    }

```

(5)

(b) Differentiate between **overloading** and **overriding** in Java with example. (5)

5. (a) What is a **directive element** in **JSP**. Give the use of any three directive elements. (5)

(b) What is the use of **ResultSet** object in **JDBC**? What is its initial cursor position? (5)

6. (a) Illustrates **HTTP Request/Response** Model in **JSP** with the help of a diagram. (5)

(b) Give the output of the following : (3+2)

(i) `<%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c" %>`
`<html>`
`<body>`
`<c:set value="10" var="num"/>`
`<c:choose>`
`<c:when test="{num%2==0}">`
`<c:out value="{num} is even number">`
`</c:out></c:when><c:otherwise>`
`<c:out value="{num} is odd number"></c:out>`
`</c:otherwise>`
`</c:choose>`
`1 + 2 + 3 = <c:out value = "{1 + 2 + 3}" />`
`</body>`
`</html>`

(ii) `<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>`
`<html>`
`<body>`
`<%! String str = null; %>`

`<%! String str1 = "Hello"; %>`
`<c:out value="{str}" default="Nothing"/>`
`
`
`<c:out value="{str1}" default="Nothing"/>`
`</body>`
`</html>`

7. (a) What is **JSTL**? Explain the following functions with example

(i) **startsWith**(string, prefix)

(ii) **join**(array, separator) (5)

(b) Write a note on **JSP life cycle**. (5)

8. (a) Write a code to create a **HTML** form with the following elements – (5)

<u>Label</u>	<u>Name</u>	<u>Type</u>
(i) Client Name	txtName	Textbox
(ii) Password	setPwd	Textbox for password
(iii) Country	ctry	Dropdown
(iv) OK	btnOK	Button
(v) Clear	btnClear	Reset Button

(b) Add a **JavaScript** code block to the above HTML form at the click of '**OK**' Button –

- (i) Client Name should not be left blank.
- (ii) Password should not be less than 8 characters.
- (iii) If the Client Name is not blank and password is greater than 8 characters, print <Client Name > lives in <Country> on next page (5)

(23)

[This question paper contains 4 printed pages]

Your Roll No.

: 2018

Sl. No. of Q. Paper

: 2310

Unique Paper Code

: 42357618

Name of the Course

: B.Sc. (Prog.)

B. Sc. Mathematical
Science - DSE - 1B

Name of the Paper

: Numerical Methods

Semester

: VI

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) All the **six** questions are compulsory.
- (c) Attempt any **two** parts from each question.
- (d) Use of non-programmable scientific calculator is allowed.

1. (a) Define absolute error and relative error with examples. If an approximate value of $1/3$ is given by 0.333, then find the absolute and relative errors. 6

(b) Perform three iterations of Newton-Raphson method to obtain the root of the equation

$$f(x) = x^4 - x - 10 = 0$$

with initial approximation $x_0 = 2$.

6

P.T.O.

- (c) Perform three iterations of Regula-Falsi method obtain the root of the equation. 6
 $f(x) = x^3 - 5x + 3 = 0$
 with initial approximation $x_0 = 0.65$ and $x_1 = 0.66$.

2. (a) Perform three iterations of bisection method obtain the root of the equation
 $f(x) = x^3 - x - 1 = 0$
 in the interval with initial [1, 2]. 6

- (b) Perform three iterations of secant method obtain the root of the equation 6
 $f(x) = x^2 - e^x + 2 = 0$
 with initial approximation $x_0 = 0$ and $x_1 = 2$.

- (c) Perform two iterations of Newton's method to solve the non-linear system of equations
 $f(x, y) = y \cos(xy) + 1 = 0$
 $g(x, y) = \sin(xy) + x - y = 0$
 with initial approximation (1, 2). 6

3. (a) Solve the linear system $Ax = b$ using Gaussian elimination with partial pivoting: 6

$$A = \begin{bmatrix} 1 & 1 & -2 \\ 4 & -2 & 1 \\ 3 & -1 & 3 \end{bmatrix} \text{ and } b = \begin{bmatrix} 3 \\ 5 \\ 8 \end{bmatrix}.$$

- (b) Starting with initial vector $(x, y, z) = (0, 0, 0)$, perform three iterations of Gauss Seidal method to solve the following system of equations: 6

2

$$\begin{aligned} 2x - y &= 7, \\ -x + 2y - z &= 1, \\ -y + 2z &= 1 \end{aligned}$$

- (c) If $f(x) = \frac{1}{x}$ then evaluate Newton Divided difference $f[a, b, c, d]$. 6

4. (a) Define the backward difference operator (∇) and central difference operator (δ).
 Prove that: 6.5

$$(i) \mu\delta = \frac{1}{2}(\Delta + \nabla) \quad (ii) \nabla + \frac{\delta^2}{2} = \delta\sqrt{1 + \frac{\delta^2}{4}}$$

- (b) Find the Lagrange interpolation polynomial for the data set (0,1), (1,3) and (3,55). Also estimate the value at $x = 2.5$. 6.5
- (c) Construct the interpolating polynomial using the Gregory-Newton backward difference interpolation for the given data set: 6.5

x	0	0.1	0.2	0.3	0.4
f(x)	-1.5	-1.27	-0.98	-0.63	-0.22

Hence estimate the value of $f(x)$ at $x = 0.15$.

5. (a) Approximate $f'(0)$, $f'(4)$ and $f''(2)$ using appropriate three point difference formula for following data: 6.5

x	0	1	2	3	4
f(x)	0	1	4	9	16

3

P.T.O.

(b) Find the approximate value of $I = \int_0^2 e^x dx$

by using Newton's Cote open two-point formula and three-point formula. 6.5

(c) Evaluate the integral $= \int_0^2 \frac{1+x}{1+x^3} dx$, using

Gaussian Quadrature 3-point formula. 6.5

6. (a) Use Euler's method to solve initial value problem

$$\frac{dy}{dt} = -y + t^2, \quad y(0) = 1$$

over the interval $[0, 2]$ with step size $h = 0.5$. 6.5

(b) Use Mid-point method (second order Runge-Kutta method) to solve initial value problem

$$\frac{dy}{dt} = yt^2 - 1.1y, \quad y(0) = 1$$

over the interval $[0, 2]$ with step size $h = 0.5$. 6.5

(c) Use finite difference method to solve boundary value problem (BVP)

$$\frac{d^2y}{dt^2} = y + x, \quad 0 \leq x \leq 1$$

With $y(0) = 2$, $y(1) = 2.5$ and $n = 4$ sub intervals. 6.5

(24)



[This question paper contains 4 printed pages]

Your Roll No. : 2018
Sl. No. of Q. Paper : 2317 IC
Unique Paper Code : 42357618
Name of the Course : B.Sc. (Prog.)
B. Sc. Mathematical
Science : DSE - 2B
Name of the Paper : Numerical Methods
Semester : VI

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) All the **six** questions are compulsory.
- (c) Attempt any **two** parts from each question.
- (c) Use of non-programmable scientific calculator is allowed.

1. (a) Define Global Truncation error with examples. If the number 754632 rounded off to four significant digits then calculate the absolute error. 6
- (b) Perform three iterations of Newton-Raphson method to obtain the root of the equation
 $f(x) = x^3 - 2x - 5 = 0$
with initial approximation $x_0 = 3$. 6

P.T.O.

- (c) Perform three iterations of secant method obtain the root of the equation

$$f(x) = 3x + \sin x - e^x = 0$$

with initial approximation $x_0 = 0.3$ and $x_1 = 0.4$. 6

2. (a) Perform four iterations of bisection method obtain the root of the equation

$$f(x) = xe^x - 1 = 0$$

in the interval with initial $[0, 1]$. 6

- (b) Define rate of convergence. Determine the rate of convergence for the Regula-Falsi method. 6

- (c) Perform two iterations of Newton's method to solve the non-linear system of equations

$$f(x, y) = x^2 y + y^3 = 10$$

$$g(x, y) = xy^2 - x^2 = 3$$

with initial approximation $(0.8, 2.2)$. 6

3. (a) Find the inverse of the following matrix using the Gauss Jordan method : 6

$$A = \begin{bmatrix} 6 & 2 & 2 \\ 6 & 2 & 1 \\ 1 & 2 & -1 \end{bmatrix}$$

- (b) Starting with initial vector $(x, y, z) = (0, 0, 0)$, perform three iterations of Gauss Seidel method to solve the following system of equations. 6

$$6x + 15y + 2z = 72,$$

$$x + y + 54z = 110,$$

$$27x + 6y - z = 85$$

2

- (c) If $f(x) = \frac{1}{x}$ then evaluate the n^{th} order Newton

Divided difference. 6

$$f[x_0, x_1, x_2, \dots, x_n]$$

4. (a) Prove that : 6.5

$$(i) \mu^2 = 1 + \frac{\delta^2}{4} \quad (ii) \nabla = -\frac{\delta^2}{2} + \delta \sqrt{1 + \frac{\delta^2}{4}}$$

- (b) Find the Lagrange interpolation polynomial for the following data set :

x	-1	1	4	7
f(x)	-2	0	63	342

Also estimate the value of 'f' at $x = 2.5$.

6.5

- (c) Construct the interpolating polynomial using the Gregory-Newton backward difference interpolation for the given data set : 6.5

x	0	0.2	0.4	0.6
f(x)	0.5403	0.3624	0.1700	-0.0292

Hence estimate the value of $f(x)$ at $x = 0.15$.

5. (a) Approximate $f'(-1)$, $f'(1)$ and $f'(3)$ using appropriate two points difference formula for following data :

x	-1	0	1	2	3
f(x)	1/3	1	3	9	27

Also estimate $f'(1)$ using Richardson extrapolation with step size $h = 2$. 6.5

3

P.T.O.

- (b) Find approximate value of the integral

$$I = \int_0^{\pi} x^2 \sin(2x) dx \quad \text{using Simpson's rule.}$$

Divide interval $[0, \pi]$ into four equal sub interval. 6.5

- (c) Obtain first extrapolated value of the integral

$$I = \int_0^2 e^x dx \quad \text{using Romberg integration and}$$

compare with exact value. 6.5

6. (a) Use fourth order Runge-Kutta method to solve initial value problem

$$\frac{dy}{dt} = yt^2 - 1.1y, \quad y(0) = 1$$

over the interval $[0, 1]$ with step size $h = 1$.

- (b) Use Heun's method without iteration to solve initial value problem 6.5

$$\frac{dy}{dt} = (1 + 2t)\sqrt{y}, \quad y(0) = 1,$$

over the interval $[0, 2]$ with step size $h = 0.5$.

- (c) Use finite difference method to solve boundary value problem (BVP) 6.5

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} = t^2 - y, \quad 0 \leq x \leq 1,$$

with $y(0) = 10$, $y(1) = 2$ and $n = 4$ sub intervals.

25

[This question paper contains 6 printed pages.]

Your Roll No.



