

N.B. 1. All questions are compulsory.

2. Figures to the right indicate marks for respective parts.

Q.1 Choose correct alternative in each of the following:

(20)

- i. Let $S = \{(x, y) \in \mathbb{R}^2 / x > 0, y > 0, x + y < 1\}$, then S is
 (a) Unbounded set (b) An open set
 (c) A closed set (d) None of these
- ii. Let $(y_n) = \left(n^{\frac{1}{n}}, \left(\frac{1}{2}\right)^n\right)$ be a sequence then sequence (y_n) is
 (a) Convergent (b) Divergent
 (c) Not bounded (d) None of these
- iii. Let $f(x, y) = \sin x \cos y$ and $a = \left(\frac{\pi}{2}, \pi\right)$ and $u = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ then directional derivative of f at a in the direction of u i.e. $D_u f(a)$ is equal to
 (a) 0 (b) -1
 (c) 1 (d) None of these
- iv. If $f(x, y) = \sin x + e^{xy}$, then $\nabla f(0, 1)$ is equal to
 (a) (0, 0) (b) (1, 1)
 (c) (2, 0) (d) None of these
- v. The level surface of $f(x, y, z) = 4$ where $f(x, y, z) = x^2 + 3y^2 + 6z^2$ is
 (a) Ellipsoid (b) Cylinder
 (c) Cone (d) Sphere
- vi. The function $f(x, y) = x^2y - xy^2$ decreases most rapidly at (3, 3) in the direction
 (a) (1, -1) (b) (-1, 1)
 (c) (1, 0) (d) None of these
- vii. Using Taylor's theorem the linearization of $f(x, y) = x\sqrt{y}$ at (1, 1) is
 (a) $x + \frac{y}{2} - \frac{1}{2}$ (b) $x + \frac{y}{2} - 1$
 (c) $x + \frac{y}{2} - \frac{3}{2}$ (d) None of these

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viii. If $z = f(x, y)$ is differentiable and $x = g(u, v)$, $y = h(u, v)$ are also differentiable functions then $\frac{\partial z}{\partial u}$ is

(a) $\frac{\partial z}{\partial x} \frac{\partial x}{\partial u} + \frac{\partial z}{\partial y} \frac{\partial y}{\partial v}$

(b) $\frac{\partial z}{\partial x} \frac{\partial x}{\partial u} - \frac{\partial z}{\partial y} \frac{\partial y}{\partial u}$

(c) $\frac{\partial z}{\partial x} \frac{\partial x}{\partial u} + \frac{\partial z}{\partial y} \frac{\partial y}{\partial u}$

(d) None of these

ix. Let $f: \mathbb{R}^n \rightarrow \mathbb{R}$, $a \in \mathbb{R}^n$ is said to be relative maximum of f if

(a) $f(x) \leq f(a) \forall x \in \mathbb{R}^n$

(b) $f(x) \leq f(a)$ in some neighborhood of a

(c) $f(x) \geq f(a)$ in some neighborhood of a

(d) None of the above

x. Let $f(x, y) = \begin{cases} x \sin \frac{1}{y} & \text{if } y \neq 0 \\ 0 & \text{otherwise} \end{cases}$

and let $l_1 = \lim_{x \rightarrow 0} \lim_{y \rightarrow 0} f(x, y)$ and $l_2 = \lim_{y \rightarrow 0} \lim_{x \rightarrow 0} f(x, y)$ then

(a) l_1 exists but l_2 does not exist

(b) l_2 exists but l_1 does not exist

(c) $l_1 = l_2$

(d) None of these

Q.2 a) Attempt any ONE question from the following:

(08)

i. Let $f: \mathbb{R}^2 \rightarrow \mathbb{R}$ be a real valued function. Let $l \in \mathbb{R}$ such that $\lim_{(x, y) \rightarrow (a, b)} f(x, y) = l$. Also assume that the one dimensional limits $\lim_{x \rightarrow a} f(x, y)$ and $\lim_{y \rightarrow b} f(x, y)$ exists, then prove that $\lim_{x \rightarrow a} \lim_{y \rightarrow b} f(x, y) = \lim_{y \rightarrow b} \lim_{x \rightarrow a} f(x, y) = l$.

ii. State and prove Mean Value Theorem for real valued n-variable function.

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b) Attempt any TWO questions from the following: (12)

i. Let $f, g: \mathbb{R}^n \rightarrow \mathbb{R}$ be two real valued functions. Let $a \in \mathbb{R}^n$ such that f and g both are continuous at a . Then prove that $f - g$ is continuous at a .

ii. $f(x, y) = y \cos \frac{1}{x}$, if $x \neq 0$. Using definition of limit, check if $\lim_{(x, y) \rightarrow (0, 0)} f(x, y)$ exists.

iii. Let $f: \mathbb{R}^n \rightarrow \mathbb{R}$ be a real valued function. Let $a \in \mathbb{R}^n$. Define i^{th} partial derivative of f at a for $1 \leq i \leq n$. Hence calculate $\frac{\partial f}{\partial x}$ at $(1, 1, 1)$ for $f(x, y, z) = 3x^3 + y^2 - 4z^2 + 5xyz$.

iv. Find the real value of $\theta \in (0, 1)$ if it exists satisfying $f(b) - f(a) = \nabla f(a + \theta(b - a)) \cdot (b - a)$ where $f(x, y, z) = xyz$, $a = (0, 0, 0)$, $b = (1, \frac{1}{2}, \frac{1}{3})$.

Q.3 a) Attempt any ONE question from the following: (08)

i. Let U be an open set in \mathbb{R}^n and $f: U \rightarrow \mathbb{R}$ be differentiable at $a \in U$. Prove that $D_i f(a)$ exists for each $i = 1, 2, \dots, n$. Explain with an example that converse of this is not true.

ii. State and prove Euler's theorem for homogeneous differentiable scalar valued functions of n variables.

b) Attempt any TWO questions from the following: (12)

i. Determine the direction in which $f(x, y, z) = \tan(x + 2y + 3z)$
 (I) increases fastest
 (II) decreases fastest
 (III) does not change ; at point $(-5, 1, 1)$

Also find the maximum rate of change of f at that point.

ii. Find the equation of tangent plane and normal line to the surface $yz = \log_e(x + z)$ at $(0, 0, 1)$.

iii. Find $\frac{df}{dt}$ using chain rule, where $f(x, y) = \sin x \cos y$, $x = \pi t$, $y = \sqrt{t}$

iv. Check if $f(x, y)$ is differentiable at $(0, 0)$ using definition, where

$$f(x, y) = \frac{x^3 y - y^3 x}{x^2 + y^2}, \text{ for } (x, y) \neq (0, 0) \text{ and } f(0, 0) = 0$$

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Q.4 a) Attempt any ONE question from the following: (08)

- Define $Df(a)$, the total derivative at $a \in \mathbb{R}^n$ for a function $f: \mathbb{R}^n \rightarrow \mathbb{R}^m$ in terms of a linear transformation. Show that if f is differentiable at a then f is continuous at a . Is the converse true? Explain with an example.
- State and prove Taylor's Theorem for a real valued function of two variables.

b) Attempt any TWO questions from the following: (12)

- If $f, g: \mathbb{R}^n \rightarrow \mathbb{R}^m$ are differentiable at $a \in \mathbb{R}^n$ then show that $f + g$ is also differentiable at a and $D(f + g)(a) = Df(a) + Dg(a)$
- If $x = \log_e u, y = \log_e v$ and $z = f(x, y)$ is differentiable then check if $\frac{\partial^2 z}{\partial y \partial x} = uv \frac{\partial^2 z}{\partial u \partial v}$
- For the function $f(x, y) = (\sin x \cos y, \sin x \sin y, \cos x \cos y)$ Find the Jacobian matrix of f at the point $(\frac{\pi}{2}, \frac{\pi}{2})$.
- Find the relative extrema of the function $f(x, y) = 2xy - 5x^2 - 2y^2 + 4x + 4y - 5$.

Q.5 Attempt any FOUR questions from the following: (20)

- Let $f: \mathbb{R}^2 \rightarrow \mathbb{R}$ be a differentiable function such that f has directional derivative 2 in the direction towards $(2, 2)$ and -2 in the direction towards $(1, -1)$ at $(1, 2)$. Find $\nabla f(1, 2)$ and compute the directional derivative at $(1, 2)$ in the direction towards $(4, 6)$.
- Use definition of limit to prove that $\lim_{(x, y) \rightarrow (1, 2)} 2x - 4y = -6$.
- Find the total derivative of $f(x, y, z) = x^{y^z}$ at $(1, 1, 1)$.
- Find $f_{xx}, f_{xy}, f_{yy}, f_{zz}, f_{yz}$ for $f(x, y, z) = x\sqrt{y-z}$.
- Determine the second order Taylor's formula for the function $\log_e(1 + x + 2y)$ at the point $(0, 0)$.
- Using Lagrange's Multiplier Method find the extreme values of $f(x, y) = xy$ on the ellipse $x^2 + 2y^2 = 1$.

- N.B. 1. All Questions are compulsory.
2. Figures to the right indicate marks to respective parts.

Q.1 Choose correct alternative in each of the following: (20)

i. Let $A = \begin{pmatrix} 1 & 2 & -1 \\ 3 & -1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -1 \\ 4 & 5 \\ 1 & 2 \end{pmatrix}$ then the standard matrix for the transformation T defined by $T(\mathbf{x}) = A(B\mathbf{x})$ is

(a) $\begin{pmatrix} 0 & 7 & 4 \\ 19 & 3 & 1 \\ 7 & 0 & 1 \end{pmatrix}$

(b) $\begin{pmatrix} 0 & 7 & -3 \\ 19 & 3 & 1 \\ 7 & 0 & 1 \end{pmatrix}$

(c) $\begin{pmatrix} 10 & 7 \\ 6 & 5 \end{pmatrix}$

(d) $\begin{pmatrix} 10 & 7 \\ 6 & -6 \end{pmatrix}$

ii. The range of the linear transformation from \mathbb{R}^2 to \mathbb{R}^2 given by the matrix $A = \begin{pmatrix} 2 & 3 \\ -6 & -9 \end{pmatrix}$ is

(a) All of \mathbb{R}^2

(b) A line through the origin having slope -3

(c) A line through the points (2,3) and (-6,-9)

(d) A line through origin having slope 2/3

iii. Let T be the linear transformation that $T(1, 0) = (4, 3)$ and $T(0, 1) = (7, 2)$. Then $T(3, -2) =$

(a) (12, -6)

(b) (-14, -4)

(c) (11, 5)

(d) (-2, 5)

iv. Area of the parallelogram spanned by vectors $(-1, 2)$ and $(3, 4)$ is

(a) 10

(b) 5

(c) 2

(d) None of the above

v. If $E = \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ then E^{-1} is

(a) $\begin{pmatrix} 1 & 0 & -2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

(b) $\begin{pmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

(c) $\begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

(d) None of the above

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vi. Which of the following is false for an invertible $n \times n$ matrix A ?

