[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 49 **G**

Unique Paper Code : 235466

Name of the Paper : MAPT-404 : Differential Equations (Mathematics–IV)

Name of the Course : **B.Sc. (H) Comp. Sc./B.Sc. (Appl. Phy. Sc.) Analytical Chemistry/Industrial Chemistry/ B.Sc. Mathematical Science/ B.Sc. Physical Science**

Semester : IV/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 **two** parts from each question.
3. **All** questions are compulsory.
4. Marks are indicated against each question.

P.T.O.

UNIT – 1

1. (a) Solve the initial value problem

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

(6½)

(b) Solve

$$(3x^2y^4+2xy)dx+(2x^3y^3-x^2)dy=0.$$

(6½)

(c) Solve

$$x^2(y-px) = yp^2$$

(6½)

2. (a) Solve

$$\frac{d^3y}{dx^3}-7\frac{dy}{dx}-6y=e^{2x}(1+x).$$

(6½)

(b) Solve

$$x^2\frac{d^2y}{dx^2}-4x\frac{dy}{dx}+4y=4x^2-6x^3.$$

(6½)

(c) Consider the differential equation

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

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

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

(iii) Find the solution that satisfies the conditions $y(1) = 3$, $y'(1) = 2$. Is this solution unique? Justify. (6½)

(a) Use the method of variation of parameters to find the general solution of

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

given that $y = x + 1$ and $y = (x + 1)^2$ are linearly independent solutions of the corresponding homogeneous equation. (6½)

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

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

find a linearly independent solution of the above equation by reducing its order. Write also the General solution. (6½)

(c) A large tank initially contains 50 gal of brine in wh there is dissolved 10 lb of salt. Brine containing 2 lb dissolved salt per gallon, flows into the tank at the ra of 5 gal/min. The mixture is kept uniform by stirrin and the stirred mixture simultaneously flows ou at a slower rate of 3 gal/min. How much salt is there in the tank at any time $t > 0$? (6½)

4. (a) Solve

$$\frac{d^2x}{dt^2} - \frac{dy}{dt} = e^t$$

$$\frac{dx}{dt} + \frac{dy}{dt} - 4x - y = 2e^t \qquad (6½)$$

(b) Solve

$$\frac{dx}{x^2(y^3 - z^3)} = \frac{dy}{y^2(z^3 - x^3)} = \frac{dz}{z^2(x^3 - y^3)}$$

(6½)

(c) Solve

$$(y+z)dx + (z+x)dy + (x+y)dz + 0. \qquad (6½)$$

UNIT – II

5. (a) Obtain the partial differential equation by eliminating the arbitrary function ϕ from the relation

$$z = \phi\left(\frac{xy}{z}\right) \qquad (5½)$$

(b) Find the general solution of the differential equation

$$2y(z-3)p + (2x-z)q = y(2x-3) \qquad (5½)$$

(c) Find the complete integral of the equation

$$p^2q^2 + x^2y^2 = x^2q^2(x^2 + y^2). \qquad (5½)$$

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

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

(b) Show that the first order partial differential equations

$$p = P(x, y), \quad q = Q(x, y)$$

are compatible if

$$\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}. \qquad (6)$$

(c) Reduce the equation

$$r + 2s + t = 0$$

to canonical form. (6)

(4)

This question paper contains 4 printed pages.

Your Roll No. .....

Sl. No. of Ques. Paper : **51** **G**

Unique Paper Code : **235666**

Name of Paper : **Mechanics and Discrete Mathematics (MAPT–606)**

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

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.

1. (a) A particle of mass m oscillates in a line with natural period $2\pi/n$. If an applied periodic force $F\cos pt$ now acts in the line so that the particle is instantaneously at rest at zero time at a distance d from the centre of oscillation, prove that the displacement of the particle at a subsequent time t is:

$$d\cos(nt)+F[\cos(pt)-\cos(nt)]/(n^2-p^2)m \qquad 8$$

(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:

P. T. O.

$$\frac{\mu a}{\sqrt{1+\mu^2}},$$

where μ is the coefficient 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) Derive an expression for radial and transverse components of velocity and acceleration of a particle moving along a plane curve. 8

(b) Mud is thrown off from the tyre of a wheel (radius a) of a car travelling at a speed v, where $v^2>ga$. Neglecting the resistance of the air, show that no mud can rise higher than a height $a+\frac{v^2}{2g}+\frac{ga^2}{2v^2}$ above the ground. 8

(c) A simple pendulum of mass m and length a is hanging in equilibrium. At time $t=0$, a small horizontal disturbing force X comes into operation and continues to act varying with time according to the formula $X=mb\sin 2pt$ where $p^2=g/a$. Find a formula giving the position of the pendulum at any time. 8

3. (a) How many vertices and how many edges do K_n have? For which value of m and n is $K_{m,n}$ regular? 7

(b) Find the adjacency matrix for C_n. 7

(c) Let G be a graph with v vertices and e edges. Let M be the maximum degree of the vertices of G and let m be the minimum degree of the vertices of G.

