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BCS-012

09107

BACHELOR IN COMPUTER APPLICATIONS

Term-End Examination

June, 2012

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : **100***

Note : Question no. one is compulsory. Attempt any three questions from four.

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1. (a) For what value of 'k' the points $(-k+1, 2k)$, $(k, 2-2k)$ and $(-4-k, 6-2k)$ are collinear. 5

(b) Solve the following system of equations by using Matrix Inverse Method. 5

$$3x+4y+7z=14$$
$$2x-y+3z=4$$
$$2x+2y-3z=0$$

(c) Use principle of Mathematical Induction to prove that : 5

$$\frac{1}{1\times2}+\frac{1}{2\times3}+\dots\dots\dots+\frac{1}{n(n+1)}=\frac{n}{n+1}$$

(d) How many terms of G.P $\sqrt{3}, 3, 3\sqrt{3}$ ______ . 5

Add upto $39+13\sqrt{3}$

(e) If $y = ae^{mx} + be^{-mx}$ Prove that $\frac{d^2y}{dx^2} = m^2y$ 5

(f) Evaluate Integral $\int \frac{x}{(x+1)\ (2x-1)}\, dx$. 5

(g) Find the unit vector in the direction of 5

$\left(\vec{a} - \vec{b}\right)$ where $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$

and $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$

(h) Find the Angle between the lines 5

$\vec{r} = 2\hat{i} + 3\hat{j} - 4\hat{k} + t\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$

$\vec{r} = 3\hat{i} - 5\hat{k} + s\left(3\hat{i} - 2\hat{j} + 6\hat{k}\right)$

2. (a) Solve the following system of linear equations using Cramer's Rule → 5

$x + 2y + 3z = 6$

$2x + 4y + z = 7$

$3x + 2y + 9z = 14$

(b) Construct a 2×2 matrix $A = [aij]_{2 \times 2}$ where each element is given by $aij = \frac{1}{2}(i + 2j)^2$ 5

(c) Reduce the Matrix to Normal form by elementary operations. **10**

$$A = \begin{bmatrix} 5 & 3 & 8 \\ 0 & 1 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

3. (a) Find the sum to Infinite Number of terms of A.G.P. **5**

$$3+5\left(\frac{1}{4}\right)+7\left(\frac{1}{4}\right)^2+9\left(\frac{1}{4}\right)^3+ \_\_\_\_\_\_$$

(b) If 1, ω, ω^2 are Cube Roots of unity show that $(1+\omega)^2-(1+\omega)^3+\omega^2=0$. **5**

(c) If α, β are roots of equation $2x^2-3x-5=0$ form a Quadratic equation whose roots are α^2, β^2. **5**

(d) Solve the inequality $\frac{3}{5}(x-2)\leq\frac{5}{3}(2-x)$ and graph the solution set. **5**

4. (a) Evaluate $\lim\limits_{x\to 3}\frac{x^3-27}{x^2-9}$ **5**

(b) A spherical ballon is being Inflated at the rate of 900 cm^3/sec. How fast is the Radius of the ballon Increasing when the Radius is 15 cm. **5**

(c) Evaluate Integral $\int e^x \left[\frac{1}{x} - \frac{1}{x^2}\right] dx$ **5**

(d) Find the area bounded by the curves $x^2 = y$ and $y = x$. **5**

5. (a) Find a unit vector perpendicular to both the vectors $\vec{a} = 4\hat{i} + \hat{j} + 3\hat{k}$ **5**

$$\vec{b} = -2\hat{i} + \hat{j} - 2\hat{k}$$

(b) Find the shortest distance between the lines $\vec{r} = \left(3\hat{i} + 4\hat{j} - 2\hat{k}\right) + t\left(-\hat{i} + 2\hat{j} + \hat{k}\right)$ **5**

and $\vec{r} = \left(\hat{i} - 7\hat{j} + 2\hat{k}\right) + t\left(\hat{i} + 3\hat{j} - 2\hat{k}\right)$

(c) Suriti wants to Invest at most ₹ 12000 in saving certificates and National Saving Bonds. She has to Invest at least ₹ 2000 in Saving certificates and at least ₹ 4000 in National Saving Bonds. If Rate of Interest on Saving certificates is 8% per annum and rate of interest on national saving bond is 10% per annum. How much money should she invest to earn maximum yearly income ? Find also the maximum yearly income. **10**

No. of Printed Pages : 4 **BCS-012**

07039

BACHELOR IN COMPUTER APPLICATIONS

Term-End Examination

December, 2012

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question no. 1 is **compulsory.** Attempt **any three** questions from the rest.*

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1. (a) Evaluate : $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ 5

(b) For all $n \geq 1$, prove that : 5

$$1^2+2^2+3^2+....+n^2=\frac{n(n+1)(2n+1)}{6}$$

(c) If the points (2, −3), (λ, −1) and (0, 4) are collinear, find the value of λ. 5

(d) The sum of n terms of two different arithmetic progressions are in the ratio $(3n+8) : (7n+15)$. Find the ratio of their 12^{th} term. 5

(e) Find $\frac{dy}{dx}$ if $y = \log\left[\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}\right]$ 5

(f) Evaluate : $\int \frac{dx}{x^2 - 6x + 13}$ 5

(g) Find the unit vector in the direction of the sum of the vectors $\vec{a} = 2i + 2j - 5k$ and $\vec{b} = 2i + j + 3k$. 5

(h) Find the angle between the vectors with direction ratios proportional to (4, −3, 5) and (3, 4, 5). 5

2. (a) Solve the following system of linear equations using Cramer's rule. $x + 2y - z = -1$, $3x + 8y + 2z = 28$, $4x + 9y + z = 14$. 5

(b) Construct a (2×3) matrix whose elements a_{ij} is given by $a_{ij} = \frac{(i+j)^2}{2}$. 5

(c) Find the inverse of $A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}$ and verify that $A^{-1}A = I$. 10

3. (a) Find the sum to n terms of the series 5

$$1+\frac{4}{5}+\frac{4}{5^2}+\frac{4}{5^3}+\dots\dots\dots$$

(b) If 1, ω, ω^2 are three cube roots of unity. Show that : 5

$$(2-\omega)(2-\omega^2)(2-\omega^{10})(2-\omega^{11})=49$$

(c) If α and β are the roots of the equation $ax^2+bx+c=0$, $a \neq 0$ find the value of $\alpha^6+\beta^6$. 5

(d) Solve the inequality $-3 < 4-7x < 18$ and graph the solution set. 5

4. (a) Evaluate : $\lim_{x\to 0}\frac{\sqrt{1+x}-1}{x}$ 5

(b) A rock is thrown into a lake producing a circular ripple. The radius of the ripple is increasing at the rate of 3 m/s. How fast is the area inside the ripple increasing when the radius is 10 m. 5

(c) Evaluate : $\int\frac{dx}{1+\cos^2 x}$ 5

(d) Find the area enclosed by the circle $x^2+y^2=a^2$. 5

5. (a) If $\vec{a} = 5i - j - 3k$ and $\vec{b} = i + 3j - 5k$. 5

Show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular.

(b) Find the angle between the vectors $5i + 3j + 4k$ and $6i - 8j - k$. 5

(c) Solve the following LPP graphically : 10

Maximize : $z = 5x + 3y$

Subject to : $3x + 5y \leq 15$

$5x + 2y \leq 10$

$x, y \geq 0$

05354

BACHELOR OF COMPUTER APPLICATIONS (Revised)

Term-End Examination

June, 2013

BCS–012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question no.* **1** *is* ***compulsory.*** *Attempt* ***any three*** *questions from the rest.*

1. (a) Evaluate $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix}$: **5**

(b) Show that the points (a, b + c), (b, c + a) and (c, a + b) are collinear. **5**

(c) For every positive integer n, prove that $7^n - 3^n$ is divisible by 4. **5**

(d) The sum of first three terms of a G.P. is $\frac{13}{12}$ and their product is -1. Find the common ratio and the terms. **5**

(e) Find $\frac{dy}{dx}$ if $y = \frac{e^x + e^{-x}}{e^x - e^{-x}}$ **5**

(f) Evaluate $\int \frac{dx}{3x^2 + 13x - 10}$ 5

(g) Write the direction ratio's of the vector $\bar{a} = i + j - 2k$ and hence calculate its direction cosines. 5

(h) Find a vector of magnitude 9, which is perpendicular to both the vectors $4i - j + 3k$ and $-2i + j - 2k$. 5

2. (a) Solve the following system of linear equations using Cramer's Rule $x + y = 0$, $y + z = 1$, $z + x = 3$. 5

(b) Find x, y and z so that $A = B$, where 5

$$A = \begin{bmatrix} x-2 & 3 & 2z \\ 18z & y+2 & 6z \end{bmatrix}, B = \begin{bmatrix} y & z & 6 \\ 6y & x & 2y \end{bmatrix}$$

(c) Reduce the matrix $A = \begin{bmatrix} 1 & 0 & 2 & 1 \\ 2 & 1 & 3 & 2 \\ 1 & 3 & 1 & 3 \end{bmatrix}$ to its normal form and hence determine its rank. 10

3. (a) Find the sum to n terms of the A.G.P. $1 + 3x + 5x^2 + 7x^3 + \ldots ;\ x \neq 1$. 5

(b) Use De Moivre's theorem to find $\left(\sqrt{3} + i\right)^3$ 5

(c) If α, β are the roots of $x^2 - 4x + 5 = 0$ form an equation whose roots are $\alpha^2 + 2$, $\beta^2 + 2$. 5