- (a) $\det A = \det A^t$ (b) $\det A = \det A^{-1}$
 (c) $\det A^2 = (\det A)^2$ (d) None of the above

vii. If $I_{23}, I_{13} \in M_3(\mathbb{R})$ then $I_{23} + I_{13}$ is

- (a) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$
 (c) $\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$ (d) $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 1 & 0 \end{pmatrix}$

viii. Which of the following set forms group under the given binary operation

- (a) $(\mathbb{N}, +)$ (b) $(\mathbb{Q}, +)$
 (c) (\mathbb{Z}, \cdot) (d) (\mathbb{Z}^*, \cdot)

ix. The order of the group S_n is

- (a) $\frac{n!}{2}$ (b) $2n$
 (c) $n!$ (d) None of these

x. The identity element of the group $G = \left\{ \begin{pmatrix} a & a \\ a & a \end{pmatrix} / a \in \mathbb{R}^* \right\}$ under multiplication of 2×2 matrices is

- (a) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$
 (c) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (d) None of these

Q.2 a) Attempt any ONE question from the following:

(08)

- i. Let V, W be vector spaces over \mathbb{R} and $T: V \rightarrow W$ be a linear transformation and if V is finite dimensional then show that $\dim V = \dim \text{Ker } T + \dim \text{Img } T$.
- ii. Show that the following are equivalent for a linear map $T: V \rightarrow V$,
 1. T is bijective
 2. $\text{Ker } T = \{0\}$
 3. $\text{Img } T = V$

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b) Attempt any TWO questions from the following: (12)

- i. Let $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ be defined as $T(\mathbf{x}) = \mathbf{A}\mathbf{x}$ where \mathbf{A} is the matrix of T with respect to standard bases $\{e_1, e_2\}$ on both sides and $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$. What is the matrix of T with respect to changed bases $\{e_1+e_2, e_2\}$ on both sides?
- ii. Let $T: \mathbb{R}^2 \rightarrow \mathbb{R}^3$ be defined as $T(\mathbf{x}) = \mathbf{A}\mathbf{x}$ where $\mathbf{A} = \begin{pmatrix} 1 & 1 \\ 2 & 1 \\ 1 & 0 \end{pmatrix}$. Determine rank T , nullity of T and hence verify the rank - nullity theorem.
- iii. Let V be the vector space of real polynomials in the variable x and let $D^3: V \rightarrow V$ defined as $D^3(f) = \frac{d^3}{dx^3}f$ then find $\ker D^3$. Also find its dimension.
- iv. Let $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$ the matrix of linear transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ defined as $T(\mathbf{x}) = \mathbf{A}\mathbf{x}$ then show that T is invertible and find formula for T^{-1} .

Q.3 a) Attempt any ONE question from the following: (08)

- i. Let $\phi: \mathbb{R}^2 \times \mathbb{R}^2 \rightarrow \mathbb{R}$ be a bilinear function such that $\phi(A^1, A^1) = 0, \forall A^1 \in \mathbb{R}^2$ and $\phi(E^1, E^2) = 1$ where E^1, E^2 are the standard unit vectors of \mathbb{R}^2 . Prove that $\phi(A^1, A^2) = \det(A^1, A^2)$ for any column vectors $A^1, A^2 \in \mathbb{R}^2$.
- ii. Prove that the row rank and the column rank of an $m \times n$ matrix A are equal.

b) Attempt any TWO questions from the following: (12)

- i. Express \mathbf{A} as product of elementary matrices where $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ 2 & 1 \end{pmatrix}$.
- ii. Define row rank, column rank of $\mathbf{A} \in M_{m \times n}(\mathbb{R})$. Find rank of $\mathbf{A} = \begin{pmatrix} 2 & 0 & 3 & 1 \\ 3 & 4 & -1 & 2 \\ 1 & 2 & 1 & 0 \end{pmatrix}$.
- iii. If A^1, A^2, \dots, A^n are n linearly dependent column vectors in \mathbb{R}^n , then prove that $\det(A^1, A^2, \dots, A^n) = 0$.
- iv. Solve the following system of linear equations using Cramer's rule

$$x + y + 2z = 1, \quad 2x + 4z = 2, \quad 3y + z = 3$$

[TURN OVER

(3 Hours)

SYBSC

Sem-III

[Total Marks : 100]

Note: (i) All questions are compulsory.

(ii) Figures to the right indicate marks for respective parts.

Q.1 Choose correct alternative in each of the following.

(20)

- i. Isolated vertex in any graph has degree
- (a) 0 (b) 1
(c) 2 (d) 3
- ii. $K_{2,3}$ is a
- (a) Planar graph (b) Nonplanar graph
(c) Disconnected graph (d) None of these
- iii. Incidence matrix of any simple graph G is always
- (a) Row matrix (b) Column matrix
(c) Square matrix (d) None of these
- iv. In a planar graph $V = 6, E = 9, R = ?$ (symbols have usual meaning)
- (a) 2 (b) 3
(c) 4 (d) 5
- v. If a tree T has 12 vertices then the number of edges are
- (a) 11 (b) 13
(c) 12 (d) 10
- vi. If a full binary tree has 100 internal vertices then the total number of vertices is
- (a) 101 (b) 200
(c) 201 (d) 100
- vii. The degree of root vertex in a full binary tree is
- (a) 1 (b) 2
(c) Atleast 2 (d) Atmost 2
- viii. If $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)} = 0$ then
- (a) $f(x)$ is $O(g(x))$, but $g(x)$ is not $O(f(x))$ (b) $g(x)$ is $O(f(x))$, but $f(x)$ is not $O(g(x))$
(c) $f(x), g(x)$ are of same order (d) None of the above
- ix. Which of the following has precise and definite syntax?
- (a) algorithm description (b) pseudocode
(c) program in language like C++ (d) None of the above
- x. A big-O estimate for $f(n) = 1 + 2 + \dots + n$ is
- (a) n^2 (b) n
(c) $\log n$ (d) None of the above

Q.2 a) Attempt any ONE question from the following:

(08)

- i. Describe the Euclid's algorithm to find the GCD and LCM of two positive integers a and b . Also trace your algorithm for $a = 35, b = 40$.

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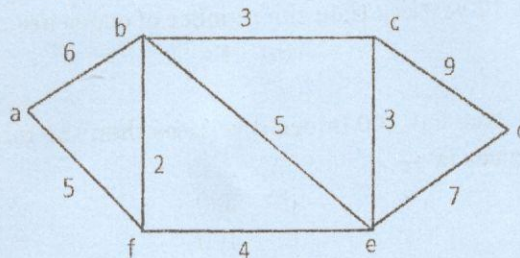
- ii. Describe the Tower of Hanoi Problem. Discuss the solution for 3 discs and design the recursive algorithm for n discs.

b) Attempt any **TWO** questions from the following: (12)

- Show that $\log x$ is big - O of x , but x is not big - O of $\log x$. Further show that $(x + 4 \log x)$ is of same order as x .
- Design an algorithm to find the maximum element of a finite set of n integers. Trace your algorithm for $n = 5$ and for the set $\{7, 2, 10, 8, 9\}$.
- Given an integer x and a list of n distinct integers in ascending order, write Binary Search algorithm for searching x in the list.
- Design an algorithm to find the sum and arithmetic mean, for the input data of n numbers a_1, a_2, \dots, a_n . Arithmetic mean = $\frac{\text{sum}}{n}$. Trace the algorithm for $n = 3$ and numbers: 6, 9, 5

Q.3 a) Attempt any **ONE** question from the following: (08)

- Find shortest path from a to d , for the following graph, using Dijkstra's algorithm.



- Define the followings, with an example in each case.
 - isomorphism of graphs.
 - connected components of the graph.
 - cut vertices.
 - planar graph.

b) Attempt any **TWO** questions from the following: (12)

- How many vertices and edges do these graphs have? Justify your answer (1) K_6 (2) $K_{3,4}$ (3) W_5 (symbols have usual meaning).
- State and explain with an appropriate example. (1) Kuratowski's theorem (2) Dirac's theorem.
- Construct a graph G with at least 4 vertices and at least 6 edges, such that graph G has Euler circuit but no Hamilton circuit. Justify your answer.

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- iv. Define adjacency matrix. Draw the graph for given adjacency matrix. Further find incidence matrix for the graph.

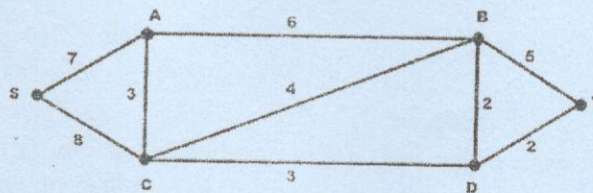
$$\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

Q.4 a) Attempt any **ONE** question from the following: (08)

- Use Huffman coding to encode the following symbols with the frequencies listed. $A : 0.10, B : 0.25, C : 0.05, D : 0.15, E : 0.30, F : 0.07, G : 0.08$.
What is the average number of bits used to encode a character?
- Prove that a graph G is connected if and only if it has a spanning tree.

b) Attempt any **TWO** questions from the following: (12)

- Define rooted tree, m -ary tree and fully m -ary tree with an example for each.
- Which trees are complete Bipartite graphs? Justify your answer.
- Construct Binary search tree for following key sequence: -
Jai, Guy, Joy, Anu, Jit, Evy, Amit, Tim, Ron, Kit, Toy, Roy, Kaj, Don.
- Apply Kruskal's algorithm to find a minimum spanning tree in the graph below. Give the weight of your minimum tree and show your steps.

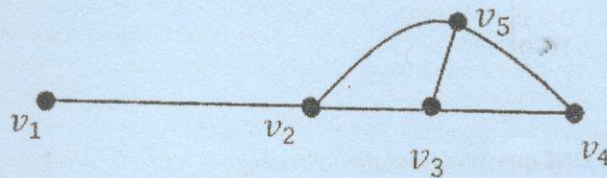


Q.5 Attempt any **FOUR** questions from the following: (20)

- Design an algorithm that replaces the triplet (x, y, z) with (y, z, x)
(i) using temporary variable t (ii) without using temporary variable.
- Design an algorithm (recursive / iterative) to find $n!$ for a given non-negative integer n .
- Define simple graph and answer the following for graph G .
(i) Find all simple paths from v_1 to v_4 ?

[TURN OVER

- (ii) Find $G - \{v_2\}$.
 (iii) Verify Euler formula for planar graph.
 (iv) Add two edges to given graph, without adding any vertex, such that newly formed graph becomes a wheel. Draw the new graph.



- d) Let G be an undirected graph, with 14 vertices and 16 edges. If degrees of vertices of G are either 2 or 3 find the number of vertices in G of degree 2.
 e) Is it possible to draw a tree with five vertices having degree sequence 1, 1, 2, 2, 4? Justify your answer.
 f) Describe Prim's algorithm to find minimal spanning tree.

Time 3Hrs

Marks: 100

N.B : (1) All questions are compulsory.

(2) Figures to the right indicate maximum marks.

(3) Use of non-programmable calculators is permitted.

(4) Symbols have their usual meaning.

Q 1 (A) Select the correct option 12

- (i) A body of mass m moving with velocity v collides with another body of mass $2m$ and sticks to it. The velocity of the final system is
(a) $v/3$ (b) $v/2$ (c) $2v$ (d) $3v$
- (ii) Time period of a compound pendulum whose radius of gyration is 4.9 m (Take $g = 9.8 \text{ m/s}^2$)
(a) 4.44 sec (b) 1 sec (c) 3.14 sec (d) 6.28 sec
- (iii) S I unit of entropy is
(a) Joule (b) Joule/calorie (c) Joule/K (d) None of these
- (iv) The efficiency of a Carnot engine is 0.4 . If the temperature of the sink is 300K , the temperature of the source is
(a) 300K (b) 400K (c) 500K (d) 600K
- (v) If $a = 12.2 \times 10^{-2} \text{ N/mol}^2$, $b = 30 \times 10^{-6} \text{ m}^3/\text{mol}$ and $R = 8.3\text{J/mol K}$, the Boyle's temperature is:
(a) 489.9K (b) 200°C (c) 273K (d) 534.7K
- (vi) If C_p is $5/2 R$, $R = 8.3\text{J/mol K}$ the value of C_v in J/mol K
(a) 1.5 (b) 12.45 (c) 2.5 (d) 11

(B) Answer in one sentence: (3)

- (i) Write down the expression for the reduced mass of a two body oscillator.
- (ii) Name two non-static processes that are not irreversible.
- (iii) Define λ point of liquid Helium.

