(1)

[This question paper contains 8 printed pages.]

15/5/18

Your Roll No. .....

Sr. No. of Question Paper : 6801 **HC**

Unique Paper Code : 42341202

Name of the Paper : Database Management Systems

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

Semester : II

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 **5** questions from **Section B.**

Section A

1. (a) Give two reasons for including class/subclass relationships and specialization in a data model? (2)

   (b) "Primary key is a minimal super key". Justify. (2)

(c) Draw the symbol used in ER diagram for following :

(i) Weak entity

(ii) Key Attribute

(iii) Total Participation of an entity in a relationship (3)

(d) What is the use of cascade in following SQL statement?

DROP TABLE DEPENDENT CASCADE. (1)

(e) Mention the cardinality ratio in the following :

(i) Actors perform in movies

(ii) An Instructor teaches at most one course

(iii) Many musicians perform in an concert

(iv) A painter paints many paintings (4)

(f) Given a relational schema R (A,B,C,D,E) with Functional dependencies (FDs)

F = {A→B, B→C, AC→D, AC→BC}. Identify :

(i) a functional dependency in F that is a consequence of the augmentation rule

(ii) a new functional dependency that can be obtained from FDs in F using the transitivity rule (3)

(g) A STUDENT table has following two attributes Rollno and Course. Write an SQL statement to insert a new attribute Grade to the STUDENT table. (1)

(h) What is meta data? (1)

(i) What are canned transactions? (1)

(j) What are the responsibilities of DBA and database designers? (2+2)

(k) What is a transaction? List any two properties of a transaction. (1+2)

Section B

2. (a) What is a ternary relationship? Illustrate with an example. (1+3)

(b) Illustrate the following constraints on specialization using a diagram in each case.

(i) Disjoint, total

(ii) Overlapping, partial (2+2)

(c) We can convert any weak entity set to a strong entity set by simply adding appropriate attributes. Why, then, do we have weak entity sets? (2)

3. (a) Draw the diagram of three-schema architecture of DBMS. (2)

(b) Identify multivalued and composite attributes from the following complex attribute, If any

{Address_phone({ Phone(Area_code, Phone_number)},

Address (Street_address (Number, Street, Apartment_number), City, State, Zip)) } (4)

(c) How does a category differ from a regular shared subclass? (4)

4. (a) Consider the two tables T1 and T2 as shown below :

T1

P	Q	R
10	a	5
15	b	8
25	a	6

T2

A	B	C
10	b	6
25	c	3
10	b	5

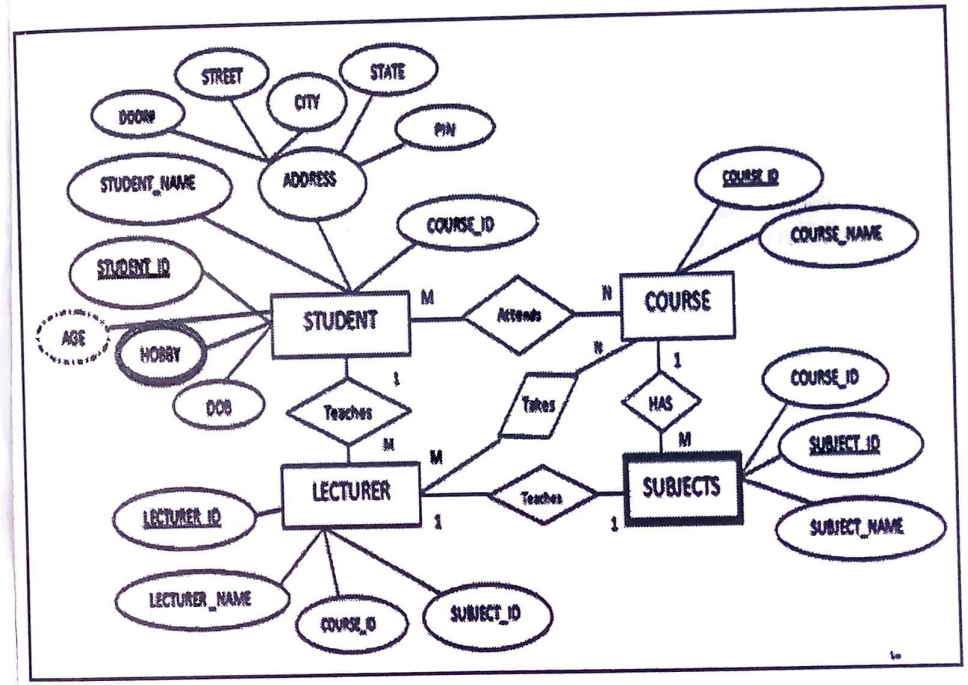
Show the results of the following operations :

(i) T1 Union T2

(ii) T1 Join $_{T1.Q=T2.B}$ T2

(iii) T1 Minus T2 . (3)

(b) Consider the following ER Diagram



Map it into relations taking into account different entity types, relationships and attributes. (7)

5. (a) For a relation R(A,B,C,D) with given dependency set F = {A→BC, BC→D}

(i) Find the primary key for the relation R

(ii) Identify the normal form in which given relation exists as of now. Justify your answer.

P.T.O.

(iii) Normalize R till 3NF, if not already in 3NF. (1+2+2)

(b) For the given table in its current state, write down its cardinality and identify two candidate keys.

EMP-SSN	EMP-Name	Date of Birth	Telephone
S1	Smith John	11/03/1987	9999999999
S2	May Helen	12/04/1980	9999999988
S3	Brit Paul	12/04/1980	8899999999
S4	Annie W	01/10/1976	9999999777
S5	Brit Paul	01/10/1977	9999999999

(1+2)

(c) How are spurious tuples generated? (2)

Refer the following COMPANY database for the Q 6 and Q 7.

