2 (OP)

QP CODE 34223

Second Semester B.C.A Degree Examinations

MAY/JUNE 2026

(CBCS NEP Scheme)

PAPER NBB 0230: DISCRETE MATHEMATICAL STRUCTURE

Time: 2 hrs] [Max. Marks: 60



Instructions:

1. *The Students should legibly write Section number along with question numbers within the margin ONLY.*
2. *The answer without Section number and question numbers will not be valued.*
3. *Draw neat and labelled diagram wherever necessary.*
4. *Section – I multiple Choice Questions should be answered in the first page of main answer book and same questions shall not be answered repeatedly.*
5. *Any identifications like marking, ticking, dots etc., in the options of MCQ (Section – I) on the question paper is strictly prohibited. Do not write anything (except register number) on the question paper.*

SECTION – I

I. Select the most appropriate answer from the options provided: $10 \times 1 = 10$

I - 1) The Contrapositive of $p \to q$ is the proposition of _____

a) $\neg p \to \neg q$ b) $\neg q \to \neg p$ c) $q \to p$ d) $\neg q \to p$

I - 2) Let P : I am in Bangalore, Q : I love Cricket then $q \to p$ is?

a) If I love Cricket then I am in Bangalore
b) I love Cricket
c) If I am in Bangalore then I love Cricket
d) I am not in Bangalore

I - 3) Which of the following statements is the negation of the statements "4 is odd or – 9 is Positive"?

a) 4 is even or – 9 is not negative
b) 4 is odd or – 9 is not negative
c) 4 is even and – 9 is negative
d) 4 is odd and – 9 is not negative

Contd..... 2

I - 4) Find the number of 5 letters words which can be formed from word PULSE without repetition using permutation

a) 20 b) 60 c) 120 d) 240

I - 5) A child has 2 pencil and 3 erasers. In how many ways he can take a pencil and eraser?

a) 5 b) 6 c) 8 d) 9

I - 6) A relation R on a set A is said to be _____, if $(a,a) \in R$, for all $a \in A$.

a) Reflexive b) Irreflexive
c) Symmetric d) Transitive

I - 7) Let $A=\{1,2,3\}$ and $B=\{2,4,5\}$ then $|A \times B|$ contains _____ members.

a) 9 b) 27 c) 6 d) 3

I - 8) What is a null graph?

a) A null graph has no nodes b) null graph has no edges
c) null graph has no odd vertex d) null graph has no even vertex

I - 9) If a walk starts and ends at the same vertex then it is said to be _____

a) Closed walk b) Open walk
c) Trial d) None of the above

I - 10) Number of edges incident with the vertex V is called.

a) Degree of a vertex b) Degree of a graph
c) Trivial graph d) None of the above

SECTION – II

II. Answer any FIVE of the following: $5 \times 3 = 15$

II - 1) Find the negation of the proposition.

a) "Michael's PC runs Linux"
b) "Vardana's Smartphone has at least 32GB of memory"

II - 2) Use quantifiers to express the statement that "there does not exist a women who has taken a flight on every airline in the world".

II - 3) The fibonacci numbers are defined recursively by $F_0 = 0, F_1 = 1$ and $F_n = F_{n-1} + F_{n-2}$ for $n \geq 2$. Evaluate F_2 to F_{10}.

Contd..... 3

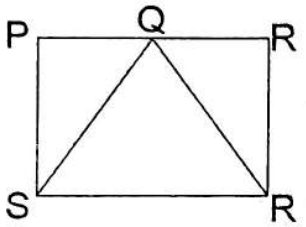
II - 4) Cars of a particular manufacturer come in 4 models, 12 colours, 3 engine sizes and 2 transmission types a) How many distinct cars can be manufactured? b) of these how many have the same colour?

II - 5) Four different mathematics books, five different computer science books and two different control theory books are to be arranged in shelf. How many different arrangements are possible if a) The books in each particular subject must be together? Only mathematics books must be together?

II - 6) The Lucus numbers are defined recursively by $L_0 = 2, L_1 = 1$ and $L_n = L_{n-1} + L_{n-2}$ for $n \geq 2$ Evaluate L_2 to L_8.