(C) Fill in the blanks (5)

- (i) If the resultant external forces acting on the body is zero, then the linear momentum is
- (ii) Amplitude of a damped harmonic oscillatorexponentially with time
- (iii) All reversible engines working between the same temperatures of source and sink have efficiency
- (iv) In case of a substance that expands on melting, $\left(\frac{\partial P}{\partial T}\right)$ is _____
- (v) Efficiency of Carnot engine is 100% if the temperature of the sink is _____

Q2 (A) Attempt any one 8

- (i) Show that the total momentum of a system of particles is equal to the product of the total mass of the system and the velocity of its center of mass. Hence show that the external force acting on the system is equal to the rate of change of linear momentum. What happens to the internal

Q. P. Code: 20507

forces acting on the particles? Also, prove the principle of conservation of linear momentum.

- (ii) Set up the equation of motion of an accelerating rocket, neglecting effect of any external forces that might be acting on it. Find the expression for the maximum velocity attained by the rocket.

(B) Attempt any one 8

- (i) Show that the total angular momentum of a system of particles is equal to the angular momentum of its center of mass plus angular momentum due to its motion about the center of mass.
- (ii) Derive Bessel's formula for reversible compound pendulum.

(C) Attempt any one 4

- (i) The potential energy of a particle of mass 1kg, performing S H M is $32x^2$ in S I units. Determine the force acting on the particle. Calculate the maximum velocity and maximum acceleration of the oscillation, if the amplitude of the oscillation is 10cm
- (ii) A bomb in flight explodes into two fragments of masses M and 3M when its velocity is $5\hat{i} + 2\hat{j}$. If the smaller mass flies with a velocity of $10\hat{i} + 5\hat{j}$, find the velocity of larger mass.

Q3 (A) Attempt any one 8

- (i) Describe Carnot's cycle using labeled diagram. Define efficiency of a heat engine. Can efficiency be greater than 1?
- (ii) State Kelvin - Planck's and Clausius statement of second law of thermodynamics. Prove that if Kelvin-Planck's statement is true then Clausius statement is true.

(B) Attempt any one 8

- (i) Show that no two isothermal processes can intersect each other. Also no two adiabatic processes can intersect each other.
- (ii) Derive the expression of entropy in terms of (1) Pressure and temperature and (2) Volume and temperature. When one gram of gas is subjected to a change from (P_1, V_1, T_1) to (P_2, V_2, T_2) , how do the expressions change when pressure is kept constant?

(C) Attempt any one 4

- (i) What is the efficiency of a Carnot engine working between 627°C and 27°C ? What is the work done if the amount of heat rejected to the sink is 200J?
- (ii) When a refrigerator is switched off the ice storage melts at a rate of 34 g/hr when the external temperature is 30°C . Find the minimum output power of the motor of the refrigerator required to prevent the ice from melting. Given: Latent heat of melting of ice = 334 KJ / Kg.

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- Q4 (A) **Attempt any one** 8
- (i) Using Maxwell's equations derive the Clausius-Clapeyron's equation and discuss the effect of pressure on the boiling point and melting point of a substance.
- (ii) Derive the expression for Joule-Thomson coefficient for Vander Waal's gas.
- (B) **Attempt any one** 8
- (i) Explain the principle and working of vapor condensation machine with a help of a neat diagram.
- (ii) With the help of PV diagram explain the step by step working of a diesel engine
- (C) **Attempt any one** 4
- (i) In an internal combustion engine of constant pressure ignition type, the temperatures at the beginning and at the end of ignition are 642°C and 1767°C respectively. The expansion ratio is 12. Find the efficiency of the engine. Given: $\gamma=1.4$.
- (ii) Calculate the drop in temperature when carbon dioxide gas suffers Joule-Thomson expansion at 27°C . The pressures on the two sides of the porous plug are 50 atm and 1 atm. respectively. The van der Waal's constants of the gas are: $a=36.56 \times 10^{-2} \text{N m}^4/\text{mol}^2$, $b=4.28 \times 10^{-5} \text{m}^3/\text{mol}$, $C_p=36.575 \text{J/K mol}$; and $R=8.3 \text{J/K mol}$.

- Q 5 **Attempt any four** 20
- (i) Set up the equation of a damped driven oscillator. Explain qualitatively the variation of amplitude with ratio of driving frequency to natural frequency of the oscillator.
- (ii) The position vectors of three particles of masses 2 gm, 3gm and 4 gm are $\vec{r}_1 = t^4 \hat{i} + 3t^2 \hat{j} - 4t^3 \hat{k}$, $\vec{r}_2 = t^2 \hat{i} - 3t^2 \hat{j} + 2t \hat{k}$ and $\vec{r}_3 = t^3 \hat{i} - 5t^2 \hat{j} - 2t \hat{k}$ where t is in seconds and distances in centimeters. Determine the center of mass and the total linear momentum of the system with respect to the origin.
- (iii) Calculate the change on entropy when 50 g of water at 27°C is mixed with 200 g of water at 100°C . (Specific heat of water = 4.186J/gK)
- (iv) Write the equation for enthalpy as a function of pressure and temperature. From this derive the Joule-Thomson Coefficient.
- (v) Derive the efficiency of an Otto engine with the help of a PV diagram.
- (vi) When 1 gram of water is converted into steam of 1676cm^3 , determine under what pressure water will boil at 130°C ? Given: Latent heat of steam = 540cal/g and $J=4.2 \times 10^7 \text{erg/cal}$ and $1 \text{atm}=10^6 \text{dynes/cm}^2$.

SVBSC

Sem III

15/11/2017

Q. P. Code:-20512

- Note: 1) All questions are compulsory.
 2) Figures to the right indicate full marks.
 3) Use of non-programmable calculator is allowed.
 4) Symbols have their usual meanings.

Q.1 A Select correct option

12

- i) If divergence of a vector is zero then it can be written as _____
 i) Div of a vector function ii) curl of a vector function
 iii) Grad of scalar function iv) none of the above
- ii) A necessary and sufficient condition that line integral $\int_C A \cdot dr = 0$ for every close curve C is.....
 i) Div A = 0 ii) div $\neq 0$
 ii) curl A $\neq 0$ iv) curl A = 0
- iii) In a transistor amplifier circuit, $V_{CE} = V_{CB} + \dots\dots\dots$
 (i) V_{BE} ii) $2 V_{BE}$
 (iii) $1.5 V_{BE}$ (iv) none of these
- iv) The biasing circuit has a stability factor of 50. If due to temperature change, I_{CBO} changes by $1 \mu A$, then I_C will change by
 (i) $100 \mu A$ (ii) $25 \mu A$
 (iii) $20 \mu A$ (iv) $50 \mu A$
- v) An op-amp has a slew rate of $5V/\mu S$. the largest sine wave o/p voltage possible at a frequency of 1MHz is
 i) 10 V ii) 5 V
 iii) 3V— iv) $5/2$ V
- vi) For non-inverting amplifier using op-amp, if $R_f/R_i = 10$ then the output voltage for an input of -1V is _____
 i) -10 V ii) -11 V
 iii) +10 V iv) +11V

B Answer in one sentence

03

- i) Define gradient of a scalar function
 ii) What do you mean by biasing?
 iii) What is the basic difference between amplifier and oscillator.

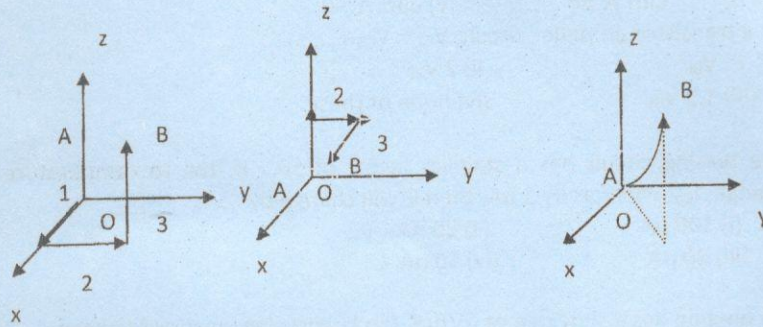
C Fill in the blank

05

- i) A vector point function is said to be solenoidal if the flux of it across any close surface is
- ii) The point of intersection of a.c. and d.c. load lines represents _____
- iii) Stokes' theorem says that $\int_S (\nabla \times V) \cdot da$ is equal to the _____ integral of V around the boundary.
- iv) A wein Bridge oscillator uses _____ feedback.
- v) When we introduce positive feedback in an amplifier circuit the stability _____.

- Q.2 A Attempt any one** (8)
- Discuss in detail the velocity (V) and acceleration (a) of a particle in spherical co-ordinates.
 - Calculate the line integral of the function $V = x^2\hat{i} + 2yx\hat{j} + y^2\hat{k}$ from the origin to the point $(1,1,1)$ by three different routes.
 - $(0,0,0) \rightarrow (1,0,0) \rightarrow (1,1,0) \rightarrow (1,1,1)$
 - $(0,0,0) \rightarrow (0,0,1) \rightarrow (0,1,1) \rightarrow (1,1,1)$
 - The direct straight line.

- B Attempt any one** (8)
- Check the fundamental theorem for gradients, using $T = x^2 + 4xy + 2yz^3$ the points $A = (0,0,0)$, $B = (1,1,1)$ and the three paths are as shown in fig.
 - $(0,0,0) \rightarrow (1,0,0) \rightarrow (1,1,0) \rightarrow (1,1,1)$
 - $(0,0,0) \rightarrow (0,0,1) \rightarrow (0,1,1) \rightarrow (1,1,1)$
 - The parabolic path $z = x^2, y = x$



- Express (8)
 - The unit vectors $\hat{r}, \hat{\theta}$ and $\hat{\phi}$ in terms of \hat{x}, \hat{y} and \hat{z} . (i.e Prove the equations for spherical polar coordinates in terms of Cartesian coordinates)
 - Work out inverse formulas giving \hat{x}, \hat{y} and \hat{z} . In terms of $\hat{r}, \hat{\theta}$ and $\hat{\phi}$.
- C Attempt any one** (04)
- Calculate $I = \int (x^2 dy - y dx)$ over the (04)
 - Straight line $y = x$ from $(0, 0)$ to $(1, 1)$
 - Parabola $y = x^2$ from $(0, 0)$ to $(1, 1)$
 - Integrate round the square $A (0,0), B (1,0), C (0,1), D (1,1)$
 - Find $\text{div } V$ in cylindrical co-ordinates, where V is a vector field. (04)

- Q.3 A Attempt any one** (8)
- Explain the Voltage Divider method of biasing in detail
 - Explain the Base Resistor method of biasing in detail.
- B Attempt any one** (8)
- Explain what happens to the Input Resistance as well to the Output Resistance of the amplifier when different types of Negative feedback are used.

- ii) Explain with reasons that why an ideal amplifier should have infinite Input Resistance (Impedance) and Low Output Resistance (Impedance)?

C Attempt any one

(4)

- i) A germanium transistor is to be operated at zero signal $I_C = 1\text{mA}$. If $V_{CC} = 10\text{V}$, what is the value of R_B in the Base resistor method? Take $\beta = 100$.
(ii) If another transistor of the same batch with $\beta = 50$ is used, what will be the new value of zero signal I_C for the same R_B ?
- ii) Find the gain in dBs for the following : (i) Voltage gain of 30 (ii) Power gain of 100.