(d) Solve the inequality $-2 < \frac{1}{5}(4 - 3x) \leq 8$ and graph the solution set. 5

4. (a) Evaluate $\lim_{x \to 0} \frac{e^x - e^{-x}}{x}$. 5

(b) If a mothball evaporates at a rate proportional to its surface area $4\pi r^2$, show that its radius decreases at a constant rate. 5

(c) Evaluate : $\int \frac{dx}{4 + 5\sin^2 x}$ 5

(d) Find the area enclosed by the ellipse 5

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

5. (a) Find a unit vector perpendicular to each of the vectors $\bar{a}+\bar{b}$ and $\bar{a}-\bar{b}$ where $\bar{a} = i + j + k$, $\bar{b} = i + 2j + 3k$. 5

(b) Find the projection of the vector $7i + j - 4k$ on $2i + 6j + 3k$. 5

(c) Solve the following LPP by graphical method. **10**

Minimize : $z = 20x + 10y$

Subject to : $x + 2y \leq 40$

$3x + y \geq 30$

$4x + 3y \geq 60$

and x, y ≥ 0

08415

BACHELOR OF COMPUTER APPLICATIONS (Revised)

Term-End Examination

December, 2013

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question no.* ***1*** *is* ***compulsory.*** *Attempt* ***any three*** *questions from the remaining questions.*

1. (a) Show that $\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ 5

(b) If $A = [2 \quad -1 \quad 3]$ and $B = \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$ check whether $AB = BA$. 5

(c) Use the principle of mathematical induction to show that $1+3+5+\text{------}+(2n-1)=n^2$ for each $n \in \mathbf{N}$. 5

(d) If α and β are roots of $x^2 - 3ax + a^2 = 0$ and $\alpha^2 + \beta^2 = \frac{7}{9}$, find the value of a. 5

(e) If $y = ax + \frac{b}{x}$, show that $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0$ 5

(f) Evaluate the integral $\int e^x \left(e^x + 7\right)^5 dx$. 5

(g) If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} - 5\hat{k}$, show that $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are perpendicular to each other. 5

(h) Find the angle between the lines $\frac{x-5}{2} = \frac{y-5}{1} = \frac{z+1}{-1}$ and $\frac{x}{3} = \frac{y-1}{2} = \frac{z+5}{3}$ 5

2. (a) If $A = \begin{bmatrix} -1 & 2 & 0 \\ -1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$, show that $A^2 = A^{-1}$. 5

(b) Show that $A = \begin{bmatrix} 3 & 4 & -5 \\ 1 & 1 & 0 \\ 1 & 1 & 5 \end{bmatrix}$ is row equivalent to I_3, where I_3 is identity matrix of order 3. 5

(c) If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, show that $A^2 - 4A + 7I_2 = 0_{2x2}$. Use this result to find A^5. Where 0_{2x2} is null matrix of order 2x2. 10

3. (a) Solve the equation $6x^3 - 11x^2 - 3x + 2 = 0$, given that the roots are in H.P. 5

(b) If $x+iy=\sqrt{\dfrac{a+ib}{c+id}}$, show that $(x^2+y^2)^2=\dfrac{a^2+b^2}{c^2+d^2}$. 5

(c) Solve the inequality $\left|\dfrac{3x-1}{2}\right|\leq 5$. 5

(d) If α and β be the roots of the equation $3x^2-4x+1=0$, find the equation whose roots are α^2/β and β^2/α. 5

4. (a) Determine the intervals in which the function $f(x)=\dfrac{1+x+x^2}{1-x+x^2}$, $x\in \mathbf{R}$ is increasing or decreasing. 5

(b) Show that $f(x)=x^2 ln(\frac{1}{x})$, $x>0$ has a local maximum at $x=\dfrac{1}{\sqrt{e}}$. 5

(c) Evaluate $\int (x+1)e^x\left(xe^x+5\right)^4 dx$. 5

(d) Find the area bounded by $y=\sqrt{x}$ and $y=x$. 5

5. (a) Find the vector and Cartesian equation of the line through the points (3, 0, −1) and (5, 2, 3). 5

(b) Show that $\left[\vec{a}\times\vec{b}\ \ \vec{b}\times\vec{c}\ \ \vec{c}\times\vec{a}\right]=\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]^2$ 5

(c) Two tailors A and B, earn ₹ 150 and ₹ 200 per day respectively. A can stich 6 shirts and 4 pants while B can stich 10 shirts and 4 pants per day. How many days should each work to stich (at least) 60 shirts and 32 pants at least labour cost ? Also calculate the least cost. **10**

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BCS-012

07489

BACHELOR OF COMPUTER APPLICATIONS (Revised)

Term-End Examination

June, 2014

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question No.* **1** *is* ***compulsory.*** *Attempt* ***any three*** *questions from the remaining four questions.*

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1. (a) Show that the points (a, b + c), (b, c + a) and (c, a + b) are collinear. 5

(b) If $A = \begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$, find $4A - A^2$. 5

(c) Use the principle of mathematical induction to show that : 5

$$1^2 + 2^2 + \ldots\ldots + n^2 = \frac{1}{6} n\,(n+1)\,(2n+1)$$

$\forall n \in \mathbf{N}$.

(d) Find the smallest positive integer *n* for which 5

$$\left(\frac{1+i}{1-i}\right)^n = 1.$$

(e) A positive number exceeds its square root by 30. Find the number. 5

(f) If $y = \frac{\ln x}{x^2}$, find $\frac{dy}{dx}$. 5

(g) Show that for any vector $\vec{a}$, 5

$$\hat{i} \times (\vec{a} \times \hat{i}) + \hat{j} \times (\vec{a} \times \hat{j}) + \hat{k} \times (\vec{a} \times \hat{k}) = 2\vec{a}$$

(h) Find an equation of the line through $(1, 0, -4)$ and parallel to the line $\frac{x+1}{3} = \frac{y+2}{4} = \frac{z-2}{2}$. 5

2. (a) Find inverse of the matrix 5

$$A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}.$$

(b) Reduce the matrix $A = \begin{bmatrix} 5 & 3 & 8 \\ 0 & 1 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ to normal form by elementary operations. 5

(c) Solve the system of linear equations 10

$2x - y + z = 5$

$3x + 2y - z = 7$

$4x + 5y - 5z = 9$

by matrix method.

3. (a) Use DeMoivre's theorem to put $(\sqrt{3}+i)^3$ in the form $a+bi$. 5

(b) Find the sum to n terms of the series $0.7+0.77+0.777+\dots\dots\dots+$ upto n terms. 5

(c) If one root of the quadratic equation $ax^2+bx+c=0$ is square of the other root, show that $b^3+a^2c+ac^2=3abc$. 5

(d) The cost of manufacturing x mobile sets by Josh Mobiles is given by $C=3000+200x$ and the revenue from selling x mobiles is given by $300x$. How many mobiles must be produced to get a profit of ₹7,03,000 or more. 5

4. (a) If $y=ae^{mx}+be^{-mx}$ and $\frac{d^2y}{dx^2}=ky$, find the value of k in terms of m. 5

(b) A man 180 cm tall walks at a rate of 2 m/s away from a source of light that is 9 m above the ground. How fast is the length of his shadow increasing when he is 3 m away from the base of light ? 5

(c) Evaluate the integral $\int \frac{x}{(x+1)(2x-1)}dx$. 5

(d) Find length of the curve $y=2x^{3/2}$ from (1, 2) to (4, 16). 5

5. (a) For any two vectors $\vec{a}$ and $\vec{b}$, prove that 5

$|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|$.

(b) Find the shortest distance between $\vec{r_1}$ and $\vec{r_2}$ given below : 5

$$\vec{r_1} = (1+\lambda)\hat{i} + (2-\lambda)\hat{j} + (1+\lambda)\hat{k}$$

$$\vec{r_2} = 2(1+\mu)\hat{i} + (1-\mu)\hat{j} + (-1+2\mu)\hat{k}.$$

(c) A tailor needs at least 40 large buttons and 60 small buttons. In the market, buttons are available in boxes and cards. A box contains 6 large and 2 small buttons and a card contains 2 large and 4 small buttons. If the cost of a box is ₹ 3 and that of card is ₹ 2, find how many boxes and cards should he buy so as to minimize the expenditure ? 10

No. of Printed Pages : 4

BCS-012

07824

BACHELOR OF COMPUTER APPLICATIONS (Revised)

Term-End Examination

December, 2014

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is* ***compulsory****. Attempt any* ***three*** *questions from the rest.*

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1. (a) Show that

$$\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix} = xyz\,(x-y)\,(y-z)\,(z-x)$$ 5

(b) Let $A = \begin{bmatrix} 2 & 3 \\ 0 & 1 \end{bmatrix}$ and $f(x) = x^2 - 3x + 2$. Show that $f(A) = O_{2\times 2}$. Use this result to find A^4. 5

(c) Use the principle of mathematical induction to show that

$$\sum_{i=0}^{n-1} 2^i = 2^n - 1, \ \forall\, n \in \mathbf{N}.$$ 5

(d) If the sum of p terms of an A.P. is $4p^2 + 3p$, find its n^{th} term. 5

(e) If $y = ln \left[e^x \left(\frac{x-1}{x+1} \right)^{1/2} \right]$, find $\frac{dy}{dx}$. 5