Sr. No. of Question Paper : 2471

Unique Paper Code : 42177919 / 32177903

Name of the Paper : Applications of Computer in Chemistry

Name of the Course : **B.Sc. (Program) / B.Sc. (Hons.) : DSE-1B/3**

Semester : VI

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.

1. Answer all parts of the question :

(a) Define the following :

(i) Software

(ii) Algorithm

(iii) Operating System

(b) Write the expanded form of the following :

(i) QBASIC

P.T.O.

(ii) ROM

(iii) CPU

(c) What is a byte? Complete the following statement :

_____ Giga Byte = _____ Tera Byte

(d) Write the following in BASIC :

(i) $Y = 56R^2 T^4 / 6.6 \times 10^{-34} P$

(ii) $p = A(1+r)^n / [q^r - 1]$

(iii) 0.00008532

(e) Convert the following :

(i) $(1100101)_2$ binary to decimal(ii) $(567.125)_{10}$ decimal to binary (3,3,2,3,4)

2. (a) Identify the errors in the following constants :

(i) 0.6351-E14

(ii) 453R7

(iii) "MO-Theory"

(iv) "X+Y"

(b) Identify the error in the following variables :

(i) CLS

(ii) 4temp

(iii) End

(iv) K\$val

(c) Write a program in BASIC to construct and multiply two 3X3 matrix, using READ....DATA statement. (4,4,4)

3. (a) Identify the error in the following :

(i) For A(I) = 1 to N Step 5

(ii) PSET (X-Y)

(iii) If P=30 then M\$=55

(iv) For I = 1 to 10 Step x

Next x

(v) DEF FN7(X) = X² - 5

(vi) Locate (45,60)

(b) Write the output of the following :

(i) Print "Name", "Roll Number", "Marks"

Print

Print N\$, R1, M2

Print A+B*C, N\$, A/C

Where N\$ = Peter, R1=60, M2=359, A=15,
B=2, C=3

(ii) 10 SCREEN 1

20 WINDOW (0,0) - (50,50)

30 PSET (30, 40)

40 LINE (0,0) - (10,10)

50 END

(6,6)

4. (a) Write the BASIC statement to produce the following effects :

(i) 1-D array to hold 50 items of data.

(ii) Assign the value 35 to a variable PI.

(iii) Assign a string MAXWELL DISTRIBUTION to the variable.

(iv) If P has a value greater than 150, then transfer control to the statement number 70, otherwise execute the next statement.

(b) Differentiate between the following :

(i) Low level Language and High Level Language

(ii) Screen 1 and Screen 2

(iii) RAM and ROM

(c) What is the use of REM statement? (4,6,2)

5. (a) Write a program in BASIC to calculate the following :

$$u_{av} = \sqrt{\frac{8RT}{\pi M}} \quad \text{and} \quad u_{rms} = \sqrt{\frac{2RT}{M}}$$

For various gases, R = 8.314, T = 350, M = 32 × 10⁻⁴

(b) Identify the errors in the following, if any :

(i) 10 For J=1 to N

30 For K= 1 to M

70 Next J

80 Next K

(ii) 20 FOR N = 1 TO 100

70 -----

90 NEXT N

120 IF N = 10 THEN 70

(c) Write a program to draw a filled rectangle box with diagonal coordinates (50, 65) and (120, 160) in high resolution mode. (4,4,4)

6. (a) Explain the function of the following keywords :

(i) LET

(ii) PSET

(iii) GOSUB

(iv) DIM

(b) Write a program in BASIC to find the value of Mean, Variance and Standard Deviation of a set of N numbers. Provide the data using Input statement.

$$\text{Mean} = 1/N \sum X_i$$

$$\text{Variance} = 1/N \sum (X_i - \bar{X})^2$$

$$\text{Standard Deviation} = (\text{Variance})^{1/2}$$

OR

(b) Write a program in BASIC to find the root of following equation using Iterative Method or Newton Raphson Method :

$$X^5 - 6x^2 + 8 = 0$$

(c) Mention any three applications of computer in Chemistry. (4,5,3)

- (c) Solve the differential equation : 6½

$$y^2 \log y = xpy + p^2.$$

2. (a) Obtain the general solution of the differential equation : 6½

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 2y = x + e^x \cos x.$$

- (b) Solve the differential equation : 6½

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

- (c) Prove that the two solutions y_1 and y_2 of the second order homogeneous linear differential equation : 6½

$$a_0(x) \frac{d^2 y}{dx^2} + a_1(x) \frac{dy}{dx} + a_2(x)y = 0$$

an either identically zero or never zero on $x \in (a, b)$ where a_0, a_1, a_2 are continuous real functions on a real interval (a, b) and $a_0(x) \neq 0$ for any $x \in (a, b)$.

3. (a) Solve the differential equation by method of variation of parameters : 6½

$$\frac{d^2 y}{dx^2} + 4y = \sec^2 2x.$$

- (b) Given that $y = x$ is a solution of 6½

$$(1-x^2) \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0.$$

Find a linearly independent solution by reducing the order.

Write the general solution.

- (c) Solve the following differential equation : 6½

$$(D^2 + a^2)y = \tan ax.$$

4. (a) Solve the simultaneous differential equations : 6½

$$\frac{dx}{dt} + \frac{dy}{dt} + 3x = \sin t$$

$$\frac{dx}{dt} + y - x = \cos t.$$

- (b) Solve : 6½

$$\frac{dx}{x^2 + 2y^2} = \frac{dy}{-xy} = \frac{dz}{xz}.$$

- (c) Solve : 6½

$$(2x^2 + 2xy + 2xz^2 + 1) dx + dy + 2z dz = 0.$$

UNIT-II

5. (a) Find the partial differential equation by eliminating the arbitrary constant a and b from the equation : $5\frac{1}{2}$

$$\log(az - 1) = x + ay + b.$$

- (b) Find the general solution of the differential equation : $5\frac{1}{2}$

$$x^2 p - q^2 y^2 = (x + y)z.$$

- (c) Find the complete integral of the equation : $5\frac{1}{2}$

$$p + q - 2px - 2qy + 1 = 0.$$

6. (a) Find the complete integral of the equation : 6

$$q = px + p^2.$$

- (b) Show that the equation $z = px + qy$ is compatible with any equation $f(x, y, z, p, q) = 0$ which is homogeneous in x, y and z . 6

- (c) Classify the following partial differential equation and reduce the equation to canonical form : 6

$$\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial y^2}.$$

(v) Positive staining

(vi) Mode

(vii) Rf

1×5=5

(b) Match the columns :

(i) Chromatography

(a) Roentgen

(ii) Mitochondria

(b) Osmium tetroxide

(iii) Electron microscopy

(c) Tswett

(iv) Chi-square Value

(d) Svedberg

(v) Centrifuge

(e) Succinate

dehydrogenase

1×5=5

(c) Expand (any five) :

(i) SDS

(ii) RFLP

(iii) GFP

(iv) RCF

(v) FACS

(vi) MALDI

(vii) NTA.

1×5=5

2. Illustrate the following techniques (showing the steps involved)

with the help of neatly labelled diagram(s) only (any 3) :

(i) Northern Hybridization

(ii) Polyacrylamide Gel Electrophoresis

(iii) FISH

(iv) Ion Exchange Chromatography

3×5=15

3. Differentiate between the following (any 5) :

(i) Light and Electron microscopy

(ii) Differential and Density gradient centrifugation

(iii) Pie Chart and Histogram

(iv) Paper and Thin Layer Chromatography

(v) Confocal and Fluorescence Microscopy

(vi) G Banding and Q Banding.

3×5=15

4. Write short notes on any 3 of the following :

(i) Marker Enzymes

(ii) Western Blotting

(iii) HPLC

(iv) AGE

(v) Mass Spectrophotometry. 3×5=15

5. (a) Justify the following statements. Attempt any five :

(i) Native polyacrylamide gel electrophoresis is different from SDS-PAGE.

(ii) The resolving power of a microscope is inversely proportional to the limit of resolution.

(iii) DNA moves towards the positive electrode in AGE.

(iv) The temperature, pH and osmotic potential of the medium are important during homogenization of the tissue.

(v) TLC is advantageous over paper chromatography.

(vi) Radioisotopes in biological research 2×5=10

(b) Using a ray diagram explain the principle and working of TEM.

5

6. Write the applications of the following in biological research

(any three) :

(i) Spectrophotometry

(ii) Biostatistics

(iii) Phase Contrast Microscope

(iv) Ultracentrifugation

(v) Gel Filtration Chromatography 3×5=15

7. (a) Name the technique used :

(i) To determine the 3-D structure of proteins

(ii) For lipid separation

(iii) To separate proteins on the basis of molecular weight

(iv) To determine the size of an unknown DNA band with the help of ladder DNA.

(v) For desalting

(vi) For studying biological membranes

P.T.O.

P.T.O.

(vii) For studying detailed structure of chromosomes

(viii) To obtain pure fraction of organelles

(ix) For pigment separation

(x) To purify enzymes

(b) In a cross between two pea plants yielding 880 seeds, 639 had green seeds and 241 had yellow seeds. The expected segregation ratio is 3:1. Calculate the chi-square value and interpret the results.

- (iv) In a nuclear reactor ----- are used to control the high energy neutrons.
- (v) ----- is used to remove particulate matter from flue gases.
- (vi) ----- is a renewable energy source.
- (b) Define the following with suitable examples or reactions (any five) :
- Ozone hole
 - Biocatalyst
 - Liebig's law of minimum
 - Green Chemistry
 - Biosphere
 - Dry adiabatic lapse rate.
- (c) Draw a labelled diagram of hydrological cycle. Indicate at what levels and how water pollution affects this cycle. 5,5,5
2. (a) How is bleaching powder manufactured ? What are its main applications ? How does bleaching powder disinfect water ?

- (b) How is iron extracted from pyrites ? Give stepwise procedure ?
- (c) "Biological treatment of water is carried out during secondary treatment process." Justify.
- (d) Explain with reactions "Oxygen plays an important role in troposphere while ozone plays a key role in stratosphere". 5,4,3,3
3. (a) What are the major sources and sinks of SO_2 in atmosphere ? Discuss a method of estimating SO_2 in an air sample.
- (b) Give different methods of liquefying gases.
- (c) Describe a process of converting low grade coal into an energy efficient fuel.
- (d) How do CO_2 and H_2O vapours act as greenhouse gases ? 5,4,3,3
4. (a) With reactions explain how chlorofluorocarbons deplete ozone ? Give the safer substitutes of chlorofluorocarbons. How are they safer ?

(b) List the pollutants present in the effluents of fertilizer and petrochemical industries. Suggest a method for treatment of the same.

(c) Draw a labelled diagram of biogeochemical cycle of Nitrogen.

(d) What are the advantages and disadvantages of geothermal energy ? How can it be harnessed ? 5,4,3,3

5. (a) Derive the expression $L_t = L_0 e^{-kt}$ for BOD calculations. Define each term involved.