Q.4 A Attempt any one

(8)

- i) Draw circuit diagram of Wein bridge oscillator and derive an expression for the frequency of the oscillator.
- ii) Draw the diagram of Hartley oscillator using BJT and explain its operation. Derive expression for resonant frequency.

B Attempt any one

(8)

- i) Explain slew rate and frequency response curve of an op-amp.
- ii) Explain with the circuit diagram working of op-amp as inverting and non-inverting amplifier.

C) Attempt any one

(4)

- i) Determine the resonant frequency, the feedback factor and minimum gain for sustain oscillations of Colpitt's oscillator, using following data:
 $C_1 = 0.05\ \mu\text{F}$, $C_2 = 0.2\ \mu\text{F}$, $L = 50\ \mu\text{H}$.
- ii) An op-amp is used as 3 input inverting adder with $R_i = R_f = 5\ \text{k}\Omega$
 $V_1 = +1.0\text{V}$, $V_2 = -2\text{V}$ and $V_3 = +4.5\text{V}$ find the output voltage. If the R_i value is reduced to $2\ \text{k}\Omega$, keeping R_f the same, what will be new output voltage?

Q.5 Attempt any four

(20)

- i) Explain the concept of
i) Line integral
ii) Surface integral
- ii) A solid of constant density $\rho = 1$ occupies the region S. find the solids M. I. about z axis. Given $r \leq 1$ by the cone $\phi = \pi/3$
- iii) Derive the general expression of Stability factor for a Common Emitter configuration.
- iv) Determine I_B , I_C and V_{CE} for a Base-biased transistor circuit with the following values : $\beta = 100$; $V_{CC} = 10\text{V}$; $R_B = 22\ \text{k}\Omega$ and $R_C = 100\Omega$.
- v) State the characteristics of an ideal op-amp
- vi) Write a short note on oscillators.

Time 3Hrs

Marks :100

- N.B : (1) All questions are compulsory.
 (2) Figures to the right indicate maximum marks.
 (3) Use of non-programmable calculators is permitted.
 (4) Symbols used have their usual meaning

Q1. A) Select the correct option

(12)

1) A single optical fiber have the core and the cladding refractive indices of 1.5 and 1.4 respectively. The critical angle of the fiber is _____
 a) 68.96° b) 46.23° c) 34.54° d) none of these

2) The process of achieving greater population of higher energy state as compared to lower energy states is known as _____
 a) Stimulated emission b) Population inversion c) Induced absorption d) none of these

3) _____ is movement of particle of matter due to its own kinetic energy from region of higher concentration to the region of lower concentration.
 a) osmosis b) surface tension c) viscosity d) Diffusion

4) _____ is pressure in atmosphere which is needed in opposite direction to stop the entry of solvent from dilute solution to concentrated solution.
 a) diffusion pressure b) surface pressure c) pressure d) osmotic pressure

5) Which of the following statement is wrong about a semiconductor?

- a) There are no free electrons at 0 K.
 b) There are no free electrons at any temperature.
 c) The number of free electrons increases with temperature.
 d) The number of free electrons is less than that in a conductor.

6) The susceptibility of paramagnetic material is _____

- a) positive and small b) positive and large c) negative d) zero

Q1. B) Answer in one sentence

(03)

- 1) Define sound absorption coefficient of a material.
 2) State any two uses of LASER?
 3) Define magnetic flux density.

Q1. C) Fill in the Blank

(05)

- 1) A communication technology that uses glass or plastic fibers to transmit data or information in the form of light pulses is called _____.
 2) LASER stands for Light Amplification by _____ emission of radiation.
 3) Golgi apparatus participates in cell wall formation and secretion. This statement is _____ (True/false)

4) In _____ semiconductor, the impurity added to an intrinsic semiconductor is trivalent.

5) The unit of magnetic induction is _____

Q2. A) Attempt any one (08)

- 1) What is Holography? Explain the construction and reconstruction of hologram with neat diagrams.
- 2) Explain the following factors affecting the acoustic quality of building.
a) Reverberation time b) Echelon effect c) Focusing

Q2. B) Attempt any one (08)

- 1) Explain the principle of optical fiber. Write its applications in communication and medicine.
- 2) With a neat energy level diagram explain the construction and working of He-Ne LASER.

Q2. C) Attempt any one (04)

- 1) For an empty assembly hall of size $20 \times 15 \times 10$ cubic meter with total surface area 1300 m^2 and average absorption coefficient 0.106. Calculate reverberation time.
- 2) The silica optical fiber with a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine critical angle at core-cladding interface and numerical aperture of the fiber in air. [refractive index for air (n_0) = 1]

Q.3 A) Attempt any one (08)

- 1) Explain **Action potential** and its propagation in cells/neurons.
- 2) What is **viscosity**? Give its units. Explain any one method to determine viscosity and factors effecting viscosity.

Q.3 B) Attempt any one (08)

- 1) Explain **Osmosis** and show how it is different from Diffusion. What is Osmotic pressure?
- 2) Explain **surface tension** based on molecular theory. Discuss factor effecting surface tension.

Q.3 C) Attempt any one (04)

- 1) Draw neat diagram and explain Electrical Properties of Cell.
- 2) Draw neat diagram and explain Prokaryotic Cell.

Q.4 A) Attempt any ONE (08)

- 1) With the help of energy band diagram, explain how materials are classified as conductors, insulators and semiconductors.

Q. P. Code: 20520

- 2) Write a note on: a) Diamagnetic materials b) Paramagnetic materials

Q.4 B) Attempt any ONE**(08)**

- 1) Write a note on : a) Metals and alloys b) Ceramics c) Polymers d) Composites.
2) Explain hysteresis curve of ferromagnetic materials on the basis of domain theory.

Q.4 C) Attempt any ONE**(04)**

- 1) Find the relative permeability of ferromagnetic material if a magnetic field of strength 220 A/m produces magnetization of 3300 A/m in it.
2) A metal wire has a resistance of 2.52Ω at 0°C . If its temperature coefficient of resistance is $3.8 \times 10^{-3} / ^\circ\text{C}$, find the resistance of wire at 55°C .

Q.5 Attempt any Four**(20)**

- 1) Explain the following properties of LASER light in brief. a) intensity b) directionality
2) A step index fiber has a numerical aperture of 0.26, a core refractive index of 1.5 and core diameter of $100 \mu\text{m}$. Calculate the refractive index of cladding and acceptance angle of the fiber in air.
3) Explain Diffusion mechanism and factors affecting rate of Diffusion.
4) Distinguish between Osmosis and Diffusion
5) Give the applications of liquid crystal display.
6) Write a note on dielectric materials.

Q.P. Code : 19759

- B) i) Explain any five conditions for 'resonance'. 05
 ii) Using Kapustinskii equation, calculate the lattice energy of Potassium nitrate from the following data 03
 Radius of K^+ ion = 139 pm
 Radius of NO_3^- ion = 188 pm
 Constant 'C' = $1.079 \times 10^5 \text{ pm}^2 \text{ mol}^{-1}$
- OR
- B) i) On the basis of molecular orbital theory explain magnetic property and bond order of oxygen molecule. 05
 ii) Radius of Cs^+ = 165 pm and that of Cl^- = 185 pm Calculate radius ratio. Predict the geometry of cesium chloride 03
- C) Draw molecular orbital diagram of B_2 molecule and calculate its bond order. 04
- OR
- C) i) Define 'lattice energy'. What is the effect of ionic charge on lattice energy? 02
 ii) Define: a) Resonance energy 02
 b) Bond order
- Q.4 A) i) Write a note on Claisen Rearrangement of allyloxy arenes. 05
 ii) Give an account of S_N1 reaction. 03
- OR
- A) i) With respect to the preparation of alcohols, explain the following reactions: 05
 a) Sulphation b) Etherification 03
 ii) What is cine substitution? Explain giving relevant example.
- B) i) Explain the mechanism of alkaline hydrolysis of tert-butyl bromide giving energy profile diagram. 05
 ii) Explain, how Ethylene oxide can be converted into the following compounds using suitable Grignard's reagent? 03
 a) 1-Butanol b) 2-Phenyl -1- ethanol c) 3-Methyl-1-butanol
- OR
- B) i) Give reasons : 05
 a) Ethyl alcohol has higher boiling point than Dimethyl ether even though their molecular weights are same.
 b) Alcohols are extremely weak acids. 03
 ii) Give one preparation method each of Phenyl lithium and n-butyl lithium.
- C) What is elimination addition mechanism? Discuss with respect to the action of sodamide in liquid ammonia on Chlorobenzene. 04
- OR
- C) i) Explain, why o-nitrophenol is steam volatile but para isomer is not. 02
 ii) Define Grignard's reagent. How is it prepared? 02

Q.P. Code : 19759

Q.5 Attempt any four of the following:

- a) Derive Gibbs-Duhem equation
 b) Differentiate between electronic conductors and electrolytic conductors.
 c) State the postulates of valence bond theory.
 d) On the basis of molecular orbital theory, explain Ne_2 does not exist.
 e) Give the ring opening reactions of Epoxide by:

05
05
05
05
05

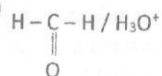
f) What is the action of following reagents on Phenyl lithium?

05

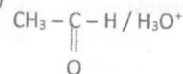
i)



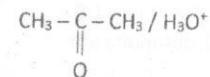
ii)



iii)



iv)



v)



10/11/2017

Q.P. Code : 19759

[Time: 03 Hours]

[Marks: 100]

Please check whether you have got the right question paper.

- N.B:
- All questions are compulsory.
 - Answer to the same question must be written together.
 - Figures to the right indicate full marks.
 - The use of log table/non-programmable calculator is allowed.

Q.1 A) Select the correct option and complete the following sentences:

12

- The decrease in Helmholtz free energy for a process at constant temperature gives _____ that can be obtained from the system during any change.
 - net work
 - useful work
 - maximum work.
- To measure extent of deviation from ideal behavior _____ is used.
 - fugacity
 - activity coefficient
 - activity
- The SI unit of specific conductance is _____.
 - $\text{mhos}^{-1} \text{cm}^{-1}$
 - Sm^{-1}
 - Scm^{-1}
- The equivalent conductance of a solution of an electrolyte _____.
 - decreases with dilution
 - increase with dilution
 - does not with dilution
- If limiting radius ratio range is $0.414 \rightarrow 0.732$, the geometry of ionic crystal is _____.
 - linear
 - triangular
 - octahedral
- Bond order in He_2 molecule is _____.
 - 0
 - 1
 - 2
- Hybridization of 'Cl' in ClF_3 molecule is _____.
 - sp^2
 - sp^3
 - sp^3d
- Number of resonating structures of CO_3^{2-} ion is _____.
 - 2
 - 3
 - 4
- Action of Sodamide in liq. NH_3 on *o*-bromo toluene gives _____.
 - only *o*-amino toluene
 - only *m*-aminotoluene
 - mixture of *o*-amino and *m*-amino toluene
- O*-acylation of Phenol leads to the formation of _____.
 - ether
 - ketone
 - ester
- An appropriate solvent for Grignard's reagent formation is _____.
 - tetrahydrofuran
 - water
 - aqueous alcohol
- Epoxides are also named as _____.
 - Oxitanes
 - Oxiranes
 - Oxaphosphetanes

B) State whether the following statements are True or False.