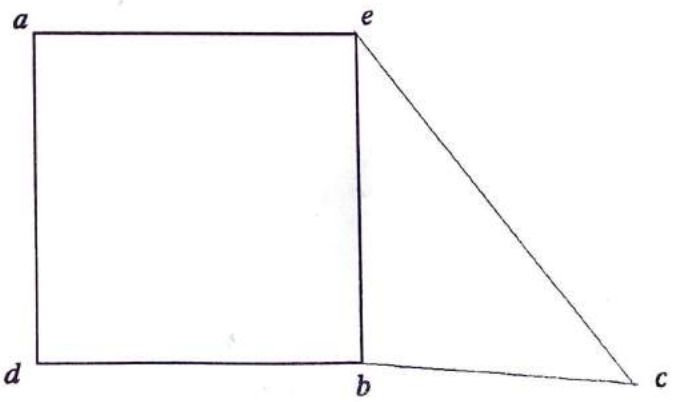
Show that:

(i) $2e/v \geq m$

(ii) $2e/v \leq m$. 7

4. (a) Show that every connected graph with n vertices has at least $(n-1)$ edges. 7

(b) How many paths of length four are there from a to e in the graph G? Identify all the paths. 7

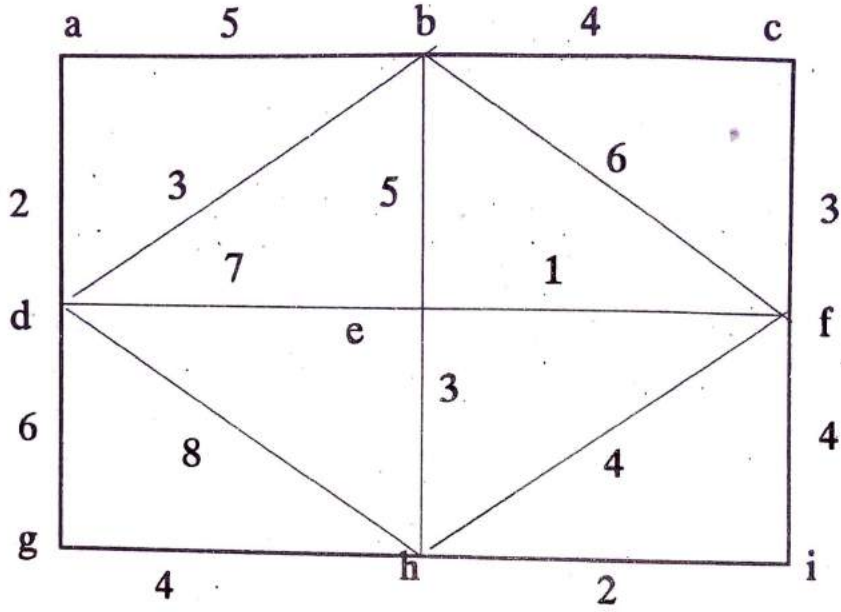


(c) What is the Konigsberg Bridge Problem? Write the graphical representation of this problem. Is it possible to cross all seven bridges in a continuous path without recrossing any bridge? Justify your answer. 7

P. T. O.

5. (a) Prove that an undirected graph is a tree if and only if there is a unique simple path between any two of its vertices. 7 1/2

(b) Use Prim's Algorithm to find a minimum spanning tree for the weighted graph. Also find total weight. 7 1/2



(c) Use Huffman coding to encode their symbols with given frequencies A : 0·10, B : 0·25, 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? 7 1/2

This question paper contains 7 printed pages] (5) 29/5/17

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **54**

Unique Paper Code : **234661** **G**

Name of the Paper : **CSPT-606 Database Management Systems**

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

Semester : **VI**

Duration : **3 Hours** Maximum Marks : **75**

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

Question No. **1** is compulsory.

Attempt any *four* questions out of the remaining Q. No. **2**-Q. No. **7**.

Parts of a question must be answered together.

1. (*a*) Explain any *two* major characteristics of the database that distinguish it more appealing than traditional file processing. 3+3=6

P.T.O.

(*b*) Briefly discuss the function of a catalogue. 3

(*c*) What are DML and DDL commands ? Give an example for each. 5

(*d*) Define the following terms : 2×3=6

(*i*) Multi-valued Attribute

(*ii*) Recursive Relation.

(*e*) Explain the following keys : 2×2=4

(*i*) Primary key

(*ii*) Foreign key.

(*f*) Consider the following database schema : 3

EMPLOYEE(Emp_id, Dept_no, Ename, Salary, Commission)

DEPARTMENT(DNo, Dname)

Write the SQL query to find the employees who earn the same salary as the minimum salary for departments.

(*g*) What are the advantages Normalization ? 3

(*h*) Consider the relation R = {A, B, C, D, E} with the set of functional dependencies as F = {AB → CD, ABC → E, C → A} and X = {ABC}. Find the closure X^+. Is X a key for relation R. 3+2=5

2. (*a*) What are the responsibilities of Database Designers and Administrators ? 3+3=6

(*b*) Explain the concepts of generalization and specialization in EER diagram. 4

3. (*a*) For the following situation draw an ER diagram : 6

A bank offers loan account, saving account and overdraft account. It operates a number of branches. Clients of the bank can have any number of accounts. More than one client may be able to operate a given account. For every

relation specify its attributes, primary keys and foreign keys. Also specify the cardinality ratios.