(b) What is photochemical smog ? How do the oxidants present in the smog affect living organisms ?

(c) Describe a case of nuclear disaster and its consequences.

(d) Differentiate between BOD and COD. Which will be higher for surface waters and why ? 5,4,3,3

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

(a) Bhopal gas disaster

(b) Safe disposal of nuclear waste

(c) Ion exchange resins and their application to water treatment

(d) Manufacture and use of borax. 3×5

(29)

[This question paper contains 8 printed pages.]

Your Roll No. LIBRARY



Sr. No. of Question Paper : 2534

Unique Paper Code : 42177926

Name of the Paper : ORGANOMETALLICS,
BIOINORGANIC
CHEMISTRY,
POLYNUCLEAR
HYDROCARBONS AND
UV, IR SPECTROSCOPY

Name of the Course : B.Sc. Programme Physical
Science/Life Science/App.
Phy. Sc. : DSE-2B

Semester : VI

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 any **three** questions each from **Section A** and **Section B**.
3. Use separate Answer booklet for each section.

SECTION A

1. (a) Explain the magnetic behaviour of potassium ferricyanide.

P.T.O.

- (b) How is $\text{Na}_3[\text{Co}(\text{NO}_2)]$ prepared?
- (c) What happens when : (Give balanced chemical equation)

(i) $\text{Na}_3[\text{Co}(\text{NO}_2)]$ is treated with KCl .

(ii) $\text{K}_2\text{Cr}_2\text{O}_7$ reacts with KI .

(iii) $\text{K}_4[\text{Fe}(\text{CN})_6]$ is treated with FeCl_3 .

(iv) Sodium nitroprusside is treated with sodium sulphide.

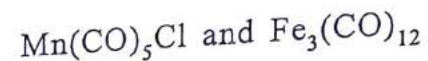
(d) (i) Explain the oxidising nature of KMnO_4 .

(ii) To an orange red solution of compound X aqueous solution of KOH is added which results in the formation of yellow solution of compound Y. On acidifying with H_2SO_4 , the yellow colour changes to orange red again. Identify the compounds X and Y and give the chemical reactions involved. (2,2,4,4.5)

2. (a) $\text{Mn}(\text{CO})_5$ dimerises. Why?

(b) Explain the synergic effect in metal carbonyls.

- (c) (i) Calculate the EAN of the following :



(ii) Draw the structure of ferrocene.

(d) The CO stretching frequency in IR spectra are as follows: $[\text{Mn}(\text{CO})_6]^+$ 2090 cm^{-1} , $[\text{Cr}(\text{CO})_6]$ 2000 cm^{-1} , $[\text{V}(\text{CO})_6]^-$ 1860 cm^{-1} , $[\text{Ti}(\text{CO})_6]^{2-}$ 1750 cm^{-1} . Its value for CO (g) is 2143 cm^{-1} . Discuss.

(2,2,4,4.5)

3. (a) What are metalloporphyrins? Discuss the role played by haemoglobin and myoglobin in transporting oxygen.

(b) Discuss the biological role of magnesium.

(c) What is active transport? Explain Na/K pump.

(4,4,4.5)

4. (a) Draw the structures of the following compounds :

(i) $\text{Co}_2(\text{CO})_8$ in solid state

(ii) $\text{Co}_2(\text{CO})_8$ in hexane

(iii) $\text{Fe}_3(\text{CO})_{12}$

(iv) $\text{Fe}_2(\text{CO})_9$

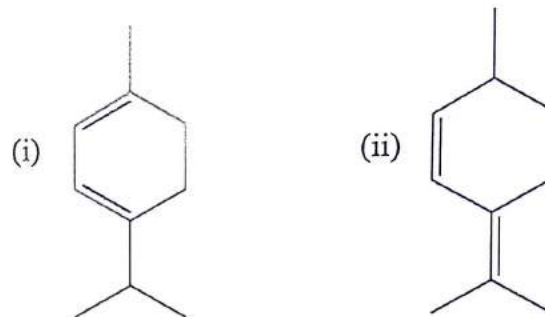
- (b) Explain why direct nitration of ferrocene is not possible? How can you get nitro derivative of ferrocene?
- (c) Discuss the role of sodium ions present in the biological system. (4,4,4,5)

SECTION B

Attempt any three questions.

5. (a) Explain molecular orbital structure of naphthalene.
- (b) What do you understand by bathochromic shift and hypsochromic shift? What shift would be observed on increasing the conjugation in the compound?
- (c) Why electrophilic attack in anthracene is favoured at C-9?
- (d) (i) How is ethyl acetoacetate prepared from acetaldehyde?
- (ii) Why is methylene group of EAA reactive? (2,2.5,4,4)

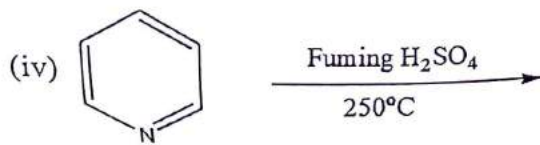
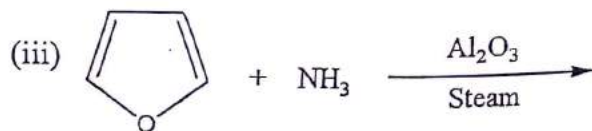
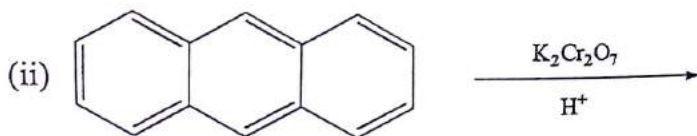
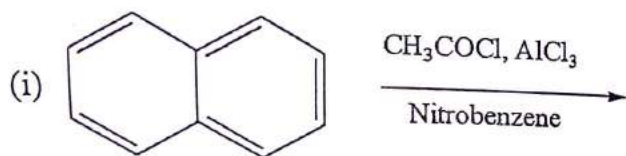
6. (a) What is the finger print region in IR spectrum? How is it useful for structure determination?
- (b) Pyridine is less reactive towards electrophiles than pyrrole and benzene. Explain.
- (c) Calculate λ_{\max} for the following compounds using Woodward Fieser rules :



- (d) How will you prepare the following from ethylacetoacetate :
- (i) 2,4-pentanedione or Acetylacetone
- (ii) 2-methyl propanoic acid (2,2.5,4,4)
7. (a) Why are the peaks observed in UV spectrum broad in comparison to the peaks in IR spectrum?

(b) Define tautomerism. What type of tautomerism exists in ethylacetoacetate? Draw the structures of tautomers.

(c) Give the products for the following reactions :



(d) What is the order of following carbonyl compounds in decreasing wavenumber? Explain by giving reasons.

butanoyl chloride; ethylbutanoate; pentanal;
propanoic acid
(2,2.5,4,4)

8. (a) Why electrophilic substitution in pyrrole and furan cannot be carried in presence of concentrated strong acids?

(b) Arrange furan, pyrrole and thiophene in increasing order of aromatic character. Give reason for your answer.

(c) How would differentiate the following compounds by using IR spectroscopy :

(i) $\text{CH}_3\text{CH}_2\text{OCH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

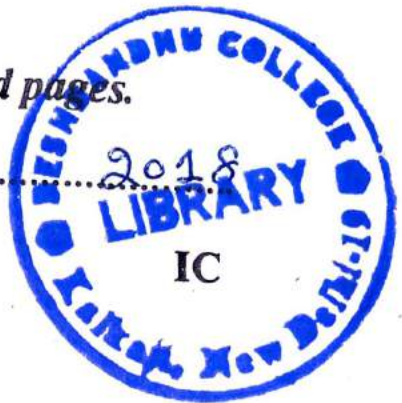
(ii) CH_3COCH_3 and $\text{CH}_3\text{CH}_2\text{COOH}$

(d) (i) Give the reaction for ketonic hydrolysis of ethylacetoacetate.

- (ii) How would you synthesize butanone starting from ethylacetoacetate. (2,2.5,4,4)

This question paper contains 3 printed pages.

Your Roll No.



S. No. of Paper : 2547

Unique Paper Code : 42237904

Name of the Paper : Immunology

Name of the Course : B.Sc. Life Sciences : DSE-2B

Semester : VI

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. (A) Define: 5
 - i. Antigenicity
 - ii. Autoimmunity
 - iii. Agglutination
 - iv. Idiotype
 - v. Cross reactivity

- (B) Differentiate between the following: 10
 - i. Monoclonal and Polyclonal serum
 - ii. Indirect and Sandwich ELISA
 - iii. Class I and Class II MHC Molecules
 - iv. T Helper and T Cytotoxic cells
 - v. Primary and Secondary Immune Response

- (C) Write contribution/s of the following scientists: 2
 - i. Edward Jenner
 - ii. Paul Portier and Charles Richet

(D) Expand the following:

- i. PAMP
- ii. MAC
- iii. MBL
- iv. CLIP
- v. HLA
- vi. IL-3

3

(E) Give immunological significance of the following:

- i. Self reactive T Cells
- ii. Adjuvants
- iii. MALT
- iv. Agrelope

4

(F) Give reasons for the following

3

- i. Passive immunization is not long lasting.
- ii. Haptens cannot elicit an immune response on their own.
- iii. Secondary cell mediated response can be induced by native and processed antigen.

2. (i) Diagrammatically depict the structure of an typical antibody and discuss the distinguishing features of different classes of antibodies.

8

(ii) Describe in detail the mechanism of action of DNA vaccine and discuss its advantages and disadvantages.

4

3. (i) Give an account of Cytosolic pathway of antigenic processing and presentation.

6

(ii) Define cytokines. Enumerate their basic properties and functions.

6

4.(i) Discuss the classical pathway of complement activation and its physiological consequences.

8

(ii) Explain the process of haematopoeisis.

4

5.(i) Discuss the factors influencing immunogenicity of an antigen.

6

(ii) What are T cell epitopes? How are they different from B cell epitopes?

6

6. (i) Define hypersensitivity. Describe Type I Hypersensitivity in detail with suitable examples.

6

(ii) Give an account of the various types of agranulocytes and granulocytes.

6

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

- i. Clonal Selection Theory
- ii. Immunoelectrophoresis
- iii. Acquired Immunodeficiency
- iv. Secondary Lymphoid Organs.

①



[This question paper contains 7 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **6810** **HC**

Unique Paper Code : 42357618

Name of the Course : **B.Sc. Mathematical
Sciences/B.Sc. (Programme) :
DSE-1B**

Name of the Paper : Numerical Methods

Semester : VI

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) All the **six** questions are compulsory.
- (c) Attempt any **two** parts from each question.
- (d) Use of non-programmable scientific calculator is allowed.

P.T.O.

1. (a) Derive the order of convergence of the secant method . 5

(b) Use bisection method to find the smallest positive root of the equation

$$x^3 + 2x^2 - 3x - 1 = 0$$

Perform three iterations. 5

(c) Find a real root of the equation :

$$x^3 - 13 = 0$$

in the interval (2,3). Perform three iterations using the False Position method.