03

- For strong electrolytes degree of dissociation is nearly equal to one.
- Molecule F_2 contains one sigma bond and two Pi bonds.
- In $\text{S}_{\text{N}}2$ reaction, the rate of reaction depends only on the concentration of alkyl halide

Q.P. Code : 19759

C) Match the following

05

Column 'X'	Column 'Y'
i) Fugacity	a) Octahedral structure
ii) Cell constant	b) Lattice energy
iii) Born Lande's equation	c) $\mu = \mu^0 + RT \ln f$
iv) Sulphur hexa fluoride	d) Detergents
v) Sulphation of alcohols	e) l/a
	f) Angle F-S-F=60°
	g) Waxes

- Q.2 A) i) Derive Gibbs-Helmholtz equation 05
 ii) The standard free energy change for a gaseous reaction is -100kJ / mol. Calculate the equilibrium constant of reaction at 25°C. (Given: $R=8.314JK^{-1}mol^{-1}$) 03
- OR
- A) i) Derive the expression for Van't Hoffs reaction isochore. 05
 ii) What is the change in Gibb's free energy of a chemical process whose change in enthalpy at 400K is -110kJ and entropy change is +40JK⁻¹. State whether the reaction is spontaneous or non-spontaneous. 03
- B) i) Describe moving boundary method for determination of transport number of ion. 05
 ii) The resistance of 0.1N salt solution is 150 ohm at 298K. Calculate equivalent conductance of the electrolyte, if the cell constant is 1.05cm⁻¹. 03
- OR
- B) i) What is limiting molar conductance? How is it determined for strong and weak electrolyte? 05
 ii) In the moving boundary method, for determination of transport number of potassium ions, in 0.1 mol.dm⁻³ of potassium chloride, the boundary moved through a distance of 6.98cm in a tube of the cross sectional area of 0.112cm². A current of 0.0061 amperes passed for 2490 seconds was responsible for the movement of the boundary. Calculate the transport number of K⁺ ion. 03
- C) Define chemical potential. Explain variation of chemical potential with pressure and temperature. 04
- OR
- C) i) State Kohlrausch's law of independent migration of ions. 02
 ii) Define: - (p) Specific conductance 02
 (q) Molar conductance
- Q.3 A) i) What is ionic bond? Explain any two conditions for the formation of ionic bond. 05
 ii) Explain the hybridization of 'Be' in BeCl₂. 03
- OR
- A) i) Explain the role of 'exchange energy' and 'ionicity' in determining the bond energies and bond-length in the formation of H₂ molecule by the valence bond approach. 05
 ii) Give comparison between 'atomic orbitals' and 'molecular orbitals'. 03

SYBSC Sem III

QP Code : 19764

[Time : 3 Hours

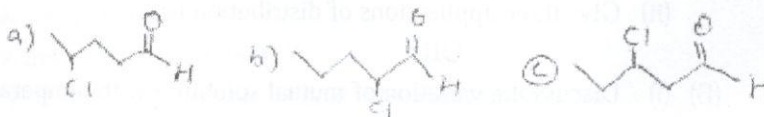
[Total Marks : 100

- N.B :**
- All questions are compulsory.
 - Answers to the same question must be written together.
 - Figures to the right indicate full marks.
 - Use of non-programmable calculator / logarithm table is permitted.

12

1. (A) Select the correct option and complete the following sentences :—

- Nitration of phenol is an example of _____ reaction.
 - consecutive
 - parallel
 - opposing
- The correct form of Arrhenius equation is _____.
 - $k = Ae^{E_a/RT}$
 - $\log k = Ae^{-E_a/RT}$
 - $k = Ae^{-E_a/RT}$
- Ideal solution is formed when its components.
 - have zero heat of mixing only
 - have zero heat of mixing and zero volume change
 - can be converted into gases.
- For the study of distribution law the two solvents should be _____.
 - volatile
 - immiscible
 - miscible
- Tincal and Suhagain are the naturally occurring ores of _____.
 - Borax
 - Diborane
 - Silicon dioxide
- _____ among the following elements has remarkably low melting point and expands when it forms a solid.
 - Indium
 - Gallium
 - Thallium
- All elements in group-14 show covalency greater than four except _____.
 - Silicon
 - Carbon
 - Germanium
- Germanium is extracted from _____ ore.
 - Colemanite
 - Argyrodite
 - Ilmenite
- The aldehyde used in the Knoevenagel reaction is having _____.
 - no α - H atom
 - α - H atom
 - α and β - H atom
- 2 - chloropentanal is _____.



[TURN OVER

(xi) The active methylene group will have _____ groups attached to it.

- (a) -CN and NO_2
 (b) $-\text{NH}_2$ and -OR
 (c) -NHCOR and -COR

(xii) The general structure of enamine is _____.



(B) State whether the following statements are true or false :—

- (i) The rate of most of the reactions increase considerably with increase in temperature.
 (ii) Nitrogen exhibits allotropy.
 (iii) Aldehydes are usually more reactive towards nucleophilic reagents than ketone.

(C) Match the columns :—

- | | |
|---|---|
| (i) Units of Energy of activation | (a) Partially miscible with upper and lower CST |
| (ii) Water + Nicotine System | (b) kJmol^{-1} |
| (iii) +3 oxidation state | (c) Carbon |
| (iv) $2s^2, 2p^2$ valence configuration | (d) electrophilic |
| (v) 'O' in $>\text{C}=\text{O}$ is | (e) Nucleophilic |
| | (f) Aluminium |
| | (g) $\text{JK}^{-1} \text{mol}^{-1}$ |
| | (h) Thallium |

2. (A) (i) Explain the application of Collision Theory to Bimolecular reactions.
 (ii) Give any three merits of Collision Theory.

OR

- (A) (i) What are Chain carriers ? Explain the important steps in a chain reaction.
 (ii) Explain reversible reactions giving a suitable example.
 (B) (i) With the help of vapour pressure-composition diagram explain positive deviations from Raoult's law.
 (ii) Give three applications of distribution law.

OR

- (B) (i) Discuss the variation of mutual solubility with temperature for the 'Phenol-water' system.
 (ii) Give the techniques used to separate the components of an azeotropic mixture.

[TURN OVER

- (C) For a first order reaction : $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$; the frequency factor 'A' is $4.3 \times 10^{13} \text{ s}^{-1}$ and E_a is $103.35 \text{ kJmol}^{-1}$. What is the rate constant ?
[Given : $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$]

OR

- (C) A mixture of water and aniline boils at a temperature of 98.5°C at pressure of $1.013 \times 10^5 \text{ Nm}^{-2}$, The vapour pressure of water at this temperature is $9.558 \times 10^4 \text{ Nm}^{-2}$, Find the composition of the distillate.
[Given : Molecular weight of water = 18, molecular weight of aniline = 93]

3. (A) (i) Discuss the gradation in properties of group 13 elements with respect to atomic radii and Ionisation energy values. 5
(ii) Give a brief account of structure of Diborane. 3

OR

- (A) (i) Explain the purification of 'Germanium' by zone refining technique. 5
(ii) 'Zone refining technique is not effective for the purification of silicon'. Give reasons. 3
(B) (i) Write notes on 'Oxidation states' exhibited by the elements of group 15. 5
(ii) Name the hydrides of group 15 elements. Give an account of the physical state and solubility of these hydrides. 3

OR

- (B) (i) Discuss the preparation of borax from 'boric acid'. Mention any two important properties and any two uses of borax. 5
(ii) Give an account of one method of preparation, and the physical properties of nitrous oxide. 3

- (C) Discuss the structure of SiO_2 . 4

OR

- (C) Explain why boron trihalides can act as Lewis acids. 4

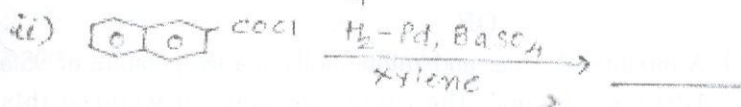
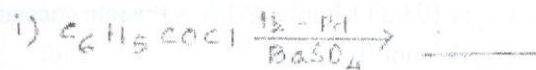
4. (A) (i) Explain the mechanism of Benzoin Condensation. 5
(ii) Give preparation of succinic acid from ethyl aceto acetate. 3

OR

- (A) (i) (a) Give preparation of benzaldehyde and acetophenone by oxidation of alcohol by using PCC. 3
(b) What are stabilised enols? 2
(ii) How will you obtain isobutyric acid from ethyl acetoacetate? 3

[TURN OVER

- (B) (i) (a) Complete the following reactions and explain the role of BaSO_4 in the reaction. 3



- (b) Discuss the reduction of propanal by using LiAlH_4 . 2

- (ii) Give the mechanism of acid catalysed enolisation. 3

OR

- (i) (a) Write a note on Gattermann - Koch formylation. 3

- (b) Discuss the reduction of 2-butenal by using NaBH_4 . 2

- (ii) Explain the general mechanism of nucleophilic addition to carbonyl compound. 3

- (C) Discuss the synthesis of primary, secondary and tertiary alcohols from Grignard reagent. 4

OR

- (C) Explain the preparation of acetal and cyclic acetal from ethanal. 4

5. Attempt any **four** :—

- (A) State and explain any five conditions for the validity of Nernst Distribution Law. 5

- (B) Compare the Collision Theory with the Activated Complex theory of reaction rates. 5

- (C) How is silicon purified by Czochralski pulling technique? 5

- (D) Give an account of the synthesis of NH_3 by Haber's process. 5

- (E) Explain the mechanism of Claisen - Schmidt reaction. 5

- (F) Give the IUPAC name of CH_3CHO , give its preparation using grignard reagent. 5

What is the action of HCN on CH_3CHO ?

SYBSC

16/11/2017

Q.P. Code: 19828

Time: 3 hours

100 marks

Please check whether you have got the right question paper.

Note: All questions are compulsory

Figures to the right indicate maximum marks

Use of non-programmable calculators is allowed.

Q1. A. Select the correct option and complete the following sentences.

[12]

- i. Polarimetry is an example of _____ method
 a. Thermal b. Electroanalytical c. Optical
- ii. Weighing of hot crucible is an example of _____ error
 a. Instrumental b. Operational c. Methodic
- iii. An auger is used for sampling of _____
 a. flowing liquids b. free flowing solids c. compact solids
- iv. Sample weight in the range of 1-10 mg is _____ analysis
 a. semi-micro b. micro c. Ultramicro
- v. When a 0.1 M solution of a weak base BOH is titrated against 0.1 M HCl solution, the pH at the equivalence point will be _____
 a. less than 7 b. more than 7 c. 7
- vi. _____ is a secondary standard
 a. succinic acid b. potassium dichromate c. sodium hydroxide
- vii. Precipitation of the ionic solid takes place if _____
 a. solubility product > ionic product
 b. solubility product < ionic product
 c. solubility product = ionic product
- viii. Iodometry is one of the most important _____ titration method
 a. neutralisation b. complexometric c. redox
- ix. Introduction of an auxochrome in a molecule shifts the absorption to _____
 a. shorter wavelength
 b. longer wavelength
 c. higher energy

- x. If the concentration is in g/dm^3 and pathlength in cm, the unit of absorptivity would be _____
 a. $\text{g}^{-1} \text{dm}^3 \text{cm}^{-1}$ b. $\text{mol}^{-1} \text{dm}^3 \text{cm}^{-1}$ c. $\text{g dm}^{-3} \text{cm}^{-1}$
- xi. For analysis in the UV region, the cuvette should be made up of _____
 a. glass b. transparent plastic c. quartz
- xii. The burette solution is known as _____
 a. titrant b. analyte c. titrand

B. State whether the following statements are true or false [3]

- i. For better quality precipitate, the precipitant should be added to cold, dilute solution of the reacting species with constant stirring.
- ii. Use of a pipette with broken tip is an example of personal error.
- iii. Eriochrome Black T indicator is generally used in complexometric titration of magnesium with EDTA.