(*b*) Convert the ER diagram obtained in Q. No. **3 (*a*)** to relational database schema. 4

4. (*a*) Consider the following database schema that keeps track of student enrolment in courses and the books in each course : 3×2=6

STUDENT(S#, Name, Major, Bdate)

COURSE(Course#, Cname, Dept)

ENROLL(S#, Course#, Quarter, Grade)

BOOK_ADOPTION(Course#, Quarter, Book_isbn)

TEXT(Book_isbn, Book_title, Publisher, Author)

Specify the primary key and foreign keys for this schema, stating any assumptions you make, where the symbols have usual meaning.

(*b*) Explain Referential Integrity constraint with help of an example. 4

5. Given the following database schemas where the symbols have usual meaning :

EMPLOYEE(SSN, Name, Salary, DeptNo, Gender, SuperSSN)

DEPT(DNo, DName, MrgSSN)

PROJECT(PNo, PName, Plocation)

WORKS_ON(SSN, PNO, hours)

Write Relational Algebra Expressions for the following :

(*a*) Retrieve the average salary of all employees. 3

(*b*) Retrieve the names of all employees who work in 'Production' department. 3

(*c*) Find the names of employees who are supervised by 'Vishal Sharma'. 4

6. Consider the following schema for company database where the symbols have usual meaning :

EMPLOYEE(SSN, Name, Salary, DeptNo, Gender, SuperSSN)

DEPT(DNo, DName, MrgSSN)

PROJECT(PNo, PName, Plocation)

WORKS_ON(SSN, PNO, hours)

Write SQL statements for the following queries :

(*a*) Find the name and SSN of every employee who works for department number 1 and also works on project number 2. 3

(*b*) Find the name and SSN of everyone who works on every project. 3

(*c*) Show the resulting salary if every employee working on 'DBMS' project is given a 10% raise. 4

7. Consider a relation given below : 6+2+2=10

$R = \{I, J, K, L, M, N\}$

With the following functional dependencies, decompose the given relation into 3NF. Also, find the primary key and prime attributes :

$I \rightarrow J$

$J \rightarrow LN$

$IJ \rightarrow M$

$L \rightarrow N$

(6)

24/5/17

This question paper contains 4 printed pages.

Roll No. .....

Sl. No. of Ques. Paper : **106** **G**

Unique Paper Code : **203291**

Name of Paper : **Technical Writing and Communication in English**

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

Semester : **VI**

Time : **3 hours**

Maximum Marks : **75**

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

All questions are compulsory.

1. Write short notes in about 75 words on any *three* of the following:

   (a) Shortcomings of Written Communication

   (b) Kinesics

   (c) Directions of Communication

   (d) Process of Communication

   (e) Noise. 3×5=15

2. Answer *either* (a) *or* (b):

   (a) Using the thesis statement given, write an essay of 3 paragraphs, in about 200 words:

P. T. O.

Skill oriented education can solve the employability issue of India to a great extent. 20

Or

(b) (i) Using the topic sentence given, write a paragraph of about 100 words:

Social media has changed the lives of youth. 10

(ii) Write the introductory and the concluding paragraph, in about 50 words each, to the passage given below:

Air pollution can further be classified into two sections— visible air pollution and invisible air pollution. Another way of looking at air pollution could be any substance that holds the potential to hinder the atmosphere or the well-being of the living beings surviving in it. The sustainment of all things living is due to a combination of gases that collectively form the atmosphere; the imbalance caused by the increase or decrease of the percentage of these gases can be harmful for survival. 10

3. (a) Prepare the minutes of the meeting of your Departmental Society held to decide about the Department Festival. (No need to write the Notice and Agenda.) 10

(b) Draft a letter to be written to your bank to stop the payment of a cheque which you had issued. 10

4. (a) As a student representative in the Canteen Committee of your College, prepare a report on the changes suggested by students for the betterment of the canteen to be submitted to the Principal. 10

Or

(b) Prepare an Instruction Sheet for students seeking admission in your College. 10

5. Rewrite as directed: 1×10=10

(a) Change the voice:

(i) The waves are washing away the embankment.

(ii) Three thousand people formed the long human chain.

(b) Change the following sentences from direct to indirect speech or *vice-versa*:

(i) Mrs. Khanna said to her husband, "The clean handkerchief is in the cupboard."

(ii) The warden asked if there was enough milk for everyone in the breakfast.

(c) Change the following sentence from negative to affirmative or *vice-versa*:

(i) My book fell off the balcony.

(ii) I had a lot of toys when I was a small kid.

(d) Provide one-word substitute:

1000 years.