(f) Evaluate : 5

$$\int \frac{e^x}{(e^x + 1)^3} \, dx$$

(g) Find the area bounded by the curve $y = \sin x$ and the lines $x = \frac{\pi}{4}$, $x = \frac{\pi}{2}$ and the x-axis. 5

(h) Find $|\vec{a} \times \vec{b}|$ if $|\vec{a}| = 10$, $|\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = 10\sqrt{2}$. 5

2\. (a) Solve the following system of equations by using Cramer's rule : 5

$$x + y = 0, \quad y + z = 1, \quad z + x = 3$$

(b) If $A = \begin{bmatrix} 3 & 2 & 0 \\ 4 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, find A^{-1}. 5

(c) Show that the points (2, 5), (4, 3) and (5, 2) are collinear. 5

(d) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 2 & 5 & 8 \end{bmatrix}$. 5

3. (a) If 7 times the 7^{th} term of an A.P. is equal to 11 times the 11^{th} term of the A.P., find its 18^{th} term. 5

(b) Find the sum to n terms of the series :

$$9 + 99 + 999 + 9999 + \ldots$$ 5

(c) If $x + iy = \sqrt{\frac{a + ib}{c + id}}$, then show that

$$x^2 + y^2 = \sqrt{\frac{a^2 + b^2}{c^2 + d^2}}.$$ 5

(d) If α and β are roots of $2x^2 - 3x + 5 = 0$, find the equation whose roots are $\alpha + (1/\beta)$ and $\beta + (1/\alpha)$. 5

4. (a) Evaluate : 5

$$\lim_{x \to 5} \frac{\sqrt{x - 1} - 2}{x - 5}$$

(b) Find the local extrema of

$$f(x) = \frac{3}{4} x^4 - 8x^3 + \frac{45}{2} x^2 + 105$$ 5

(c) Evaluate : 5

$$\int \frac{x^2 + 1}{x (x^2 - 1)} dx$$

(d) Find the length of the curve $y = \frac{2}{3}x^{3/2}$ from (0, 0) to (4, 16/3). *5*

5. (a) Find the area of Δ ABC with vertices A(1, 3, 2), B(2, – 1, 1) and C(– 1, 2, 3). *5*

(b) Find the angle between the lines

$$\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{-1} \text{ and } \frac{x}{3} = \frac{y}{-1} = \frac{z-2}{3}.$$ *5*

(c) A tailor needs at least 40 large buttons and 60 small buttons. In the market two kinds of boxes are available. Box A contains 6 large and 2 small buttons and costs ₹ 3, box B contains 2 large and 4 small buttons and costs ₹ 2. Find out how many boxes of each type should be purchased to minimize the expenditure. *10*

No. of Printed Pages : 4 **BCS-012**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

08313 **June, 2015**

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the rest.*

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1. (a) Show that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc + bc + ca + ab. \qquad 5$$

(b) If $A = \begin{pmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$, find A^3. 5

(c) Use the principle of mathematical induction to show that

$$2 + 2^2 + ... + 2^n = 2^{n+1} - 2. \ \forall \ n \in \mathbf{N} \qquad 5$$

(d) Find the 18th term of a G.P. whose 5th term is 1 and common ratio is 2/3. 5

(e) If $(a - ib)(x + iy) = (a^2 + b^2) i$ and $a + ib \neq 0$, find x and y. 5

(f) Find two numbers whose sum is 54 and product is 629. 5

(g) If $y = ae^{mx} + be^{-mx}$, show that $\frac{d^2y}{dx^2} = m^2y$. 5

(h) Find the equation of the straight line through (–2, 0, 3) and (3, 5, –2). 5

2. (a) If $A = \begin{bmatrix} 5 & 3 & 0 \\ 3 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, find A^{-1}. 5

(b) Solve the system of equations $x + y + z = 5$, $y + z = 2$, $x + z = 3$ by using Cramer's rule. 5

(c) Find the area of Δ ABC whose vertices are A (1, 3), B (2, 2) and C (0, 1). 5

(d) Reduce $A = \begin{bmatrix} 5 & 3 & 8 \\ 0 & 1 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ to normal form by elementary operations. 5

3. (a) Find the sum to n terms of the series $0 \cdot 7 + 0 \cdot 77 + 0 \cdot 777 + \ldots$ 5

(b) Find three terms in G.P. such that their sum is 31 and the sum of their squares is 651. 5

(c) If α and β are roots of $x^2 - 4x + 2 = 0$, find the equation whose roots are $\alpha^2 + 1$ and $\beta^2 + 1$. 5

(d) Solve the inequality

$$x^2 - 4x - 21 \leq 0.$$ 5

4. (a) Find the value of constant k so that

$$f(x) = \begin{cases} \dfrac{x^2 - 25}{x - 5} & \text{if } x \neq 5 \\ k & \text{if } x = 5 \end{cases}$$ 5

is continuous at $x = 5$.

(b) If $y = \dfrac{1 - e^x}{e^{2x}}$, find $\dfrac{dy}{dx}$. 5

(c) If a mothball evaporates at a rate proportional to its surface area $4\pi r^2$, show that its radius decreases at a constant rate. 5

(d) Evaluate :

$$\int_0^2 \frac{x^2}{(x + 2)^3} \, dx$$ 5

5. (a) Show that the three points with position vectors $-2\vec{a} + 3\vec{b} + 5\vec{c}$, $\vec{a} + 2\vec{b} + 3\vec{c}$, $7\vec{a} - \vec{c}$ are collinear. *5*

(b) Find the direction cosines of the line passing through (1, 2, 3) and (– 1, 1, 0). *5*

(c) Two electricians, A and B, charge ₹ 400 and ₹ 500 per day respectively. A can service 6 ACs and 4 coolers per day while B can service 10 ACs and 4 coolers per day. For how many days must each be employed so as to service at least 60 ACs and at least 32 coolers at minimum labour cost ? Also calculate the least cost. *10*

No. of Printed Pages : 4

BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

6814

December, 2015

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the rest.*

1. Attempt any ***eight*** parts from the following :

(a) Show that

$$\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & 0 \end{vmatrix} = 0$$

where ω is a complex cube root of unity. 5

(b) If $A = \begin{pmatrix} 3 & -1 \\ 2 & 1 \end{pmatrix}$,

show that $A^2 - 4A + 5I_2 = 0$.

Also, find A^4. 5

(c) Show that 133 divides $11^{n+2} + 12^{2n+1}$ for every natural number n. 5

(d) If p^{th} term of an A.P is q and q^{th} term of the A.P. is p, find its r^{th} term. 5

(e) If 1, ω, ω^2 are cube roots of unity, show that $(2 - \omega)(2 - \omega^2)(2 - \omega^{19})(2 - \omega^{23}) = 49$. 5

(f) If α, β are roots of $x^2 - 3ax + a^2 = 0$, find the value(s) of a if $\alpha^2 + \beta^2 = \frac{7}{4}$. 5

(g) If $y = ln\left(\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}\right)$, find $\frac{dy}{dx}$. 5

(h) Evaluate :

$$\int x^2 \sqrt{5x - 3}\, dx$$ 5

2\. (a) If $A = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 0 & 3 \\ 3 & 0 & -1 \end{bmatrix}$, show that $A\,(adj.A) = |A|\, I_3$. 5

(b) If $A = \begin{bmatrix} 2 & -1 & 7 \\ 3 & 5 & 2 \\ 1 & 1 & 3 \end{bmatrix}$, show that A is row equivalent to I_3. 5

(c) If $A = \begin{pmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{pmatrix}$,

$B = \begin{pmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{pmatrix}$, show that

$AB = 6\ I_3$. Use it to solve the system of linear equations $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$. *10*

3. (a) Find the sum of all the integers between 100 and 1000 that are divisible by 9. *5*

(b) Use De Moivre's theorem to find $(\sqrt{3} + i)^3$. *5*

(c) Solve the equation

$$x^3 - 13x^2 + 15x + 189 = 0,$$

given that one of the roots exceeds the other by 2. *5*

(d) Solve the inequality

$$\frac{2}{|x-1|} > 5$$

and graph its solution. *5*

4. (a) Determine the values of x for which $f(x) = x^4 - 8x^3 + 22x^2 - 24x + 21$ is increasing and for which it is decreasing. *5*

(b) Find the points of local maxima and local minima of

$$f(x) = x^3 - 6x^2 + 9x + 2014, x \in \mathbf{R}.$$ 5

(c) Evaluate :

$$\int \frac{dx}{\left(e^x - 1\right)^2}$$ 5

(d) Using integration, find length of the curve $y = 3 - x$ from $(-1, 4)$ to $(3, 0)$. 5

5. (a) Show that

$$[\vec{a} - \vec{b} \quad \vec{b} - \vec{c} \quad \vec{c} - \vec{a}] = 0.$$ 5

(b) Show that the lines

$$\frac{x-5}{4} = \frac{y-7}{-4} = \frac{z-3}{-5} \text{ and } \frac{x-8}{4} = \frac{y-4}{-4} = \frac{z-5}{4}$$

intersect. 5

(c) A tailor needs at least 40 large buttons and 60 small buttons. In the market, buttons are available in two boxes or cards. A box contains 6 large and 2 small buttons and a card contains 2 large and 4 small buttons. If the cost of a box is ₹ 3 and cost of a card is ₹ 2, find how many boxes and cards should be purchased so as to minimize the expenditure. 10

