

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Second Semester)

Branch - **MATHEMATICS WITH COMPUTER APPLICATIONS**

PROGRAMMING IN C

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	A ____ is an identifier that is used to represent some specified type of information within a designated portion of a program. (a) Data types (b) Arrays (c) Variables (d) Functions	K1	CO1
	2	Which of the following operators are used to assign the values of an expression to an identifier? (a) Unary (b) Assignment (c) Conditional (d) Logical	K2	CO1
2	3	The ____ statement is used to terminate the loop or exit from a switch. (a) break (b) continue (c) comma (d) goto	K1	CO2
	4	What is the use of getchar()? (a) The next input character each time it is called. (b) EOF when it encounters end of file (c) The next input character each time it is called EOF when it encounters end of file (d) reading character doesn't require a return-type	K2	CO2
3	5	Which of the following is a process by which a function calls itself repeatedly, until some specified condition has been Satisfied? (a) Arguments (b) Recursion (c) Prototypes (d) Structure	K1	CO3
	6	The ____ variables are defined within a function. (a) Automatic (b) Global (c) Storage (d) Static	K2	CO3
4	7	Which of the following is a variable that represents the memory address of another variable as its value? (a) Pointer (b) Array (c) Structure (d) Memory	K1	CO4
	8	The ____ feature allows user to define new data type that are equivalent to existing data type. (a) deftype (b) typedef (c) type (d) new type	K2	CO4
5	9	The ____ is a data type similar to a structure or a union. (a) Enumerations (b) Files (c) String (d) Arguments	K1	CO5
	10	Which function is used to open a file in C? (a) Open() (b) fopen() (c) Fileopen (d) Create	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain declarations with suitable example.	K2	CO1
	(OR)			
	11.b.	Discuss arithmetic operators with example.		
2	12.a.	Write a c program to calculate simple compound Interest.	K2	CO2
	(OR)			
	12.b.	Discuss for loop with syntax and example.		
3	13.a.	Describe with example how do you passing arguments to a function?	K3	CO3
	(OR)			
	13.b.	Infer automatic variable. Write c program to calculate the factorial of an integer.		
4	14.a.	Explain with syntax and example how do you declare a pointer in C?	K3	CO4
	(OR)			
	14.b.	Write a C program to search a character from given string.		
5	15.a.	Discuss how do you open and close a file in C with example.	K3	CO5
	(OR)			
	15.b.	Write C program to reading a data file.		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Illustrate four different types of constants with suitable example.	K2	CO1
2	17	Write a C program to find the average of N numbers using While loop.	K2	CO2
3	18	Illustrate the following (i) Introduction to array (ii) Multidimensional array	K3	CO3
4	19	Compare structure and union with syntax and suitable example.	K3	CO4
5	20	Illustrate Command line arguments with suitable example.	K3	CO5

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Third Semester)

Branch - MATHEMATICS WITH COMPUTER APPLICATIONS

PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Question No.	Question	K Level	CO
1	The _____ of equation is the greatest exponent of the highest order. (a) form (b) order (c) degree (d) linear equation	K1	CO1
2	An equation which is not linear is called a _____ differential equation. (a) linear (b) non-linear (c) fractional (d) constant	K1	CO1
3	A _____ of a differential equation is a relation between the variables, by means of which and the derivatives obtained there from the equation is satisfied. (a) solution (b) complete integral (c) particular integral (d) fraction	K1	CO2
4	Charpit's method is primarily used to find _____. (a) second-order PDEs (b) particular solutions to nonlinear PDEs (c) first-order linear PDEs (d) linear equations	K2	CO2
5	An equation is said to be of order _____, if it involves atleast one of the differential coefficients $\frac{\partial^2 z}{\partial x^2}, \frac{\partial^2 z}{\partial x \partial y}, \frac{\partial^2 z}{\partial y^2}$. (a) zero (b) one (c) two (d) three	K2	CO3
6	The general form of a second-order PDE with variable coefficients includes _____. (a) only constant coefficients (b) variable functions multiplying the derivatives (c) no derivatives (d) only one dependent variable	K2	CO3
7	_____ are infinite series that represent periodic functions terms of cosines and sines. (a) Series (b) Fourier Series (c) Analytic (d) Equations	K1	CO4
8	f(x) is an _____ function if $f(-x) = f(x)$. (a) even (b) odd (c) cosine (d) sine	K2	CO4
9	The one-dimensional wave equation is given by _____. (a) $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ (b) $\frac{\partial^2 u}{\partial x^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ (c) $\frac{\partial^2 u}{\partial x^2} = c^2 \frac{\partial^2 u}{\partial t^2}$ (d) $\frac{\partial^2 u}{\partial t^2} = c \frac{\partial^2 u}{\partial x^2}$	K2	CO5
10	The values $\lambda_n = \frac{c_n \pi}{L}$ are called the _____ of the vibrating string. (a) function (b) eigen function (c) spectrum (d) eigen values	K2	CO5

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	Find the partial differential equation by eliminating a and b from the equation $z = ax + by + a^2 + b^2$.	K2	CO1
	(OR)		

Cont...