EMPLOYEE (Name, Ssn, Bdate, Address, Gender, Salary, SuperSsn, Dno)

DEPARTMENT(Dname, Dnumber, MgrSsn, MgrStartDate)

DEPENDENT(Essn, DependentName, Gender, Bdate, Relationship)

PROJECT(Pname, Pnumber, Plocation, Dnum)

WORKS_ON(Essn, Pno, Hours)

6. (a) Answer the following queries using relational algebra.

(i) Retrieve the names and addresses of all the employees who work for 'Administration' department.

(ii) Retrieve the names of the employees who have no dependents.

(iii) Find the names of the employees who work on all the projects controlled by department number 10.

(iv) Retrieve the social security numbers of employees who either work in department No. 2 or directly supervise an employee who works in department No. 2. (4×2)

(b) Illustrate the division operator of relational algebra by taking a suitable example. (2)

7. Answer the following queries using SQL.

(i) Give a 10 percent raise in salary of all empolyees.

(ii) Update the address of employees living in 'Mumbai' to 'Delhi'.

(iii) For each project on which more than two employees work, retrieve the project number and the number of employees who work on that project.

(iv) Retrieve the names of all employees who do not have supervisors identified by SuperSsn.

(v) For each department, retrieve the department number, number of employees in the department and their average salary. (5×2)

8. Differentiate the following :

(i) Entity and Referential Integrity

(ii) Procedural and Nonprocedural DML

(iii) Logical and Physical Data Independence

(iv) Database State and Database Schema

(v) Total and Partial Dependency (5×2)

[This question paper contains 4 printed pages.]

2018

Your Roll No.....

Sr. No. of Question Paper : 6803

Unique Paper Code : 42351201

Name of the Paper : Calculus and Geometry

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

Semester : II

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 of each part are indicated.

1. (a) Let f be a function defined by

$$f(x)=\begin{cases}\dfrac{e^{1/x}-1}{e^{1/x}+1}, & x\neq 0\\ 0, & x=0\end{cases}.$$

P.T.O.

Show that f is discontinuous at $x = 0$. State the kind of discontinuity. (6)

(b) Use (ϵ, δ) definition to show that (6)

$$\lim_{x \to 4} x^2 = 16 .$$

(c) Show that the function f defined by $f(x) = \sqrt{x}$ is uniformly continuous in [0,1]. (6)

2. (a) Discuss the differentiability of the function f defined by $f(x) = |x| + |x - 1|$ at $x = 0,1$. (6)

(b) State Lagrange's Mean Value Theorem. Verify the theorem for the function $f(x) = x(x-1)(x-2)$ in

$$\left[0, \frac{1}{2}\right].$$ (6)

(c) Find the asymptotes of the curve

$$x^3 + x^2y - xy^2 - y^3 - 2x^2 + 2y^2 + x + y + 1 = 0.$$ (6)

3. (a) Find the open intervals on which $f(x) = 3x^4 - 4x^3$ is concave up and concave down. Also determine the points of inflexion, if any. (6)

(b) Find the position and nature of multiple points of the curve given by $x^4 + y^3 - 2x^3 + 3y^2 = 0$. Also, find tangent(s) at the origin, if any. (6)

(c) Trace the curve $x = a\cos^3\theta$, $y = a\sin^3\theta$; $0 \le \theta \le 2\pi$. (6)

4. (a) Obtain the reduction formula for $\int_0^{\pi/2} \sin^n x\,dx$. Hence evaluate $\int_0^{\pi/2} \sin^5 x\,dx$. (7)

(b) Sketch the curve $x^2y^2 = x^2 - a^2$. (7)

(c) Sketch the polar curve $r = 2 + 3\cos\theta$, $0 \le \theta \le 2\pi$. (7)

5. (a) Find the volume of the solid that results when the region enclosed by $y = x^2$, $y = x^3$ is revolved about the x axis. (6)

(b) Describe the graph of the equation

$$x^2 + 9y^2 + 2x - 18y + 1 = 0.$$ (6)

(c) Find an equation for the parabola that has vertex at (1,1) and directrix $y = -2$. Also, write the reflection property of parabola. (6)

P.T.O.

6. (a) Sketch the curve $xy = 1$. (6½)

(b) (i) Find $\nabla.(\nabla \times F)$ if $F(x, y, z) = e^{xz}i + 3xe^{y}j - e^{yz}k$

(ii) Prove $\text{div}(F+G) = \text{div}F + \text{div}G$ where $F = F(x,y,z)$ and $G = G(x,y,z)$ are vector valued functions. (6½)

(c) Sketch the graph of $z^2 = x^2 + \frac{y^2}{4}$. (6½)

(3)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6912 **HC**

Unique Paper Code : 42511201

Name of the Paper : Linear and Digital Integrated Circuits

Name of the Course : **B.Sc. Program**

Semester : II

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. Attempt **four** questions from the rest of the paper.

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

   (a) Explain what is meant by CMRR in op-amp.

   (b) Which logic gates are known as universal gates and why?

(c) Subtract $(111110)_2$ from $(111000)_2$ using 2's complement method.

(d) State and explain De Morgan's first and second theorem.

(e) How many flip flops are required to construct a mod-64 counter? What is the largest decimal number that can be stored in a mod-32 counter.

(f) What is meant by racing in JK flip flop? List two ways to avoid it.

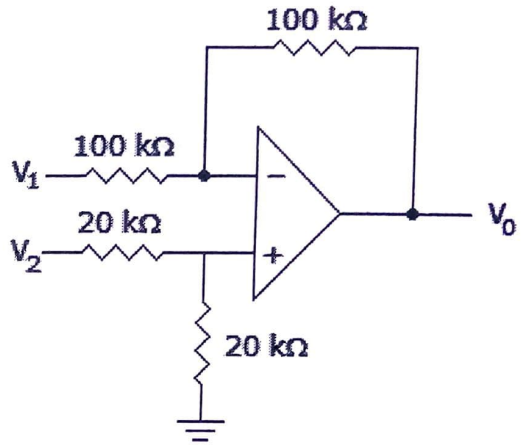
(g) Differentiate between synchronous and asynchronous inputs of a flip flop.