5

2. (a) Find an iteration formula based on the Newton-Raphson method for finding \sqrt{N} . Apply the method for finding $\sqrt{18}$. Obtain the result correct to two decimal places. 6.5

(b) Compute the approximate solution of the system of non-linear equations by Newton's method. Perform two iterations taking initial approximation as $x_0 = 1$, $y_0 = 1$

$$f(x,y) = x^2 + 4y^2 - 16 = 0$$

$$g(x,y) = xy^2 - 4 = 0 \quad (6.5)$$

(c) Solve the following system of linear equations using Gauss Jacobi method

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25 \quad 6.5$$

Perform three iterations taking initial approximation as $X^{(0)} = (0,0,0)$.

3. (a) Use Gauss elimination method to solve the following system of linear equations :

$$2x + 8y + 2z = 14$$

$$x + 6y - z = 13$$

$$2x - y + 2z = 5 \quad (6.5)$$

(b) Apply Gauss Seidel iteration method to solve the following system of linear equations performing three iterations. Take the initial approximation as $X^{(0)} = (0,0,0)$.

$$8x - 3y + 2z = 20$$

$$4x + 11y - z = 33$$

$$x + y + 4z = 9 \quad 6.5$$

(c) Given $f(0) = 1$, $f(1) = 2$, $f(2) = 11$, $f(3) = 34$, find the Lagrange's interpolating polynomial. Hence approximate the value of the function at $x = 2.5$ 6.5

4. (a) Construct the divided difference table for the following data :

x :	4	5	7	10	11	13
f(x) :	48	100	294	900	1210	2028

6.5

(b) Construct the backward difference table for the following data :

x :	0	1	2	3	4
f(x) :	2	3	12	35	78

Hence the Gregory Newton backward difference interpolating polynomial. Interpolate the value $f(3)$. 6.5

(c) For the following data, estimate the value of $f(2.5)$ using cubic splines :

i	x_i	$f(x_i)$
0	1	0.5
1	2	1.333
2	3	0.25

6.5

5. (a) Apply Euler's modified method to estimate the solution of the initial value problem and calculate $y(1.3)$ by using $h=0.1$

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}, y(1) = 1 \quad 6.5$$

(b) Find the approximate value of $I = \int_0^1 \frac{dx}{1+x}$

using (1) Trapezoidal rule (2) Simpson's rule.

6.5

(c) Given $\frac{dy}{dx} = \frac{1}{xy}$ with $y(1)=2$, $x=0.1$. Find $y(1.2)$. Solve using Runge-Kutta fourth order method.

6.5

6. (a) Estimate $\int_{0.1}^{1.3} 5xe^{-2x} dx$ by 2-point Gauss quadrature rule.

6.5

(b) Given $f(x) = 5xe^{-2x}$, find the value of $f'(0.35)$, using CDD (central divided difference) formula given by

$$\left[f'(x) \approx \frac{f(x+h) - f(x-h)}{2h} \right]$$

with $h = 0.25$ and $h=0.125$

6.5

(c) Given $\frac{dy}{dx} = y - 2x$, where $y(0) = 2$, find $y(0.3)$ with $h=0.1$ using Midpoint method.

6.5

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[This question paper contains 7 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **6810-A** **HC**

Unique Paper Code : 42357618

Name of the Course : **B.Sc.(Mathematical Sciences)/B.Sc.(Programme) DSE-2B**

Name of the Paper : Numerical Methods

Semester : VI

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) Questions No. **six** are compulsory. Attempt any **two** parts from each question.
 - (c) Use of non-programmable scientific calculator is allowed.
1. (a) Define the order of convergence of an iterative method. Derive the order of convergence of the Newton Raphson method .

- (b) Use Bisection method to determine the root of the equation:

$$X^2 - 3 = 0$$

on the interval (1,2) up to four iterations.

5

- (c) Find a real root of the equation:

$$x^3 - 5x + 1 = 0$$

on the interval (0,1). Perform four iterations using Secant Method.

5

2. (a) Apply Newton Raphson's method to determine the root of the equation-

$$x^3 + x^2 - 3x - 3 = 0$$

on the interval (1,2). Perform three iterations.

6.5

- (b) Perform two iterations of Newton's method to solve the non-linear system of equations

$$x^2 + xy + y^2 = 7$$

$$x^3 + y^3 = 9$$

Take the initial approximations as

$$x_0 = 1.5, y_0 = 0.5.$$

6.5

- (c) Solve the following system of linear equations using Gauss Seidel method

$$5x + y + 2z = 10$$

$$-3x + 9y + 4z = -14$$

$$x + 2y - 7z = -33$$

Perform three iterations taking initial approximation $X^{(0)} = (0,0,0)$.

6.5

3. (a) Using Gauss Jordan method find the inverse of the matrix

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

Hence solve the following system of equations :

$$3x - y + 2z = 1$$

$$x + y + 2z = 2$$

$$2x - 2y - z = 3 \quad (6.5)$$

(b) Solve the system of linear equations

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

$$x + 4y + 2z = -5$$

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

using Gauss Jacobi method performing three iterations. Take the initial approximation as

$$X^{(0)} = (0, 0, 0).$$

6.5

(c) Using the cubic splines fit the following data :

Estimate the value of $f(\)$?

i	x_i	$f(x_i)$
1	3.0	2.5
2	4.5	1.0
3	7.0	2.5

6.5

4. (a) Use the Lagrange's interpolation to find a polynomial that passes

through the points $(-2, 4)$, $(0, 2)$ and $(2, 8)$. Hence approximate the function at the point $x = -1$. (6.5)

(b) (i) Construct the divided difference table for the following data :

x :	0.0	0.1	0.2	0.3	0.4	0.5
f(x) :	-1	-1.27	-0.98	-0.63	-0.22	0.25

3

(ii) Show that :

3.5

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

(c) Construct the forward difference table for the following data :

x :	0.1	0.2	0.3	0.4	0.5
f(x) :	1.4	1.56	1.76	2.0	2.28

Hence obtain the Gregory Newton forward difference interpolating

polynomial. Interpolate the function at $x = 0.25$. (6.5)

5. (a) Evaluate $\int_1^2 \frac{dx}{1+x^2}$ using Simpson's 3/8 rule for $n=9$ correct to 5 decimal places.

6.5

- (b) Using Euler's method find the approximate value of y when $x=0.3$

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

$$y(0)=1 \text{ and } h=0.1 \quad 6.5$$

- (c) Apply finite difference method to solve the given problem

$$\frac{d^2y}{dx^2} = y + x(x-4), \quad 0 \leq x \leq 4$$

$$y(0) = 0, \quad y(4) = 0 \text{ with } h=1 \quad 6.5$$

6. (a) Using the central difference formula for $f'(x)$

evaluate $f'(3)$ for the following data

X:	1	2	3	4	5
f(x):	3	5	9	17	33

Further apply Richardson Extrapolation for $h = 1, 2$ and evaluate the value of

$f'(3)$. Compare the two values.

6.5

- (b) Apply mid-point theorem (R.K. Second order) to solve the initial value problem

$$\frac{dy}{dx} = yx^3 - 1.5y$$

from $x=0$ to 2 where $y(0)=1$ by using $h=1$ 6.5

- (c) Estimate $\int_{0.1}^{1.3} 5xe^{-2x} dx$ by 3-point Gauss quadrature rule. 6.5

(B)



[This question paper contains 8 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **8764** **HC**

Unique Paper Code : 42347903

Name of the Course : **B.Sc.(Programme) :**
DSE-1B Computer Science.

Name of the Paper : Internet Technologies

Semester : VI

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

Instructions for Candidates :

- Write your Roll No. on the top immediately on receipt of this question paper.
- Section **A** compulsory.
- Attempt any **five** questions from Section **B**.

Section - A

- (a) Name the attributes of Table tag in HTML to control : 2
 - the distance between the data in a cell and the boundaries of the cell.
 - the spacing between adjacent cells in the table.

P.T.O.

- (b) Which Property in CSS is used for : 2
- (i) changing the background color of an element.
- (ii) inserting an image in the background of an element.
- (c) "JavaScript variables are loosely cast". Explain. 2
- (d) What is the difference between alert() and prompt() functions in JavaScript ? 2
- (e) **var tot = eval("15*6/2");** 2
What value will be stored in the variable "tot" ? 2
- (f) What is the use of "Arithmetic Exception" in Java ? 2
- (g) Write a java code to print the following pattern using loops : 3
1
12
123
- (h) Name the three JSP lifecycle methods and mention its purpose. 3
- (i) What are the five basic steps to connect a database in Java ? 3

2

- (j) Explain the following JSP elements with example : 4
- (i) Scriptlet
- (ii) Declaration

Section - B

2. (a) Write a code in HTML to create an image '**xyz.jpg**' as a hyperlink to a URL '**abcd.htm**'. Name four shapes in which image map regions can be created. 4
- (b) What is CSS ? What is its advantage in designing a web page ? Explain with example. 4
- (c) Give any two text attributes used in CSS. 2
3. (a) When is the JavaScript Event Handler '**onBlur()**' executed ? Give its one use with example. 4
- (b) Give the output for the following JavaScript code : 4
- ```
<script language='JavaScript'>
x=50
y=30
z=(x>y) ? 'Happy' : 'Sad'
document.write(z)
</script>
```

3

P.T.O.

Rewrite the above code in JavaScript using 'if' statement.

- (c) Write a code in Javascript to set the HTML document's background color to red, using hexadecimal code.

4. (a) Give the output for the following Java code :

```
class show {
public static void main(String args[]) {
int p[][] = new int [4][];
p[0] = new int[1];
p[1] = new int[2];
p[2] = new int[3];
p[3] = new int[4];
int i, j, k = 0;
for(i=0; i<4; i++)
for(j=0; j<i+1 ; j++)
{
p[i][j] = k;
k++;
}
```

```
for(i=0; i<4; i++) {
for(j=0; j<i+1 ; j++)
System.out.println(p[i][j] + " ");
System.out.println();
}
}
```

- (b) Write a java program to copy the contents of file **A.txt** to file **B.txt**.
- (c) What is the use of keyword '**finally**' in exception handling in Java.
5. (a) What is the advantage of JDBC in java ? In JDBC, What is the purpose of the following :
- SQL statement
  - Callable statement
  - Prepared statement
- (b) Give the direction of the cursor movement in the following resultset type in JDBC :
- ResultSet.TYPE\_FORWARD\_ONLY
  - ResultSet.TYPE\_SCROLL\_INSENSITIVE

- (c) What is the purpose of the following code line in JDBC ?

```
Class.forName("com.mysql.jdbc.Driver");
```

2

6. (a) What is JSP ? Mention its three advantages over Servlets. 4

- (b) Explain any four JSP implicit objects. 4

- (c) Give the use of the following Directives of JSP : 2

(i) page

(ii) include

7. (a) How can the data present in the textbox of an HTML form be used by a JSP page ?