No. of Printed Pages : 5

BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

June, 2016

04336

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is* ***compulsory****. Attempt any* ***three*** *questions from the remaining questions.*

1. Attempt ***all*** parts :

(a) Show that

$$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a). \quad 5$$

(b) If $A = \begin{pmatrix} 1 & -2 \\ 2 & -1 \end{pmatrix}$, $B = \begin{pmatrix} a & 1 \\ b & -1 \end{pmatrix}$ and

$(A+B)^2 = A^2 + B^2$, find a and b. 5

(c) Use the principle of mathematical induction to show that $2 + 2^2 + \ldots + 2^n = 2^{n+1} - 2$ for each natural number n. 5

(d) Find the 10^{th} term of the harmonic progression $\frac{1}{7}, \frac{1}{15}, \frac{1}{23}, \frac{1}{31}, \ldots$ 5

(e) If Z is a complex number such that

$| Z - 2i | = | Z + 2i |$, show that $\text{Im}(Z) = 0$. 5

(f) Find the quadratic equation whose roots are $2 - \sqrt{3}, \ 2 + \sqrt{3}$. 5

(g) If $y = ln\left[e^x\left(\frac{x-2}{x+2}\right)^{3/4}\right]$, find $\frac{dy}{dx}$. 5

(h) Evaluate : 5

$$\int \frac{dx}{\sqrt{x} + x}$$

2\. (a) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, show that

$A^2 - 4A - 5I_3 = 0$. Hence obtain A^{-1} and A^3. 10

(b) If $A = \begin{bmatrix} 3 & 4 & -5 \\ 1 & 1 & 0 \\ 1 & 1 & 5 \end{bmatrix}$, show that A is row equivalent to I_3. 5

(c) Use Cramer's rule to solve the following system of equations : 5

$$x + 2y + 2z = 3$$

$$3x - 2y + z = 4$$

$$x + y + z = 2$$

3\. (a) Find the sum of an infinite G.P. whose first term is 28 and fourth term is $\frac{4}{49}$. 5

(b) If $x = a + b$, $y = a\omega + b\omega^2$, $z = a\omega^2 + b\omega$ (where ω is a cube root of unity and $\omega \neq 1$), show that $xyz = a^3 + b^3$. 5

(c) If the roots of $ax^3 + bx^2 + cx + d = 0$ are in A.P., show that

$$2b^3 - 9abc + 27a^2d = 0.$$ 5

(d) Solve the inequality

$$\frac{5}{|x-3|} < 7.$$ 5

4. (a) Determine the values of x for which $f(x) = 5x^{3/2} - 3x^{5/2},\ x > 0$ is

(i) increasing

(ii) decreasing. 5

(b) Find the points of local extrema of

$$f(x) = \frac{3}{4}x^4 - 8x^3 + \frac{45}{2}x^2 + 2015.$$ 5

(c) Evaluate : 5

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

(d) Find the area bounded by the curves $y = x^2$ and $y^2 = x$. 5

5. (a) For any vectors show that

$$|\vec{a} + \vec{b}| \le |\vec{a}| + |\vec{b}|.$$ 5

(b) Find the shortest distance between

$\vec{r} = (1 + \lambda)\hat{i} + (2 - \lambda)\hat{j} + (1 + \lambda)\hat{k}$ and

$\vec{r} = 2(1 + \mu)\hat{i} + (1 - \mu)\hat{j} + (-1 + 2\mu)\hat{k}$. 5

(c) A man wishes to invest at most ₹ 12,000 in Bond A and Bond B. He must invest at least ₹ 2,000 in Bond A and at least ₹ 4,000 in Bond B. If Bond A gives return of 8% and Bond B that of 10%, find how much money be invested in the two bonds to maximize the return. *10*

No. of Printed Pages : 4

BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

December, 2016

08955

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the remaining four questions.*

1. (a) Evaluate the determinant

$$\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}, \text{ where } \omega \text{ is a cube root}$$

of unity. 5

(b) Using determinant, find the area of the triangle whose vertices are $(-3, 5)$, $(3, -6)$ and $(7, 2)$. 5

(c) Use the principle of mathematical induction to show that $2 + 2^2 + \ldots + 2^n = 2^{n+1} - 2$ for every natural number n. 5

(d) Find the sum of all integers between 100 and 1000 which are divisible by 9. 5

(e) Check the continuity of the function f(x) at x = 0 : 5

$$f(x) = \begin{cases} \dfrac{|x|}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

(f) If $y = \dfrac{\ln x}{x}$, show that $\dfrac{d^2y}{dx^2} = \dfrac{2 \ln x - 3}{x^3}$. 5

(g) If the mid-points of the consecutive sides of a quadrilateral are joined, then show (by using vectors) that they form a parallelogram. 5

(h) Find the scalar component of projection of the vector $\vec{a} = 2\hat{i} + 3\hat{j} + 5\hat{k}$ on the vector $\vec{b} = 2\hat{i} - 2\hat{j} - \hat{k}$. 5

2. (a) Solve the following system of linear equations using Cramer's rule : 5

$x + 2y - z = -1,$

$3x + 8y + 2z = 28,$

$4x + 9y + z = 14.$

(b) Let $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ and $f(x) = x^2 - 4x + 7$.

Show that $f(A) = O_{2\times2}$. Hence find A^5. 10

(c) Determine the rank of the matrix

$$A = \begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \\ 5 & 3 & 14 & 4 \end{bmatrix}.$$ 5

3. (a) The common ratio of a G.P. is $-4/5$ and the sum to infinity is $80/9$. Find the first term of the G.P. 5

(b) If $\left(\frac{1-i}{1+i}\right)^{100} = a + ib$, then show that $a = 1$, $b = 0$. 5

(c) Solve the equation $8x^3 - 14x^2 + 7x - 1 = 0$, the roots being in G.P. 5

(d) Find the solution set for the inequality $15x^2 + 4x - 4 \geq 0$. 5

4. (a) If a mothball evaporates at a rate proportional to its surface area $4\pi r^2$, show that its radius decreases at a constant rate. 5

(b) Find the absolute maximum and minimum of the function $f(x) = \frac{x^3}{x+2}$ on the interval $[-1, 1]$. 5

(c) Evaluate the integral

$$I = \int \frac{dx}{1 + 3e^x + 2e^{2x}}.$$ 5

(d) Find the length of the curve

$y = 2x + 3$ from $(1, 5)$ to $(2, 7)$. 5

5. (a) Find the value of λ for which the vectors

$\vec{a} = \hat{i} - 4\hat{j} + \hat{k}$, $\vec{b} = \lambda\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{c} = 2\hat{i} + 3\hat{j} + 3\hat{k}$ are coplanar. *5*

(b) Find the equations of the line (both Vector and Cartesian) passing through the point (1, −1, −2) and parallel to the vector $3\hat{i} - 2\hat{j} + 5\hat{k}$. *5*

(c) A manufacturer makes two types of furniture, chairs and tables. Both the products are processed on three machines A_1, A_2 and A_3. Machine A_1 requires 3 hours for a chair and 3 hours for a table, machine A_2 requires 5 hours for a chair and 2 hours for a table and machine A_3 requires 2 hours for a chair and 6 hours for a table. The maximum time available on machines A_1, A_2 and A_3 is 36 hours, 50 hours and 60 hours respectively. Profits are ₹ 20 per chair and ₹ 30 per table. Formulate the above as a linear programming problem to maximize the profit and solve it. *10*

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BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

09411

June, 2017

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the remaining four questions.*

1. (a) Show that

$$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (b-a)(c-a)(c-b).$$ *5*

(b) Using determinants, find the area of the triangle whose vertices are (1, 2), (– 2, 3) and (– 3, – 4). *5*

(c) Use the principle of mathematical induction to prove that

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

for every natural number n. *5*

(d) If the first term of an A.P. is 22, the common difference is -4, and the sum to n terms is 64, find n. 5

(e) Find the points of discontinuity of the following function : 5

$$f(x) = \begin{cases} x^2, & \text{if } x > 0 \\ x + 3, & \text{if } x \leq 0 \end{cases}.$$

(f) If $y = ax + \frac{b}{x}$, show that

$$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0.$$ 5

(g) Prove that the three medians of a triangle meet at a point called centroid of the triangle which divides each of the medians in the ratio 2 : 1. 5

(h) Show that $|\vec{a}|\vec{b} + |\vec{b}|\vec{a}$ is perpendicular to $|\vec{a}|\vec{b} - |\vec{b}|\vec{a}$, for any two non-zero vectors $\vec{a}$ and $\vec{b}$. 5

2. (a) Solve the following system of linear equations using Cramer's rule : 5

$$x + y = 0, \quad y + z = 1, \quad z + x = 3$$

(b) If $A = \begin{bmatrix} 1 & -2 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$, find a and b. 5

(c) Reduce the matrix

$$A = \begin{bmatrix} 5 & 3 & 8 \\ 0 & 1 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

to normal form and hence find its rank. 5

(d) Show that $n(n + 1)(2n + 1)$ is a multiple of 6 for every natural number n. 5

3. (a) Find the sum of an infinite G.P. whose first term is 28 and fourth term is $\frac{4}{49}$. 5

(b) Use De Moivre's theorem to find $(\sqrt{3} + i)^3$. 5

(c) If 1, ω, ω^2 are cube roots of unity, show that

$$(2 - \omega)(2 - \omega^2)(2 - \omega^{10})(2 - \omega^{11}) = 49.$$ 5

(d) Solve the equation

$$2x^3 - 15x^2 + 37x - 30 = 0,$$

given that the roots of the equation are in A.P. 5

4. (a) A young child is flying a kite which is at a height of 50 m. The wind is carrying the kite horizontally away from the child at a speed of 6·5 m/s. How fast must the kite string be let out when the string is 130 m ? 5