C. Match the following. [5]

Sr. no	Column A	Sr. no.	Column B
1	Operational error	a	Acid- base indicator
2	DTA	b	grating
3	Methyl orange	c	Thermal method
4	monochromator	d	Shift to longer wavelength
5	conjugated compound	e	Incomplete drying
		f	Conductometry

- Q2. A (i) Classify determinate errors according to their sources and explain each class with suitable example. [5]
- (ii) Describe concentric tube thief and its use in sampling of free flowing solids. [3]

OR

- A. (i) Explain, different methods adopted to minimize determinate errors. [5]
- (ii) What are electroanalytical methods of analysis? Mention any two electroanalytical methods indicating the property measured. [3]
- B. (i) The replicate measurements on the determination of percentage of sulphide in an industrial sample gave the following results: 40.16, 40.20, 40.22, 40.18 [5]
- The true value for the percentage of sulphide in the sample is 40.18. Calculate the absolute error and relative error for each of the observations in parts per thousand.

(ii) Write a note on sampling of flowing liquids. [3]

OR

B. (i) Calculate the absolute error and relative error in percent in the following: [5]

sample	Measured value	Accepted value
a	22.68 g	22.57 g
b	45.02 cm ³	45.31 cm ³
c	2.68 %	2.71%
d	85.6 cm	85.0 cm

(ii) Distinguish between accuracy and precision. [3]

C. Define the following: [4]

- i. Constant error ii. Increment iii. Analysis sample iv. Proximate analysis

OR

C. Define the following: [4]

- i. Sampling unit ii. Trace analysis iii. Sub sample iv. Universe

Q3. A. (i) Explain various types of titrations with suitable examples. [5]

(ii) Explain the importance of washing of precipitate in gravimetric analysis. [3]

OR

(i) Explain the important steps involved in the precipitation gravimetric analysis. [5]

(ii) What are primary standards? What are the requirements a primary standard must fulfill? [3]

B. (i) 50 cm³ of 0.1 M solution of a weak acid HA ($K_a = 1 \times 10^{-5}$) is titrated with 0.1 M NaOH.

Calculate pH at the start of the titration and after addition of 10.0 cm³ of NaOH. [5]

(ii) Explain the purpose of drying and ignition of precipitate. [3]

OR

B. (i) Calculate the equivalent weight of the following substances

I. Ammonia-NH₃

II, Oxalic acid - H₂C₂O₄ (in reaction with NaOH) [5]

[Atomic weights: N = 14, O = 16, H = 1, C = 12]

(ii) What is meant by potentiometric titrations? Write examples of reference and indicator electrodes used in potentiometric titrations. [3]

C. Define the following

- i. Equivalence point ii. Titrimetry iii. End point iv. Standard solution [4]

OR

C. Explain gravimetric estimation of Nickel in cupronickel alloy using DMG. [4]

- Q4. A.(i) State Beer-Lambert's law and explain the deviations from the law. [5]
 (ii) What are wavelength selectors? Explain the use of prism as a wavelength selector. [3]

OR

- (i) What are photometric titrations? Explain the different shapes of photometric titration curves with suitable examples. [5]
 (ii) Draw a neat labelled diagram of a single beam spectrophotometer. And mention the sources used for UV and visible region. [3]

- B. (i) Titanium is reacted with hydrogen peroxide in 1 M sulphuric acid to form a coloured complex. If a 2.0×10^{-5} M solution absorbs 31.5 % of the radiation at 415 nm in a cell of 1 cm, what would be (a) absorbance of the solution and (b) If the concentration of the solution is changed to 6.0×10^{-5} M, what would be the absorbance of the resultant solution. [5]

- (ii) Distinguish between colorimeter and spectrophotometer. [3]

OR

- (i) The transmittance of 4.0×10^{-3} M solution of a nickel salt is 48% at a wavelength of 510 nm, when placed in a cell of 1 cm length. Calculate (i) absorbance and (ii) molar absorptivity of the solution. [5]
 (ii) Explain quantitative estimation by calibration curve method. [3]
 C. (i) Define: I) Molar absorptivity II) λ_{\max} [2]
 (ii) Explain determination of Cu (II) and Bi (III) in a mixture using photometric titrations. [2]

OR

- C. Explain any two applications of UV-VIS spectrophotometry. [4]

- Q5. Attempt **Any Four** of the following: [20]

- A. Explain experimental set up for photometric titration.
 B. What are photocells? Explain the construction and working of a photomultiplier tube.
 C. What are the different methods of sample size reduction? Explain any one method in detail.
 D. Explain estimation of aluminium as its oxide using gravimetric analysis.
 E. What is neutralisation titration curve? Explain the role of indicators in acid-base titrations.
 F. What is the purpose of sampling? Explain random sampling.

-----XXXX-----

Q.P. Code : 19580

[Time: Three Hours]

[Marks: 100]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Figures to the right indicate marks.
 3. Draw neat and labeled diagrams wherever necessary.

Q.1 A) Choose the correct option from the following:

10

- Sargassum* belongs to the division _____.
 a) Cyanophyta b) Chlorophyta c) Rhodophyta d) Phaeophyta
- Algin is obtained from members belonging to _____.
 a) Cyanophyta b) Chlorophyta c) Rhodophyta d) Phaeophyta
- The sporophyte of *Anthoceros* is characterized by the presence of _____.
 a) Foot, Seta and Capsule b) Foot and Capsule only
 c) Seta and Capsule only d) Capsule only
- Capsule of *Funaria* is differentiated into _____.
 a) 2-regions b) 4-regions c) 3-regions d) Many regions
- Syngenesious anther is characteristic of family _____.
 a) Asteraceae b) Amaranthaceae c) Palmae d) Leguminosae
- Sunflower is botanically known as _____.
 a) *Carthamus tinctorious* b) *Helianthus annuus*
 c) *Tridax procumbens* d) *Eclipta alba*
- 'K' in floral formula refer to _____.
 a) Calyx b) Corolla c) Stamens d) Carpels
- Coconut water is basically _____.
 a) Secretion from plants b) Liquid endosperm
 c) Endocarp d) Mesocarp
- First _____ was made in 1931 by Ernst Ruska and Max Knoll.
 a) Electron microscope b) Electrophoresis unit
 c) Compound microscope d) Dissecting microscope
- The mobile phase in paper chromatography is _____.
 a) Solid b) Liquid c) Gas d) Inert

Q.P. Code : 19580

- Q.1 B)** Answer the following in **one or two** sentences: 10
- i) Give the economic importance of *Sargassum*.
 - ii) Give two examples of phaeophytes with heterotrichous forms of thallus.
 - iii) What are diadelphous stamens?
 - iv) What is Plant nomenclature?
 - v) What is herbarium?
- Q.2** Answer **any two** of the following: 20
- i) Describe the sexual reproduction in *Anthoceros*.
 - ii) Discuss the range of thallus structure in Phaeophyta.
 - iii) With the help of neat and labeled diagrams, explain the external and internal structure of sporophyte of *Funaria*.
 - iv) What is alternation of generation? Explain it with reference to the life cycle of *Sargassum*.
- Q.3** Answer **any two** of the following. 20
- i) Give systematic position, distinguishing characters and floral formula of subfamily Papilionaceae.
 - ii) Assign any two plants to their respective subfamily / families giving reasons and give their economic importance
 - (a) *Cocos nucifera*
 - (b) *Achyranthes aspera*
 - (c) *Mimosa pudica*
 - iii) Describe the importance of Anatomy in relation to Taxonomy.
 - iv) Give a detailed account on objectives and goals of plant systematics.
- Q.4** Answer **any two** of the following: 20
- i) Give a detailed account of herbarium preparation.
 - ii) Explain the principle and working of light microscope.
 - iii) Discuss the working of electrophoresis apparatus.
 - iv) Describe TLC and give its applications.
- Q.5** Write short notes on **any four**: 20
- i) Systematic position of *Sargassum*.
 - ii) Economic importance of subfamily Caesalpinae.
 - iii) Ecology in relation to Taxonomy.
 - iv) Reproduction in phaeophyta.
 - v) Advantages and disadvantages of electron microscope.
 - vi) Ascending Paper Chromatography.

[Time: Three Hours]

[Marks: 100]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Figures to the right indicate marks.
 3. Draw neat and labeled diagram wherever necessary.

Q.1 A) Choose the correct option from the following:

10

- i) In *Sargassum* the fertile laterals are known as _____.
a) Leaves b) Phylloclades c) Vesicles d) Receptacles
- ii) Members of _____ are commonly called brown algae.
a) Chlorophyta b) Chrysophyta c) Phaeophyta d) Rhodophyta
- iii) *Anthoceros* is commonly known as _____.
a) Liverwort b) Hornwort c) Seaweed d) Moss
- iv) *Funaria* belongs to the class _____.
a) Musci b) Anthocerotopsida c) Funariales d) Eubrya
- v) 'Supari' is obtained from the tree of _____.
a) *Cocos nucifera* b) *Borassus flabellifer* c) *Areca catechu* d) *Caryota urens*
- vi) *Gomphrena globosa* belongs to family _____.
a) Leguminosae b) Amaranthaceae c) Palmae d) Asteraceae
- vii) Father of Taxonomy is _____.
a) Carl Linnaeus b) Bentham and Hooker c) Charles Darwin d) Roxburgh
- viii) '%' in foral formula refers to _____.
a) Actinomorphic b) Zygomorphic c) Bisexual d) Unisexual
- ix) The mobile phase in paper chromatography is _____.
a) Liquid b) Solid c) Gas d) Inert
- x) _____ electrophoresis is an example of discontinuous type.
a) Horizontal b) Vertical c) Polar d) Non polar.

Q.1 B) Answer the following in one or two sentences:

10

- i) Mention any two economic importance of brown algae.
- ii) Name any two methods of vegetative reproduction in *Funaria*.
- iii) What is a herbarium?
- iv) What is plant systematics?
- v) Mention any two advantages of Thin Layer Chromatography.

Q.P. Code : 19579

- Q.2** Answer **any two** of the following: 20
- i) Discuss the range of thallus structure in Phaeophyta.
 - ii) With the help of diagram describe the external morphology *Sargassum*.
 - iii) Explain the internal structure of *Anthoceros* gametophyte.
 - iv) Describe external and internal structure of sporophyte of *Funaria*.
- Q.3** Answer **any two** of the following. 20
- i) Give systematic position, distinguishing characters and floral formula of family Asteraceae.
 - ii) Assign any two plants to their respective families giving reasons and give their economic importance.
 - i) *Pisum sativum*
 - ii) *Cocos nucifera*
 - iii) *Mimosa pudica*
 - iii) Discuss the importance of palynology in relation to taxonomy.
 - iv) Define Plant Nomenclature. Discuss International Code of Botanical Nomenclature.
- Q.4** Answer **any two** of the following: 20
- i) Describe the process of Herbarium making in detail.
 - ii) Explain the principle and working of light microscope.
 - iii) Give an account of Thin Layer Chromatography.
 - iv) Explain any one type of Electrophoresis.
- Q.5** Write short notes on **any four**: 20
- i) Vegetative reproduction in *Funaria*.
 - ii) Female conceptacle in *Sargassum*.
 - iii) Papilionaceous corolla.
 - iv) Ecology in relation to Taxonomy.
 - v) Wet preservation techniques.
 - vi) Economic importance of Sub-family Caesalpinae

Q.P. Code :19593

[Time: Three Hours]

[Marks:100]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Figures to the right indicate marks.
 3. Draw neat and labelled diagrams wherever necessary.