Illustrate with an example. 4

- (b) What will be the output of the following JSP code : 4

```
<%! int font Size; %>
```

```
<html>
```

```
<body>
```

```
<%for(font Size=1;font Size<=3; font Size++)
<font color="green" size= "<%=font Size %>">
```

```
JSP
```

```


```

```
<% } %>
```

```
</body>
```

```
</html>
```

- (c) Find the error and make correction in the following JSP code line : 2

```
<%! 5+6*2 %>
```

8. (a) Write a code to create a HTML form with the following elements - 4

Lable	Name	Type
(i) Employee Name	txtName	Textbox
(ii) Salary	txtAge	Textbox
(iii) OK	btnOK	Button
(iv) Clear	btnClear	Reset Button

(b) Add JavaScript code block to validate the above HTML form at the click of 'OK' Button-

(i) Employee Name should not be blank.

(ii) Salary should be a numeric value.

(iii) If the data entered is valid, display

**'Welcome <Employee Name>'**

Otherwise, display **'Please enter valid values'**. 4

(c) What is the difference between colspan and rowspan attributes of a frame in HTML ?

2

(M)

This question paper contains 6 printed pages



Sl. No. of Ques. Paper : 8783  
Unique Paper Code : 42177925  
Name of Paper : Chemistry of *d* block elements,  
Quantum Chemistry and  
Spectroscopy  
Name of Course : B.Sc. (Prog.) : DSE-1B  
Semester : VI  
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.

Use separate answer sheets for Section A and Section B.  
Calculators and log tables may be used.

### SECTION A

Attempt any *three* questions.

1. (a) Give brief reason for any *three* of the following :
  - (i) Transition metals and some of their many compounds act as good catalyst.
  - (ii) Chromium is typical hard metal while mercury is liquid.

(iii) Transition elements readily form alloys.

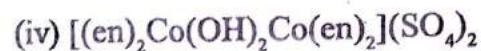
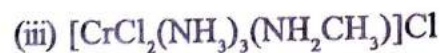
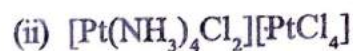
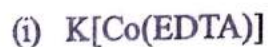
(iv) Zn(II) salts are not colored while Ni(II) salts are colored.

(v) Ce(III) can be easily oxidized to Ce(IV).

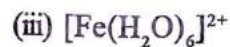
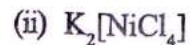
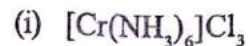
(b) A compound with an empirical formula  $\text{CoCl}_3 \cdot 4\text{H}_2\text{O}$  exists in two isomeric forms *A* and *B*. Both *A* and *B* react with  $\text{AgNO}_3$  to give one mole of  $\text{AgCl}$ . *A* has dipole moment 5.96 D whereas *B* has zero dipole moment. Suggest the structures of the two isomers and also indicate the possible optical isomers (if any) of the two forms. 9,3½

2. (a) In  $[\text{MnF}_6]^{4-}$ , the Mn-F bond lengths are all equal but in  $[\text{CrF}_6]^{4-}$ , two of the Cr-F bonds are shorter than the remaining four. Explain and draw the splitting diagram on the basis of CFT. What is the driving force towards this distortion?

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



(c) Using VBT, predict the hybridization, geometry and magnetic behavior of any *two* of the following :



5,4½,3

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

(i) pentaamminenitrito-*o*-cobalt(III) ion

(ii) tetrahydroxozincate(II)

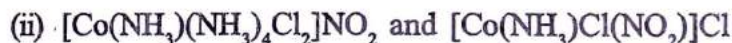
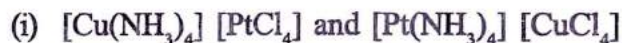
(iii) potassiumtri(oxalato)chromate(III)

(iv) dichlorobis(ethane-1,2-diamine)platinum(IV) nitrate

(b) Calculate the CFSE of  $\text{Ni}^{2+}$  ion in octahedral weak field.

What will be the CFSE in a tetrahedral field? Draw the splitting diagram of  $\text{Ni}^{2+}$  ion in tetrahedral field and octahedral field.

(c) Indicate the type of isomerism in the following pairs :



(d) Write the possible isomers for  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  4½,4,2,2

4. (a) Predict the appropriate choice and give brief reason :

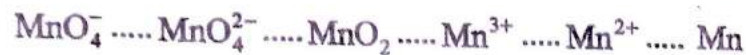
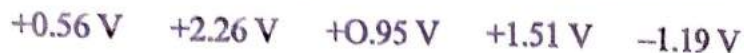
(i) Greater no. of oxidation state Fe, Mn

(ii) Greater value of  $\Delta_0$   $[\text{Co}(\text{NH}_3)_6]^{3+}$  or  $[\text{Co}(\text{F})_6]^{3-}$

(iii) Ambidentate ligand  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{NO}_2^-$



- (b) Consider the Latimer diagram for Mn in acidic medium :



Answer the following questions :

- (i) Calculate skip step EMF for  $\text{MnO}_2$  to  $\text{Mn}^{2+}$ .
  - (ii) Which oxidation states of Mn are likely to disproportionate?
  - (iii) Which is the most stable species?
- (c) (i) Which out of  $\text{Lu}(\text{OH})_3$  and  $\text{La}(\text{OH})_3$  are more basic and why?
- (ii) Briefly explain Ion-exchange method for separation of lanthanides. 3,4½,5

#### SECTION B – PHYSICAL CHEMISTRY

##### Physical Constants

Planck's constant  $6.626 \times 10^{-34} \text{ J s}$

Velocity of light  $3 \times 10^8 \text{ ms}^{-1}$

Avogadro's number  $6.023 \times 10^{23} \text{ mol}^{-1}$

Atomic mass unit  $1.661 \times 10^{-27} \text{ kg}$

Mass of electron  $9.109 \times 10^{-31} \text{ kg}$

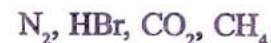
5. (a) Explain the physical significance of wave functions  $\Psi$  and  $\Psi^2$ .
- (b) Is it mandatory for the zero-point energy to be zero?  
Comment.

- (c) What is meant by eigenvalues and eigenfunctions? Support your answer with an example.

- (d) A particle is in the state :  $\Psi = e^{-idx}$  where  $d$  is a constant. Is this state an eigen function of the momentum operator,  $P_x$ ?  
(Prove your answer.) 3,3,3½

6. (a) Although there are no quantum mechanical restrictions on the change in the vibrational quantum number change during an electronic transition, the probabilities and intensities of such vibrational changes during electronic transitions are not the same. Explain.

- (b) Which of the following molecules have a vibrational spectrum?



How many fundamental modes of vibrations do each of the molecules have?

- (d) For each of the photon energies find the frequency (in Hz) and the wavelength of light. State to which part of the electromagnetic spectrum does each photon belong?

(i)  $6.454 \times 10^{-20}$

(ii)  $3.353 \times 10^{-19}$

4½,4,4

7. (a) The molecule  $^{14}\text{N}^{16}\text{O}$  absorbs in the microwave region with a gap of  $3.390 \text{ cm}^{-1}$  between adjacent lines in the spectrum. Calculate (i) rotational constant (ii) the moment, of inertia

$I$ , (iii) the reduced mass ( $\mu$ ) and (iv) the average bond length of the molecule.  $M_N = 14.0031$  g/mol and  $M_O = 15.9949$  g/mol.

- (b) There are some reactions which are characterized by high quantum yield while some reactions are characterized by low quantum yield. Comment.
- (c) For harmonic oscillator derive the expression of equilibrium vibrational frequency ( $\nu_0$ ). Draw few quantized vibrational energy levels and also show that in case of harmonic oscillators various levels are equally spaced.      4,4, 4½

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

- (i) Lambert-Beer's Law and its limitations
- (ii) Dissociation and Predissociation
- (iii) Effect of substitution on vibrational frequencies.
- (iv) Chemiluminescence.      4½,4,4,4

5

This question paper contains 6 printed pages.



Your Roll No. ....

S. No. of Paper : 8786  
Unique paper code : 42167901  
Name of the paper : **Economic Botany and Biotechnology**  
Name of course : **B.Sc. (Prog.) Life Sciences : DSE-1B**  
Semester : **VI**  
Duration : **3 hours**  
Maximum marks : **75**

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

*Attempt Sections A and B on separate answer sheets.*

*Question No. 1 of both Sections is compulsory.*

*Attempt **three** questions from Section A and **three** questions from Section B including Q. No. 1 of both Sections.*

*Attempt all parts of a question together.*

SECTION A

1. (a) Give the botanical name and family of any *five* of the following: 5x1=5

- i. A plant which has caryopsis as a fruit
- ii. An old world cotton
- iii. A plant which is a source of spice obtained from fruits

P. T. O.

- iv. A plant which is the richest source of proteins amongst the legumes
- v. A plant which is a source of eugenol
- vi. A plant which is a source of non alcoholic beverage

(b) Fill in the blanks in any *five* of the following:

5x0.5=2.5

- i. The state with highest production of black pepper is .....
- ii. .... is the protein which results in the formation of an elastic dough and excellent baking quality of wheat.
- iii. A new synthetic textile fiber called ..... is manufactured from peanut protein.
- iv. .... is acute anemic condition resulting from eating uncooked beans of *Vicia faba*.
- v. .... is a new world crop.
- vi. IARI stands for .....

2.(a) Give the principal State of India where the following are extensively grown: 5x1=5

- i. Groundnut
- ii. Tea
- iii. Cotton
- iv. Soybean
- v. Pepper.

(b) Give botanical names and family of the plants exhibiting the following special features: 5x1=5

- i. Caryopsis fruit
- ii. Most plant parts aromatic in nature
- iii. Dimorphic branching

- iv. Geocarpic fruit
- v. Drupe fruit.

(c) Differentiate between any *two* of the following:

2x2.5=5

- i. Black tea and Green tea
- ii. Animal fibre and Vegetable fibre
- iii. Assam Tea and China Tea
- iv. Semi drying oil and Drying oil.

3.(a) Draw well labelled diagrams of any *two* of the following: 2x2.5=5

- i. V.S. of tea leaf
- ii. L.S. of clove floral bud
- iii. C.S. of black pepper
- iv. L.S. of wheat caryopsis.

(b) Write short notes on the following:

4x2.5=10

- i. Significance of antioxidants in fatty oils
- ii. Importance of study of centre of origin of cultivated crops
- iii. Origin of hexaploid wheat
- iv. General utilization of spices.

4.(a) Fill in the blanks. Attempt any *ten*. 10x0.5=5

- i. The term ..... is given to those members of the Poaceae which are cultivated for their fruits (grains).
- ii. ...., Russian botanist, worked extensively on origin of cultivated crops.

- iii. Triglycerides of complex organic acids are called .....
- iv. Legumes are important source of ..... in daily diet of vegetarians.
- v. Wonder bean meat is botanically known as .....
