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JSB-1037

B.C.A. (IInd Semester) Examination, June-2025 MATHEMATICS FOR COMPUTER SCIENCE

Paper - BCA 4.5 DCCT-24

Time : 3 Hours]

[Maximum Marks : 120

Section-A

(Marks : $2 \times 10 = 20$)

Note :- Answer all *ten* questions. Questions (i) to (v) are multiple choice questions, while questions (vi) to (x) are fill in the blank questions. Each question carries 2 marks.

(खण्ड-अ)

(अंक : $2 \times 10 = 20$)

नोट :- सभी दस प्रश्नों के उत्तर दीजिए। प्रश्न संख्या (i) से (v) बहुविकल्पीय प्रश्न एवं प्रश्न संख्या (vi) से (x) रिक्त स्थान भरने वाले प्रश्न हैं। प्रत्येक प्रश्न 2 अंक का है।

Section-B

(Marks : $8 \times 5 = 40$)

Note :- Answer all *five* questions. Each question has internal choice (Answer limit 150 words). Each question carries 8 marks.

(खण्ड-ब)

(अंक : $8 \times 5 = 40$)

नोट :- सभी पाँच प्रश्नों के उत्तर दीजिए। प्रत्येक प्रश्न में विकल्प का चयन कीजिए (उत्तर-सीमा 150 शब्द)। प्रत्येक प्रश्न 8 अंक का है।

Section-C

(Marks : $20 \times 3 = 60$)

Note :- Answer any *three* questions out of five (Answer limit **400** words). Each question carries **20** marks.

(खण्ड-स)

(अंक : $20 \times 3 = 60$)

नोट :- पाँच में से किन्हीं **तीन** प्रश्नों के उत्तर दीजिए (उत्तर-सीमा **400** शब्द)। प्रत्येक प्रश्न **20** अंक का है।

Section-A

1. (i) A matrix with same number of columns and rows is called :
 - (a) Square matrix
 - (b) Row matrix
 - (c) Column matrix
 - (d) Null matrix
- (ii) A statement in propositional logic that is always true is called :
 - (a) Contradiction
 - (b) Tautology
 - (c) Contingency
 - (d) Proposition

(iii) The principle of mathematical induction is mainly used to prove :

- (a) Equations involving variables
- (b) Results true for infinitely many natural numbers
- (c) Identities between two variables
- (d) Solution of differential equations

(iv) The power set of set A is defined as :

- (a) The set of all elements of A
- (b) The set of all proper subsets of A
- (c) The set of all supersets of A
- (d) The set of all subsets of A

(v) A relation that is reflexive, symmetric and transitive is called :

- (a) Partial order
- (b) Function
- (c) Equivalence relation
- (d) Identity relation

- (vi) A matrix having only one column is called a
matrix.
- (vii) A statement that is sometimes true and sometimes false is called a
.....
- (viii) The statement $a \equiv b \pmod{n}$ means that n divides
- (ix) The number of proper subsets of a set with 4 elements is
- (x) The probability of an impossible event is

Section-B

Unit-I

2. Find the eigenvalues of following matrix :

$$A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

Or

Find the product of following matrices :

$$X = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}$$

$$B = \begin{bmatrix} 2 & 1 & 2 & 3 \\ 0 & 0 & -2 & 8 \end{bmatrix}$$

Unit-II

- 3 Explain the concept of conditional and biconditional statements using their truth tables.

Or

Using suitable example, explain the concept of types of quantifiers.

Unit-III

- 4 Using mathematical induction, prove the following :

$$1 + 3 + 5 + \dots + (2n - 1) = n^2 \text{ for } n \geq 1$$

Or

Using mathematical induction, prove the following :

$$n! \geq 2^{n-1} \quad \forall n \geq 1.$$

Unit-IV

- 5 If $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5, 6\}$, find $A \cup B$ and $A \cap B$.

Or

If $A = \{x : x \text{ is a vowel in the English alphabet}\}$ and $B = \{a, e, i\}$, find

$A - B$.

Unit-V

6. A fair dice is rolled once. What is the probability of getting a number greater than 4 ?

Or

A card is drawn at random from a standard deck of 52 cards. Find the probability that it is a king, given that the card drawn is a face card.

Section-C

7. Find the adjoint and inverse of following matrix :

$$A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$$

8. Let P be "The system is stable" and Q be "The feedback is negative". Express the following statement in a symbolic logic :

"If the feedback is not negative, then the system is not stable. However, if the system is stable, then the feedback must be negative."

Is this compound statement logically equivalent to $(P \Leftrightarrow Q)$? Briefly justify your answer.

9. Prove by mathematical induction for $n \geq 1$:

$n^3 + (n + 1)^3 + (n + 2)^3$ is divisible by 9.

10. In a class of 40 students 22 play hockey, 26 play basketball and 14 play both hockey and basketball.
- (a) How many students play either hockey or basketball ?
 - (b) How many students do not play either of the games ?
11. A bag contains 3 red balls and 2 green balls. One ball is drawn at random and it is red. What is the probability that it came from a bag which originally has 4 red balls and 3 green balls, given there are two bags ?