2015

(1st Semester)

BACHELOR OF COMPUTER APPLICATION

Paper No. : BCA–102 (OC)

[Mathematics—I (Discrete)]

(Old Course)

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—I

(*Marks* : 15)

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

1. The cardinal number of 'the set of all the district capitals of Mizoram' is equal to

(a) 7 ( )

(b) 8 ( )

(c) 9 ( )

(d) 10 ( )

2. If $*$ is a binary on a set A such that $a * b = b * a$ for every pair of elements a, b in A, then $*$ is

(a) associative ( )

(b) reflexive ( )

(c) commutative ( )

(d) closed ( )

3. If $A = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$, $a \neq 0 \neq b$, then A^{-1} is equal to

(a) $\begin{bmatrix} \frac{1}{a} & 0 \\ 0 & \frac{1}{b} \end{bmatrix}$ ( )

(b) $\begin{bmatrix} \frac{1}{b} & 0 \\ 0 & \frac{1}{a} \end{bmatrix}$ ( )

(c) $\begin{bmatrix} b & 0 \\ 0 & a \end{bmatrix}$ ( )

(d) $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ ( )

4. The determinant of the matrix

$$\begin{bmatrix} \sin x & \cos x \\ -\cos x & \sin x \end{bmatrix}$$

is equal to

(a) -1 ( )

(b) 0 ( )

(c) 1 ( )

(d) $\sin^2 x - \cos^2 x$ ( )

5. A finite connected graph is Eulerian if and only if each vertex has

(a) even degree ( )

(b) odd degree ( )

(c) same degree ( )

(d) None of the above ( )

6. A bipartite graph is always

(a) 5-colourable ( )

(b) 4-colourable ( )

(c) 3-colourable ( )

(d) 2-colourable ( )

7. Which of the following functions is continuous at every point of $\mathbb{R}$?

(a) $f(x) = 1 / x$ ( )

(b) $f(x) = 1 / \sin x$ ( )

(c) $f(x) = 1 / e^x$ ( )

(d) $f(x) = 1 / x^2$ ( )

8. How many four-letter words can be formed using the letters of the word 'ABBA'?

(a) 4 ( )

(b) 5 ( )

(c) 8 ( )

(d) 6 ( )

9. $\frac{dx^3}{dx^2} =$

(a) x ( )

(b) $\frac{3x}{2}$ ( )

(c) $\frac{3}{2}$ ( )

(d) $3x^2$ ( )

10. If $\int_0^a \cos x = 1$, then the value of a is

(a) 1 ( )

(b) $\frac{5\pi}{2}$ ( )

(c) π ( )

(d) $\frac{\pi}{2}$ ( )

Tick (✓) whether the following statements are *True* or *False* : 1×5=5

11. For any two sets A and B, $A \setminus B = B \setminus A$, where $\setminus$ is set minus operator.

True ( ) / *False* ( )

12. Multiplication of matrices is commutative.

True ( ) / *False* ( )

13. Every complete graph is regular for some degree k.

True ( ) / *False* ( )

14. $\frac{d}{dx}\tan^{-1} x + \frac{d}{dx}\cot^{-1} x = 0$

True ( ) / *False* ( )

15. $\int \frac{1}{a^2 + x^2} dx = \tan^{-1} \frac{x}{a}$

True ( ) / *False* ( )

SECTION—II

(*Marks* : 10)

Answer the following questions : 2×5=10

1. Let X and Y be two sets such that $n(X) = 107$, $n(Y) = 123$ and $n(X \cap Y) = 50$. Find $n(X \cup Y)$.

2. Find the determinant of the matrix

$$\begin{bmatrix} 1 & 1 & 1 \\ 3 & 8 & 4 \\ -2 & 1 & 7 \end{bmatrix}$$

3. Draw the graph of K_6, a complete graph with six vertices. Find the length of the longest cycle which is a subgraph of K_6.

4. Differentiate $y = e^{\sin^2 x}$ with respect to x.

5. Evaluate :

$$\int \frac{3x^2}{4+x^3}\,dx$$

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2015

(1st Semester)

BACHELOR OF COMPUTER APPLICATION

Paper No. : BCA–102 (OC)

[Mathematics—I (Discrete)]

(Old Course)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Let A, B and C be three sets such that

$A = \{1, 2, 3, 7, 9, 13, 8, 10, 12, 14\}$
$B = \{11, 15, 1, 2, 4, 5, 6, 3, 7, 9, 13\}$
$C = \{3, 7, 4, 5, 6, 9, 13, 8, 10, 16, 17\}$

Find the following : 1+2+2=5

(i) $A \cap B \cap C$

(ii) $A \oplus B$

(iii) $(A \setminus B) \cap C$

Or

(b) Let f, g and h be functions such that $f(x) = x^2$, $g(x) = \frac{1}{x}$ and $h(x) = e^x$.