- vi. .... fibers are epidermal prolongations of the seed coat cells.
- vii. The botanical name of New world or American Cotton is .....
- viii. .... is known as the King of Spices .
- ix. .... non-volatile fraction responsible for the pungency of black pepper.
- x. The stimulating and refreshing characteristic of tea is due to the presence of alkaloid .....
- xi. .... is the protein which results in the formation of an elastic dough and excellent baking quality of wheat.
- xii. "Mother of cloves is the ripened ..... of clove.

(b) Comment on any *four* of the following statements.

Support your answer giving reasons:  $4 \times 2.5 = 10$

- i. Toxic substances in some legumes can cause diseases in human beings.

- ii. Hydrogenated end product of fatty oil has better keeping quality than the fatty oil itself.
- iii. Dwarf varieties have played an important role in increasing the productivity in wheat.
- iv. Tea plant is pruned regularly.
- v. The groundnut fruits develop underground but the flowers are aerial.

#### SECTION B

1. (a) Expand any *five* the following:  $0.5 \times 5 = 2.5$

- (i) STR
- (ii) EtBr
- (iii) c-DNA
- (iv) SNP
- (v) BAP
- (vi) VNTR
- (vii) HRP

(b) Define any *five* of the following:  $5 \times 1 = 5$

- (i) PCR
- (ii) Monoclonal antibody
- (iii) Micropropagation
- (iv) ELISA
- (v) Gynogenesis
- (vi) Primer
- (vii) T-DNA

2. Differentiate between any *five* of the following:

$5 \times 3 = 15$

- (i) Monoclonal and polyclonal antibody
- (ii) DNA sequencing and DNA fingerprinting

- (iii) SNP and VNTR
- (iv) PCR and Southern blotting
- (v) Androgenesis and gynogenesis
- (vi) Genetic transformation and conventional breeding.

3. (a) Explain the principle of DNA fingerprinting. How is the technique important in forensic science? Mention other important applications of the technique. 8

(b) What is hybridoma and how is it produced? What are its applications in the field of molecular diagnostics? 7

4. (a) Explain the tissue culture methodology of embryo culture along with suitable diagrams. 7

(b) What is golden rice? Name its inventors. Explain the technique of production of golden rice in detail.

6

This question paper contains 7 printed pages]



Roll No. 

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S. No. of Question Paper : 8834

Unique Paper Code : 42177926

HC

Name of the Paper : Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy

Name of the Course : B.Sc. (Prog.) Chemistry–DSE 2B

Semester : VI

Duration : 3 Hours

Maximum Marks : 75

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

Attempt three questions each from Section A and Section B.

Sections A and B are to be attempted in separate answer sheets.

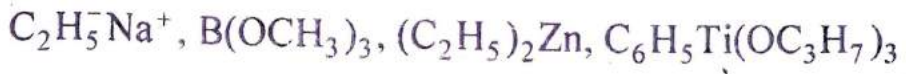
All questions carry equal marks.

The questions should be numbered in accordance to the number in the question paper.

**SECTION A (Inorganic Chemistry)**

(Attempt any three questions)

- 1. (a) Which of the following is not considered an organometallic compound and why ?



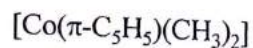
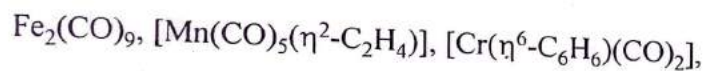
(b) On the basis of VBT predict the shape of  $\text{Cr}(\text{CO})_6$  which is found to be diamagnetic.

(c) Why is  $\text{Na}^+\text{C}_5\text{H}_5^-$  more stable than  $\text{Na}^+\text{C}_5\text{H}_{11}^-$  ?

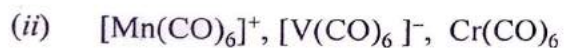
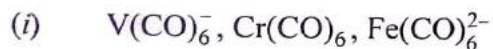
(d) The C-C distance in Zeise's salt is 137.5 pm in comparison with 133.7 pm in free ethylene. Explain the statement in detail.

4,2,2,4,5

2. (a) Calculate the effective atomic number or  $18 e^-$  count in the following compounds :



(b) Arrange the following species in their decreasing CO stretching vibrational frequencies and explain the reason :



(c) Write down any *one* the method for the preparation of  $\text{Fe}(\text{CO})_5$ . Using VBT explain the structure of  $\text{Fe}(\text{CO})_5$ . Are all the Fe-C bond lengths identical at room temperature ? Explain.

4,4,4,5

3. (a) Inability to synthesize transferrin may result in anaemia as well as overload of iron. Explain.

(b) How will you explain the binding of oxygen by hemoglobin by considering the change in magnetic behaviour of iron (II) in haemoglobin and oxyhemoglobin.

(c) What do understand by essential and non-essential elements ? In which category—essential, non-essential or toxic elements, will you place the following :

Ca, Sr, Cd, Hg, Cu.

4,4,4,5

4. (a) When alkali is added to an orange coloured solution of compound A, it is converted into yellow coloured solution of compound B which gives yellow precipitate on adding lead acetate. To alkaline solution of compound B, 30%  $\text{H}_2\text{O}_2$  is added, a red-brown coloured paramagnetic compound C is formed whereas neutral or slightly acidic solution of compound A, on reaction with  $\text{H}_2\text{O}_2$ , gives blue-violet coloured diamagnetic compound D is formed. Identify compounds A to D and write their oxidation states.

(b) Equivalent mass of  $\text{KMnO}_4$  in acidic medium is one-fifth of its molecular weight. Explain by giving reaction.

(c) Draw the structure of chlorophyll 'a'. Explain the role of  $\text{Mg}^{2+}$  in chlorophyll.

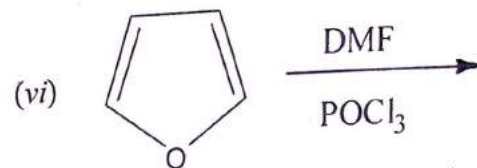
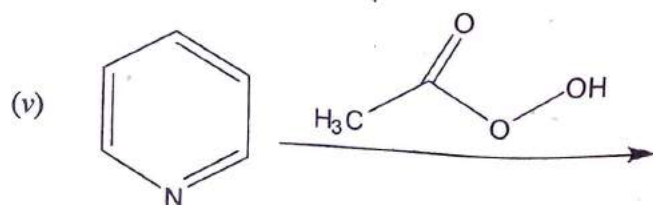
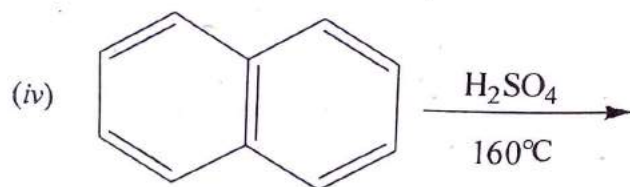
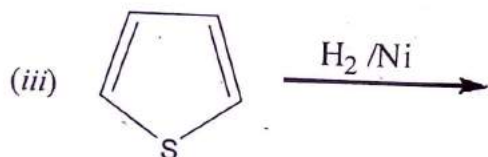
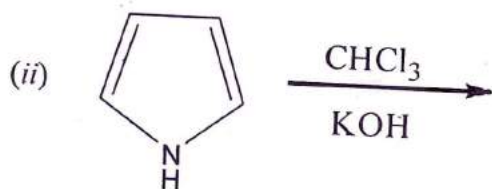
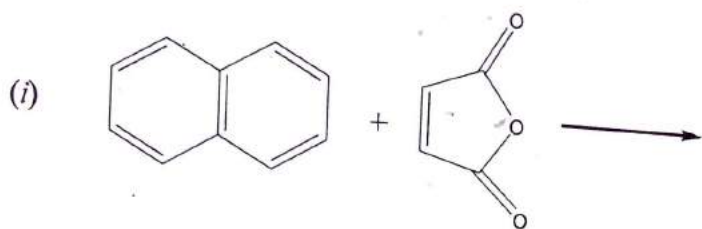
6,2,4,5



## SECTION B (Organic Chemistry)

(Attempt any three questions)

5. (a) Complete the following reactions :



(b) Pyridine is more basic than pyrrole. Justify.

(c) Electrophilic substitution in naphthalene takes place at 1 position. Explain.

(d) Give the steps of preparation of Haworth synthesis of Naphthalene. 6,2,2,2,5

6. (a) Write reactions for the preparation of any three of the following from ethylacetoacetate :

(i) Succinic acid

(ii) 4-oxopentanoic acid

(iii) Crotonic acid

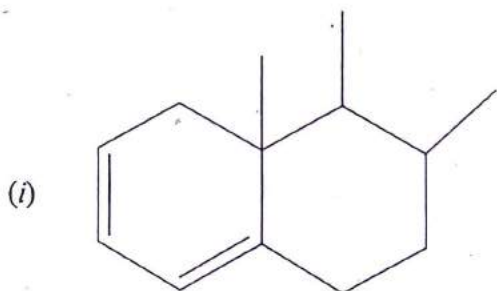
(iv) Adipic acid

(b) Arrange pyrrole, thiophene and furan in increasing order of their aromaticity with suitable explanation.

(c) Anthracene undergoes electrophilic substitution reactions at C9, C10 positions. Explain.

(d) Write the mechanism for the preparation of Ethylacetoacetate by Claisen Condensation. 6,2,2,2,5

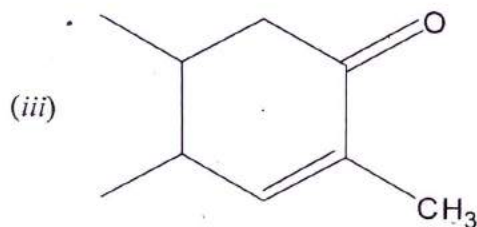
7. (a) Calculate  $\lambda_{\max}$  of any *three* of following structures :



Base value = 253 nm



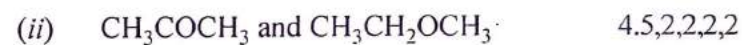
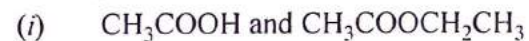
Base value = 217 nm



Base value = 215 nm

- (b) A conjugated diene absorbs at higher wavelength as compared to diene in which the double bonds are isolated. Explain.
- (c) Hydrogen bonding changes the position of absorption (O-H stretching) in IR spectroscopy. Justify.

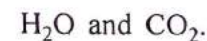
- (d) Explain auxochrome and chromophore with suitable examples.
- (e) How will you distinguish between the following pairs of compounds by IR spectroscopy :



8. (a) Explain :

- (i)  $\nu_{\text{C=O}}$  stretching in amides occur at lower frequency than corresponding acids.
- (ii) Explain the fingerprint region in IR spectroscopy.
- (iii) Define bathochromic and hypsochromic shift.
- (iv) Furan is the only five membered heteroaromatic compound which undergoes Diels Alder Reaction.
- (v) Draw the resonating structures of anthracene.

- (b) Calculate the number of fundamental vibrational modes in the following molecules :      10,2,5





This question paper contains 4 printed pages]

Roll No.

