

2025

(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

Paper : MAT-201

(Mathematics—II)

Full Marks : 70

Pass Marks : 45%

Time : 3 hours

(PART : B—DESCRIPTIVE)

(Marks : 50)

*The figures in the margin indicate full marks
for the questions*

1. (a) For any two sets A and B , prove that—

(i) $(A \cup B)' = A' \cap B'$

(ii) $(A \cap B)' = A' \cup B'$

4

(b) Write the duals of the following set equations :

3

(i) $(A \cup B \cup C)' = (A \cup C)' \cap (A \cup B)'$

(ii) $(A \cap U)' \cap A = \phi$

(c) What is a relation? Explain three types of relations. 3

2. (a) Find the vector and Cartesian equations of the line passing through the points $A(2, -1, 4)$ and $B(1, 1, -2)$. 6

Or

A line passes through the point $(2, 1, -3)$ and is parallel to the vector $\hat{i} - 2\hat{j} + 3\hat{k}$. Find the equations of the line in vector and Cartesian forms.

(b) Find the direction cosines of the sides of the triangle whose vertices are $(3, 5, -4)$, $(-1, 1, 2)$ and $(-5, -5, -2)$. 4

3. (a) Let A and B be the events with $P(A) = 0.6$, $P(B) = 0.3$ and $P(A \cap B) = 0.2$. Find (i) $P(A \cup B)$, (ii) $P\left(\frac{A}{B}\right)$ and (iii) $P\left(\frac{B}{A}\right)$. 4

Or

20 cards are numbered from 1 to 20. One card is drawn at random. What is the probability that the number on the card drawn is (i) a prime number, (ii) an odd number, (iii) a multiple of 5 and (iv) not divisible by 3?

(Continued)

(b) Three unbiased coins are tossed once. What is the probability of getting (i) all heads, (ii) two heads, (iii) one head, (iv) at least 1 head, (v) at least 2 heads and (vi) at most 2 heads? 6

4. (a) Prove that

$$\frac{\sin \theta - \cos \theta + 1}{\sin \theta + \cos \theta - 1} = \frac{1 + \sin \theta}{\cos \theta} \quad 5$$

Or

If $A + B + C = \pi$, then prove that $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$

(b) Find the value of $\tan \frac{\pi}{8}$. 3

(c) Find the value of $\sin 15^\circ$. 2

5. (a) Explain the equivalence relation with examples. 6

(b) Find the domain and range of the real-valued function

$$f(x) = \frac{1}{\sqrt{x-4}} \quad 4$$

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(**Mathematics—II**)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

1. Put a Tick (✓) mark against the correct answer in the brackets provided : 1×10=10

(a) What is the possible number of outcomes when we toss a coin four times?

(i) 4 ()

(ii) 8 ()

(iii) 12 ()

(iv) 16 ()

(b) Two coins are tossed simultaneously the probability of getting at least 1 head is

(i) $\frac{1}{4}$ ()

(ii) $\frac{3}{4}$ ()

(iii) $\frac{2}{4}$ ()

(iv) None of the above ()

(c) A bag has 7 red balls and 5 black balls. If we take a ball from the bag, what is the probability of getting red balls only?

(i) $\frac{7}{12}$ ()

(ii) $\frac{5}{12}$ ()

(iii) $\frac{7}{5}$ ()

(iv) $\frac{2}{12}$ ()

(d) What is the probability that a number selected from the numbers 1 to 15 is a multiple of 4?

(i) $\frac{4}{15}$ ()

(ii) $\frac{1}{5}$ ()

(iii) $\frac{2}{11}$ ()

(iv) $\frac{3}{11}$ ()

(e) $\cos(x + y) =$

(i) $\sin x \cos y - \cos x \sin y$ ()

(ii) $\sin x \cos y + \cos x \sin y$ ()

(iii) $\cos x \cos y - \sin x \sin y$ ()

(iv) $\cos x \cos y + \sin x \sin y$ ()

(4)

(f) $\tan(405^\circ) =$

(i) $\sqrt{3}$ ()

(ii) 1 ()

(iii) $\frac{1}{\sqrt{3}}$ ()

(iv) Not defined ()

(g) If θ lies in the 4th quadrant, then

(i) only $\sin \theta$ and $\operatorname{cosec} \theta$ are positive ()

(ii) only $\cos \theta$ and $\sec \theta$ are positive ()

(iii) only $\tan \theta$ and $\cot \theta$ are positive ()

(iv) All trigonometric ratios are positive ()

(h) The general solution of the trigonometric equation $\cos \theta = 0$ is

(i) $n, n \in I$ ()

(ii) $2n, n \in I$ ()

(iii) $(2n+1)\frac{\pi}{2}, n \in I$ ()

(iv) $n\pi, n \in I$ ()

(i) The direction cosines of the vector $-\hat{i}$ are

(i) $-1, 0, 0$ ()

(ii) $0, -1, 0$ ()

(iii) $1, 0, 0$ ()

(iv) $0, 1, 0$ ()

(j) The direction ratios of a line segment joining the points $A(2, 5, 7)$ and $B(3, 2, 9)$ are

(i) $2, -3, 3$ ()

(ii) $-1, 3, -2$ ()

(iii) $-2, 3, -3$ ()

(iv) $1, -3, 2$ ()

2. State whether the following statements are *True* or *False* by putting a Tick (✓) mark. 1×5=5

(a) The range of the trigonometric function, $y = \cos x$ is $[1, -1]$.

True () False ()

(b) If the probability of an event, E is denoted by $P(E)$, then $0 \leq P(E) \leq 1$.

True () False ()

(c) If the occurrence of one event does not affect the probability of occurrence of another event, then such events are called dependent events.

True () False ()

(d) The general solution of $\tan \theta = 0$ is $\theta = n\pi$ where n is integer.

True () False ()

(e) Direction cosines are unique whereas direction ratios are not unique.

True () False ()

3. Fill in the blanks :

1×5=5

(a) If l, m, n are the direction cosines of a line, then

$$l^2 + m^2 + n^2 = \dots\dots\dots$$

(b) $\frac{n!}{(n-1)!}$ where $n = 1000 = \dots\dots\dots$

(c) $1 + \tan^2 \theta = \dots\dots\dots$

(d) $\log_{10}(0.1) = \dots\dots\dots$

(e) For any real numbers x and y , $\cos x = \cos y$

implies $x = \dots\dots\dots$ where
 $n \in \mathbb{Z}$.