Evaluate the following compositions : 1+2+2=5

(i) $f \circ g \circ h(x)$

(ii) $h \circ f \circ g(x) + g \circ f(x)$

(iii) $f \circ g(x) + g \circ h(x) + h \circ f(x)$

2. (a) Using the properties of determinants, show that

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$ 5

Or

(b) Find the inverse of the matrix

$$\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$$ 5

3. (a) In how many ways can a committee consisting of four men and three women be chosen from seven men and five women? 4

Or

(b) In how many ways can ten students be divided into three—one containing four students and the others three? 4

4. *(a)* Expand $(2x+1)^{10}$ using binomial theorem and find the difference between the coefficients of x^5 and x^7. 4

Or

(b) Evaluate : 4

$$\lim_{x \to 0} \frac{(e^{3x}-1)\sin 5x}{(e^{2x}-1)\sin 3x}$$

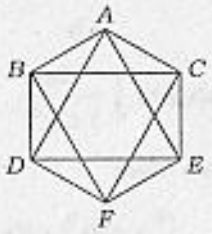
5. *(a)* *(i)* Draw all trees with exactly six vertices and find their diameters. 5

(ii) Prove that a finite connected graph G is Eulerian if and only if each vertex has even degree. 5

Or

(b) *(i)* Draw the graph $K_{2,5}$. Show that it is traversable and find its traversable path. 5

(ii) Draw a planar representation of the graph given below :



Colour the graph and hence find the minimum number of colours required to paint it. 5

6. *(a)* *(i)* Differentiate x^n with respect to x by using first principle. 4

(ii) Evaluate $\frac{dy}{dx}$, where $y = x^y + e^{xy}$. 4

(iii) Evaluate $\int \frac{x}{(x^2+x+1)^2}\,dx$. 4

Or

(b) *(i)* Differentiate $\sin x$ with respect to x by using first principle. 4

(ii) Find $\frac{dy}{dx}$, if $x^y = y^x$. 4

(iii) Evaluate $\int \frac{dx}{e^x - 1}$. 4

7. *(a)* *(i)* Evaluate $\int \sqrt{\tan x}\,dx$. 5

(ii) Prove that

$$\int_0^{\frac{\pi}{2}} \frac{\sin x}{\sin x + \cos x}\,dx = \frac{\pi}{4}$$ 5

Or

(b) *(i)* Evaluate $\int \frac{dx}{1+x^4}$. 5

(ii) Prove that

$$\int_0^{\pi} x \sin^3 x\,dx = \frac{2\pi}{3}$$ 5

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(1st Semester)

BACHELOR OF COMPUTER APPLICATION

Paper No. : BCA–102

[Mathematics—I (Bridge Course)]

(New Course)

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—I

(*Marks* : 15)

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

(a) Prime number means

(i) a number that is an odd number ( )

(ii) a number divisible by 3 ( )

(iii) a number that has two factors ( )

(iv) a number not divisible by even number ( )

(b) Divisibility means

(i) numerator and denominator must be same ( )

(ii) remainder must be 1 ( )

(iii) remainder must be 0 ( )

(iv) denominator must be bigger than numerator ( )

(c) By adding the terms of a sequence, we get a/an

(i) arithmetic progression ( )

(ii) geometric progression ( )

(iii) series ( )

(iv) arithmetic mean ( )

(d) The general term of an AP is given by

(i) $a + (1 - n)d$ ( )

(ii) $\frac{(n-1)d}{a}$ ( )

(iii) $a + (n - 1)d$ ( )

(iv) None of the above ( )

(e) For a 2×2 matrix given by $a_{ij} = (i + 2j)$, the element a_{22} is

(i) 1 ( )

(ii) 3 ( )

(iii) 5 ( )

(iv) 6 ( )

(f) The value of $\begin{vmatrix} -4 & 5 \\ -1 & -5 \end{vmatrix}$ is

(i) 15 ( )

(ii) 25 ( )

(iii) 35 ( )

(iv) 45 ( )

(g) The value of $\lim_{x \to 0} \sin x$ is

(i) 1 ( )

(ii) 2 ( )

(iii) 3 ( )

(iv) 0 ( )

(h) The value of $\frac{d}{dx}(x^n)$ is

(i) x^{n-1} ( )

(ii) x^{n+1} ( )

(iii) nx^{n+1} ( )

(iv) nx^{n-1} ( )

(i) In the AP 7, 13, 19, ..., 205, we have

(i) 32 terms ( )

(ii) 33 terms ( )

(iii) 34 terms ( )

(iv) 35 terms ( )

(j) The value of $\int \left(\frac{\log x}{x}\right)$ is

(i) $\frac{1}{x}\log x + c$ ( )

(ii) $\sin x^2 + c$ ( )

(iii) $x \log x + c$ ( )

(iv) $\frac{1}{2}(\log x)^2 + c$ ( )

2. Tick (✓) either *True* or *False* : 1×5=5

(a) The value of $\frac{d}{dx}(\sin^{-1} x)$ is $\frac{1}{\sqrt{1-x^2}}$.