(h) Using Boolean algebra show that

$$\left(\overline{AC}+B\right)\left(\overline{\overline{A}+\overline{C}}\right)=BAC$$

2. (a) Draw the circuit diagram of an op-amp used as an Integrator. Derive the expression for its output voltage. If $R_1\ C_F = 1$ Second in an op amp integrator and a constant voltage of 2 V is applied at the input, determine the output voltage and sketch it. (10)

(b) Find the output voltage for the following circuit if $V_1 = 8V$ and $V_2 = 10\ V$



(5)

3. (a) Derive the expression for the output of an op-amp based summing and averaging amplifier in non-inverting configuration. (8)

(b) Explain with the help of suitable diagram working of a clocked SR Flip flop. Explain how a D flip flop can be made using SR flip flop. (7)

4. (a) Obtain the logic expressions for the sum and carry outputs of a full adder using K-Maps and draw it's NAND equivalent circuit. (10)

(b) Design a full adder using two half adders and one OR gate. (5)

5. (a) Draw the circuit diagram of binary weighed resistor type DAC and explain its working. Explain how R-2R ladder network is advantageous over it. (10)

(b) For a four input R-2R ladder find full scale output voltage and output for digital input 1010. Assume 0 = 0V and 1 = 10 V. (5)

6. (a) Draw the circuit of a 3 bit binary decoder and explain its working. (8)

(b) Simplify the following expression using K-map and hence draw the logic circuit for the simplified expression $F(A,B,C,D) = \Sigma m(1,2,3,4,7,9,10,12)$. (7)

7. (a) Design an asynchronous MOD-8 counter using JK flip flops and explain its working. (8)

(b) Draw the circuit for 4 bit serial in parallel out shift register and explain its working. (7)

This question paper contains 4+1 printed pages] 18/5/18

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

S. No. of Question Paper : **6913**

Unique Paper Code : **42221201** **HC**

Name of the Paper : **Electricity, Magnetism and EMT**

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

Semester : **II**

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.

Q. No. **1** is compulsory. Attempt *four* questions from the rest of paper.

Use of non-programmable scientific calculator is allowed.

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

(*a*) Show that :

$$\nabla r^n = nr^{n-2}\vec{r}\,.$$

(*a*) If $\vec{r}$ is the position vector, show that $\iint_S \vec{r}\,.\,\hat{n}\,dS = 3\,V$, where V is the volume enclosed by the surface S.

P.T.O.

(*c*) Show that the work done in moving an electric charge in an electric field is path independent.

(*d*) What is the magnitude of a point charge so that the electric field 50 cm away has a magnitude 2.0 N/C ?

(*e*) Explain the term potential gradient and establish the relation $\vec{E} = -\vec{\nabla} V$.

(*f*) A magnetic vector potential $\vec{A}$ is given by $3x^3\hat{i} + yz\hat{j}$. Obtain $\vec{B}$, the magnetic field at the point (1, 3, 5).

(*g*) What is the significance of Lenz's law ?

2. (*a*) Express Gauss Divergence theorem in words and write it in differential form. 3

(*b*) A vector field is given by $\vec{A} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$. Is this field irrotational ? If so, find its scalar potential. 5

(*c*) Evaluate $\iiint_R (x^2 + y^2 + z^2)dx\,dy\,dz$, where R denotes the region bounded by $x = 0$, $y = 0$, $z = 0$ and $x + y + z = a$, $(a > 0)$. 7

3. (*a*) State and prove Gauss's theorem of electrostatics. 5

(*b*) Use Gauss's law to find the electric field due to an infinite length of wire of linear charge density λ. 6

(*c*) Three charges, each equal to q, are placed at the three corners of a square of side a. Find the electric field at the fourth corner. 4

4. (*a*) What is dipole moment ? Obtain an expression for the potential and field due to an electric dipole. 6

(*b*) Prove that the energy stored in an electric field is given by : 5

$$\frac{1}{2}\varepsilon_0 \iiint_{\text{all space}} E^2\, d\tau.$$

(*c*) A potential of 50 V is applied between two parallel plates of a capacitor which are 4 cm apart. Obtain the force acting on charge of 4.3×10^{-7} C placed between the plates. 4

5. (*a*) State the Biot-Savart Law. Using the Biot-Savart Law, find the magnetic field along the axis of a circular current loop of radius '*a*' carrying current I. 7

(*b*) The magnetic field $\vec{B}$ due to a current carrying circular loop of radius 12 cm at its centre is 0.5×10^{-4} T. Find the magnetic field due to this loop at a point on the axis at a distance of 5.0 cm from the centre. 3

(*c*) Find the capacitance of two concentric spherical shells, with radii a and b ($> a$). 5

6. (*a*) Define self inductance. Does it depend on the geometry of the circuit ? Find the self inductance of a solenoid of radius R and n number of turns per unit length. 7

(*b*) Derive the expression for mutual inductance of concentric solenoids. 5

(*c*) Derive the expression for the energy stored in the magnetic field of an inductor. Find the energy stored in the magnetic field for a 60 mH coil carrying a current of 3A. 3

7. (*a*) Obtain the wave equation for electric and magnetic field vectors in free space and show that electromagnetic waves are transverse in nature. 7

(*b*) Write Maxwell's equations for electromagnetic field in integral form and explain their physical meaning. 5

(*c*) Show that equation of continuity is a consequence of Maxwell's equation. 3

Physical Constants :

$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2/N\text{-}m^2$

$\mu_0 = 4\pi \times 10^{-7}$ Wb/A-m

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

$c = 3 \times 10^8$ m/s.