11.b.	Solve $(y^2z/x)p + xzq = y^2$.	K2	CO1
12.a.	Show that the equations $xp = yq$ and $z(xp + yq) = 2xy$ are compatible and solve them.	K3	CO2
(OR)			
12.b.	Find the complete integral of $px + qy = pq$.		
13.a.	Solve $r = 6x$.	K3	CO3
(OR)			
13.b.	Solve $xyz = 1$.		
14.a.	Find the Fourier series of the function $f(x) = \begin{cases} 0 & \text{if } -2 < x < -1 \\ k & \text{if } -1 < x < 1 \\ 0 & \text{if } 1 < x < 2 \end{cases}$ $p = 2L = 4, L = 2$.	K3	CO4
(OR)			
14.b.	Find the Fourier series of the function $f(x) = x + \pi$ if $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$.		
15.a.	Prove that $u_n(x, t) = (B_n \cos \lambda_n t + B_n^* \sin \lambda_n t) \sin \frac{n\pi}{L} x$.	K3	CO5
(OR)			
15.b.	Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature 0, assuming that the initial temperature is $f(x) = \begin{cases} x & \text{if } 0 < x < L/2 \\ L - x & \text{if } L/2 < x < L \end{cases}$		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Question No.	Question	K Level	CO
16	Form a partial differential equation by eliminating the function ϕ from $lx + my + nz = \phi(x^2 + y^2 + z^2)$.	K2	CO1
17	Show that the equations $xp - yq = x$ and $x^2p + q = xz$ are compatible and find their solution.	K3	CO2
18	Solve: $ys - p = xy^2 \cos(xy)$.	K3	CO3
19	Find the Fourier coefficients of the periodic function $f(x)$ if $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$ and $f(x + 2\pi) = f(x)$.	K3	CO4
20	Prove that $u(x, y) = \sum_{n=1}^{\infty} A_n^* \sin \frac{n\pi x}{a} \sinh \frac{n\pi y}{a}$.	K3	CO5

Z-Z-Z END

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Third Semester)

Branch - MATHEMATICS WITH COMPUTER APPLICATIONS

DATABASE MANAGEMENT SYSTEMS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	What is the term used to refer to a row? a) Attribute b) Tuple c) Field d) Instance	K1	CO1
	2	Statement 1: A tuple is a row in a relation Statement 2: Existence of multiple foreign keys in a same relation is possible which one of the following is correct? a) Both the statements are true b) Statement 1 is correct but Statement 2 is false c) Statement 1 is false but Statement 2 is correct d) Both the statements are false	K2	CO1
2	3	Which of the following is NOT a valid keyword in SQL? a) SELECT b) DELETE c) WHERE d) INCLUDE	K1	CO2
	4	The _____ clause allows us to select only those rows in the result relation of the _____ clause that satisfy a specified predicate. a) Where, from b) From, select c) Select, from d) From, where	K2	CO2
3	5	Which of the following tasks CANNOT be accomplished using SQL? a) Creating and modifying database structures b) Writing complex algorithms for data analysis c) Retrieving specific data from a database d) Adding new data to a database	K1	CO3
	6	The SQL LIKE operator is used in which of the following clause? a) Having b) Select c) Where d) Group by	K2	CO3
4	7	In which of the following formats data is stored in the database management system? a) Image b) Text c) Table d) Graph	K1	CO4
	8	Find which of the following is not a feature of DBMS? a) Minimum Duplication and Redundancy of Data b) High Level of Security c) Single-user Access only d) Support ACID Property	K2	CO4
5	9	The DBMS acts as an interface between _____ and _____ of an enterprise-class system. a) Data and the DBMS b) Application and SQL c) Database application and the database d) The user and the software	K1	CO5
	10	Which of the following set should be associated with weak entity set for weak entity to be meaningful? a) Neighbour set b) Strong entity set c) Owner set d) Identifying set	K2	CO5

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SECTION - B (35 Marks)Answer **ALL** questions**ALL** questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Identify different Database Languages.	K3	CO1
	(OR)			
	11.b.	Construct the architecture of the Database Structure.		
2	12.a.	List out the types of SQL statements.	K4	CO2
	(OR)			
	12.b.	Categorize the basic SQL operations.		
3	13.a.	Design a Database with the application of NULL values with example.	K6	CO3
	(OR)			
	13.b.	Build different nested sub queries used in SQL for a STUDENT Database.		
4	14.a.	Compare different types of schemes used to create a Database.	K4	CO4
	(OR)			
	14.b.	Examine the JOIN expression used in SQL.		
5	15.a.	Analyze an Entity Relationship Model for a STUDENT Database.	K4	CO5
	(OR)			
	15.b.	Distinguish the strong and weak entity set from any one of the Database as per your interest.		