Q.1 A) Choose the correct option from the following:

(10)

- The two sub units of prokaryotic ribosomes are _____.
a) 60 S & 40 S b) 50 S & 30 S c) 60 S & 30 S d) 70 S & 30 S
- During which stage of prophase-I, crossing over takes place _____.
a) Leptotene b) Zygotene c) Pachytene d) Diplotene
- Which of the following type of DNA is left handed helix _____.
a) A b) Z c) B d) C
- Crossover suppressing characteristic is shown by _____ chromosomal aberration.
a) deletion b) duplication c) Inversion d) Translocation
- In reptiles and fishes _____ method of sex determination is found.
a) XX-XO b) XX-XY c) ZW-ZZ d) ZO-ZZ
- The daughters of a man who is colour blind and a woman who is homozygous dominant normal vision will be _____.
a) Colour blind b) Carrier c) Normal vision d) Colour blind and carrier
- Evidence of cytoplasmic inheritance in *Mirabilis jalapa* was first reported by _____.
a) Nass b) Correns c) Rhoades d) Sonneborn
- Messelson & Stahl used _____ bacterium in their experiments.
a) *E.coli* b) *Salmonella typhi* c) *Streptococcus pneumoniae* d) *Salmonella typhimurium*
- _____ protein binds to single - stranded DNA, and prevents it from forming duplex DNA.
a) DSB b) SSB c) TSB d) PSB
- Synthesis of _____ strand of DNA involves formation of series of discontinuous short segments of nucleotides called okazaki fragments.
a) Leading b) Lagging c) Parental d) Primer

B) Answer the following in **one or two** sentences.

(10)

- What is karyokinesis ?
- What is the function of peroxisome?
- Name the two types of inversion.
- What is the significance of cytoplasmic male sterility?
- What do you mean by replicon?

Q.P. Code :19593

- Q. 2** Answer **any two** of the following: (20)
- Describe the ultra structure of mitochondria. Add a note on its function.
 - Describe the structure of t-RNA. Add a note on its function.
 - Describe B and C forms of DNA.
 - Define meiosis. Give a detailed account of prophase - I of meiosis - I.
- Q. 3** Answer **any two** of the following: (20)
- What are chromosomal aberrations? Discuss duplication with reference to their origin and genetic significance in *Drosophila*.
 - Explain the methods of sex determination in homogametic females with the help of a suitable examples.
 - What is sex-linked inheritance? Explain it with reference to haemophilia in human beings.
 - Explain Cytoplasmic inheritance in *Mirabilis jalapa*.
- Q. 4** Answer **any two** of the following: (20)
- Explain the role of various enzymes involved in Eukaryotic DNA replication.
 - Describe how Messelson-Stahl's experiment proved that DNA replication is semi-conservative.
 - Describe briefly the molecular mechanism of DNA replication in prokaryotes.
 - Explain the process of transcription in eukaryotes.
- Q. 5** Write short notes on **any four**. (20)
- Telophase
 - Z-DNA
 - ZO-ZZ type of sex determination
 - Lyon's hypothesis
 - Translocations
 - Central Dogma

15/11/2017

Q.P. Code :19594

[Time: Three Hours]

[Marks:100]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Figures to the right indicate marks.
 3. Draw neat and labelled diagrams wherever necessary.

Q. 1 A) Choose the correct option from the following:

(10)

- i) DNA replication occurs in _____.
a) S phase b) G1 Phase c) G2 Phase d) M Phase
- ii) Who coined the term Mitochondria _____.
a) Kolliker b) Altman c) Benda d) Flemming
- iii) The anticodon region is an important structural component of _____.
a) m - RNA b) r - RNA c) DNA d) t - RNA
- iv) In _____ type of inversion centromere is not a part of inverted segment.
a) Pericentric b) Paracentric c) Genetic inversion d) Zygotic inversion
- v) *Drosophila* has _____ pairs of chromosomes.
a) 3 b) 4 c) 6 d) 8
- vi) Y - linked genes are also called _____.
a) Holandric genes b) Plasma genes c) Cytoplasmic genes d) Sex- linked genes
- vii) In *Mirabilis jalapa* plant, if the female parent is from green branch and the male parent from variegated branch the colour of the offspring will be _____.
a) White b) Variegated c) Green d) Mixed
- viii) _____ is ATP dependent unwinding enzyme which promotes separation of the two parental strands by disrupting hydrogen bonds.
a) Nuclease b) Helicase c) Ligase d) Primase
- ix) The replication of DNA starts at a specific or unique sequence of nitrogenous bases in the DNA molecule called _____ of replication.
a) Terminal b) Priming c) Origin d) Initiation
- x) The enzyme _____ hydrolyses the p-p into inorganic phosphates (pi) & releases energy in DNA replication.
a) Pyrophosphatase b) Helicase c) Ligase d) Primase

B) Answer the following in one or two sentences.

(10)

- i) What are the two subunits of prokaryotic & Eukaryotic ribosome?
- ii) What is the function of DNA.
- iii) Define chromosomal aberration.
- iv) What is haemophilia.
- v) What is the function of SSB proteins.

- Q. 2** Answer **any two** of the following: (20)
- Define Mitosis. Explain the various stages of Mitosis.
 - Describe the Watsons and Crick's double helical structure of DNA.
 - Describe briefly the structure of t-RNA. Add a note on its functions.
 - Describe the Ultrastructure of mitochondria and give its functions.
- Q. 3** Answer **any two** of the following: (20)
- What are chromosomal aberrations? Discuss translocation with reference to their cytological and genetic significance.
 - Explain Genic balance theory of sex determination in *Drosophila*.
 - What is sex linked inheritance? Explain it with reference to haemophilia in human beings.
 - What is cytoplasmic inheritance? Explain streptomycin resistance in *chlamydomonas*.
- Q. 4** Answer **any two** of the following: (20)
- Explain the role of various DNA polymerases involved in eukaryotic DNA replication.
 - Explain the three modes of DNA replication.
 - Explain the process of transcription in prokaryotes.
 - Describe in brief the RNA processing involved in eukaryotes.
- Q. 5** Write short notes on **any four**. (20)
- Function of Glyoxysomes and Peroxisomes.
 - Significance of mitosis and meiosis.
 - Duplications.
 - XX-XY type of sex determination.
 - Sex influenced character.
 - Central Dogma.

16/11/2017

SYBSC Sem-III

Q.P. Code : 19586

(3 Hours)

[Total Marks : 100

- N.B. :** (1) All questions are **compulsory**.
 (2) **Figures** to the right **indicate marks**.
 (3) Draw **neat** and **labelled diagrams** wherever **necessary**.

1. (A) Choose the correct option from the following :

10

(i) First edition of Indian Pharmacopoeia was published in _____.

- (a) 1965 (b) 1955
 (c) 1975 (d) 1985

(ii) *Saraca asoca* belongs to the family _____.

- (a) Caesalpinaceae (b) Fabaceae
 (c) Acanthaceae (d) Combretaceae

(iii) Common name of *Centella asiatica* is _____.

- (a) Shatavari (b) Niruri
 (c) Brahmi (d) Jasmine

(iv) Saffron is obtained from _____.

- (a) Style and stigma of *Cocus* (b) Style and stigma of *Crocus*
 (c) Petals of *Chrysanthemum* (d) Flowers of *Syzygium*

(v) Social forestry helps in _____.

- (a) conservation of forest
 (b) reducing soil erosion
 (c) providing firewood to villagers
 (d) all of the above

(vi) Organic farming avoids use of _____ and protects environment from pollution.

- (a) manures (b) chemicals
 (c) biofertilizers (d) all of the above

(vii) Papain is obtained from the plant _____.

- (a) *Ananus comosus* (b) *Citrus limon*
 (c) *Carica papaya* (d) *Garcinia cambogia*

TURN OVER

Q.P. Code : 19586

2

(viii) _____ oil is commonly used as carrier oil in aromatherapy.

- (a) Lemon (b) Neem
(c) Jasmine (d) Jojoba

(ix) _____ is a rich source of iron.

- (a) Kale (b) Lemon
(c) Vanilla (d) Spirulina

(x) Botanical source of bromelain is _____.

- (a) *Citrus limon* (b) *Garcinia cambogia*
(c) *Ananas comosus* (d) *Carica papaya*

(B) Answer the following in **One** or **Two** sentences :

10

- (i) What are adulterants?
(ii) Give **any two** examples of secondary metabolites.
(iii) Define Fibre.
(iv) Define Urban forestry.
(v) Define Neutraceutical.

2. Answer **Any Two** of the following :

20

- (i) Explain Indian Herbal pharmacopoeia.
(ii) Give a detailed account of the secondary metabolites in *Glycyrrhiza glabra* and its adulterant.
(iii) Discuss the possible harmful effects of *Terminalia tomentosa* if it is used to adulterate *Terminalia arjuna*. Write a note on the secondary metabolites and medicinal uses of *Terminalia arjuna*.
(iv) With the help of suitable examples, explain the effect of regional and seasonal variations in secondary metabolites.

3. Answer **Any Two** of the following :

20

- (i) Give the botanical name and biological source of Jute. Discuss the process of extraction and processing of jute fibre.
(ii) Give the botanical name and biological source of cardamom. Describe the morphology of cardamom.

TURN OVER

Q.P. Code : 19586

3

- (iii) Define agro-forestry. Describe **any three** types of agro-forestry system practiced in India.
- (iv) Mention the different types of forests found in India. Describe tropical evergreen forests in detail.

4. Answer **Any Two** of the following :

- (i) What is aromatherapy? Discuss **any two** plants used in aromatherapy.
- (ii) What are Biofuels? Explain the process of biofuel production from *Jatropha*.
- (iii) Give the botanical source, nutritional values and uses of *Garcinia cambogia*.
- (iv) Mention the botanical source, properties and uses of cellulases.

20

5. Write short notes on **(Any Four)** :

- (i) Monograph.
- (ii) Uses of *Saraca asoca* and *Centella asiatica*.
- (iii) Types of Silviculture System.
- (iv) Subtropical montane forests.
- (v) Uses of Jasmine.
- (vi) Uses of Cotton fibre.

20

(3 Hours)

Marks : 100

- NB : (1) All questions are compulsory.
(2) Figures to the right indicate full marks.
(3) Draw neat and labelled diagrams wherever necessary.

1. (A) Choose the correct option from the following :

10

(i) _____ is a compilation of official standards for drugs manufactured in India.

- (a) Ayush (b) Ayurveda
(c) Indian Pharmacopoeia (d) Monograph

(ii) _____ is commonly known as Brahmi and Mandukaparni.

- (a) *Saraca asoca* (b) *Polyalthia longifolia*
(c) *Centella asiatica* (d) *Phyllanthus amarus*

(iii) *Glycyrrhiza glabra* is commonly known as _____.

- (a) Nicotine (b) Brahmi
(c) Licorice (d) Arjuna

(iv) Jute fibre is obtained from _____.

- (a) Xylem (b) Phloem
(c) Epidermis (d) Mesocarp

(v) Raising trees in an integrated manner is known as _____.

- (a) Urban forestry (b) Silvopasture
(c) Agroforestry (d) Riparian Buffer

(vi) Most alpine are found along _____.

- (a) Nilgiris (b) Satpudas
(c) Western ghats (d) Himalayas

(vii) Lemon is a rich source of vitamin _____.

- (a) A (b) C
(c) B (d) D

(viii) *Chlorella* is a rich source of _____.

- (a) Carbohydrate (b) Iron
(c) Protein (d) Vitamin C

(ix) Nutraceuticals normally contain _____.