(e) Choose the right words to fill in the blanks:

(i) You must study hard ..... you wish to rise high. (if/unless)

(ii) Was she waiting for ..... return? (their/there)

(f) Punctuate:

a child called me and asked uncle where is the zoo

6. The following passage has 10 errors. Identify the errors and correct them. 10

Like other renters, I am tired by renting. One reason is that my annual rent go up like anything. Every year my landlord raises the rent of five percent. Then I never now who is going to be my neighbour. I had all kind of experiences with neighbours. Some of them would get by my nerves through their actions. Once I had to call police as one of my neighbour would drum the whole night with his friends. On a top of it I was told that I was lucky as he was not having his friends that regularly. Millions of people would be happy to have floor on their heads. I wish to have one at my own one day.

(7)

This question paper contains 6 printed pages.

Your Roll No......

Sl. No. of Ques. Paper : **136**

Unique Paper Code : **217661**

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

Name of Course : **B.Sc. (Prog.) Life Sc. / Physical Sc. / Industrial Chemistry / Analytical Chemistry / Agro-chemicals & Pest Management**

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

SECTION A

1. (a) Compound (A) when heated with a soluble chloride and concentrated H_2SO_4 gives orange red vapours of compound (B). When passed through NaOH these vapours give coloured solution (C). Addition of lead acetate to acidified solution of (C) gives yellow coloured precipitate of

compound (D). On addition of H_2O_2 to an acidified aqueous solution of compound (A), a blue colour of compound (E) develops in solution which can be extracted in ether. Identify (A) to (E) and also give chemical reactions involved.

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

(i) Alkaline solution of CrO_5 is treated with H_2O_2

(ii) Sodium nitroprusside is treated with sodium sulphide

(iii) $CoCl_2$ is treated with $NaNO_2$ in the presence of acetic acid.

(iv) A vigorous stream of air is drawn through a solution of $COCl_2$ containing ammonia, ammonium chloride and activated charcoal

(v) $KMnO_4$ reacts with a ferrous salt in acidic medium? 7·5,5

2. (a) What are organometallic compounds? Which of the following are not organometallic compounds and why?

(i) $[K_2Zn(CN)_4]$

(ii) $(C_2H_5)_2Zn$

(iii) $B(OCH_3)_3$

(iv) $K[Pt(C_2H_4)Cl_3]$

(b) CO has two lone pairs of electrons, one on carbon and the other on oxygen, but, it is always the lone

pair on carbon which is used for bonding and not the one on oxygen. Why?

(c) Explain the term Synergic effect. How does it help in explaining that CO, which has negligible donor properties towards Lewis acids like BF_3, forms stable transition metal carbonyls even with low coordination state of metal.

(d) Draw the structure of Ferrocene. 4,3·5,3,2

3. (a) The symmetric CO stretching frequencies in $[Ti(CO)_6]^{2-}$, $[V(CO)_6]-$ and $[Cr(CO)_6]$ are 1748, 1859, and 2000 cm_{-1} respectively while the symmetric CO stretching frequency for $CO(g)$ is 2143 cm_{-1}. Explain the observations.

(b) Draw the structure of $CO_2(CO)_8$ in solid state and in hexane. Write down one method for its preparation.

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

(i) The number of M–M bonds in $Co_4(CO)_{12}$

(ii) The 3*d* metal in $M(CO)_6$

(iii) The value of *x* in $Mn_2(CO)_x$

(d) Both $Mn(CO)_5$ and $V(CO)_6$ do not follow the 18 e^- rule. While $Mn(CO)^5$ dimerizes to form more stable $Mn_2(CO)_{10}$, $V(CO)_6$ does not. Why? 4,3·5,3,2

4. (a) Explain the term 'active transport' with reference to the working of the sodium potassium pump in the animal cells. What is the source of energy for

the functioning of the pump? Give a diagrammatic representation of the Na – K pump.

(b) Which metal is responsible for blood clotting? How does it help in clotting of blood?

(c) What do you understand by the term bulk elements and trace elements in biological systems? Give suitable examples. 6,3·5,3

Section B

Attempt any three questions.

5. (a) (i) Explain why the C_1-C_2 bond length in naphthalene is shorter than the C_2-C_3 bond length?

(ii) How will you prepare alanine using Strecker synthesis?

(b) What are essential amino acids? Give two examples.

(c) How will you separate a mixture of amino acids using electrophoresis?

(d) (i) Explain the fingerprint region in IR spectroscopy.

(ii) Why are absorption bands formed in UV spectrum instead of sharp peaks? 5,1,2·5,4

6. (a) Explain briefly the Lambert-Beer law.

(b) What is the effect of steric strain on λ_{max}?

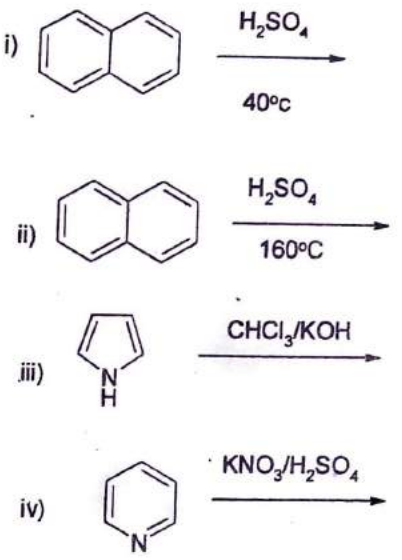
(c) Write short notes on (any *two*):

(i) Merrifield solid phase synthesis

(ii) Edman degradation

(iii) Secondary structure of proteins.