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S. No. of Question Paper : 8835A

Unique Paper Code : 42357633

HC

Name of the Paper : Mathematics-I (Differential Equations)

Name of the Course : B.Sc. (P) : DSE-2B

Semester : VI

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 question.

All questions are compulsory.

Marks are indicated against each question.

### Unit I

1. (a) Solve :

$$(2x^2 + y)dx + (x^2y - x)dy = 0. \quad 6\frac{1}{2}$$

(b) Solve the initial value problem :

$$(3x^2 + 4xy)dx + (2x^2 + 2y)dy = 0, \quad y(0) = 1. \quad 6\frac{1}{2}$$

(c) Solve :

$$p^2y + p(x-y) - x = 0. \quad 6\frac{1}{2}$$

P.T.O.

2. (a) Consider the differential equation :

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

- (i) Show that  $x$  and  $x^2$  are linearly independent solutions of this equation on the interval  $0 < x < \infty$ .
- (ii) Write the general solution of the given equation.
- (iii) Find the solution that satisfies the condition  $y(1) = 3, y'(1) = 2$ . Explain why this solution is unique.

6½

- (b) Solve :

$$x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2y = x^3.$$

6½

- (c) Solve :

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} - 3y = 2e^{4x}.$$

6½

3. (a) Using method of variation of parameters, find the general solution of :

$$\frac{d^2 y}{dx^2} + y = \sec x$$

given that  $y = \sin x$  and  $y = \cos x$  are linearly independent solutions of the corresponding homogeneous equation.

6½

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

$$(x^2 - 1) \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2y = 0,$$

find a linearly independent solution by reducing its order. Write the general solution.

6½

- (c) Solve the following equations :

(i)  $\frac{d^3 y}{dx^3} - 6 \frac{d^2 y}{dx^2} + 12 \frac{dy}{dx} - 8y = 0$

(ii)  $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = 0.$

6½

4. (a) Solve :

$$\frac{dx}{dt} - 4x - y = 0,$$

$$\frac{dy}{dt} - x - 2y = 0.$$

6½

- (b) Solve :

$$zydx - zxdy - y^2 dz = 0.$$

6½

- (c) Solve :

$$\frac{yzdx}{y-z} = \frac{zxdy}{z-x} = \frac{xydz}{x-y}.$$

6½

## Unit II

5. (a) Eliminate the arbitrary function  $f$  from the equation :

$$z = x + y - f(xy). \quad 5\frac{1}{2}$$

- (b) Find the general integral of the differential equation :

$$z(xp - yq) = y^2 - x^2. \quad 5\frac{1}{2}$$

- (c) Find the complete integral of :

$$p^2x + q^2y = z. \quad 5\frac{1}{2}$$

6. (a) Show that the equations :

$$xp - yq = x, \quad x^2p + q = xz$$

are compatible and solve them. 6

- (b) Find the complete integral of the equation :

$$(p^2 + q^2)y = qz \quad 6$$

- (c) Check whether the following equation is elliptic, parabolic or hyperbolic and reduce it into canonical form :

$$\frac{\partial^2 z}{\partial x^2} = x^2 \frac{\partial^2 z}{\partial y^2}. \quad 6$$

(8)

[This question paper contains 4 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 8845

HC

Unique Paper Code : 42237904

Name of the Paper : Immunology

Name of the Course : B.Sc. (P) Life Sciences : DSE-2B

Semester : VI

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 No. 1 is compulsory.

1 (a) Define :

(5)

- (i) Atopic
- (ii) Autoimmunity
- (iii) Thymectomy
- (iv) Haptens
- (v) Haematopoiesis

P.T.O.

(b) Differentiate between the following : (10)

- (i) Immediate hypersensitivity and Delayed hypersensitivity
- (ii) Complete and Incomplete adjuvant
- (iii) Antigen and Immunogen
- (iv) MHC I and MHC II
- (v) Macrophage and Monocyte

(c) Write the contribution/s of the following scientists : (2)

- (i) Gerald M Edelman and Rodney Porter
- (ii) Elie Metchnikoff
- (iii) Robert Koch
- (iv) Gell and Coomb

(d) Expand the following : (3)

- (i) MALT
- (ii) TCR
- (iii) PALS
- (iv) TNF
- (v) CDR
- (v) HIM

(e) Write the immunological significance of the following : (4)

- (i) IgA
- (ii) Opsonins
- (iii) NK cells
- (iv) Lymph Nodes

(f) Explain why (3)

- (i) Immune response is not generated against developing fetus
- (ii) Passive immunization is transient
- (iii) IgM is a better complement activator than IgG

2. (a) Illustrate and discuss the endocytic pathway for processing exogenous antigen. (6)

(b) Describe the Primary and Secondary humoral response to an antigen. (6)

3. (a) What are primary lymphoid organs? Write a note on structure and function of Thymus. (2,4)

(b) What are cytokines? Discuss any four biological properties of cytokines. (2,4)

4. (a) Describe the classical pathways of activation of complement system. (7)
- (b) Give a brief account of different types of vaccines. (5)
5. (a) How was the structure of antibodies deduced? (4)
- (b) Compare the structure and function of IgM and IgA. (4)
- (c) What is Erythroblastosis Fetalis? (4)
6. (a) What are the various barriers of innate immunity? Briefly discuss them. (6)
- (b) Distinguish between active and passive immunity. Give suitable examples. (6)
7. Write short notes: (**Any Three**) (4,4,4)
- (i) Hybridoma technology of Mab production
- (ii) Natural Killer Cells
- (iii) Clonal Selection Theory
- (iv) Antigen Presenting Cell



(9)

[This question paper contains 8 printed pages.]

Your Roll No.....



Sr. No. of Question Paper : 8883

Unique Paper Code : 42177926

Name of the Paper : Organometallic and Bio-inorganic  
Chemistry, Polynuclear Hydrocarbons  
& UV, IR

Name of the Course : B.Sc. (Prog.) DSE – 3B

Semester : VI

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

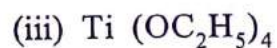
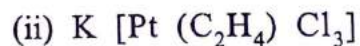
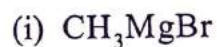
## Section A

(Attempt any three questions.)

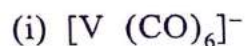
1. (a) A green chromium compound (A) on fusion with alkali gives a yellow compound (B) which on acidification gives an orange colored compound (C). (C) on treatment with  $\text{NH}_4\text{Cl}$  gives an orange colored product (D) which on strong heating decomposes to give back compound (A). Identify A, B, C and D. Write down the structure of compound C.
- (b) What happens when (Give balanced chemical equation, any five) :
- $\text{SO}_2$  gas is passed through acidic  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
  - $\text{K}_4\text{Fe}(\text{CN})_6$  is added into  $\text{CuSO}_4$  solution.
  - Sodium nitroprusside is treated with sodium sulphide.
  - $\text{K}_4\text{Fe}(\text{CN})_6$  is treated with ferric salts.
  - $\text{KMnO}_4$  reacts with oxalic acid in acidic medium.
  - $\text{K}_4\text{Fe}(\text{CN})_6$  is treated with concentrated sulphuric acid.
- (c) How do you distinguish between  $\text{CrO}_4^{2-}$  and  $\text{Cr}_2\text{O}_7^{2-}$ ? Are these interconvertible? (5.5,5,2)

2. (a) (i) The symmetric CO stretching frequencies in isoelectronic series of  $\text{V}(\text{CO})_6^-$ ,  $\text{Cr}(\text{CO})_6$  and  $\text{Mn}(\text{CO})_6^+$  are  $1860\text{ cm}^{-1}$ ,  $2000\text{ cm}^{-1}$  and  $2090\text{ cm}^{-1}$  respectively. Explain these observations.
- (ii) Discuss the structure and silent features of Zeise salt.
- (b) Using  $18\text{ e}^-$  rule as a guide find
- number of M-M bond in  $\text{Mn}_2(\text{CO})_{10}$
  - number of M-M bond in  $\text{Fe}_2(\text{CO})_9$
  - number of M-M bond in  $\text{Co}_4(\text{CO})_{12}$
  - value of 'x' in  $\text{Co}_2(\text{CO})_x$
  - value of 'x' in  $\text{Fe}_3(\text{CO})_x$
- (c) What is meant by the term 'haptacity'? Give an example where the same ligand can show different haptacity. (5.5,5,2)
3. (a) (i) Discuss the behavior of CO as strong  $\pi$  acid ligand with the help of molecular orbital diagramme.
- (ii) Draw the structure of Ferrocene in eclipsed and staggered form.

(b) Define organometallic compounds. Which of the following compounds are organometallic and why?



(c) Define Effective Atomic Number (EAN) rule. Which of the following species obey EAN?



4. (a) Differentiate between active and passive transport? Give a diagrammatic representation of the Na/K pump and explain the mechanism involved in it.

(b) Discuss the role of  $\text{Ca}^{2+}$  ion and important steps involved in blood clotting.

or

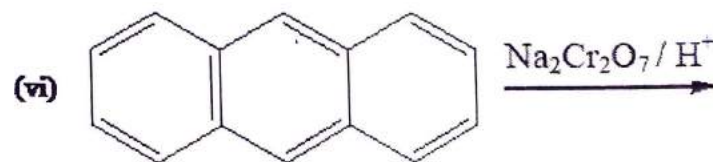
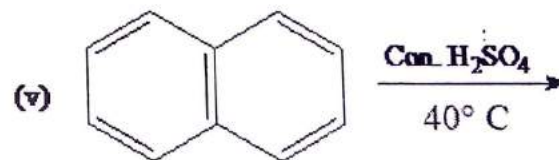
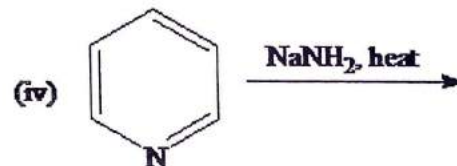
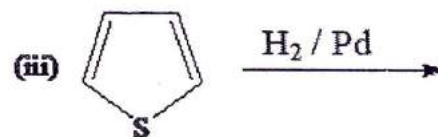
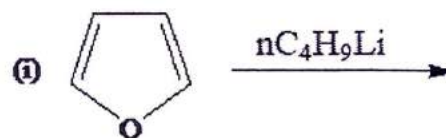
Draw and discuss myoglobin and hemoglobin binding curve at different partial pressure of  $\text{O}_2$ .

(c) What do you mean by essential, non-essential, trace and toxic elements in biological system? Give suitable examples. (6,3.5,3)

### SECTION B

(Attempt any three questions)

5. (a) Complete the following reactions :



- (b) Establish the structure of Napthalene.
- (c) Arrange pyrrole, thiophene and furan in increasing order of their reactivity, also give suitable reason for your answer. (6,4,2.5)

6. (a) Write reactions for the preparation of any **two** of the following from ethylacetoacetate.