- (a) Lipids (b) Proteins
(c) Vitamins (d) All of the above

[TURN OVER

- (x) _____ is commonly known as kokum.
- (a) *Brassica oleracea* (b) *Ananus comosus*
 (c) *Garcinia indica* (d) *Bacopa monnieri*

1. (B) Answer the following in **one or two** sentences : 10
- (i) Define monograph.
 - (ii) What are secondary metabolites ?
 - (iii) Name the various types of Tropical forests.
 - (iv) Mention the botanical name and family of cotton.
 - (v) Define Aromatherapy.
2. Answer **any two** of the following : 20
- (i) Give botanical source, properties and uses of *Saraca asoca*.
 - (ii) Illustrate with example different types of materials used for adulterating herbal drugs.
 - (iii) Describe how different species of *Phyllanthus* are distinguished from each other.
 - (iv) Differentiate between macroscopic and microscopic characters of *Saraca asoca* and *Polyalthia longifolia*.
3. Answer **any two** of the following : 20
- (i) Describe any two types of forests of India.
 - (ii) Define Urban forestry. Discuss it in detail.
 - (iii) Define organic farming. Discuss the various methods of organic farming.
 - (iv) Discuss the various agricultural practices that are followed for the cultivation of saffron.
4. Answer **any two** of the following : 20
- (i) Jojoba and Lemon are considered important plants in Aromatherapy. Discuss it in detail.
 - (ii) What are botanicals and Nutraceuticals ? Give a detailed account of *Spirulina* and *Chlorella* as the same.
 - (iii) What are enzymes ? Discuss the properties and uses of cellulases.
 - (iv) What are biofuels ? Discuss it in detail.
5. Write short notes on (**Any Four**) 20
- (i) Substitute and Adulterant
 - (ii) Properties and uses of *Bacopa monnieri* and *Centella asiatica*.
 - (iii) Objectives of agroforestry
 - (iv) Sub-alpine forests
 - (v) Uses of Vanillin
 - (vi) Uses of Bromelain

Q.P. Code :19672

[Time: Three Hours]

[Marks:100]

Please check whether you have got the right question paper.

- N.B:
1. ALL QUESTIONS ARE COMPULSORY.
 2. FIGURES TO THE RIGHT INDICATE FULL MARKS.
 3. DRAW NEAT AND LABELED DIAGRAM WHEREVER NECESSARY.

Q.1 A) Fill in the blanks by choosing the correct option given in the brackets: 05

- a) The trait expressed by the genes present on the X-chromosome is called as _____ inheritance.
(X-linked, Y-linked, Autosomal)
- b) Haplodiploidy is observed in _____.
(Drosophila, Crocodile, Honey bee)
- c) Mary Lyon proposed hypothesis for random _____ of one of the X-chromosome.
(inactivation, activation, non-disjunction)
- d) Nucleotides link to each other by _____ linkages to form polynucleotide chain.
(peptide, phosphodiester, lipid)
- e) DNA molecule is _____ stranded.
(single, double, triple)

Q.1 B) Match column I with column II and rewrite: 05

Column I		Column II
a) Recessive epistasis	1)	Hormonal influence in sex determination
b) ABO blood group	2)	9:3:4 ratio (phenotypic)
c) Sex reversal	3)	Dr Karl Landsteiner
d) Griffith	4)	Virgin birth
e) Parthenogenesis	5)	Transformation experiment

Q.1 C) State 'True' or 'False': 05

- a) Some disorders such as colour blindness and haemophilia are controlled by Y-linked genes.
- b) In reciprocal chiasma out of four chromatids only two are involved in the double crossing over.
- c) There are 22 pairs of autosomes in human beings.
- d) Mitochondrial DNA is an example of extra nuclear DNA.
- e) Translation occurs in the nucleus.

Q.1 D) Define the following: 05

- a) Back cross
- b) Gene
- c) Balbiani rings
- d) Gynandromorph
- e) Transcription

Q.P. Code :19672

- Q.2** A) Describe in detail the monohybrid cross and state the Mendelian principle of inheritance derived from it. **10**
it.
OR
A) Explain the inheritance of multiple alleles with the help of suitable example. **10**
- Q.2 B) Write short notes on (ANY TWO):** **10**
a) Classical and modern concept of gene
b) Differences between dominant and recessive traits
c) Test cross
d) Chromosome theory of inheritance
- Q.3** A) Explain sex determination in *Drosophila*. **10**
OR
A) Describe sex chromosomes **10**
- Q.3 B) Write short notes on (ANY TWO):** **10**
a) Lampbrush chromosomes
b) Role of environment in sex determination
c) Sex influenced genes
d) Haemophilia
- Q.4** A) Describe different types of RNA and their functions **10**
OR
A) Describe the regulation of gene with Lac Operon **10**
- Q.4 B) Write short notes on (ANY TWO):** **10**
a) Salient features of Watson and Crick model of DNA
b) One gene-one polypeptide theory
c) H-DNA
d) Chromosomal DNA in prokaryotes.
- Q.5** **Write short notes on (ANY FOUR):** **20**
a) Incomplete dominance
b) X-linked recessive inheritance
c) Barr bodies
d) XX-XO mechanism of sex determination
e) RNA polymerases
f) Wobble hypothesis.

SYBSC

Sem III

15/11/2017

Q. P. Code: 19677

Time: 03 Hours

Marks: 100

Please check whether you have got the right question paper.

N. b.

1. All questions are compulsory and carry equal marks.
2. Figures to right indicate full marks.
3. Draw neat labeled diagrams wherever necessary.
4. Attempt the questions in order.

Q.1 A) Fill in the blanks by choosing the correct options given below 05

- a) Fermentation of the food takes place in ----- of the ruminant stomach
(rumen, reticulum, omasum)
- b) Mammalian kidney is -----
(pronephric, metanephric, mesonephric)
- c) Coronary sinus is a vein which collects blood from-----
(Heart, head, hands).
- d) Alpha cells of islets of Langerhans produce hormone -----
(insulin, somatostatin, glucagon).
- e) Monotremes are -----
(oviparous, ovoviviparous, viviparous)

B) Match the columns I and II and rewrite 05

Column I

Column II

- | | |
|--------------|------------------------|
| a) Amphioxus | i. Venous heart |
| b) Bivalve | ii. Sole gel theory |
| c) Spider | iii. Organs of Bojanus |
| d) Shark | iv Book lungs |
| e) Amoeba | v. Wheel organ |

C) State whether True or False 05

- a) Earthworm is a triploblastic coelomate animal.
- b) Ultrafiltration takes place in malphigian body.
- c) Lymph contains RBC.
- d) Neurotransmitters are chemical messengers which help in transmission of impulse.
- e) Locomotion in starfish is takes place with the help of tube feet.

D) Define the following. 05

- a) Peristalsis
- b) Respiration
- c) Open circulation
- d) Homeostasis
- e) Polyspermic fertilization.

- Q.2 A) Explain physiology of carbohydrate and protein digestion in man. 10
OR
A) Explain structure of nephron in man
- B) Explain any two from the following. 10
a) Complete digestive system of earthworm.
b) Structure of gizzard in cockroach.
c) Flame cell in *Planaria*.
d) Uric acid as excretory product
- Q.3 A) Explain the structure of gills and mechanism of respiration in *Rohu*. 10
OR
A) Explain types of blood vascular system.
- B) Explain any two from the following. 10
a) Labyrinthine organ of *Anabas*.
b) Pulmonary ventilation in man
c) WBC's in man
d) S.A. node and A.V. node
- Q.4 A) Sliding filament theory 10
OR
A) Types of asexual reproduction.
- B) Explain any two from the following. 10
a) Nerve net in hydra.
b) Sole Gel theory
c) Oviparity and viviparity.
d) Structure of human sperm
- Q.5 Write short notes on any four 20
a) Gastrovascular cavity of hydra.
b) Organ of Bojanus.
c) Sinus venosus
d) Types of fertilization.
e) Schematic presentation of process of spermatogenesis.

SYBSC Sem-III

QP CODE : 20426

(3 Hours)

Marks : 100

- NB : (1) **All** questions are **compulsory**.
 (2) **Figures** to the **right** indicate full **marks**.
 (3) Draw neat, labelled diagrams wherever necessary.

1. (A) Fill in the blanks by choosing the correct option :-

05

- (a) _____ has deep red to brown body with white fur in belly area.
 a. Mantis shrimp b. Malabar giant squirrel
 c. Malabar pit viper
- (b) Common Kingfisher has _____ beak.
 a. long and pointed
 b. short and curved
 c. deeply curved
- (c) Gorilla's clenched teeth with mouth closed indicate _____.
 a. fear b. anger c. affection
- (d) Butter is clarified into _____ at low temperature.
 a. paneer b. curd c. ghee
- (e) pH range of _____ is suitable for survival of earthworms.
 a. 4 - 7 b. 5 - 9 c. 9 - 11

(B) Match the columns I and II and rewrite.

05

- | I | II |
|----------------------|-------------------------------------|
| (a) Drongo | (i) Dog breed |
| (b) Lion | (ii) Dr.Kurien |
| (c) Blue mormon | (iii) Forked tail |
| (d) German shepherd | (iv) Predatory behaviour |
| (e) White revolution | (v) State butterfly of Maharashtra. |

(C) State whether true or false

05

- (a) Lesser flemingo is a tall, large bodied bird with a long neck and small head.
 (b) Animals can not use chemical communication.
 (c) Deers often hunt in social units called pride.
 (d) Earthworms can tolerate higher salt concentration in soil.
 (e) Milk is important source of dietary calcium.

[TURN OVER

- (D) Answer in one sentence.
- Which is the fish having ability to walk on mudflats ?
 - Which is the fastest mammal on land ?
 - Give the full form of FAP.
 - State any one advantage of vermicompost.
 - What is skimmed milk ?
2. (A) Give an account of Komodo dragon and Great white pelican. 10
- OR**
- (A) Describe flying frog and gharial. 10
2. (B) Describe **any two** of the following. 10
- Striped tiger butterfly
 - Sperm whale
 - The Matilda viper
 - Mantis shrimp
3. (A) Discuss Nature versus Nurture controversy. 10
- OR**
- (A) Describe community wild life conservancies in Namibia. 10
3. (B) Describe **any two** of the following. 10
- In - situ conservation strategies.
 - Social behaviour in elephants.
 - Courtship behaviour in Great crested Grebe
 - Extinction crisis
4. (A) Describe different species of earthworms used in vermiculture 10
- OR**
- (A) Describe care and breeding behaviour of Gold fish and Siamese fighting fish. 10
4. (B) Describe **any two** of the following. 10
- Cheese
 - Mudhol hound dog
 - Persian cat
 - Milk powder

[TURN OVER

3

5. Write short notes on **any four** of the following :

20

- (a) Flying fish
 - (b) The Michael Jackson monkey
 - (c) HIPPCO
 - (d) Defensive behaviour in Octopus
 - (e) Ice-cream
 - (f) Windrows method of vermicomposting
-

Foundation Course - III
SyBA/SyBse 09/11/2017

Q.P. Code: 22448

(2 ½ hours)

Total marks: 75

N. B. (1) All questions are compulsory

(2) Figures to the right indicate full marks.

- 1) A. Explain the following concepts: (any five) (15)
1. Scheduled Castes
 2. Bonded labour
 3. Disaster Mitigation
 4. Rehabilitation
 5. Enlightenment
 6. Technology
 7. Verbal Communication
 8. Sign language

OR

B. Write a detailed note on the Foundation Course (Semester III) project submitted by you.

- 2) A. Explain the two legal provisions that deal with domestic violence and sexual harassment of women at workplace. (15)

OR

B. State and explain the different forms of violations faced by the disabled in the country and discuss the legal safeguards given to them.

- 3) A. Explain the different types and effects of disasters on human life. (15)

OR

B. Discuss issues related to the compensation and equitable distribution of relief.

- 4) A. Discuss the role of technology in ensuring health. (15)

OR

B. Explain the significance of scientific temper in modern India. Illustrate your answer.

- 5) A. Comment on various steps to improve presentation skills. (15)

OR

B) Group discussion can be used to analyze a student's personality. In view of this explain ways to excel in a group discussion.