True ( ) / *False* ( )

(b) All the diagonal elements are zeros in a diagonal matrix.

True ( ) / *False* ( )

(c) Integration is the inverse of differentiation.

True ( ) / *False* ( )

(d) The sum of the series 5, 9, 13, 17, ... up to 23 terms is 1127.

True ( ) / *False* ( )

(e) If $y = \frac{e^x}{x}$, then the value of $\frac{dy}{dx}$ is $\frac{e^x(x-1)}{x^2}$.

True ( ) / *False* ( )

SECTION—II

(*Marks* : 10)

Answer the following questions : 2×5=10

1. Differentiate between HCF and LCM.

2. Which one is greater from the following?

$$\frac{8}{9} \text{ and } \frac{2}{3}$$

=10

3. Explain skew-symmetric matrix.

4. If $5A = \begin{bmatrix} 5 & 10 & -15 \\ 2 & 3 & 4 \\ 1 & 0 & -5 \end{bmatrix}$, find A.

5. Differentiate $y = \sin x^3$.

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(1st Semester)

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[Mathematics—I (Bridge Course)]

(New Course)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Evaluate $(\sqrt{2}+1)^6+(\sqrt{2}-1)^6$ using binomial theorem. 4

(b) A bag contains ₹ 187 in the form of 1-rupee, 50-paise and 10-paise coins in the ratio of 3 : 4 : 5. Find the number of each type of coins. 4

(c) What must be added to each of the numbers 9, 17, 21, 37 so that the new numbers are in proportion? 4

OR

2. *(a)* There are 20 boys in a class. Their average weight is 50 kg. When one boy leaves the class, the average reduces by 80 gram. Find the weight of the boy who left the class. 4

(b) Find *(i)* the greatest 4-digit number, and *(ii)* the smallest 4-digit number so that they are exactly divisible by 12, 15, 20 and 35. 4

(c) Find the 10th term of $\left(2x^2 + \frac{1}{x}\right)^{12}$. 4

3. *(a)* Write the first 5 terms of the sequence

$$a_n = (-1)^{n-1} \times 2^{n+1}$$ 3

(b) If the 9th term of an AP is 0, prove that its 29th term is double of the 19th term. 4

(c) Deduce the formula $S_n = \{2a + (n-1)d\}$ for the AP where n is the number of terms, a is the first element and d is the common difference. 5

OR

4. *(a)* Find the 10th and nth term of the geometric progression (GP)

$$12, 4, \frac{4}{3}, \frac{4}{9}, \ldots$$ 3

(b) Find three numbers in GP whose sum is 13 and the sum of whose squares is 91. 4

(c) Explain the relation among arithmetic mean (AM), geometric mean (GM) and harmonic mean (HM) along with examples. 5

5. (a) Construct a matrix whose elements are given by

$$a_{ij} = \frac{1}{2}|5i - 3j|$$ 3

(b) Express the matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$ as the sum of symmetric and skew-symmetric matrix. 4

(c) By using elementary row operation, find the inverse of the matrix $\begin{bmatrix} 6 & 7 \\ 8 & 9 \end{bmatrix}$. 4

OR

6. (a) Find the minors of the determinant

$$A = \begin{vmatrix} 1 & -3 & 2 \\ 4 & -1 & 2 \\ 3 & 5 & 2 \end{vmatrix}$$ 3

(b) Evaluate

$$\begin{vmatrix} 9 & 9 & 12 \\ 1 & -3 & -4 \\ 1 & 9 & 12 \end{vmatrix}$$ 3

(c) Using the properties of determinant, prove that

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ca & ab \end{vmatrix} = (a-b)(b-c)(c-a)$$ 5

7. (a) Differentiate $\cot x$ from the 1st principle. 6

(b) Differentiate $\frac{1+\sin x}{1-\sin x}$. 6

(c) Differentiate $\sin 2x \cos 3x$. 3

OR

8. (a) Evaluate

$$\int \frac{(3x^4 - 5x^3 + 4x^2 - x + 2)}{x^3} dx$$ 3

(b) Evaluate $\int \sec^{-1} x \, dx$. 3

(c) Evaluate $\int x \cos^3 x \sin x \, dx$. 5

(d) Evaluate $\int \frac{x^8}{(1-x^3)^{1/3}}$. 4

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