(d) Complete the following reactions:—



2,1·5,5,4

7. (a) (i) Draw the resonating structures of anthracene.

(ii) Explain why pyridine is more basic than pyrrole.

(b) Write down the structure of the complex formed when an amino acid reacts with ninhydrin solution.

P.T.O.

(c) (i) How many peptide bonds are there in a tripeptide?

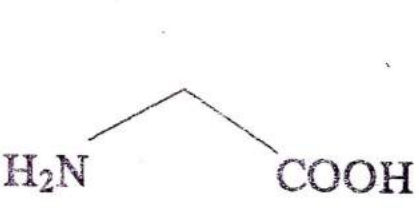
(ii) Define isoelectric point.

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

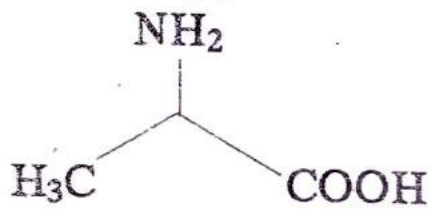
(i) CH_3COOH and $CH_3COOCH_2CH_3$

(ii) CH_3COCH_3 and $CH_3CH_2OCH_3$ 4,2·5,2,4

8. (a) Write the steps required for the synthesis of the dipeptide ala-gly from alanine and glycine.



Glycine



Alanine

(b) Explain why:

(i) The electrophilic substitution occurs preferentially at 2-position in Furan.

(ii) Pyridine undergoes nucleophilic substitution at 2-position.

(c) Explain:—

(i) Chromophore

(ii) Auxochrome.

(d) Explain how hydrogen bonding changes the position of absorption in IR spectroscopy. 4,4,2,2·5

(8)

18/5/19

This question paper contains 4 printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **139**

Unique Paper Code : **217683** **G**

Name of the Paper : **Polymers Science : Industrial Chemistry-VI**

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

Semester : **VI**

Duration : **3 Hours** Maximum Marks : **75**

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

Attempt *six* questions in all.

Question No. **1** is compulsory.

1. (*a*) Give the structural formula(e) of the monomer and various Important uses of the following polymers : 3×(1+1)

(*i*) Buna-S

(*ii*) Polyisobutylene

(*iii*) Nylon 6, 6.

P.T.O.

(*b*) Differentiate between the following types (with suitable examples) : 2×3

(*i*) Thermosetting polymer and Thermoplastic polymer

(*ii*) Block co-polymer and Graft co-polymer.

(*c*) Write the chemical formula of the following commonly named polymers : 3×1

(*i*) Perlon

(*ii*) Nomex

(*iii*) Kevlar.

2. (*a*) Discuss the Number Average Molecular Weight (M_n) of polymers. 3

(*b*) (*i*) Describe the osmotic pressure method for the determination of molecular weight of polymers. 6

(*ii*) Distinguish between Soft foam and Hard foam. 3

3. (*a*) Discuss the kinetics and deduce the general rate equation for step growth polymerisation. 6

(*b*) How the degree of polymerization affects the properties (mainly mechanical) of polymers ? 3

(*c*) Describe the important uses of Poly Tetra Fluoro Ethylene (PTFE). 3

4. (*a*) Explain Glass Transition Temperature (T_g) of polymers. Discuss various factors affecting the T_g of a polymers. 3,3

(*b*) What are the experimental conditions used for preparing low and high density polythenes ? How the two are different ? 2,2

(*c*) Write a brief note on Lower Critical Solution Temperature. 2

5. (*a*) What do you understand by crystalline melting point (CMP) ? Discuss various factors affecting CMP in case of polymers. 3,3

(*b*) How will you synthesize polystyrene from benzene ? 3

(*c*) Examine the criteria for solubility of polymers. 3

P.T.O.

6. (*a*) Write various steps of anionic polymerizations in case of Polystyrene. 5

(*b*) What are conducting polymers ? Give a few examples along with applications of conducting polymers. 1,2,2

(*c*) What is the relationships between functionality and extent of polymerization reaction ? 2

7. Write short notes on (any *three*) : 3×4

(*a*) Plasticizer

(*b*) Preparation and uses of Bakelite

(*c*) Polydispersity index

(*d*) Silicone polymers.

(9)

This question paper contains 4 printed pages] 15/5/17

Roll No. | | | | | | | | | | |

S. No. of Question Paper : 143

Unique Paper Code : 217663 G

Name of the Paper : Instrumentation Methods of Analysis

[ICPT-606]

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

Industrial Chemistry

Semester : VI

Duration : 3 Hours Maximum Marks : 75

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

Attempt *six* questions in all.

Question No. 1 is compulsory.

1. (*i*) What are the factors which affect the viscosity of a liquid ? 3

(*ii*) What is HPLC ? Name the various components in the equipment. 3

(*iii*) Give an account for the qualitative estimation of anions (Cl^- CH_3COO^-, CO_3^{-2}). 3

P.T.O.

