

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION MAY 2026
(Second Semester)

Branch – COMPUTER SCIENCE WITH DATA ANALYTICS

DISCRETE STRUCTURES & 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	A compound proposition that is neither a tautology nor a contradiction is called a _____. (i) contingency (ii) non-tautology (iii) non-contradiction (iv) super-proposition	K1	CO1
	2	Let P(x) be the statement “ $x \leq 4$ ”. what is the truth value of P(6) (i) True (ii) False (iii) zero (iv) not known	K2	CO1
2	3	Let A be the set of positive integers greater than 10 then $\bar{A}$ = _____. (i) {1,2,3,4,5} (ii) {1,2,3,4,5,6,7,8,9,10} (iii) {10} (iv) {}	K1	CO2
	4	A function f is said to be one-to-one, if and only if $f(a) = f(b)$ implies that _____. (i) $a > b$ (ii) $a \neq b$ (iii) $a < b$ (iv) $a = b$	K2	CO2
3	5	A relation R on a set A is called _____ if whenever $(a,b) \in R$ and $(b,c) \in R$ then $(a,c) \in R$, for all $a,b,c \in A$ (i) Transitive (ii) void (iii) symmetric (iv) reflexive	K1	CO3
	6	A relation on set A is called an _____ relation if it is reflexive, symmetric and transitive. (i) congruence (ii) irregular (iii) equivalence (iv) regular	K2	CO3
4	7	A vertex is _____ if and only if it has degree one. (i) pendant (ii) loop (iii) null (iv) unknown	K1	CO4
	8	An undirected graph has an _____ number of vertices of odd degree. (i) 0 (ii) odd (iii) infinite (iv) even	K2	CO4
5	9	A tree is a connected undirected graph with no simple _____. (i) Circuits (iii) graph (ii) Forest (iv) euler path.	K1	CO5
	10	A tree with n vertices has _____ edges. (i) n (ii) n-1 (iii) n+1 (iv) 0	K2	CO5

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.	Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.	K2	CO2
		(OR)		
2	11.b.	Use truth table to demonstrate $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent.	K3	CO3
	12.a.	Show that if n is a positive integer, then $1 + 2 + \dots + n = n(n + 1)/2$		
		(OR)		

Cont...

	12.b.	A group of 30 people have been trained as astronauts to go on the first mission to mars. How many ways are there to select a crew of six people to go on this mission. Assume that all crew members have the same job.		
3	13.a.	Let R be a relation on a set A. Then prove that there is a path of length n , where n is a positive integer, from a to b if and only if $(a,b) \in R^n$	K4	CO2
	(OR)			
	13.b.	Suppose that the relations R1 and R2 on a set A are represented by the matrices. $M_{R1} = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \quad M_{R2} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ What are the matrices representing $R1 \cup R2$ and $R1 \cap R2$?		
4	14.a.	Prove that a simple graph is bipartite if and only if it is possible to assign one of two different colors to each vertex of the graph so that no two adjacent vertices are assigned the same color.	K3	CO3
	(OR)			
	14.b.	Draw a graph with the adjacency matrix $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ With respect to the ordering of vertices a,b,c,d.		
5	15.a.	Explain decision tree with suitable examples	K1	CO2
	(OR)			
	15.b.	The value of a vertex of a game tree tells us the payoff to the first player if both players follow the minmax strategy and play starts from the position represented by this vertex. Prove the statement.		

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	Express the statement ' if a person is female and is a parent, then this person is someone's mother' as a logical expression involving predicates, quantifiers with a domain consisting of all people, and logical connectives.	K2	CO2
2	17	Show that whenever $n \geq 3$, $f_n > a^{n-2}$, where $a = (1 + \sqrt{5})/2$	K3	CO3
3	18	Let R be an equivalence relation on a set A. Prove these statements for elements a and b of A are equivalent. i) aRb ii) $[a] = [b]$ iii) $[a] \cap [b] \neq \emptyset$	K4	CO4
4	19	Explain briefly about complete graph and bipartite graph.	K1	CO1
5	20	Use Huffman coding to encode the following symbols with the frequencies listed : A: 0.08, B: 0.10, C: 0.12, D: 0.15, E: 0.20, F: 0.35. what is the average number of bits used to encode a character?	K5	CO5

Z-Z-Z

END