(b) Using first derivative test, find the local maxima and minima of the function

$$f(x) = x^3 - 12x.$$ *5*

(c) Evaluate the integral

$$I = \int \frac{x^2}{(x+1)^3} dx.$$ *5*

(d) Find the length of the curve

$$y = 3 + \frac{1}{2}(x) \text{ from } (0, 3) \text{ to } (2, 4).$$ *5*

5. (a) If $\vec{a}$, $\vec{b}$, $\vec{c}$ are coplanar, then prove that $\vec{a} + \vec{b}$, $\vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are also coplanar. *5*

(b) Find the Vector and Cartesian equations of the line passing through the points (– 2, 0, 3) and (3, 5, – 2). *5*

(c) Best Gift Packs company manufactures two types of gift packs, type A and type B. Type A requires 5 minutes each for cutting and 10 minutes each for assembling it. Type B requires 8 minutes each for cutting and 8 minutes each for assembling. There are at most 200 minutes available for cutting and at most 4 hours available for assembling. The profit is ₹ 50 each for type A and ₹ 25 each for type B. How many gift packs of each type should the company manufacture in order to maximise the profit ? *10*

No. of Printed Pages : 5

BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

10403

December, 2017

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the rest.*

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1. (a) Show that

$$\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}.$$ 5

(b) Let $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ and $f(x) = x^2 - 4x + 7$.

Show that $f(A) = O_{2\times2}$. Use this result to find A^5. 5

(c) Find the sum up to n terms of the series

$$0{\cdot}4 + 0{\cdot}44 + 0{\cdot}444 + \dots$$ 5

(d) If 1, ω, ω^2 are cube roots of unity, show that $(1+\omega)(1+\omega^2)(1+\omega^3)(1+\omega^4)(1+\omega^6)(1+\omega^8) = 4$. 5

(e) If $y = ae^{mx} + be^{-mx} + 4$, show that

$$\frac{d^2y}{dx^2} = m^2(y-4).$$ 5

(f) A spherical balloon is being inflated at the rate of 900 cubic centimetres per second. How fast is the radius of the balloon increasing when the radius is 25 cm ? 5

(g) Find the value of λ for which the vectors $\vec{a} = 2\hat{i} - 4\hat{j} + 3\hat{k}$, $\vec{b} = \lambda\hat{i} - 2\hat{j} + \hat{k}$, $\vec{c} = 2\hat{i} + 3\hat{j} + 3\hat{k}$ are co-planar. 5

(h) Find the angle between the pair of lines

$$\frac{x-5}{2} = \frac{y-3}{3} = \frac{z-1}{-3} \text{ and}$$

$$\frac{x}{3} = \frac{y-1}{2} = \frac{z+5}{-3}.$$ 5

2. (a) Solve the following system of equations by using matrix inverse : 5

$3x + 4y + 7z = 14$, $2x - y + 3z = 4$, $x + 2y - 3z = 0$

(b) Show that $A = \begin{bmatrix} 3 & 4 & -5 \\ 2 & 2 & 0 \\ 1 & 1 & 5 \end{bmatrix}$ is row equivalent to I_3. 5

(c) Use the principle of mathematical induction to prove that

$$1^3 + 2^3 + \dots + n^3 = \frac{1}{4} n^2 (n+1)^2$$

for every natural number n. 5

(d) Find the quadratic equation with real coefficients and with the pair of roots $\frac{1}{5-\sqrt{72}}, \frac{1}{5+6\sqrt{2}}$. 5

3. (a) How many terms of the G.P. $\sqrt{3}$, 3, $3\sqrt{3}$, ... add up to $120 + 40\sqrt{3}$? 5

(b) If $\left(\frac{1-i}{1+i}\right)^{10} = a + ib$, then show that a = 1 and b = 0. 5

(c) Solve the equation $8x^3 - 14x^2 + 7x - 1 = 0$, the roots being in G.P. 5

(d) Solve the inequality $\left|\frac{x-4}{2}\right| \leq \frac{5}{12}$ and graph the solution set. 5

4. (a) Determine the values of x for which the following function is increasing and for which it is decreasing : 5

$$f(x) = x^4 - 8x^3 + 22x^2 - 24x + 21$$

(b) Show that $f(x) = 1 + x^2 \, ln\left(\frac{1}{x}\right)$ has a local maximum at $x = \frac{1}{\sqrt{e}}$, $(x > 0)$. 5

(c) Evaluate the integral

$$\int \frac{dx}{1 + 3e^x + 2e^{2x}}.$$ 5

(d) Find the length of the curve $y = \frac{2}{3} x^{3/2}$ from $(0, 0)$ to $\left(1, \frac{2}{3}\right)$. 5

5. (a) Check the continuity of a function f at x = 0 : 5

$$f(x) = \begin{cases} \frac{2|x|}{x}; & x \neq 0 \\ 0; & x = 0 \end{cases}$$

(b) Find the Vector and Cartesian equations of the line passing through the point (1, –1, –2) and parallel to the vector $3\hat{i} - 2\hat{j} + 5\hat{k}$. 5

(c) Find the shortest distance between the lines

$\vec{r} = (3\hat{i} + 4\hat{j} - 2\hat{k}) + t(-\hat{i} + 2\hat{j} + \hat{k})$ and

$\vec{r} = (\hat{i} - 7\hat{j} - 2\hat{k}) + t(\hat{i} + 3\hat{j} + 2\hat{k})$. 5

(d) Find the maximum value of $5x + 2y$ subject to the constraints

$$-2x - 3y \leq -6$$

$$x - 2y \leq 2$$

$$6x + 4y \leq 24$$

$$-3x + 2y \leq 3$$

$$x \geq 0,\ y \geq 0$$ 5

No. of Printed Pages : 4

BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

June, 2018

02735

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the rest.*

1. (a) Show that

$$\begin{vmatrix} 1 & a & a^2 \\ a^2 & 1 & a \\ a & a^2 & 1 \end{vmatrix} = (a^3 - 1)^2$$ 5

(b) Find the inverse of $A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}$. 5

(c) Find the sum up to n terms of the series

$3 + 33 + 333 + \ldots$ 5

(d) If $1, \omega, \omega^2$ are the cube roots of unity, show that $(1 + \omega + \omega^2)^5 + (1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5 = 32$ 5

(e) If $y = 1 + ln\ (x + \sqrt{x^2 + 1})$, prove that

$$(x^2 + 1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0.$$ 5

(f) A stone is thrown into a lake producing a circular ripple. The radius of the ripple is increasing at the rate of 5 m/s. How fast is the area inside the ripple increasing when the radius is 10 m ? 5

(g) Find the value of λ for which the vectors $\vec{a} = \hat{i} - 4\hat{j} + \hat{k}$, $\vec{b} = \lambda\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{c} = 2\hat{i} + 3\hat{j} + 3\hat{k}$ are coplanar. 5

(h) Find the angle between the lines

$$\vec{r} = 2\hat{i} + 3\hat{j} - 4\hat{k} + t(\hat{i} - 2\hat{j} + 2\hat{k})$$

$$\vec{r} = 3\hat{i} - 5\hat{k} + s(3\hat{i} - 2\hat{j} + 6\hat{k}).$$ 5

2. (a) Solve the following system of equations by the matrix method :

$2x - y + 3z = 5,\ 3x + 2y - z = 7,$

$4x + 5y - 5z = 9.$ 5

(b) Show that $A = \begin{bmatrix} 3 & 4 & -5 \\ 3 & 3 & 0 \\ 1 & 1 & 5 \end{bmatrix}$ is row equivalent to I_3. 5

(c) Use the principle of mathematical induction to show that

$$1 + 4 + 7 + \ldots + (3n - 2) = \frac{1}{2} n (3n - 1).$$ 5

(d) Find the quadratic equations with real coefficients and with the following pair of roots : $\frac{m-n}{m+n}, -\frac{m+n}{m-n}$ 5

3. (a) Evaluate : 5

$$\lim_{x \to 0} \frac{\sqrt{1+2x} - \sqrt{1-2x}}{x}$$

(b) If $(x + iy)^{1/3} = a + ib$, prove that

$$\frac{x}{a} + \frac{y}{b} = 4(a^2 - b^2)$$ 5

(c) Solve the equation

$$2x^3 - 15x^4 + 37x - 30 = 0,$$

if the roots of the equation are in A.P. 5

(d) Draw the graph of the solution set of the following inequalities : 5

$$2x + y \geq 8, \; x + 2y \geq 8 \text{ and } x + y \leq 6.$$

4. (a) Determine the values of x for which the following function is increasing and for which it is decreasing :

$$f(x) = (x - 1)(x - 2)^2$$ 5

(b) Find the absolute maximum and minimum of the following function :

$$f(x) = \frac{x^3}{x+2} \text{ on } [-1, 1].$$ 5

(c) Find the length of the curve $y = 2x^{3/2}$ from the point (1, 2) to (4, 16). 5

(d) Evaluate the integral

$$\int \frac{(x+1)^2}{(x-1)^2} dx$$ 5

5. (a) If $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - \hat{k}$, verify that

$\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$. 5

(b) Find the vector and Cartesian equations of the line passing through the points (– 2, 0, 3) and (3, 5, – 2). 5

