U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

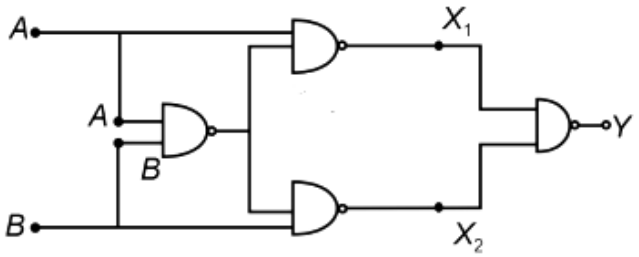
January / February 2025 Semester End Main Examinations

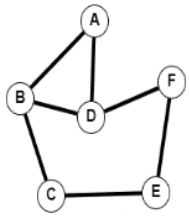
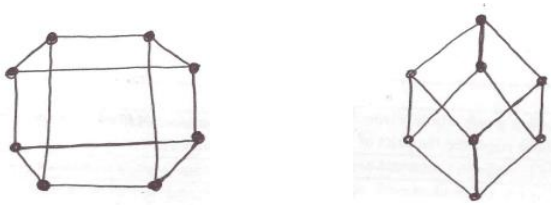
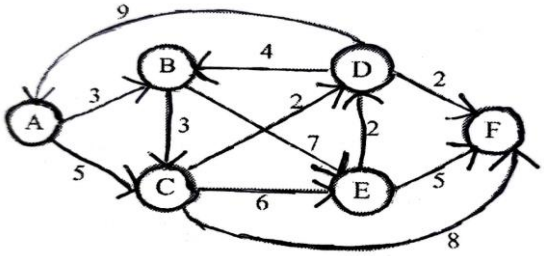
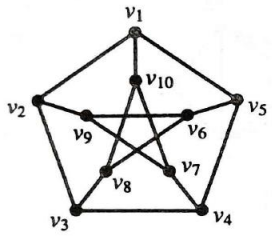
Programme: B.E. **Semester: III**
Branch: Computer Science and Business Systems **Duration: 3 hrs.**
Course Code: 24MA3BSDBS **Max Marks: 100**
Course: Discrete Mathematics for Business Systems

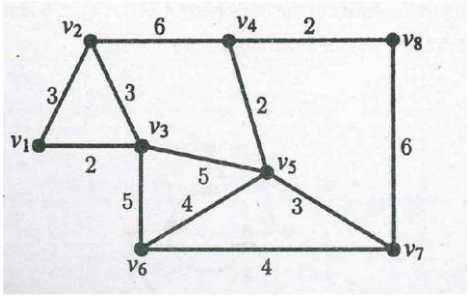
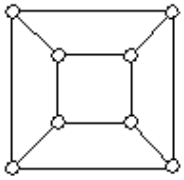
Instructions: 1. All questions have internal choices.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - 1	*CO*	*PO*	Marks
1	a)	Let p: *A circle is a conic.* q: $\sqrt{5}$ *is an irrational number* r: *Exponential series is convergent.* Express the following compound propositions in words. $i)\ p \wedge (\neg q)$ $ii)\ p \rightarrow (q \wedge \neg r)$ $iii)\ \neg p \leftrightarrow (q \vee r)$	*1*	*1*	**6**
	b)	Examine whether the given statement is a tautology or a contradiction using the required truth table $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$.	*1*	*1*	**7**
	c)	Show that $i)\ (p \wedge q) \rightarrow r \equiv (p \rightarrow r) \vee (q \rightarrow r)$ $ii)\ (p \vee q) \wedge [\neg\{(\neg p) \wedge q\}] \equiv p$ using laws of logic.	*1*	*1*	**7**
		OR			
2	a)	Let p and q be the primitive statements for which the implication $p \rightarrow q$ is false. Determine the truth values of the following compound propositions: $i)\ \neg p \wedge q$ $ii)\ p \vee q$ $iii)(p \wedge q) \rightarrow q$.	*1*	*1*	**6**
	b)	Prove that, for any three propositions p, q and r $[p \rightarrow (q \wedge r)] \Leftrightarrow [(p \rightarrow q) \vee (p \rightarrow r)]$ by constructing the required truth table.	*1*	*1*	**7**
	c)	Test whether the given argument is valid or not: *If Ravi goes out with friends, then he will not study. If Ravi does not study, his father becomes angry. His father is not angry.* ∴ *Ravi has not gone out with friends.*	*2*	*1*	**7**
		UNIT – 2			
3	a)	Find the sequences generated by the following function: (i) $2x^2(1-x)^{-1}$ (ii) $\frac{1}{1-x} + 2x^3$.	*1*	*1*	**6**
	b)	In how many ways can the 26 letters of the English alphabet be permuted so that none of the patterns CAR, DOG, PUN or BYTE occurs?	*2*	*1*	**7**