SECTION -C (30 Marks)Answer **ANY THREE** questions**ALL** questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Identify the different views of data in DBMS.	K3	CO1
2	17	Inference about the SET operations used in SQL queries.	K4	CO2
3	18	Create a Database by applying various ways of modifications in it.	K6	CO3
4	19	Classify different KEY CONSTRAINTS needed for the Database administration.	K4	CO4
5	20	Discover an E-R Model by using all the symbols for a STUDENT Database.	K4	CO5

Z-Z-Z END

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**BSc DEGREE EXAMINATION DECEMBER 2024
(Third Semester)**

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

DISCRETE MATHEMATICS AND GRAPH THEORY

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Which of the following is an example of a tautology? a) She is both a doctor and a lawyer. b) Either it will rain tomorrow or it will not rain tomorrow. c) The book is on the table. d) He likes pizza more than anything else.	K1	CO1
	2	A ____ statement (or atomic proposition) is a basic statement in logic that cannot be broken down into simpler components. a) primitive b) conditional c) contradict d) normal	K2	CO1
2	3	If $P(n)$ denotes the number of partitions of n , then $P(5) = \underline{\hspace{2cm}}$. a) 12 b) 6 c) 5 d) 4	K1	CO2
	4	The Fibonacci sequence follows the recurrence relation $F(n) = \underline{\hspace{2cm}}$ a) $F(n-1)+F(n-2)$ b) $F(n+1)+F(n-2)$ c) $F(n-1)-F(n-2)$ d) $F(n)+F(n-1)$	K2	CO2
3	5	A ____ relation is a mathematical formula that expresses each term of a sequence in terms of one or more of its previous terms. a) binary b) cubic c) equivalence d) recurrence	K1	CO3
	6	What is the 5th term in the Fibonacci sequence? a) 3 b) 7 c) 8 d) 5	K2	CO3
4	7	Let V be a set of n vertices. The ____ graph on V , denote undirected graph where for all $a, b \in V$, $a \neq b$, there is an edge (a, b) . a) complete graph b) Regular graph c) connectd graph d) Euler graph.	K1	CO4
	8	In a directed graph, what is the in degree of a vertex v ? a) The number of edges leaving vertex v . b) The total number of edges incident to vertex v . c) The number of edges entering vertex v . d) The number of vertices adjacent to vertex v .	K2	CO4
5	9	A tree is a connected graph with no cycles and has n vertices and edges. a) n b) $n+2$ c) $n+1$ d) $n-1$	K1	CO5
	10	What is a spanning tree of a graph? a) A subgraph that contains all vertices of the graph and some of its edges, with no cycles. b) A tree that connects all vertices with the minimum possible edges. c) A graph that includes all edges of the original graph. d) A subgraph that contains all edges of the graph without any vertices.	K2	CO5

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SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Find the truth tables for the compound statements $p \vee (q \wedge r)$ and $(p \vee q) \wedge r$.	K2	CO1
		(OR)		
	11.b.	Verify that $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology.		
2	12.a.	How many ways can a police captain distribute 24 refile shells to four police officers so that each officer gets at least three shells, but not more than eight?	K3	CO2
		(OR)		
	12.b.	A company hires 11 new employees, each of whom is to be assigned to 3 one of four subdivisions. Each subdivision will get at least one new employee. In how many ways can these assignments be made?		
3	13.a.	Solve the recurrence relation $a_n + a_{n-1} - 6a_{n-2} = 0$ where $n \geq 2$ and $a_0 = 1, a_1 = 2$.	K4	CO3
		(OR)		
	13.b.	Solve the recurrence relation $a_n - 3a_{n-1} = 5(3^n)$, where $n \geq 1$ and $a_0 = 2$.		
4	14.a.	If $G=(V,E)$ is an undirected graph or multigraph, then prove that $\sum_{v \in V} \deg(v) = 2 E $.	K3	CO4
		(OR)		
	14.b.	State and prove decomposition theorem for Chromatic polynomials.		
5	15.a.	For any tree $T=(V,E)$, $ E \geq 2$, Then prove that T has at least two pendant vertices.	K4	CO5
		(OR)		
	15.b.	If T is an optimal tree for the n weights $w_1 \leq w_2 \leq \dots \leq w_n$ then prove that there exist an optimal tree T' in which the leaves of weights w_1 and w_2 are siblings at the maximal level (in T')		