(5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6914

Unique Paper Code : 42171209

Name of the Paper : Fossil Fuels, Cleansing Agents and Food Additives

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

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

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

1. Answer any **five** of the following : (5×3)

   (i) What are detergent binders?

   (ii) Define the term Artificial Sweeteners and write the structure of any two of them.

   (iii) Give the advantage of synthetic detergents over soap.

P.T.O.

(iv) Give the properties of lubricants.

(v) Define Reforming of Gasoline. Why is it done?

(vi) Give the composition and uses of water gas and producer gas.

2. (i) Give the composition of crude petroleum. What is the principle of Fractional Distillation? Give the uses of any two fractions obtained after Fractional Distillation of crude petroleum.

(ii) Define surfactants and give their classification with examples. What is the main drawback associated with Alkyl Benzene Sulphonates (ABS) and how is it solved? (2×6)

3. (i) Define Viscosity Index of Lubricants and give methods for its determination.

(ii) What is meant by Calorific value of a fuel? How is it determined?

(iii) Discuss Hydro gasification and Catalytic gasification of coal. (3×4)

4. (i) Discuss about additives used in the manufacture of soap.

(ii) How can we increase the anti-knocking capacity of a fuel?

(iii) Give the classification of oil.

(iv) Write a note on production of vinyl acetate. (4×3)

5. Write short notes on : (4×3)

(i) Food Preservatives

(ii) Food Coloring Agents

(iii) Clean Fuel

(iv) Requirement of an efficient metallurgical coke

6. Differentiate between : (4×3)

(i) Oils and Fats

(ii) Solid and Semisolid lubricants

(iii) Renewable and Non-renewable sources of energy

(iv) Thermal and Catalytic cracking

7. (i) Define Saponification number and mention its importance.

(ii) Explain the different types of carbonization of coal.

(iii) Define Cloud point and Pour point and give a method for determination of any one of them.

(iv) Give the preparation of isoprene and its uses.

(4×3)

8. (i) What are the uses of coal tar products?

(ii) What are petrochemicals? Give their uses.

(iii) What is hydrolytic and oxidative rancidity? Explain.

(iv) What are the different methods employed for fat splitting?

(4×3)

(6)

[This question paper contains 4 printed pages.]

2018

Your Roll No. .....

Sr. No. of Question Paper : 6915 **H.C**

Unique Paper Code : 42351211

Name of the Paper : Mathematics-I : Calculus and Matrices : MAPT-101

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

Semester : II

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** questions from each section.

SECTION I

1. (a) Define a basis of vector space. Show that the set $S=\{(1,0,1),(1,1,1),(1,2,4)\}$ is a basis for R^3.

   (b) Let $T: R^3 \to \mathbb{R}^2$ be a linear transformation such that $T(1,0,1) = (2,-1)$, $T(0,1,1) = (1,1)$, $T(1,1,0) = (-1,4)$. Find $T(2,-1,1)$. (6,6)

P.T.O.

2. (a) Define Rank of matrix. Reduce the matrix $A=\begin{bmatrix}5 & 3 & 14 & 4\\ 0 & 1 & 2 & 1\\ 1 & -1 & 2 & 0\end{bmatrix}$ to triangular form by elementary row operations and hence determine its rank.

(b) Find the characteristic equation, eigenvalues and eigenvectors for the matrix $A=\begin{bmatrix}-1 & 0 & 0\\ -1 & 3 & 0\\ 3 & 2 & -2\end{bmatrix}$. (6,6)

3. (a) Examine which of the following is a subspace of R^2? If it is a Subspace, give its geometric representation :

(i) $V_1=\{(a,b^2):a,b\in R\}$

(ii) $V_2=\{(a,2a):a\in R\}$

(b) Solve the system of equations :

$x+y+z=6$

$2x+3y+4z=20$

$x+y=z$ (6,6)

SECTION II

4. (a) Sketch the graph of the function $y=\frac{1}{2}x^2-3x+\frac{11}{2}$.

(b) A certain culture of bacteria grows at a rate that is proportional to the number present. It is found that the number doubles in 4 hours, how many may be expected at the end of 24 hours ?

(c) Find the n^{th} derivative of $y=\frac{x}{1+3x+2x^2}$. (6,6,6)

5. (a) Verify which of the following sequences are monotonic and bounded :

(i) $\{n-2^n\}$ (ii) $\left\{\frac{n!}{n^n}\right\}$.

(b) Show that : $u(x,t)=\sin(x+ct)+\cos(3x+3ct)$ is a solution of wave equation $u_{xx}=e^2u_{tt}$

(c) If $u=f(r)$ where $r=\sqrt{x^2+y^2}$

Show that $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=f''(r)+\frac{1}{r}f'(r)$. (6,6,6)

6. (a) If $y=\sin(m\sin^{-1}x)$, show that :

$(1-x^2)y_{n+2}=(2n+1)xy_{n+1}+(n^2-m^2)y_n$

(b) Find the Taylor series generated by $f(x)=\frac{1}{x}$ at $x=2$.

When does this series converge to $\frac{1}{x}$?

P.T.O.

(c) Draw the level curves of height k=1,2,5 for the surface $f(x,y) = 9x^2 + 25y^2$. (6,6,6)

SECTION III

7. (a) Give the geometrical representation of the sum of two complex numbers.