(*iv*) What is the significance of chromophores and auxochromes in Ultra Violet (UV) spectroscopy ? Explain with suitable examples. 3

(*v*) Give the principle of any *one* of thermal analytical techniques. 3

2. (*i*) What is the purpose of preparing sodium carbonate extract for identification of anions ? 4

(*ii*) Write short note on electrode-less discharge lamp. 4

(*iii*) What do you understand by monochromatic light ? Discuss the role of monochromator in spectroscopy. 4

3. (*i*) What are the advantages of Induced Couple Plasma Spectroscopy over Flame Spectroscopy. 4

(*ii*) Define chromatography. Give factors affecting R_f value. 4

(*iii*) What is the effect of polar solvents on the shifts of absorption bands in UV-Visible Spectroscopy. 4

4. (*i*) Describe briefly different methods of solvent extraction used for purification of organic compounds. 4

(*ii*) What is chemical shift ? Explain. 4

(*iii*) Explain 'spin-spin relaxation' and 'spin-lattice relaxation'. 4

5. (*i*) Explain Lambert Beer's law. What will be the effect on absorbance if the path length is doubled ? 4

(*ii*) Describe standards (any *two*) : 2×2

(*a*) BTS

(*b*) ISI

(*c*) EURO.

(*iii*) What are the fundamental vibrational frequencies observed in Infra-Red spectrum of CO_2 ? Explain, which of these are active and which are inactive. 4

6. Define the terms (any *three*) : 3×4

(*i*) Chromophore

(*ii*) Bathochromic shift

(*iii*) Auxochrome

(*iv*) Hypsochromic shift.

7. (*i*) Draw a labeled diagram of combination electrode used in pH meter. 4

(*ii*) Mention *two* advantages of conductometric titrations over ordinary titrations. 4

(*iii*) Draw and explain the conductometric titration curve for the following titrations : 2×2

(*a*) HCl *Vs* NaOH

(*b*) CH_3COOH *Vs* NaOH.

[This question paper contains 3 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 145 **G**

Unique Paper Code : 222663

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

Name of the Course : **B.Sc. (Physical 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 **five** questions.
3. **All** questions carry equal marks.

1. (a) What is a Reciprocal Lattice ? Mention its importance . Sketch any one unit cell of a simple cubic lattice and draw the planes : (122), (111), (201). (10)

   (b) Derive an expression for interplanar spacing for a family of parallel planes *(hkl)*. (5)

P.T.O.

2. (a) Define the polarizability of the atoms and molecules. Obtain the Clausius Mossottirelation between polariz ability and dielectric constant of a solid. (2,2,6)

(b) Describe powder method of X-ray diffraction. (5)

3. (a) Discuss the formation of allowed and forbidden energy bands on the basis of Kronig Penny model. (10)

(b) Define the effective mass of an electron and give its physical significance. (5)

4. (a) Distinguish the superconducting state from the normal state of a metal. (5)

(b) What is Meissner effect ? Obtain an expression for the London penetration depth of magnetic field for a superconductor. (3,7)

5. (a) What is β decay ? Explain with full reaction. (2,4)

(b) Polonium - 212 emits an α-particle of 8.776 MeV energy. Calculate the disintegration energy or energy available in the reaction. (3)

(c) Distinguish between nuclear fission and nuclear fusion. (6)

6. (a) What are the salient features of nuclear forces w. r. t. their range and strength. (10)

(b) Write the following reactions by putting appropriate particles on the arrows.

$$_{92}U^{238} \rightarrow {}_{90}Th^{234} \rightarrow {}_{91}Pa^{234} \rightarrow {}_{92}U^{234} \rightarrow {}_{90}Th^{230} \rightarrow {}_{88}Ra^{226}$$

(5)

7. (a) Enumerate five conservation laws obeyed in nuclear reactions in particle physics. (10)

(b) What do you understand by mass defect and binding energy ? (5)

8. (a) Classify various types of elementary particles in reference to their lepton numbers and spin. (10)

(b) Define Baryons. What is Baryon number of nucleons and pions ? (5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 146 G

Unique Paper Code : 216651

Name of the Paper : Applied Biology and Biotechnology-LSPT 613

Name of the Course : **B.Sc. Life Science**

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** in all and Question no. 1 is **COMPULSORY.**

1. (a) Define the following: (05)

   (i) Single-cell protein

   (ii) Ti Plasmid

   (iii) Vaccine

   (iv) Pasteurization

   (v) Transgenesis

P.T.O.

(b) Distinguish between: (10)

(i) Primary and Secondary host

(ii) Type I and Type II restriction endonuclease

(iii) Sporogony and Schizogony

(iv) Embryonic and Adult stem cells

(v) High and Low temperature methods for food preservation

(c) Give reason for the following: (2)

(i) An ideal cloning vector should have selectable marker gene.

(ii) A bacterial cell undergoing chemical transformation needs to be competent.