(c) Reduce the matrix

$$A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$$

to its normal form and hence determine its rank. 5

(d) Find the direction cosines of the line passing through the two points (1, 2, 3) and (– 1, 1, 0). 5

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BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

00603

December, 2018

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number 1 is **compulsory**. Attempt any **three** questions from the remaining questions.*

1. Attempt all parts :

(a) Show that

$$\begin{vmatrix} b-c & c-a & a-b \\ c-a & a-b & b-c \\ a-b & b-c & c-a \end{vmatrix} = 0.$$ 5

(b) If $A = \begin{pmatrix} 1 & -2 \\ 2 & 1 \end{pmatrix}$, and $I_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, find $(A - I_2)^2$. 5

(c) Show that 7 divides $2^{3n} - 1 \; \forall \; n \in \mathbf{N}$. 5

(d) If 7 times the 7^{th} term of an A.P. is equal to 11 times the 11^{th} term of the A.P., find its 18^{th} term. 5

(e) If 1, ω, ω^2 are the cube roots of unity, find

$$(2 + \omega + \omega^2)^6 + (3 + \omega + \omega^2)^6.$$ 5

(f) If α, β are roots of $x^2 - 2kx + k^2 - 1 = 0$, and $\alpha^2 + \beta^2 = 10$, find k. 5

(g) If $y = (x + \sqrt{x^2 + 1})^3$, find $\frac{dy}{dx}$. 5

(h) Evaluate : 5

$$\int x \sqrt{3 - 2x}\, dx$$

2. (a) If $A = \begin{bmatrix} -1 & 2 & 3 \\ 4 & 5 & 7 \\ 5 & 3 & 4 \end{bmatrix}$, show that $A(\text{adj } A) = 0$. 5

(b) If $A = \begin{pmatrix} 1 & 1 & 3 \\ 0 & 5 & 2 \\ 2 & -1 & 7 \end{pmatrix}$, show that A is row equivalent to I_3. 5

(c) Solve the following system of linear equations by using matrix inverse :

$$3x + 4y + 7z = -2$$

$$2x - y + 3z = 6$$

$$2x + 2y - 3z = 0$$

and hence, obtain the value of $3x - 2y + z$. *10*

3. (a) Find the sum of first all integers between 100 and 1000 which are divisible by 7. *5*

(b) Use De Moivre's theorem to find $(i + \sqrt{3})^3$. *5*

(c) Solve : *5*

$$32x^3 - 48x^2 + 22x - 3 = 0,$$

given the roots are in A.P.

(d) Solve : *5*

$$\frac{2x-5}{x+2} < 5, \ x \in \mathbf{R}$$

4. (a) Find the points of local maxima and local minima of

$$f(x) = x^3 - 6x^2 + 9x + 100.$$ *5*

(b) Evaluate : *5*

$$\int \frac{dx}{e^x + 1}$$

(c) Find the area lying between two curves

$$y = 3 + 2x, \; y = 3 - x, \; 0 \le x \le 3,$$

using integration. 5

(d) Find length of $y = 3 - 2x$ from $(0, 3)$ to $(2, -1)$, using integration. 5

5. (a) If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, show that

$$\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}.$$ 5

(b) Check if the lines

$$\frac{x-1}{4} = \frac{y-3}{4} = \frac{z+2}{-5} \text{ and}$$

$$\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$$

intersect or not. 5

(c) Perky Owl takes up designing and photography jobs. Designing job fetches the company ₹ 2000/hr and photography fetches them ₹ 1500/hr. The company can devote at most 20 hours per day to designing and at most 15 hours to photography. If total hours available for a day is at most 30, find the maximum revenue Perky Owl can get per day. 10

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No. of Printed Pages : 4

BCS-012

BACHELOR OF COMPUTER APPLICATION

(BCA) (REVISED)

Term-End Examination, 2019

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours] **[Maximum Marks : 100**

Note : Question **No.1** is **compulsory**. Attempt **any three** questions from the remaining questions.

1. Attempt all parts :

(a) Show that : [5]

$$\begin{vmatrix} 1 & ab & (a+b)c \\ 1 & ca & (c+a)b \\ 1 & bc & (b+c)a \end{vmatrix} = 0$$

(b) If $A = \begin{pmatrix} 2 & -1 \\ 0 & 3 \end{pmatrix}$ and $I_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, find $A^2 - 5A + 6I_2$. [5]

(c) Show that 8 divides $3^{2n} - 1 \ \forall n \in \mathrm{N}$. [5]

(d) If a, b, c are pth, qth and rth term of an A.P. respectively, show that : [5]

(q - r) a + (r - p) b + (p-q)c = 0

(e) If 1, w, w^2 are cube roots of unity, find : [5]

$(1 + w + 3w^2)^6 + (1 + 2w + 2w^2)^6$

(f) If α, β are roots of $x^2 - 4ax + 4a^2 - 9 = 0$ and $\alpha^2 + \beta^2 = 26$, find a. [5]

(g) If $y = ln\left(x + \sqrt{x^2 + 1}\right)$, find $\frac{dy}{dx}$. [5]

(h) Evaluate $\int \sqrt{x}(3 + 2x)\,dx$. [5]

2. (a) If $A = \begin{pmatrix} 3 & -1 & 2 \\ 2 & 1 & 1 \\ 1 & -2 & 1 \end{pmatrix}$, show that A (adj A) =0. [5]

(b) If $A = \begin{pmatrix} 1 & -1 & 2 \\ 0 & 4 & 7 \\ 3 & 2 & 1 \end{pmatrix}$, show that A is row equivalent to I_3. [5]

(c) If $A = \begin{pmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{pmatrix}$ and

$B = \begin{pmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{pmatrix}$, show that $AB = 6I_3$. Use it to solve the system of linear equations : [10]

$x - y = 1$

$2x + 3y + 4z = 7$

$y + 2z = 1$

3. (a) Find the sum of all the integers between 100 and 700 which are divisible by 8. [5]

(b) Use DeMoivre's theorem to obtain $(1 + i)^8$ [5]

(c) Solve $x^3 - 9x^2 + 23x - 15 = 0$, two of the roots are in the ratio 3 : 5. [5]

(d) Solve $\frac{3x-1}{x+2} < 3$, $x \in \mathbb{R}$ [5]

4. (a) Determine the interval in $f(x) = e^{1/x}$, $x \neq 0$, is decreasing. [5]

(b) Evaluate $\int \frac{e^{2x}}{e^x + 1} dx$ [5]

(c) Find the area bounded by $y = \sqrt{x}$ and $y = x$. [5]

(d) Using integration find the length of y = 3 + x from (1, 4) to (3, 6). [5]

5. (a) Show that : [5]

$$[\vec{a}+\vec{b} \quad \vec{b}+\vec{c} \quad \vec{c}+\vec{a}] = 2[\vec{a}\,\vec{b} \quad \vec{c}]$$

(b) Find shortest distance between

$\vec{r} = \hat{i} - \hat{j} + t(2\hat{i} + \hat{k})$ and

$\vec{r} = 2\hat{i} - \hat{j} + s(\hat{i} + \hat{j} - \hat{k})$ [5]

(c) Right moves dance academy wishes to run two dance courses - Hip-hop and Contemporary. Fee for Hip-hop is Rs. 300 per hour and for contemporary it is Rs. 250 per hour. The academy can accommodate at most 15 in hip-hop and at most 20 in contemporary. If the total number of students cannot exceed 30, find the maximum revenue academy can get per hour. [10]

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No. of Printed Pages : 4 **13994** **BCS-012**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination, 2019

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours] **[Maximum Marks : 100**

Note : Question **no.1** is **compulsory.** Attempt **any three** questions from remaining four questions.

1. (a) Show that : $\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = \begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ [5]

(b) Using determinants, find the area of the triangle whose vertices are (2,1), (3, -2) and (-4,-3). [5]

(c) Use mathematical induction to show that $1+3+5+........+(2n-1) = n^2 \ \forall \ n \in N$ [5]

(d) If α, β are roots of $x^2 - 3ax + a^2 = 0$, find a if $\alpha^2 + \beta^2 = \frac{1}{7}$. [5]

(e) If 1, w, w^2 are cube roots of unity, find the value of : $(2+w)(2+w^2)(2+w^{22})(2+w^{26})$ [5]

(f) If 9th term of an A.P. is 25 and 17th term of the A.P. is 41, find its 20th term. [5]

(g) If y = $3xe^{-x}$, find $\frac{d^2y}{dx^2}$ [5]

(h) Evaluate $\int x\sqrt{2x+3}\,dx$. [5]

2. (a) If A= $\begin{bmatrix} 0 & 3 & -1 \\ 2 & 1 & 3 \\ -1 & 0 & 0 \end{bmatrix}$, show that A(adjA)= |A|$I_3$. [5]

(b) If A= $\begin{pmatrix} 3 & -1 & 0 \\ 2 & 1 & 1 \\ 1 & 1 & 0 \end{pmatrix}$, show that A is equivalent to I_3. [5]

(c) If A = $\begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, show that $A^2 - 4A + I = O$, where I and O are identity and null matrix respectively of order 2. Also, find A^5. [5]

(d) Use principle of mathematical induction to show that $2^{3n}-1$ is divisible by 7. [5]

3. (a) Find all solutions of : $z^2 = \bar{z}$ [5]

($\bar{z}$ is conjugate of z)

(b) Solve the equation : [5]

$x^3 - 13x^2 + 15x + 189 = 0$ if one root of the equation exceeds other by 2.