(b) State the Fundamental Theorem of Algebra. Also form an equation in lowest degree with real coefficients which has $2-3i$, $3+2i$ as two of its roots. (3.5,4)

8. (a) Use De Moivre's Theorem to solve the following equation

$$z^3 + 1 = 0.$$

(b) If $x = \cos\theta + i\sin\theta$ and $y = \cos\varnothing + i\sin\varnothing$, prove that :

$$\frac{x-y}{x+y} = i\tan\frac{\theta-\varnothing}{2}.$$ (4,3.5)

9. (a) Find the centre and radius of the circle whose equation is

$$|z-i| = 3|z+i|.$$

(b) Prove that $|z_1+z_2|^2 + |z_1-z_2|^2 = 2\left(|z_1|^2 + |z_2|^2\right)$ for any two complex numbers z_1 and z_2, also interpret the result geometrically. (3.5,4)

[This question paper contains 4 printed pages.]

Your Roll No. ....

Sr. No. of Question Paper : 6916 HC

Unique Paper Code : 42231202

Name of the Paper : Comparative Anatomy & Developmental Biology of Vertebrates

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

Semester : II

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.** Q. No. **1** for each section is compulsory.
3. Use separate sheets for **Section A** and **Section B.**

SECTION A

1.(i) Define the following terms :

(a) Infundibulum

(b) Vasa deferentia

P.T.O.

(c) Carnassial tooth

(d) Iter (4)

(ii) Differentiate between :

(a) Unguligrade and digitigrade

(b) Claws and nails

(c) Larynx and syrinx

(d) Lamelliform and filliform gills

(e) Ductus arteriosus and Ductus caroticus (10)

2. (a) Discuss the fate of first and second visceral arches in vertebrates.

(b) Justify the statement Integument is Jack of all trades. (8,4)

3. (a) What are receptors? Classify them with suitable examples.

(b) Briefly describe the structure and function of air sac in birds. (8,4)

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

(a) Aortic Arches

(b) Ruminant stomach

(c) Dentition in mammals

(d) Swim bladder (4,4,4)

SECTION B

(To be answered on separate sheet)

1. (a) Define the following terms :

(i) Determination

(ii) Implantation

(iii) Morphogenesis (3)

(b) Differentiate between the following pairs of terms :

(i) Deciduate placenta and non-deciduate placenta

(ii) Invagination and Involution

(iii) Rotational cleavage and Radial cleavage (6)

(c) Fill in the blanks :

(i) Fast-block to polyspermy involves change in _____ .

(ii) Acrosome of spermatozoon is derived from _____ .

(iii) Set of physiological changes by which the sperm becomes competent to fertilize the egg is called _____ .

(iv) Type of morphogenetic movement that leads to the formation of ectoderm is _____ . (4)

2. (a) What is a cortical reaction? Discuss its role to block polyspermy.

(b) Explain the process of oogenesis in humans. (4,8)

3. (a) Describe the development of frog from fertilized egg to gastrula with the help of suitable diagrams.

(b) Explain the process of yolk synthesis in birds. (8,4)

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

(i) Acrosome reaction

(ii) Biochemical changes in frog metamorphosis

(iii) Egg activation in mammals

(iv) Spermiogenesis (4,4,4)

(8)

[This question paper contains 6 printed pages.]

Your Roll No......

Sr. No. of Question Paper : 6917 **HC**

Unique Paper Code : 42161201

Name of the Paper : Plant Ecology and Taxonomy

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

Semester : II

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 **Section A** and **Section B** on Separate Sheets.
3. Question No. **1** is compulsory in both **Section A** and **Section B.** Attempt any **three** questions from **Section A** and any **three** questions from **Section B** including question number **1.**
4. **All** parts of questions must be attempted together.

Section A

1. (a) Fill in the blanks (Any 5) : (5×0.5=2.5)

(i) The thin top layer on the earth's crust comprising rock particles mixed with organic matter is called _____.

P.T.O.

(ii) In _____ the perennating buds are present on the erect shoots or twigs much above the ground level and they are least protected.

(iii) The shape of the pyramid of energy is always _____ .

(iv) The system resulting from the integration of all the living and non-living factors of the environment is called _____ .

(v) _____ is the development of bare area without any form of life.

(vi) The phenomenon of increased variety of plants as well as animals at the community junction is called _____ .

(b) Define the following **(any 5)** : (5×1=5)

(i) Hygroscopic water

(ii) Edaphic factor

(iii) Trophic level

(iv) Phytogeography

(v) Heliophytes

(vi) Consumers

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

(a) Primary and secondary succession

(b) Autotrophs and heterotrophs

(c) Pyramid of number and pyramid of biomass

(d) Density and frequency

(e) Food chain and food web

(f) Gravitational water and runaway water

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

(a) Thermal stratification in water bodies

(b) Biogeochemical cycle of phosphorus

(c) Analytical quantitative characters used to study a community

(d) Shelford's law of tolerance

4. (a) What is endemism? Define various forms of endemism. (5)

(b) What is soil weathering? Describe various chemical processes responsible for soil weathering. (5)

P.T.O.

(c) What is ecological succession? Explain the process of stabilisation/climax. (5)

Section B

1. (a) Give one word answer **(any 5)** : (5×0.5=2.5)

(i) Suffix used for the rank class

(ii) Type genus for Gramineae

(iii) Size of a standard herbarium sheet

(iv) Verticillaster inflorescence is present in the family

(v) Author of *Species plantarum*

(vi) Name a species for commemoration of a person

(b) Expand the following **(any 5)** : (5×1=5)

ICN, Linn., *sp. nov.*, APG, OTU, nom. nud.

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

(a) Artificial and natural system of classification

(b) Paratype and lectotype

(c) Tautonym and autonym

(d) Genus and species

(e) Bracketed and serial key

(f) Phenogram and cladogram

3. (a) Give the contribution of de Candolle family in taxonomy. (5)

(b) Interpret the following **(any 2)** : (4)

(i) *Carex kashmirensis* Clarke *in* Hook.f.

(ii) *Lupinus* [Tourne.] L.

(iii) *Cynodon dactylon* (Linn.) Pers.