(d) Expand the following: (03)

(i) pBR322

(ii) BCG

(iii) HGH

(iv) amp^R

(v) SCID

(vi) MCS

(e) Write down the contribution of the following scientists: (05)

(i) Ian Wilmut

(ii) E. M. Southern

(iii) Kary Mullis

(iv) Karl Ereky

(v) Alexander Fleming

(f) Match the following: (02)

Column I	Column II
(i) Ligase	(a) RNA dependent synthesis of DNA
(ii) Phosphatase	(b) Join together DNA fragments
(iii) Klenow fragment	(c) Remove terminal phosphate group
(iv) Reverse Transcriptase	(d) Polymerization of nucleotides

2. (a) Describe the method of industrial production of Glycine and Glutamic acid.

(b) Enumerate the procedure of DNA sequencing by Sanger's method (6,6)

3. (a) Explain with diagram the production of Bt cotton. Give an account on its significance.

(b) Give an account on subunit vaccines with appropriate examples. (7,5)

4. Write the causative agent and symptoms of Malaria. Enlist the factors contributing to the transmission of the parasite and its control. (12)

5. (a) Illustrate the map of pUC19. How are the transformants carrying pUC19 selected?

(b) Briefly describe the method of DNA microarray. Give its applications. (5,7)

6. (a) Add a appr note on gene therapy for Cystic fibrosis. Give an appropriate diagram.

(b) How is the human insulin (Humulin) produced by recombinant DNA technology ? (6,6)

7. Write short notes on the following: (Any **Three**)

(i) Polymerase Chain Reaction

(ii) Molecular diagnosis of sickle-cell anaemia

(iii) Bioremediation

(iv) Japanese Encephalitis

(v) Antibiotics

(4,4,4)

(12)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 148 G

Unique Paper Code : 223653 (LSPT 614)

Name of the Paper : Developmental Biology and Physiology - Animal

Name of the Course : **B.Sc. (Prog.) Life 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 **five** questions in all, **two each** from Section A and Section B. Question No. 1 is **compulsory.**

1. (a) Define the following terms:

   (i) Muscle twitch

   (ii) Bohr effect

   (iii) Ovulation

   (iv) Epiboly

P.T.O.

(v) Blastula (5)

(b) Differentiate between the following pairs of terms:

(i) Determinate and Indeterminate cleavage

(ii) Tachycardia and Bradycardia

(iii) Cortical and Juxtamedullary Nephrons

(iv) Centrolecithal and Telolecithal eggs

(v) Peristalsis and Segmentation (10)

(c) Expand the following terms :

(i) PNS

(ii) CCK

(iii) ECM

(iv) ERV (4)

(d) Give the location and function of the following:

(i) β cells

(ii) Grey crescent

(iii) Sarcoplasmic reticulum

(iv) Graffian follicle (8)

SECTION A

(Attempt any two questions)

2. (a) What is polyspermy? Explain the mechanism of slow block to polyspermy.

(b) Give a brief account of the various planes of cleavage. (8+4)

3. (a) Give an account of gastrulation in chick embryo.

(b) Explain the mechanism of oogenesis in human females. (8+4)

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

(i) Acrosomal reaction

(ii) von Baer's Principles

(iii) Extra embryonic membranes in amniotes

(iv) Fertilization in mammals (4+4+4)

SECTION B

(Attempt any two questions)

5. (a) Describe the mechanical events in cardiac cycle.

(b) Write a short note on "All or none principle" (9+3)

6. (a) Explain the molecular mechanism of muscle contraction.

(b) Illustrate the process of protein digestion in the alimentary canal. (8+4)

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

(i) Oxy-hemoglobin curve

(ii) Calcium homeostasis

(iii) Renin - Angiotensin system

(iv) Conduction in medullary nerve fibres (4+4+4)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 151 **G**

Unique Paper Code : 222665

Name of the Paper : Communication Electronics
ELCT-602

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) Why is modulation necessary in electronic communication? Explain the terms modulation and demodulation. (7)

   (b) The Fourier series for the saw-tooth wave is (8)

$$V(t) = \frac{V}{2} - \frac{V}{\pi}\left(\sin\omega t + \frac{1}{2}\sin 2\omega t + \frac{1}{3} + \sin 3\omega t + \frac{1}{4}\sin 4\omega t + \ldots\right)$$

P.T.O.

Find seventh harmonic. Draw accurately to scale the spectrum up to the seventh harmonic. What is the value of the dc component?

2. (a) Define amplitude modulation and modulation index. Find the equation for the amplitude modulated wave and draw its frequency spectrum. (8)

(b) A carrier wave is given by (7)

$$V_c = 5.0 \times \cos(6 \times 10^6 \times t)$$

This carrier is amplitude modulated by a baseband signal given by

$$V_m = 3.0 \times \cos(100t)$$

Find the spectrum of AM signal so generated. Also find the value of modulation index.

3. (a) Explain Phase-Shift method for SSB generation. (7)

(b) A single tone FM is represented by the voltage equation given as (8)

$$V(t) = 12Cos(6\times10^8 t + 5Sin1250t)$$

Determine

(a) Carrier Frequency

(b) Modulating Frequency

(c) Modulation Index

(d) Maximum Deviation

(e) What Power will this FM wave dissipate in 10Ω resistance?