(i) 2-Pentanone

(ii) 2-Methylbutanoic acid

(iii) Crotonic Acid

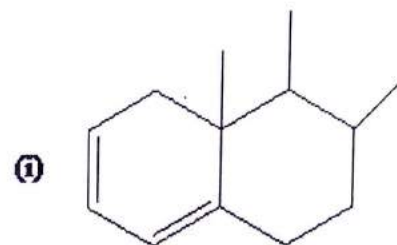
(b) Anthracene on catalytic reduction gives 9, 10 Dihydroanthracene. Justify.

(c) Furan is the only five membered heteroaromatic compound which undergoes Diels Alder Reaction.

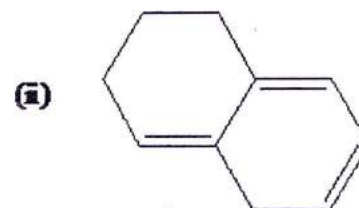
(d) How will you differentiate ethanamide and ethylamine by IR spectroscopy?

(e) What is Tautomerism? Give the structures of keto and enol forms of Ethylacetoacetate. (4,2,2,2,2.5)

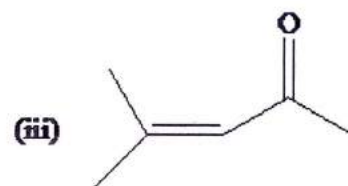
7. (a) Calculate  $\lambda_{\max}$  of the following structures.



**Base value = 253 nm**



**Base value = 253 nm**



**Base value = 215 nm**

(b) Explain briefly Lambert Beer's law.

(c) Hydrogen bonding changes the position of absorption (O-H stretching) in IR spectroscopy. Justify.

(d) Define Bathochromic shift and Hypsochromic shift.

- (e) Calculate the number of fundamental vibrational modes in  $\text{H}_2\text{O}$  and  $\text{CO}_2$ . (4.5,2,2,2,2)

8. (a) Explain :

(i)  $\nu_{\text{C=O}}$  stretching is higher in  $\text{CH}_3\text{CHO}$  than  $\nu_{\text{C=O}}$  stretching in  $\text{CH}_3\text{COCH}_3$ .

(ii) Fingerprint region in IR spectroscopy.

(iii) Pyridine undergoes nucleophilic substitution reaction at 2-position.

(iv) UV spectra of organic compounds consists of bands and not sharp peaks.

(v) Electrophilic substitution reactions in naphthalene are more favoured at 1-position than at 2-position.

(b) Give all steps for the preparation of anthracene by Haworth method. (10,2.5)

70

[This question paper contains 4 printed pages.]

Your Roll No.....



**Sr. No. of Question Paper : 8900**

Unique Paper Code : 42227637

Name of the Paper : Solid State Physics

Name of the Course : **B.Sc. (Prog.) Physics – DSE – 3B**

Semester : VI

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. Do any **five** questions.
3. Question No. 1 is compulsory.

1. Attempt any **five** :

(a) Give the differences between amorphous and crystalline substances with one example each.

(b) Distance between (111) planes in a cubic crystal is  $2A^\circ$ . Determine the lattice parameters.

P.T.O.

- (c) Prove that the volume of the reciprocal lattice is inverse of the volume of direct lattice.
- (d) What is the significance of the complex dielectric constant?
- (e) Distinguish between conductors, semiconductors and insulators on the basis of band theory of solids.
- (f) What is the origin of diamagnetism in a free atom?
- (g) What is Hall effect? Give one application. (3×5)
2. (a) How are X rays useful for investigating the structure of a single crystal?
- (b) What is meant by geometrical factor. Calculate it for bcc unit cell and determine from which planes X rays will not be reflected? (5,10)
3. (a) Derive and discuss the dispersion relation for a linear diatomic lattice.
- (b) Discuss the behaviour in the limits

(i)  $M$  and  $m$  are equal

- (ii)  $M \rightarrow \text{infinity}$
- (iii)  $M \rightarrow 0$  (10,5)
4. (a) State the assumptions made in Einstein theory of lattice specific heat of solids and derive the formula for molar heat capacity of solids. Discuss it at low and high temperature limits.
- (b) For Cu, the frequency of vibration of its atoms in the solid state is  $4.8 \times 10^{12}$  Hz. Calculate Einstein's temperature. Given:  $h = 6.6 \times 10^{-34}$  Js and  $K_B = 1.38 \times 10^{-23}$  J/K. (10,5)
5. (a) Derive an expression for variation of electronic polarizability with frequency.
- (b) Discuss normal and anomalous dispersion. (10,5)
6. What are diamagnetic materials. Explain Larmour precession? Derive an expression for the magnetic susceptibility on the basis of classical Langevin's theory. (15)
7. (a) On the basis of E-k diagram explain the differences between insulators, semiconductors and metals.

- (b) Explain Meissner Effect with the help of diagrams and elaborate how perfect diamagnetism is a fundamental property of superconductors. Discuss Type I and Type II superconductors on the basis of Meissner Effect. (7,8)



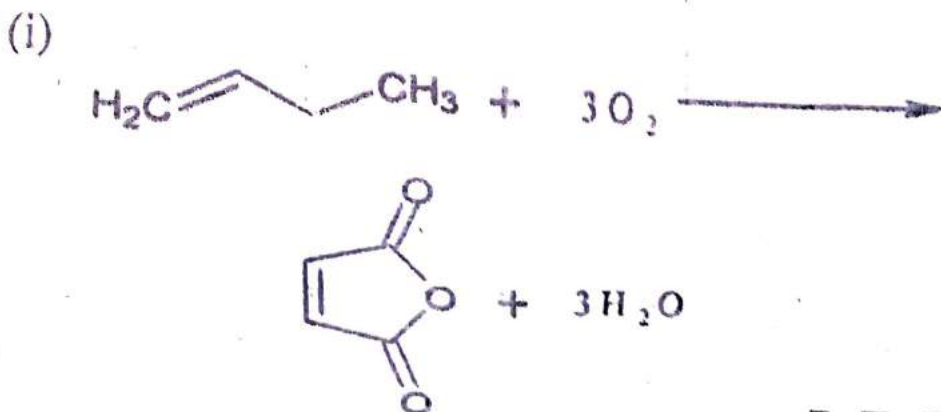
S. No. of Paper : 9422 HC  
 Unique Paper Code : 32177908  
 Name of the Paper : Green Chemistry  
 Name of the Course : B.Sc. (Hons.) Chemistry / B.Sc. (Prog.)  
 : DSE-3 / 1B ✓  
 Semester : VI  
 Duration : 3 hours  
 Maximum Marks : 75



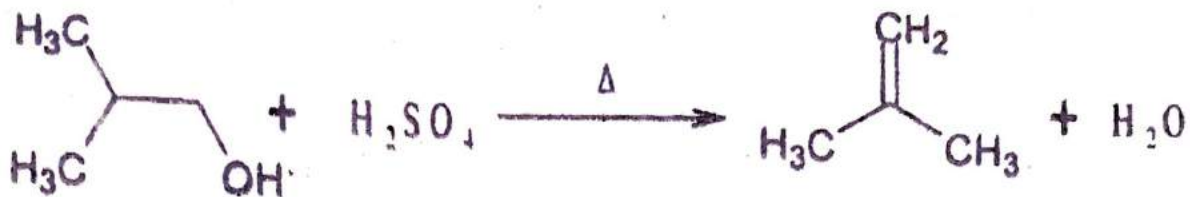
(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any five questions. Each question carries 15 marks.  
 Attempt all parts of a question together.

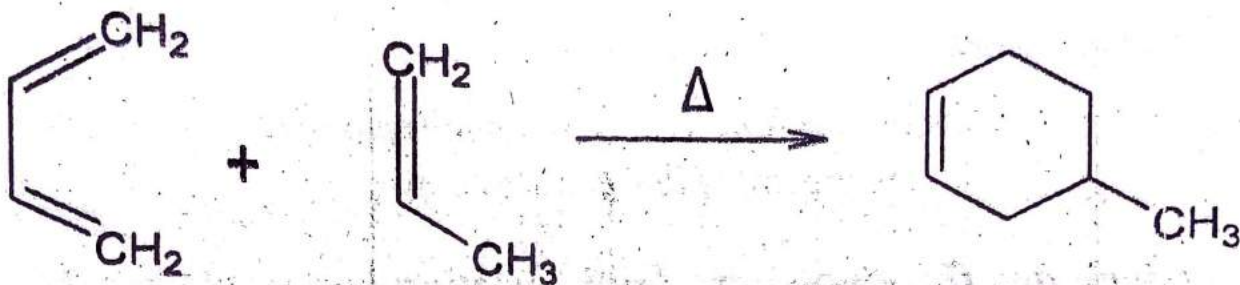
1. (a) Define atom economy.
- (b) Explain by taking suitable example, how per cent yield is different from atom economy in a chemical reaction.
- (c) Find out the per cent yield and atom economy of the following reactions. Compare and comment on their values:



(ii)



(iii)



(Molecular mass of C=12, N=14, O=16, S=32, H=1)

(d) What are Rightfit pigments? What are their advantages over heavy metal or organic pigments? 1,2,3 x 3,3

2. (a) What do you understand by alternative sources of energy? Give one example.

(b) Explain the principle of heat transfer in conventional method of heating and compare it with microwave assisted heating.

- (c) What type of vessels are used in microwave assisted chemical reactions?
- (d) Discuss the following reactions under microwave radiations. Give at least two advantages over the conventional method.
- (i) Hoffman Elimination
- (ii) Diels Alder Reaction. 2,3,2,2 x 4
3. (a) Why is ultrasound preferred over the conventional energy source?
- (b) Explain the benefits of Simmons Smith reaction in ultrasonic condition over conventional method by providing both the routes.
- (c) What are ionic liquids? Explain with an example.
- (d) How is supercritical CO<sub>2</sub> a viable green alternative? Discuss its role in drycleaning.
- (e) Explain the difference between homogeneous and heterogeneous catalyst by taking suitable example. 2,3,3,4,3
4. (a) Write down the green synthesis of the following compounds:
- (i) Catechol
- (ii) Polylactic acid.
- Also give the conventional synthetic route and explain why the conventional method is not green.

- (b) What are the advantages of biocatalysts over heavy metal catalysts?
- (c) Discuss the application of enzymes in the industrial process by taking the example of Adipic acid.
- (d) What are VOC's? What are its greener alternatives?

2 x 4,2,2,3

5. (a) What is green chemistry?

(b) How is Green Chemistry need of the hour?

(c) Write down twelve principles of green chemistry and briefly discuss any two principles with suitable example.

(d) How do chlorofluorocarbons (CFCs) and  $N_2O$  deplete the ozone layer? Explain this with relevant chemical reactions.

2,2,7,4

6. (a) Write short notes on any *four* of the following:

(i) Solventless processes.

(ii) Analytical techniques to minimize the generation of hazardous substances in chemical processes.

(iii) Waste or pollution prevention hierarchy.

(iv) Aqueous phase reactions.

(v) Inherent safer designs to prevent chemical accidents.

(vi) Green Chemistry in sustainable development.

(b) Discuss the role of tellurium in organic synthesis.

3 x 4,3