SECTION - C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Find the d.n.f. for $f:B^3 \rightarrow B$, where $f(x,y,z) = xy + \bar{x}z$.	K3	CO1
2	17	Find a formula to express $0^2 + 1^2 + 2^2 + \dots + n^2$ as a function of n.	K3	CO2
3	18	Solve the recurrence relation $2a_{n+3} = a_{n+2} + 2a_{n+1} - a_n$, $n \geq 0$, $a_0 = 0$, $a_1 = 1$, $a_2 = 2$.	K4	CO3
4	19	Let $G = (V,E)$ be a connected planar graph or multigraph with $ V =v$ and $ E =e$. Let r be the number of regions in the plane determined by a planar embedding of G ; one of these regions has infinite area and is called the infinite region. Then prove that $v - e + r = 2$.	K4	CO4
5	20	If $G = (V, E)$ is an undirected graph. Then prove that G is connected if and only if G has a spanning tree.	K3	CO5

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Fourth Semester)

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

SEQUENCE, SERIES AND TRIGONOMETRY

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 If a sequence diverges to infinity, the sequence is
(i) bounded (ii) bounded above
(iii) bounded below (iv) oscillates
- 2 Consider the statements:
(a) Any bounded sequence is Cauchy
(b) A subsequence of a Cauchy sequence is Cauchy
In the above statements
(i) Both (a) and (b) are true (ii) (a) is true and (b) is false
(iii) (a) is false and (b) is true (iv) Both (a) and (b) are false
- 3 _____ is not absolutely convergent sequence.
(i) $\sum \frac{(-1)^n}{n^2}$ (ii) $\sum \frac{(-1)^n}{n}$
(iii) $\sum \frac{x^{n-1}}{(n-1)!}$ (iv) $\sum \frac{(-1)^n \sin n\alpha}{n^3}$
- 4 $\cosh 2x + \sinh 2x =$ _____
(i) $\frac{1 + \tanh x}{1 - \tanh x}$ (ii) $\frac{1 + \cosh^2 x}{1 - \cosh^2 x}$
(iii) $\frac{1 + \tanh x}{1 - \tanh x}$ (iv) $\frac{1 + \sinh^2 x}{1 - \sinh^2 x}$
- 5 What is the sum of the series $\left(\frac{2}{3} + \frac{1}{7}\right) - \frac{1}{3}\left(\frac{2}{3^3} + \frac{1}{7^3}\right) + \frac{1}{5}\left(\frac{2}{3^5} + \frac{1}{7^5}\right) - \dots$?
(i) $\frac{\pi}{4}$ (ii) $\frac{\pi}{2}$ (iii) $\frac{\pi}{6}$ (iv) $\frac{\pi}{12}$

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a If the sequence of real numbers $(s_n)_{n=1}^{\infty}$ converges to L then prove that any subsequence of $(s_n)_{n=1}^{\infty}$ is also converges to L .
OR
b If the sequence of real numbers $(s_n)_{n=1}^{\infty}$ is convergent then prove that $(s_n)_{n=1}^{\infty}$ is bounded.
- 7 a Prove that if $(s_n)_{n=1}^{\infty}$ is a Cauchy sequence of real numbers then $(s_n)_{n=1}^{\infty}$ is bounded.
OR
b If $(s_n)_{n=1}^{\infty}$ is a sequence of real numbers which converges to L , then prove that $(s_n^2)_{n=1}^{\infty}$ converges to L^2

Cont....

- 8 a If $\sum_{n=1}^{\infty} a_n$ converges absolutely then prove that $\sum_{n=1}^{\infty} a_n$ converges.

OR

- b Using root test to find the convergence of the series $\sum_{n=1}^{\infty} \frac{x^n}{n}$.

- 9 a Expand $\sin^6 \theta$ in a series of sines of multiples of θ .

OR

- b If $\cos \alpha \cdot \cosh \beta = \cos \phi$, $\sin \alpha \sinh \beta = \sin \phi$ prove that $\sin \phi = \pm \sin^2 \alpha = \pm \sinh^2 \beta$.

- 10 a Sum to infinity the series $c \cos \alpha - \frac{c^3}{3} \cos 3\alpha + \frac{c^5}{5} \cos 5\alpha - \dots$

OR

- b If $\log \sin(\theta + i\phi) = L + iB$, then compute $2e^{2L}$.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

- 11 a Prove that the sequence is $\left\{ \left(1 + \frac{1}{n}\right)^n \right\}_{n=1}^{\infty}$ is convergent.