(c) Name the authors who used the following group names in their classification **(any 6)** : (6×1=6)

(i) Ordines anomali

(ii) Monochlamydeae

(iii) Monandria

(iv) Tetradynamous

(v) Embryophyta siphonogama

(vi) Lignosae

(vii) Archichlamydeae

4. (a) What is numerical taxonomy and discuss about its principle ? (7)

(b) Write down the Principle of ICN. (6)

(c) Discuss about the role of cytology in taxonomy with one example. (2)

[This question paper contains 6 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 6921 **HC**

Unique Paper Code : 42171205

Name of the Paper : Chemistry (Chemical Energetics, Equilibria and Functional Group Organic Chemistry – I)

Name of the Course : **B.Sc. Programme**

Semester : II

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. Use of log tables and scientific calculators is allowed.
3. Use separate sheets for **Section A** and **Section B.**

Section A

(PHYSICAL CHEMISTRY)

Attempt **three** *questions from this section.*

Q. No. **1** *is compulsory.*

1. (a) Define :

(i) Integral heat of solution

(ii) Solubility product

(b) State third law of thermodynamics. Why is it important in thermodynamics?

(c) What is the difference between bond enthalpy and bond dissociation energy?

(d) What is the significance of ΔG° ?

(e) Calculate the pH of pure water at 40°C, given that K_w at 40°C is 3.8×10^{-14} M^2.

(f) Briefly explain the application of solubility product principle in purification of common salt.

(2,2,2,2,3,2)

2. (a) Derive the expression for Kirchoff's equation for variation of enthalpy of reaction with temperature.

(b) What will be the pH value of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume to 500 cm^3 ? Given K_a of acetic acid = 1.8×10^{-5} at 25°C.

(c) State Le Chatelier's Principle. Consider the reactions :

(i) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\Delta H^\circ = -92.4$ kJ

(ii) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ $\Delta H^\circ = 12.42$ kJ

What is the effect of increase of temperature and pressure on the course of the above reactions?

(4,5,3)

3. (a) Define heat of formation and heat of combustion of a compound. Calculate the heat of formation of ethyl alcohol, given that heat of combustion of ethyl alcohol is -1380.7 kJ mol^{-1} and the heats of formation of H_2O (l) and CO_2 (g) are -286.6 kJ mol^{-1} and -394.5 kJ mol^{-1} respectively.

(b) Derive the law of chemical equilibrium thermodynamically.

(c) What is the significance of Debye's T-cubed law?

(d) Derive expressions for hydrolysis constant, degree of hydrolysis and pH for salt of weak acid and weak base.

(4,3,1,4)

4. (a) A mixture of solid $SrSO_4$ and solid $BaSO_4$ is shaken up with water until saturation equilibrium is established. Given K_{sp} $(SrSO_4) = 7.6 \times 10^{-7}$ M^2 and K_{sp} $(BaSO_4) = 1.5 \times 10^{-9}$ M^2, calculate the concentrations of Sr^{2+}, Ba^{2+} and SO_4^{2-}.

(b) Starting from the expression for K_p, derive relationships between K_p, K_c and K_x. The value of $K_p^\circ = 2.21 \times 10^{-5}$ at 25°C for the reaction, calculate the value of K_c°.

(c) Propane has the structure $H_3C\text{-}CH_2\text{-}CH_3$. Calculate the change in enthalpy for the following reaction :

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$$

P.T.O.

Given the average bond enthalpies (in kJ mol^{-1}) are :

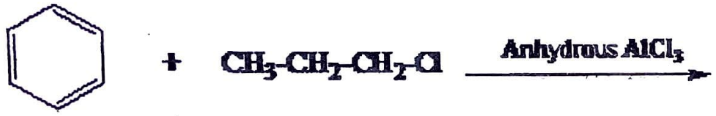
C-C	C-H	C=O	O=O	O-H
347	414	741	498	464

(4,4,4)

Section B
(Organic Chemistry)

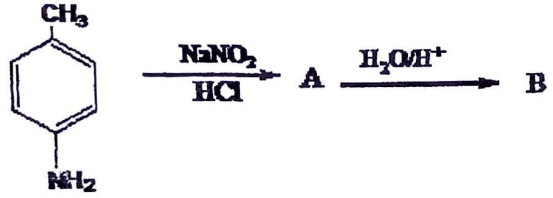
Attempt **three** *questions from this section.*
Q. No. **5** *is compulsory.*

5. (a) Complete the following reactions :

(i) 

(ii) 

(iii) 

(iv) 

(v) 

(b) Give the steps involved in the formation of phenol from benzene by Cumenehydroperoxide method.

(c) Describe Lucas test to distinguish between primary, Secondary and tertiary alcohols. (8,2,4)

6. (a) Write down key differences between the S_N^2 and S_N^1 mechanism followed by alkyl halides.

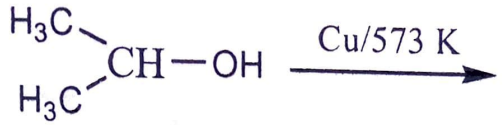
(b) Explain why allyl chloride is more reactive than vinyl chloride towards nucleophilic substitution.

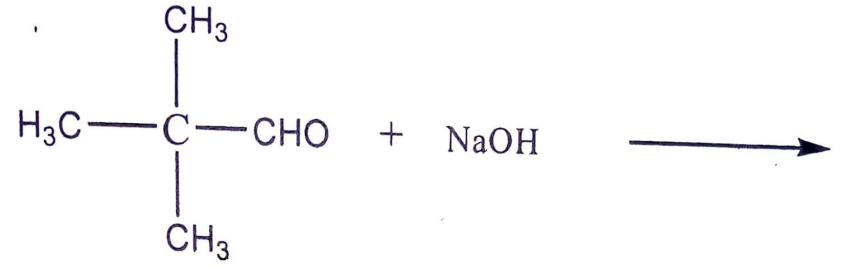
(c) How will you synthesize Methyl propyl ether using Williamson ether synthesis and what are the products if this ether reacts with HI?