II - 7) Define the Graph terminologies with example a) Adjacent vertices
b) Pendent vertex c) Parallel Edges

II - 8) Find the Vertex – Set, Edge – Set, order and size of below graph.



SECTION – III

III. Answer any THREE questions from the following: 3 × 5 = 15

III - 1) Show that $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent by developing a series of logical equivalences.

III - 2) Show that the premises "A student in this class has not read the book" and "Everyone in this class passed the first exam" imply the conclusion "someone who passed the first exam has not read the book".

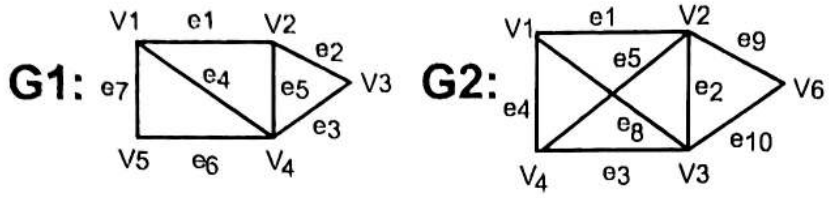
III - 3) How many numbers greater than 1,000,000 can be formed by using the digits 1, 2, 2, 2, 4, 4, 0?

III - 4) Prove by mathematical induction that, for all positive integers $n \geq 1$.

$$1+2+3+....+n = \frac{1}{2}n(n+1)$$

Contd.....4

III - 5) For graph $G1$ and $G2$, find $G1 \cup G2$.



SECTION – IV

IV. Answer the following: $2 \times 10 = 20$

IV - 1) a) List the applications of propositional logic. Explain any there with examples.

b) Define the following with truth tables a) Conjunction b) Exclusive OR

c) Give a direct proof of the theorem "If n is an odd integer, then n^2 is odd." $(5 + 2 + 3)$

OR

IV - 1) a) Prove the following identities.

i) $C(n,r-1)+C(n,r)=C(n+1,r)$

b) In how many ways we can distribute 10 identical marbles among 6 distinct containers?

c) State Pigeonhole Principle. Let ABC is an equilateral triangle whose side are of length 1 cm each. If we select 5 points inside the triangle, prove that at least 2 of these points are such that the distance between them is less than $\frac{1}{2}$ cm. $(3 + 2 + 5)$

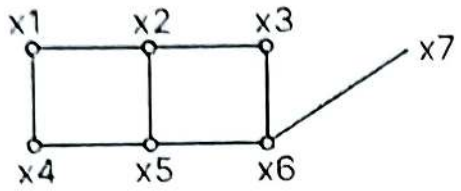
IV - 2) a) Consider the set $A=\{a,b,c\}$ and $B=\{1,2,3\}$ and the relations $R=\{(a,1),(b,1),(c,2),(c,3)\}$ and $S=\{(a,1),(a,2),(b,1),(b,2)\}$ from A to B. Determine $A\times B$, $\overline{R}$, $\overline{S}$, $R\cup S, R\cap S, R^C$ and S^C.

b) List and explain any 4 properties of Relations with example. $(6 + 4)$

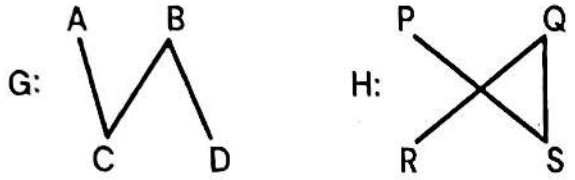
OR

IV - 2) a) Check whether given graph is bipartite or not. If bipartite, identify whether it is a complete bipartite graph.

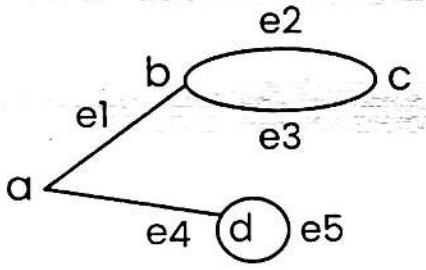
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b) Show that the following graphs are isomorphic.



c) Find the adjacency, incident and path matrix of the given graph. Path matrix between vertices a and c. (2½ + 2½ + 5)



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