OR

- b If $(s_n)_{n=1}^{\infty}$ is a sequence of non negative numbers n if $\lim_{n \rightarrow \infty} S_n = L$ then prove that $L \geq 0$.

- 12 a If $(s_n)_{n=1}^{\infty}$ and $(t_n)_{n=1}^{\infty}$ are sequences of real numbers, If $\lim_{n \rightarrow \infty} s_n = L$ and if $\lim_{n \rightarrow \infty} t_n = M$ where $M \neq 0$ then prove that $\lim_{n \rightarrow \infty} \left(\frac{s_n}{t_n} \right) = \frac{L}{M}$.

OR

- b If $(s_n)_{n=1}^{\infty}$ is a Cauchy sequence of real numbers, then prove that $(s_n)_{n=1}^{\infty}$ is convergent.

- 13 a State and prove Minkowski's inequality.

OR

- b Prove that (i) The series $\sum_{n=1}^{\infty} \frac{1}{n^2}$ is converges

(ii) The series $\sum_{n=1}^{\infty} \frac{1}{n}$ is diverges (iii) The series $\sum_{n=1}^{\infty} \frac{1}{n \log n}$ is diverges

- 14 a Separate into real and imaginary parts $\tan^{-1}(x + iy)$.

OR

- b Analyze $\frac{\sin 7\theta}{\sin \theta} = 7 - 56 \sin^2 \theta + 112 \sin^4 \theta - 64 \sin^6 \theta$.

- 15 a Examine the sum to infinity the series

$$\cos \alpha + \frac{1}{2} \cos(\alpha + \beta) + \frac{1}{2} \frac{3}{4} \cos(\alpha + 2\beta) + \dots$$

OR

- b Find the sum to infinity of the series

$$\sin \alpha + c \sin(\alpha + \beta) + \frac{c^2}{2} \sin(\alpha + 2\beta) + \dots \text{when } |c| < 1$$

Z-Z-Z

END

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Fifth Semester)

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

ABSTRACT ALGEBRA

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (5 x 1 = 5)

- 1 The relation congruence modulo n defines an equivalence relation on the set of _____.
(i) real numbers (ii) natural numbers
(iii) integers (iv) rational numbers
- 2 Every sub group of an abelian group is -----
(i) normal (ii) an ideal (iii) integral domain (iv) semi-group
- 3 Any group of order p^2 is _____.
(i) normal (ii) abelian (iii) semi-group (iv) isomorphic
- 4 If a commutative ring has no zero divisors then that is called _____.
(i) Ideal (ii) Division ring
(iii) Integral domain (iv) Field
- 5 Let R be a commutative ring with unit element. An element $a \in R$ is a unit in R if there exists an element $b \in R$ such that _____.
(i) $a + b = 1$ (ii) $a - b = 1$ (iii) $\frac{a}{b} = 1$ (iv) $ab = 1$

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 3 = 15)

- 6 a) Prove that a nonempty subset H of a group G is a subgroup of G if and only if $a, b \in H$ implies that $ab \in H$ and $a \in H$ implies that $a^{-1} \in H$.
OR
b) Show that the relation $a \equiv b \pmod{H}$ is an equivalence relation.
- 7 a) Prove that HK is a subgroup of G if and only if $HK = KH$.
OR
b) If G is a finite group and N is a normal subgroup of G then prove that $o(G/N) = o(G)/o(N)$.
- 8 a) Let G be a group and ϕ an automorphism of G . If $a \in G$ is of order $o(a) > 0$ then prove that $o(\phi(a)) = o(a)$.
OR
b) Prove that every permutation is a product of 2-cycles.
- 9 a) If ϕ is a homomorphism of R into R' then prove that $\phi(0) = 0$ and $\phi(-a) = -\phi(a)$ for every $a \in R$.
OR
b) Prove that a finite integral domain is a Field.

Cont...

- 10 a) Let R be a commutative ring with unit element whose only ideals are (0) and R itself then prove that R is a Field .

OR

- b) Let R be a Euclidean ring prove that any two elements a and b in R have a greatest common divisor d . Moreover prove that $d = \lambda a + \mu b$.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