(d) Describe the benzyne mechanism for nucleophilic substitution of aryl halide. (3,3,3,3)

7. (a) Reaction of carbonyl compounds with ammonia derivative occur under controlled pH condition. Why?

(b) Complete the following reactions :

(i) 

(ii) 

(iii) 

(c) What products are likely to be obtained when a benzyl alcohol and propyl alcohol is oxidized with PCC and alkaline $KMnO_4$ respectively? Explain with the help of an example.

(d) With the help of a suitable example write down S_N^i mechanism.

(3,3,3,3)

8. Write notes on any **four** of the following :

(i) Iodoform reaction

(ii) Benzoin condensation

(iii) Pinacol- Pinacolone rearrangement

(iv) Houben - Hoesch condensation

(v) Wolf Kishner reduction

(vi) Aldol condensation

(3,3,3,3)

(10)

H

18/5/18

Set-D

Sr. No. of Question Paper : 5028 Your Roll No.....
Unique Paper Code : 235266
Name of the Course : B.Sc.(M.S.)/ B.Sc.(Phy.Sc.)/ B.Sc.(H)Comp Science
Name of the Paper : MAPT-202 Calculus and Geometry
Semester : II
Duration: 3 Hours Maximum Marks

Instructions for Candidates

1. Write your roll no. on the top immediately on the receipt of this question paper.
2. This question paper has six questions in all.
3. Attempt any two parts from each question.
4. All questions are compulsory.

1(a) Show that $\frac{v-u}{1+v^2} < \tan^{-1} v - \tan^{-1} u < \frac{v-u}{1+u^2}$

(b) Define uniform continuity. Show that the function $f(x) = \frac{1}{x}$ is not uniformly con]0,1].

(c) Investigate the continuity of the function

$$f(x) = \begin{cases} \dfrac{e^{\frac{1}{x}} - e^{-\frac{1}{x}}}{e^{\frac{1}{x}} + e^{-\frac{1}{x}}}, & x \neq 0 \\ 1, & x = 0 \end{cases} \quad \text{at } x = 0.$$

2 (a) State intermediate value theorem. Show that if continuity condition is dropped t conclusion of the intermediate value theorem may not hold.

(b) Determine the position and nature of double points of $y^2 = (x-a)^2(x-b)$.

(c) Prove that continuity is necessary condition for differentiability of a function. Is it condition also? Justify.

3 (a) Trace the curves $r = a(1 + \cos\theta)$

(c) Find the volume of the solid generated by the revolution of the cycloid $x = a(1-$ the x-axis.

4(a) Trace the curve:

$$y = (x^3 - x^2 - 8)/(x - 1)$$

(b) Deduce the Reduction formula for

$\int sin^m x \, cos^n x \, dx$,n, m being a positive integers.

(c) Find the length of the loop of the curve:

$$9ay^2 = (x - 2a)(x - 5a)^2$$

5(a) Find the area between the curves $y = x^2$, $y = x^3$ and the line $x = 3$

(b) Describe the graph of the equation:

$$x^2 - 2y^2 + 4xy - 6 = 0$$

(c) Sketch the ellipse and label the foci, the vertices and the ends of the minor axis

$$16(x-1)^2 + 9(y-3)^2 = 144$$

6(a) Rotate the axes of coordinates to remove the xy-term from the equation:

$$x^2 - xy + y^2 - 2 = 0$$

Then name the conic and sketch the graph.

(b) (i) Find $(A \times \nabla) \times B$ at the point(1,-1,2), where

$$A = xz^2 i + 2y\,j - 3xz\,k \text{ and } B = 3xzi + 2yz\,j - z^2 k$$

(ii) Sketch the graph of the quadric surface $4z = x^2 + 2y^2$.

(c) A particle moves along the curve $r(t) = e^{-t} i + 2\cos 3t\, j + 2\sin 3t\, k$, where t is the time.

Find the component of the velocity and acceleration at t=0.

(11)

21/5/18

Sl-No. 07 Q.P: 5097

H

Unique Paper Code : 234291
Name of the paper : Computational Skills
Name of the Course : B.Sc. (~~APS~~)/ B. Sc. (H) Elec; ~~CSAT - 201~~
Semester : II (Phy)

Duration of Examination : Three Hours Maximum Marks: 75 Marks

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

Section A is compulsory.

Attempt any Five questions from section B.

Parts of a question must be answered together.
Marks are indicated against each question.

Section A

(Compulsory)

Q1. Answer the following questions:

a. Classify the following as System Software or Application Software:
   1) compiler
   2) Customised Software
   3) General Software
   4) Assembler (2)

b. Give the full form of following abbreviations:
   i) USB
   ii) HTTP
   iii) WWW
   iv) ASCII (2)

c. What is the function of an input unit? (1)

d. When was Information Technology Act notified? (1)

e. What is the value of base for decimal, hexadecimal, binary and octal number systems? (2)

f. List any four logic gates. (2)

g. Differentiate between data and information. (2)

h. What is a flash drive? (2)

i. List the main function of ALU in a computer system? (2)

j. List one advantage and one limitation of optical disk? (2)

k. What are the two types of storage of a computer system? (2)

l. Why is Linux operating system not prone to virus attacks? (2)

m. What is the difference between bit and a byte? (2)

n. A _____ can store 'A' in binary form (bit/ byte). (1)

Section B

Q2. (a) Give the full form of following abbreviations: (1*5)

1) CD-ROM
2) OMR
3) RAM
4) GB
5) GIGO

(b) Perform the following operations: (5)