(c) Solve the inequality : $\left|\frac{2x-3}{4}\right| \leq \frac{2}{3}$ [5]

(d) If $y = ln\left[e^x \left(\frac{x-1}{x+1}\right)^{3/2}\right]$, find $\frac{dy}{dx}$. [5]

4. (a) If a>0, find local maximum and local minimum values of $f(x) = x^3 - 2ax^2 + a^2x$. [5]

(b) Evaluate $\int \frac{dx}{3+e^x}$. [5]

(c) Evaluate $\int_{-1}^{2} \frac{x}{(x^2+1)^2}\, dx$ [5]

(d) Find the area bounded by the $x - axis,\ y = 3 + 4x$ and the ordinates $x = 1$ and $x = 2$, by using integration. [5]

5. (a) If the mid-points of the consecutive sides of a quadrilateral are joined, then show that the quadrilateral formed is a parallelogram. [5]

(b) If $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}, \vec{b} = \hat{j} + \hat{k}, \vec{c} = 3\hat{i} - \hat{j} + k$, find $(\vec{a} \times \vec{b}) \times \vec{c}$. [5]

(c) Find equation of line passing through (-1,-2,3) and perpendicular to the lines :

$$\frac{x}{1} = \frac{y}{3} = \frac{z}{2} \text{ and } \frac{x+2}{-3} = \frac{y-1}{5} = \frac{z+1}{2}$$ [5]

(d) Maximize : [5]

$Z = 2x + 3y$

Subject to :

$x + y \geq 1$

$2x + y \leq 4$

$x + 2\ y \leq 4,$

$x \geq 0,\ y \geq 0$

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BCS-012

BACHELOR OF COMPUTER APPLICATION (BCA) (Revised)

Term-End Examination

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours] *[Maximum Marks : 100*

Note: Question number 1 is compulsory. Answer any three questions from remaining four questions.

1. (a) Show that: 5

$$\begin{vmatrix} b-c & c-a & a-b \\ c-a & a-b & b-c \\ a-b & b-c & c-a \end{vmatrix} = 0$$

(b) If $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$, show that:

$A^2 - 5A + I = O$, where I and O are identity and null matrices respectively of order 2. 5

(c) Show that $3^{2n} - 1$ is divisible by 8 for each $n \in \mathbb{N}$. 5

(d) If α, β are roots of $x^2 + ax + b = 0$, find value of $\alpha^4 + \beta^4$ in terms of a, b. 5

(e) If $x = a + b$, $y = aw + bw^2$ and $z = aw^2 + bw$, show that $xyz = a^3 + b^3$ 5

(f) Show that:

$$\underbrace{11 \text{-----} 1}_{91}$$

is not a prime. 5

(g) If $y = 3\sin x + 4\cos x$, find $\frac{d^2y}{dx^2}$. 5

(h) Evaluate $\int xe^x dx$. 5

2. (a) If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$, where $i^2 = -1$, show that $(A+B)^2 = A^2 + B^2$. 5

(b) If $A = \begin{bmatrix} -1 & 2 & 0 \\ -1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$, show that $A^2 = A^{-1}$. 5

(c) If $A = \begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 0 \end{bmatrix}$ find AB and BA. 5

(d) Use principle of Mathematical induction to show that:

$$\frac{1}{2}+\frac{1}{2^2}+\ldots\ldots+\frac{1}{2^n}<1 \quad \forall n \in \mathbb{N}$$ 5

3. (a) Find sum of all three digit numbers which are divisible by 7. 5

(b) Use De Moivre's theorem to find $\left(1+\sqrt{3}\, i\right)^3$. 5

(c) Solve the inequality: 5

$$\frac{4}{|x-2|}>5$$

(d) Solve the equation:

$$8x^3-14x^2+7x-1=0$$

if the roots are in G.P. 5

4. (a) If $y=\dfrac{\sqrt{x^2+1}+\sqrt{x^2-1}}{\sqrt{x^2+1}-\sqrt{x^2-1}}$, find $\dfrac{dy}{dx}$. 5

(b) Show that: 5

$$f(x)=\frac{1+x+x^2}{1-x+x^2}$$

is a decreasing function on the interval $(1, \infty)$.

(c) Evaluate: 5

$$\int \frac{\left(a^x + b^x\right)^2}{a^x b^x} dx$$ 5

(d) Find the area bounded by the line $y = 3 + 2x$, x-axis and the ordinates $x = 2$ and $x = 3$. 5

5. (a) Show that:

$$\left[\vec{b}+\vec{c} \quad \vec{c}+\vec{a} \quad \vec{a}+\vec{b}\right] = 2\left[\vec{a} \quad \vec{b} \quad \vec{c}\right]$$ 5

(b) Show that the lines:

$\frac{x-5}{4} = \frac{y-7}{-4} = \frac{z-3}{-5}$ and

$\frac{x-8}{4} = \frac{y-4}{-4} = \frac{z-5}{8}$ intersect. 5

(c) Two tailors, A and B, earn Rs. 700 and Rs. 1000 per day respectively. A can stitch 6 shirts and 4 pants while B can stitch 10 shirts and 4 pants per day. How many days shall each have to work if it is desired to produce at least 60 shirts and 32 pants at a minimum labour cost? Also, calculate the least cost.

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No. of Printed Pages : 4 **BCS-012**

BACHELOR OF COMPUTER APPLICATIONS (B. C. A.) (Revised)

Term-End Examination

December, 2020

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours *Maximum Marks : 100*

Note : *Question number* ***1 is compulsory****. Attempt any* ***three*** *questions from the remaining questions.*

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1. (a) Show that : 5

$$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a).$$

(b) Use the principle of mathematical induction to prove : 5

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

where n is a natural number.

(c) Find the sum of n terms, for the series given below : 5

$$3 + 33 + 333 + ...$$

(d) Evaluate : 5

$$\lim_{x \to 0} \frac{\sqrt{1+2x} - \sqrt{1-2x}}{x}.$$

(e) Evaluate : 5

$$\int \frac{dx}{\sqrt{x} + x}.$$

(f) If $y = ax + \frac{b}{x}$, show that : 5

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0.$$

(g) If 1, ω and ω^2 are the cube roots of unity, show that : 5

$$(1+\omega+\omega^2)^5 + (1-\omega+\omega^2)^5 + (1+\omega-\omega^2)^5 = 32.$$

(h) Find the value of λ for which the vectors $\vec{a} = \hat{i} - 4\hat{j} + \hat{k}$; $\vec{b} = \lambda\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{c} = 2\hat{i} + 3\hat{j} + 3\hat{k}$ are coplanar. 5

2\. (a) Solve the following system of equations, using Cramer's rule : 5

$$x + 2y + 2z = 3;$$

$$3x - 2y + z = 4;$$

$$x + y + z = 2.$$

(b) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, show that $A^2 - 4A - 5I_3 = 0$.

Hence find A^{-1} and A^3. 10

(c) If $A = \begin{bmatrix} 3 & 4 & -5 \\ 1 & 1 & 0 \\ 1 & 1 & 5 \end{bmatrix}$, show that A is row equivalent to I_3. 5

3. (a) Solve the equation $2x^3 - 15x^2 + 37x - 30 = 0$, given that the roots of the equation are in A. P. 5

(b) If 1, ω and ω^2 are cube roots of unity, show that $(2-\omega)(2-\omega^2)(2-\omega^{10})(2-\omega^{11}) = 49$. 5

(c) Use De-Moivre's theorem to find $\left(\sqrt{3}+i\right)^3$ .5

(d) Find the sum of an infinite G. P., whose first term is 28 and fourth term is $\frac{4}{49}$. 5

4. (a) Determine the values of x for which the following function is increasing and decreasing : 5

$$f(x) = (x-1)(x-2)^2$$

(b) Find the length of the curve $y = 2x^{3/2}$ from the point (1, 2) to (4, 16). 5

P. T. O.

(c) If $\vec{a}+\vec{b}+\vec{c}=10$, show that : 5

$$\vec{a}\times\vec{b}=\vec{b}\times\vec{c}=\vec{c}\times\vec{a}.$$

(d) Solve : 5

$$\frac{2x-5}{x+2}<5,\ x\in \mathrm{R}.$$

5. (a) A man wishes to invest at most ₹ 12,000 in Bond-A and Bond-B. He must invest at least ₹ 2,000 in Bond-A and at least ₹ 4,000 in Bond-B. If Bond-A gives return of 8% and Bond-B gives return of 10%, determine how much money, should be invested in the two bonds to maximize the returns. 10

(b) Find the points of local maxima and local minima of the function $f(x)$, given below : 5

$$f(x)=x^3-6x^2+9x+100.$$

(c) Show that 7 divides $2^{3n}-1$, $\forall n\in \mathbf{N}$ i. e. set of natural numbers, using mathematical induction. 5

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BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

June, 2021

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number **1** is **compulsory**. Attempt any **three** questions from the remaining questions.*

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1. (a) If $A = \begin{bmatrix} 1 & -2 \\ 2 & -1 \end{bmatrix}$; $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$, find a and b. *5*

(b) If the first term of an AP is 22, the common difference is – 4, and the sum to n terms is 64, find n. *5*