- 11 a) If G is a group then prove the following:
 (i) The identity element of G is unique
 (ii) Every $a \in G$ has a unique inverse in G
 (iii) For every $a \in G$, $(a^{-1})^{-1} = a$
 (iv) For all $a, b \in G$, $(a \cdot b)^{-1} = b^{-1} \cdot a^{-1}$
 OR
 b) If G is a finite group and H is a subgroup of G then prove that $o(H)$ is a divisor of $o(G)$.
- 12 a) State and prove Cauchy's theorem for abelian groups.
 OR
 b) State and prove Sylow's theorem for abelian groups .
- 13 a) If G is a group then prove that the set of automorphism of G is also a group.
 OR
 b) If G is a group, H a subgroup of G and S is the set of all right cosets of H in G Then prove that there is a homomorphism θ of G into $A(S)$ and the kernel of θ is the largest normal subgroup of G which is contained in H .
- 14 a) If R is a ring, for all $a, b \in R$ then prove the following
 (i) $a \cdot 0 = 0a = 0$
 (ii) $a(-b) = (-a)b = -(ab)$
 (iii) $(-a)(-b) = ab$
 If in addition, R has a unit element 1 then
 (iv) $(-1)a = -a$
 (v) $(-1)(-1) = 1$
 OR
 b) If p is a prime number then prove that J_p the ring of integers mod p is a field .
- 15 a) Prove that $J[i]$ is a Euclidean ring.
 OR
 b) Prove that the ideal $A = (a_0)$ is a maximal ideal of the Euclidean ring R if and only if a_0 is a prime element of R .

Z-Z-Z

END

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Fifth Semester)

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

DATA STRUCTURES AND ALGORITHMS

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (5 x 1 = 5)

- 1 _____ is a data structure?
(i) A programming language (ii) A collection of algorithms
(iii) A way to store and organize data (iv) A type of computer hardware
- 2 What are the disadvantages of arrays?
(i) Index value of an array can be negative
(ii) Elements are sequentially accessed
(iii) Data structure like queue or stack cannot be implemented
(iv) There are chances of wastage of memory space if elements inserted in an array are lesser than the allocated size
- 3 Which data structure is used for implementing recursion?
(i) Stack (ii) Queue
(iii) List (iv) Array
- 4 Which algorithm is used in the top tree data structure?
(i) Backtracking (ii) Divide and Conquer
(iii) Branch (iv) Greedy
- 5 Which of the following sort algorithms has execution time that is least dependent on initial ordering of the input?
(i) Insertion sort (ii) Quick sort
(iii) Merge sort (iv) selection sort

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 3 = 15)

- 6 a Explain elementary data organization.
OR
b Discuss traversing linear arrays.
- 7 a Discuss about Traversing a linked list.
OR
b Discuss about searching a linked list.
- 8 a Explain the array implementation of stack ADT in detail?
OR
b List any five applications of stack.
- 9 a Explain traversing binary trees with an illustration.
OR
b Explain deleting in a binary search tree with an example.

Cont...

- 10 a Explain selection sort with an example.

OR

- b Explain merge sort with an example.

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks

(5 x 6 = 30)

- 11 a Briefly discuss about control structures in data structures with an example.

OR

- b Briefly explain representation of linear arrays in memory.

- 12 a Explain the insertion operation in linked list. How nodes are inserted after a specified node.

OR

- b How to perform deletion operation using linked list?

- 13 a What is a stack? What are the operations performed on stack? Explain with an examples.

OR

- b Explain linked list implementation of queue ADT in detail?

- 14 a Briefly discuss about the various types of binary trees.

OR

- b Briefly discuss about searching and inserting in binary tree.

- 15 a Discuss about insertion sort with an example.

OR

- b Discuss about radix sort with an example.

Z-Z-Z

END

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2024
(Fifth Semester)

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

REAL ANALYSIS

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

1. A sequence of points in any metric space converges to
 - (i) Only one limit point
 - (ii) More than one limit point
 - (iii) More than two limit points
 - (iv) Not more than two limit points
2. The function $g(x) = \begin{cases} \frac{\sin x}{x}, & x \in \mathbb{R}, x \neq 0 \\ 1, & x = 0 \end{cases}$ is
 - (i) Continuous at $x = 0$
 - (ii) Does not defined on $x = 0$
 - (iii) Discontinuous at $x = 0$
 - (iv) Diverges at $x = 0$
3. If A is a connected subset of the metric space M then $\bar{A}$ is
 - (i) Not connected
 - (ii) Finite
 - (iii) Countable
 - (iv) Connected
4. Every finite subset of any metric space is
 - (i) Compact
 - (ii) Closed
 - (iii) Bounded
 - (iv) Countable
5. If $f, g \in \mathcal{R}[a, b]$ then
 - (i) $|f| \in \mathcal{R}$
 - (ii) $f + g \in \mathcal{R}$
 - (iii) $\lambda f \in \mathcal{R}$
 - (iv) All are true

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a) If $\lim_{x \rightarrow a} f(x) = L$ and $\lim_{x \rightarrow a} g(x) = M$ then prove that $f(x) + g(x)$ has a limit as $x \rightarrow a$ that is $\lim_{x \rightarrow a} [f(x) + g(x)] = L + M$.