I. Add $(10011)_2$ and $(1001)_2$

II. Subtract $(0111000)_2$ from $(1011100)_2$ using 2's complement method.

Q3. a) What is a Computer? What is an algorithm? What are the commonly used ways to represent an algorithm? (1+1+3)

b) What is client server configuration in Distributed computers? (5)

Q4. a) What is a multimedia computer system? List three multimedia applications? (5)

b) What are the key hardware technologies used in first, second, third, fourth and fifth generation of computers. (5)

Q5. a) What is an IP address? Why is it needed? (5)

b) Name any two computer codes. Why is Unicode the universally accepted character-encoding standard? (5)

Q6. If a computer has 64 operation codes and 16K addresses, answer following questions: (3)

i) How many bits are there in the Program Counter (PC) Register?
ii) What is the length of Accumulator (AC) Register?

b) Name any two web browsers (2)

c) Differentiate between i) CISC and RISC; iii) Bridge and Router (5)

Q7. a) Perform the following conversions: (2*5)

I. $(562)_8 = (?)_2$
II. $(110.101)_2 = (?)_{10}$
III. $(127.54)_8 = (?)_{10}$
IV. $(10101110)_2 = (?)_{16}$
V. $(9F2)_{16} = (?)_2$

Q8. Write short notes on the following

i) Joystick
ii) LAN and WAN
iii) Touch Screen
iv) Digitizer
v) Speech Recognition Devices (2x5)

(12)

Sl-No. 07 Q.P: 5100

16/5/2018

~~SET~~ B

Unique Paper Code: 217261

Name of the Paper: Thermodynamics, Equilibria and Functional Group Organic Chemistry – I (Chemistry – II, CHPT -202)

Name of the Course: B.Sc. ~~Life Sciences/Applied Life Sciences/ ACPM/ Industrial Chemistry/ ALS/ APS/ ACPT~~ (Prog.)

Semester: II

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. Use of scientific calculators and log tables is allowed.
3. Use **separate sheets** for **Section A** and **Section B**.

Section A
(Physical Chemistry)

Attempt any <u>three</u> questions in this section. All questions carry equal marks.

1. (a) What are state functions? Give examples.
   (b) Give the Henderson's equation for the pH of basic buffer solution.
   (c) Predict the effect of increasing temperature and pressure on the following reaction.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) + \text{Heat}$$

   (d) State the "Third Law of Thermodynamics".
   (e) When 1 mL of NH_4Cl is added to water, pH changes sharply but when it is added to a mixture of acetic acid and sodium acetate, the pH remains constant. Explain.

2.5 x 5 = 12.5

2. (a) One mole of an ideal gas is allowed to expand isothermally and reversibly from a volume of 1 dm^3 to 50 dm^3 at 273K. Calculate w, q, ΔE and ΔH for this change.
   (b) Show that $C_p - C_v = nR$ for an ideal gas.
   (c) Calculate the pH of a solution of 10^{-7} M HCl at 25°C.

3. (a) Derive Kirchoff's equation showing the variation of ΔH with temperature.
   (b) Calculate the solubility product of Ag_2CrO_4 when its solubility is 7×10^{-5} mol/dm^3.
   (c) Show that K_h (hydrolysis constant) of salt of weak acid and weak base is independent of the concentration of the solution.

4,3.5,5

4,4,4.5

4. (a) Starting from $G = H - TS$ derive the following relation:

$$\left|\frac{\partial(\Delta G/T)}{\partial T}\right|_P = -\frac{\Delta H}{T^2}$$

(b) Write short notes on the following (any three)

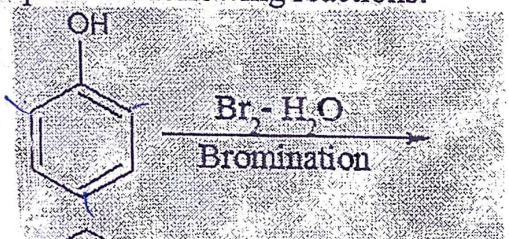
i. Hess's Law of constant heat summation
ii. pH Scale
iii. Common-ion effect
iv. Ostwald dilution Law

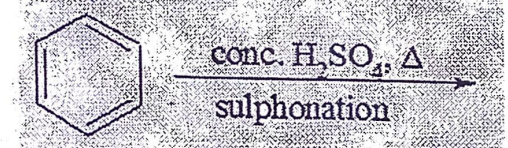
5,2.5 x 3=~~7.5~~

Section B
(Organic Chemistry)

Attempt any <u>three</u> questions in this section. All questions carry equal marks.

5. (a) Complete the following reactions:

i. 

ii. 

iii. $CH_3CHO + EtMgI \longrightarrow A \xrightarrow{H_3O^+} B$

(b) Explain Friedel-Crafts acylation reaction with mechanism by taking a suitable example.
(c) What is an ambident nucleophile? How can you prepare the following from a given alkyl halide:
   i. Nitrite and nitro
   ii. Nitrile and isonitrile

4,4,4.5

6. (a) Give S_N2 mechanism for alkyl halides by taking a suitable example.
(b) Explain Sandmeyer's reaction of aryl halide with the help of two examples. **(Mechanism not required)**
(c) Which type of compounds give Iodoform test? Give the mechanism of the reaction? Give one example.

4,4,4.5

7. (a) How can you distinguish between primary, secondary and tertiary alcohols by Lucas test?
(b) Give the reactions and structure of the products when acetaldehyde is reacted with
   i. NH_2OH ii. HCN

(c) How can you obtain phenol from benzene by cumene hydroperoxide method? 7

8. Write short notes on **any three** of the following: 4,4,4.5
   i. Schotten – Baumann reaction
   ii. Cannizzaro reaction
   iii. Pinacol - Pinacolone rearrangement
   iv. Aldol condensation.

4,4,4.5