		c)	Prove $1^2 + 3^2 + 5^2 + \cdots + (2n-1)^2 = \frac{1}{3}n(2n-1)(2n+1)$ by mathematical induction for $n \geq 1$.	*1*	*1*	**7**
			OR			
	4	a)	State the generalized pigeonhole principle. How many persons must be chosen in order that at least five of them will have birth days in the same calendar month?	*1*	*1*	**6**
		b)	Use generating function to determine in how many ways can two dozen identical robots be assigned to four assembly lines with at least 3 robots assigned to each line.	*2*	*1*	**7**
		c)	Solve the recurrence relation $2a_{n+3} = a_{n+2} + 2\,a_{n+1} - a_n$ where $n \geq 0$, given that $a_0 = 0$, $a_1 = 1$ and $a_2 = 2$.	*1*	*1*	**7**
			UNIT – 3			
	5	a)	Prove that $AB + A(B+C) + B(B+C) = B + AC$ using Boolean algebra techniques.	*1*	*1*	**6**
		b)	Obtain the truth table for the complement of $F = x\bar{y}z + \bar{x}yz$.	*1*	*1*	**7**
		c)	Construct the logic circuits using basic gates that produce the following outputs: $i)\ (A+B)\bar{A}$ $\quad ii)(A+B+C)(\bar{A}\ \bar{B}\ \bar{C}\ )$.	*1*	*1*	**7**
			OR			
	6	a)	Obtain the dual of the following Boolean expressions: i. $(A + \bar{C})B + 0$ ii. $(A+B) + (\overline{C+D})$ iii. $AB + AC + BC$	*1*	*1*	**6**
		b)	Determine the output expression associated with the given logic circuit and simplify it. Write the expression in each stage. 	*1*	*1*	**7**
		c)	Express the Boolean expression $f(A,B,C) = A + \bar{A}\,\bar{C}\,(B+C)$ as sum of minterms and product of maxterms.	*1*	*1*	**7**
			UNIT - 4			
	7	a)	Define bipartite graph and complete bipartite graph. Show that the hypercube Q_3 is a bipartite graph but not a complete bipartite graph.	*1*	*1*	**6**
		b)	Suppose a committee has seven members, these members meet each day for lunch at a round table. They decide to sit in such a way that every member has different neighbors at each lunch. How many ways can this arrangement last? Also list the possible arrangements.	*1*	*1*	**7**

		c)	Draw the complement of the graph below and then write the adjacency matrix of the complement of the graph. 	*1*	*1*	**7**
			OR			
	8	a)	Verify whether the following graphs are isomorphic or not by showing one to one correspondence between the vertices and edges of the two graphs. 	*1*	*1*	**6**
		b)	Let G be a disconnected graph of even order n with two components each of which is complete. Prove that G has a minimum of $\frac{n(n-2)}{4}$ edges.	*1*	*1*	**7**
		c)	Apply Dijkstra's algorithm to obtain the shortest path and shortest distance from vertex A to vertex F in the weighted, directed network shown below. 	*2*	*1*	**7**
			UNIT - 5			
	9	a)	Define the chromatic number of a graph. Find the chromatic number of the Petersen graph as shown below. 	*1*	*1*	**6**
		b)	Show that the Kuratowski's second graph is non-planar. Justify that removal of one edge from Kuratowski's second graph makes it a planar graph.	*1*	*1*	**7**

		c)	Apply Kruskal's algorithm to find a minimal spanning tree for the given weighted graph and hence find its weight.  	*2*	*1*	**7**
			OR			
	10	a)	Prove that a graph G is 2-chromatic if and only if it is a non-null bipartite graph.	*1*	*1*	**6**
		b)	Verify Euler's polyhedron formula for the given planar graph and obtain the dual of the given graph G.  G	*1*	*1*	**7**
		c)	Eight cities A, B, C, D, E, F, G, H are required to be connected by a new railway network. The possible tracks and the cost involved to lay them (in crores of rupees) are summarized in the Table: Track between / Cost / Track between / Cost C and E 95 A and B 155 D and F 100 A and D 145 E and F 150 A and G 120 F and G 140 B and C 145 F and H 150 C and D 150 G and H 160 Determine a railway network of minimal cost that connects all these cities using Kruskal's algorithm.	*2*	*1*	**7**

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