OR

b) If f is a monotone function on the open interval (a, b) and if $c \in (a, b)$ then prove that $\lim_{x \rightarrow c} +f(x)$ and $\lim_{x \rightarrow c} -f(x)$ both exist ?
- 7 a) If f and g are real valued functions if f is continuous at a and if g is continuous at $f(a)$ then prove that $g \circ f$ is continuous at a

OR

b) Let $\mathfrak{G}$ be any nonempty family of open subsets of a metric space M then prove that $\bigcup_{G \in \mathfrak{G}} G$ is also an open subset of M .
- 8 a) Let f be a continuous function from a metric space M_1 into a metric space M_2 . If M_1 is connected then prove that the range of f is also connected.

OR

b) If the subset A of the metric space $\langle M, \rho \rangle$ is totally bounded then prove that A is bounded.

Cont...

- 9 a). The metric space M is compact if and only if whenever $\mathfrak{F}$ is a family of closed subset of M with the finite intersection property then prove that $\bigcap_{F \in \mathfrak{F}} F \neq \emptyset$.
- OR
- b). If f is a 1-1 continuous function from the compact metric space M_1 onto the metric space M_2 then prove that f^{-1} is continuous on M_2 and hence prove that f is a homomorphism of M_1 onto M_2 .
- 10 a). Let f be a bounded function on the closed bounded interval $[a, b]$ then prove that $f \in \mathcal{R}[a, b]$ if and only if for each $\varepsilon > 0$ there exists a subdivision σ of $[a, b]$ such that $U[f; \sigma] < L[f; \sigma] + \varepsilon$.
- OR
- b). If the real valued function f has a derivative at the point $c \in R'$ then prove that f is continuous at c .

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 x 6 = 30)

- 11 a). Let $\langle M, \rho \rangle$ be a metric space and let a be a point in M . Let f and g be real valued functions whose domains are subset of M . If $\lim_{x \rightarrow a} f(x) = L$ and $\lim_{x \rightarrow a} g(x) = N$ then prove that (i). $\lim_{x \rightarrow a} [f(x) + g(x)] = L + N$
(ii). $\lim_{x \rightarrow a} [f(x) - g(x)] = L - N$
(iii). $\lim_{x \rightarrow a} [f(x)g(x)] = LN$
- OR
- b). Let l^∞ denote the set of all bounded sequences of real numbers. If $x = \{x_n\}_{n=1}^\infty$ and $y = \{y_n\}_{n=1}^\infty$ are points in l^∞ . Define $f(x) = \sup_{1 \leq n < \infty} |x_n - y_n|$ then prove that (l^∞, ρ) is a metric.
- 12 a). Let $\langle M_1, \rho_1 \rangle$ and $\langle M_2, \rho_2 \rangle$ be metric spaces and let $f: M_1 \rightarrow M_2$ then prove that f is continuous on M_1 if and only if $f^{-1}(G)$ is open in M_1 whenever G is open in M_2 .
- OR
- b). Prove that the set R' is of second category.
- 13 a). Let $\langle M, \rho \rangle$ be a metric space and let A be a subset of M then prove that A has one of the following properties (i). It is impossible to find nonempty subsets A_1, A_2 of M such that $A = A_1 \cup A_2$, $\overline{A_1} \cap A_2 = \emptyset$, $A_1 \cap \overline{A_2} = \emptyset$ (ii). When $\langle A, \rho \rangle$ is itself regarded as a metric space then there is no set except A and $\emptyset$ which is both open and closed in $\langle A, \rho \rangle$?
- OR
- b). State and prove Picard's fixed point theorem.
- 14 a). Prove that the metric space $\langle M, \rho \rangle$ is compact if and only if every sequence of point in M has a sequence covering to a point in M .
- OR
- b). Let $\langle M_1, \rho_1 \rangle$ be a compact metric space. If f is a continuous function from M_1 into a metric space $\langle M_2, \rho_2 \rangle$ then prove that f is uniformly continuous on M_1 .
- 15 a). Let f be a bounded function on the closed bounded interval $[a, b]$ then prove that $f \in \mathcal{R}[a, b]$ if and only if f is continuous at almost every point in $[a, b]$.
- OR
- b). Suppose g has a derivative at c and that f has a derivative at $g(c)$ then prove that $\phi = f \circ g$ has a derivative at c and $\phi'(c) = f'[g(c)]g'(c)$.