4. Describe demodulation of frequency modulated signal by Foster-Seeley discriminator. (15)

5. (a) Draw the block diagram of Super-heterodyne receiver and explain the function of each block. (9)

(b) Differentiate between PAM, PPM and PWM using proper diagrams. (6)

6. (a) Give the block diagram for TDM and explain its functioning. (9)

(b) Define ASK, PSK and FSK and explain with the wave form obtained from binary signal in each case. (6)

7. (a) What do you understand by satellite communication? Explain why geostationary satellites are used for worldwide communications, in preference to any other kind. (9)

(b) Draw and explain the block diagram of a satellite transponder. (6)

8. Write a short note on any two of the following: (7½+7½)

(a) AM transmitter

(b) Diode detector

(c) Cellular telephone system

(d) Optical fibre communication

(14)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 152 **G**

Unique Paper Code : 216655

Name of the Paper : Ecology and Environmental Management (LSPT-615)

Name of the Course : **B.Sc. Life 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 **five** questions in all.
3. **Question No. 1** is compulsory.
4. **All** questions carry equal marks.
5. **All parts** of a question must be answered together.

1. (a) Explain the following terms (any **five**): (5×1=5)

   (i) Biome

   (ii) Niche

   (iii) Heliophytes

P.T.O.

(iv) Cryopreservation

(v) Natality

(vi) Secondary air pollutant

(b) Fill in the blanks. (any **five**) (5×1=5)

(i) _____ and _____ are two components of ecosystem.

(ii) _____ is the instrument to measure light intensity.

(iii) _____ is a process of successful establishment of a species in a bare area.

(iv) _____ is the study of relation between organism and their natural environment.

(v) _____ is an example of an insectivorous plant.

(vi) _____ is the book listing threatened and endangered species of plants and animals.

(c) Expand the following. (any **five**) (5×1=5)

(i) CITES

(ii) EPA

(iii) CBD

(iv) UNESCO

(v) BSI

(vi) UNEP

(vii) IUCN

2. Differentiate between the following. (**any three**) (3×5=15)

(a) National Parks and Sanctuaries

(b) Primary and Secondary succession

(c) Food chain and Food Web

(d) Habitat and Niche

(e) Tundra and Taiga

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

(i) Global Climate change

(ii) Raunkiaer's life forms

(iii) Hydrological cycle

(iv) Soil Profile

(v) Theory of Tolerance

4. (a) Define a population. Discuss the various attributes of a population. (7)

(b) Give a detailed account of vegetation of India. (8)

5. (a) Discuss in detail the methods and processes involved in Environmental Impact Assessment (EIA). (7)

(b) What are the various sources and effects of water pollution? (8)

6. (a) What is biodiversity? List the various causes for loss of biodiversity. (8)

(b) Discuss the various stages in a Xerosere. (7)

7. (a) Define Ecosystem. Discuss the flow of energy in an ecosystem with an illustrated diagram. (8)

(b) Discuss wind as an ecological factor.

[This question paper contains 4 printed pages.]

(15)

Your Roll No.....

Sr. No. of Question Paper : 153 **G**

Unique Paper Code : 234663

Name of the Paper : CSCT-602 Multimedia Systems and Applications

Name of the Course : **B.Sc. Physical Science**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instruction for Candidates:

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Question 1** is compulsory.
3. Attempt **any 5** questions from Section B

Section A

1. (i) What is the content type of a WAV format file? (1)

   (ii) What are the two main features of a typical multimedia project? (2)

   (iii) List any two sound editing operations. (2)

P.T.O.

(iv) Differentiate between UTF-32 and UTF-16 (2)

(v) Define non-linearity in multimedia. (2)

(vi) Differentiate between Text and Rich Text. (2)

(vii) Differentiate between Cel animation and Path animation. (3)

(viii) Distinguish between anchor and target document. (3)

(ix) What are the different competing sets of standards for data recording on DVD? (2)

(x) What is OMR and how it is used? (2)

(xi) Differentiate between Lossy and Lossless compression techniques. (4)

Section B

2. (i) Explain any two components of multimedia. (4)

(ii) Explain the role of multimedia in education and in medical field. (6)

3. (i) Distinguish between

(a) Image and graphics

(b) Video and animation (4)

(ii) Differentiate between CRT and LCD projectors. (6)

4. (i) Write the full form of the following file formats:

BMP, JPEG, PNG, GIF

Also mention where each is used. (6)

(ii) Differentiate between RGB and CMYK color models (4)

5. (i) How the CD-ROM format is different from CD-DA format? What is Mode 1 and Mode 2? (6)

(ii) What is time code? (4)

6. (i) What is digital video? Explain the uses of digital video in developing Multimedia application. (6)

(ii) List and explain the four important features of a 3D modeling software? (4)

7. (i) Write about two different types of authoring tools available in the market. (4)

(ii) Differentiate between the pan, orbit and track camera movements. (6)

8. (i) Write Short notes on

(a) Rendering

(b) Microphone (6)

(ii) Explain the concept of device independent audio. (4)