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(First Semester)

Branch - MATHEMATICS WITH COMPUTER APPLICATIONS

CALCULUS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	A force is given by a vector $F=3i+4j+5k$ and moves a particle from the point $P(2,1,0)$ to the point $Q(4,6,2)$. Find the work done a) 32 b) 30 c) 28 d) 36	K1	CO1
	2	The curvature of a circle of radius 'a' is a) a^2 b) 1 c) a d) $\frac{1}{a}$	K2	CO1
2	3	The value of $\lim_{(x,y) \rightarrow (1,2)} x^2y^3 - x^3y^2 + 3x + 2y$ a) 10 b) 11 c) 9 d) 0	K1	CO2
	4	If $f(x, y) = ye^{xy}$, then $f_y(0,1)$ is a) 0 b) -1 c) 1 d) 2	K2	CO2
3	5	Find the local maximum of $f(x,y)=x^4+y^4-4xy+1$ at $(0,0)$ a) 10 b) -1 c) 1 d) No Maximum point	K1	CO3
	6	A rectangular box without a lid is to be made from 12 m^2 of cardboard. Find the maximum volume a) 10 b) 4 c) 1 d) 8	K2	CO3
4	7	$\int_0^2 \int_1^2 x^2 y dy dx = \underline{\hspace{2cm}}$ a) $\frac{27}{2}$ b) $-\frac{27}{2}$ c) $\frac{27}{4}$ d) 0	K1	CO4
	8	The moment of inertia is also called as a) First moment b) Second moment c) Polar coordinates d) Cartesian Coordinate	K2	CO4
5	9	The cylindrical coordinates of the point with rectangular coordinates $(3, -3, -7)$ is a) $(3, -3, -7)$ b) $(3\sqrt{2}, \pi/4, 7)$ c) $(3\sqrt{2}, \pi/4, -7)$ d) $(3\sqrt{2}, -\pi/4, -7)$	K1	CO5
	10	The Spherical coordinates of the point with rectangular coordinates $(0, 2\sqrt{3}, -2)$ is a) $(2, -3, -7)$ b) $(4, -\pi/2, \pi/3)$ c) $(4, \pi/2, 2\pi/3)$ d) $(3\sqrt{2}, -\pi/4, -7)$	K2	CO5

Cont....

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Find a vector perpendicular to the plane passes through the points P(1,4,6), Q(-2,5,1) and R(1,-1,1)	K2	CO1
		(OR)		
	11.b.	Find the derivative of $\vec{r}(t) = (1 + t^3)\vec{i} + te^{-t}\vec{j} + \sin 2t\vec{k}$ and find the unit tangent vector at the point where $t = 0$.		
2	12.a.	If $f(x, y) = \frac{xy}{x^2 + y^2}$, find $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$ if it exists.	K3	CO2
		(OR)		
	12.b.	Find the tangent plane to the elliptic paraboloid $z = 2x^2 + y^2$ at the point (1,1,3).		
3	13.a.	If $u = x^4y + y^2z^3$, where $x = rse^t$, $y = rs^2e^{-t}$ and $z = r^2s \sin t$ find the value of $\frac{\partial u}{\partial s}$ when $r = 2$, $s = 1$, $t = 0$.	K3	CO3
		(OR)		
	13.b.	Find the gradient and directional derivative of the function $f(x, y, z) = x \sin(yz)$ at the point (1,3,0) in the direction of the vector $\mathbf{v} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$		
4	14.a.	Use a double integral to find the area enclosed by one loop of the four leaved rose $r = \cos 2\theta$.	K3	CO4
		(OR)		
	14.b.	Find the mass and center of mass of a triangular lamina with vertices (0,0), (1,0) and (0,2) if the density function is $1 + 3x + y$		
5	15.a.	Use a triple integral to find the volume of the Tetrahedron T bounded by the planes $x + 2y + z = 2$, $x = 2y$, $x = 0$ and $z = 0$	K4	CO5
		(OR)		
	15.b.	Evaluate $\iiint_B e^{(x^2 + y^2 + z^2)^{3/2}} dV$, where $B = \{(x, y, z) \mid x^2 + y^2 + z^2 \leq 1\}$		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	(i) Find the angle between the planes $x + y + z = 1$ and $x - 2y + 3z = 1$ (ii) Find symmetric equations for the line of intersection L of these two planes	K3	CO1
2	17	(i) Calculate f_{xyz} if $f(x, y, z) = \sin(3x + yz)$ (ii) Verify the function $u(x, t) = \sin(x - at)$ satisfies the wave equation	K4	CO2
3	18	Find the shortest distance from the point (1, 0, -2) to the plane $x + 2y + z = 4$.	K4	CO3
4	19	Find the volume of the solid that lies under the paraboloid $x^2 + 2y^2 + z = 16$, the planes $x = 2$ and $y = 2$ and the three coordinate planes.	K4	CO4
5	20	Derive the formula for triple integration in spherical coordinates.	K5	CO5

Z-Z-Z END