(c) Find the angle between the lines

$\vec{r_1} = 2\hat{i} + 3\hat{j} - 4\hat{k} + t(\hat{i} - 2\hat{j} + 2\hat{k})$

$\vec{r_2} = 3\hat{i} - 5\hat{k} + s(3\hat{i} - 2\hat{j} + 6\hat{k})$. *5*

(d) If α, β are roots of $x^2 - 2kx + k^2 - 1 = 0$, and $\alpha^2 + \beta^2 = 10$, find k. *5*

(e) If $y = 1 + ln\,(x + \sqrt{x^2 + 1})$, prove that

$$(x^2 + 1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0.$$ 5

(f) Find the points of discontinuity of the following function : 5

$$f(x) = \begin{cases} x^2, & x > 0 \\ x + 3, & x \leq 0 \end{cases}$$

(g) Solve the inequality $\frac{5}{|x - 3|} < 7.$ 5

(h) Evaluate the integral

$$I = \int \frac{x^2}{(1 + x)^3}\,dx.$$ 5

2. (a) Use the principle of mathematical induction to show that $2 + 2^2 + ... + 2^n = 2^{n+1} - 2$ for each natural number n. 5

(b) Using determinant, find the area of the triangle whose vertices are (1, 2); (– 2, 3) and (– 3, – 4). 5

(c) Draw the graph of the solution set for the following inequalities :

$$2x + y \geq 8, \quad x + 2y \geq 8 \quad \text{and} \quad x + y \leq 6$$ 5

(d) Use De Moivre's theorem to find $(i + \sqrt{3})^3$. 5

3\. (a) Find the absolute maximum and minimum of the following function : 5

$$f(x) = \frac{x^3}{x+2} \quad \text{on} \quad [-1, 1]$$

(b) Reduce the matrix $A = \begin{bmatrix} 5 & 3 & 8 \\ 0 & 1 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ to normal form and hence find its rank. 5

(c) If $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$; $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - \hat{k}$; verify that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$. 5

(d) Find the length of function $y = 3 - 2x$ from $(0, 3)$ to $(2, -1)$ using integration. 5

4\. (a) Find the quadratic equation with real coefficients and with the following pair of roots : 5

$$\left(\frac{m-n}{m+n}\right); \left(\frac{m+n}{m-n}\right)$$

(b) If $x = a + b$, $y = a\omega + b\omega^2$, $z = a\omega^2 + b\omega$ (where ω is a cube root of unity and $\omega \neq 1$), show that $xyz = a^3 + b^3$. 5

(c) Solve the following system of linear equations using Cramer's rule : 5

$$x + y = 0; \; y + z = 1; \; z + x = 3$$

(d) If $y = \ln \left[e^{x} \left(\frac{x-2}{x+2} \right)^{3/4} \right]$, find $\frac{dy}{dx}$. 5

5. (a) A software development company took the designing and development job of a website. The designing job fetches the company ₹ 2,000 per hour and development job fetches them ₹ 1,500 per hour. The company can devote at most 20 hours per day for designing and atmost 15 hours for development of website. If total hours available for a day is at most 30, find the maximum revenue the software company can get per day. *10*

(b) Evaluate $\int x \sqrt{3 - 2x} \; dx$. 5

(c) Find the vector and Cartesian equations of the line passing through the points $(-2, 0, 3)$ and $(3, 5, -2)$. 5

No. of Printed Pages : 6 **BCS-012**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (REVISED)

Term-End Examination

December, 2021

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours *Maximum Marks : 100*

Note : *Question number 1 is compulsory. Attempt any* ***three*** *questions from the remaining questions.*

1. (a) Find the inverse of matrix : 5

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

(b) If 7 times the 7th term of an A.P. is equal to 11 times the 11th term of the A.P., find its 18th term. 5

(c) If z is a complex number such that $|z - 2i| = |z + 2i|$, show that Im $(z) = 0$. 5

(d) Show that $|\vec{a}|\vec{b} + |\vec{b}|\vec{a}$ is perpendicular to $|\vec{a}|\vec{b} - |\vec{b}|\vec{a}$, for any two non-zero vectors $\vec{a}$ and $\vec{b}$. 5

(e) Use the principle of mathematical induction to show that : 5

$$1 + 4 + 7 + \ldots\ldots + (3k - 2) = \frac{1}{2}k(3k - 1)$$

(f) Evaluate $\int \frac{dx}{e^x + 1}$. 5

(g) Find the quadratic equation whose roots are $(2 - \sqrt{3})$ and $(2 + \sqrt{3})$. 5

(h) Find the length of the curve :

$$y = 3 + \frac{1}{2}(x)$$

from (0, 3) to (2, 4). 5

2. (a) Find the shortest distance between : 5

$$\vec{r_1} = (1+\lambda)\hat{i} + (2-\lambda)\hat{j} + (1+\lambda)\hat{k}$$

and $\vec{r_2} = 2(1+\mu)\hat{i} + (1-\mu)\hat{j} + (-1+2\mu)\hat{k}$

(b) Find the points of local minima and local maxima, for function : 5

$$f(x) = \frac{3}{4}x^4 - 8x^3 + \frac{45}{2}x^2 + 2015$$

(c) Find the sum of all integers between 100 and 1000 which are divisible by 7. 5

(d) If $A = \begin{bmatrix} 1 & 1 & 3 \\ 0 & 5 & 2 \\ 2 & -1 & 7 \end{bmatrix}$, show that A is row equivalent to I_3. 5

3. (a) A stone is thrown into a lake, producing circular ripple. The radius of the ripple is increasing at the rate of 5 m/s. How fast is

the area inside the ripple increasing when the radius is 10 m ? 5

(b) If $(x+iy)^{1/3} = a+ib$, prove that : 5

$$\frac{x}{a} + \frac{y}{b} = 4(a^2 - b^2)$$

(c) Find the 10th term of the harmonic progression : 5

$$\frac{1}{7}, \frac{1}{15}, \frac{1}{23}, \frac{1}{31}, \ldots\ldots\ldots$$

(d) For any two vectors $\vec{a}$ and $\vec{b}$, show that : 5

$$|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|$$

4. (a) Determine the values of x for which :

$$f(x) = 5x^{3/2} - 3x^{5/2}, \ x > 0$$

is increasing and decreasing. 5

(b) Solve the following system of liner equations by using matrix inverse : 10

$$3x + 4y + 7z = -2$$

$$2x - y + 3z = 6$$

$$2x + 2y - 3z = 0$$

and hance, obtain the value of $3x - 2y + z$.

(c) Find the area bounded by the curves $y = x^2$ and $y^2 = x$. 5

5. (a) If $y = \left(x + \sqrt{x^2 + 1}\right)^3$, find $\frac{dy}{dx}$. 5

(b) A company wishes to invest at most \$ 12,000 in project A and project B. Company must invest at least \$ 2,000 in project A and at least \$ 4,000 in project B.

If project A gives return of 8% and project B gives return of 10%, find how much money is to be invested in the two projects to maximize the return. 10

(c) Solve the equation :

$$2x^3 - 15x^2 + 37x - 30 = 0$$

if roots of the equation are in A. P. 5

No. of Printed Pages : 4 **BCS-012**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

June, 2022

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question number **1** is **compulsory**. Attempt any **three** questions from the remaining questions.*

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1. (a) Solve the following system of linear equations using Cramer's rule : 5

$$x + y = 0; \; y + z = 1; \; z + x = 3$$

(b) If 1, ω and ω^2 are cube roots of unity, show that

$$(2 - \omega)(2 - \omega^2)(2 - \omega^{10})(2 - \omega^{11}) = 49.$$ 5

(c) Evaluate the integral $I = \int \frac{x^2}{(x+1)^3} dx$. 5

(d) Solve the inequality $\frac{5}{|x-3|} < 7$. 5

(e) Show that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (b - a)(c - a)(c - b)$. 5

(f) Find the quadratic equation whose roots are $(2 - \sqrt{3})$ and $(2 + \sqrt{3})$. 5

(g) Find the sum of an Infinite G.P., whose first term is 28 and fourth term is $\frac{4}{49}$. 5

(h) If z is a complex number such that $|z - 2i| = |z + 2i|$, show that $\text{Im}(z) = 0$. 5

2. (a) Evaluate $\lim\limits_{x \to 0} \dfrac{\sqrt{1 + 2x} - \sqrt{1 - 2x}}{x}$. 5

(b) Prove that the three medians of a triangle meet at a point called centroid of the triangle which divides each of the medians in the ratio 2 : 1. 7

(c) A young child is flying a kite which is at a height of 50 m. The wind is carrying the kite horizontally away from the child at a speed of 6·5 m/s. How fast must the kite string be let out when the string is 130 m ? 8

3. (a) Using Principle of Mathematical Induction, show that n(n + 1) (2n + 1) is a multiple of 6 for every natural number n. 5

(b) Find the points of local minima and local maxima for

$$f(x) = \frac{3}{4}x^4 - 8x^3 + \frac{45}{2}x^2 + 2015.$$ 5

(c) Determine the 100^{th} term of the Harmonic Progression $\frac{1}{7}, \frac{1}{15}, \frac{1}{23}, \frac{1}{31}, ...$ 5

(d) Find the length of the curve $y = 2x^{3/2}$ from the point (1, 2) to (4, 16). 5

4. (a) Determine the shortest distance between

$\vec{r_1} = (1 + \lambda)\hat{i} + (2 - \lambda)\hat{j} + (1 + \lambda)\hat{k}$ and

$\vec{r_2} = 2(1 + \mu)\hat{i} + (1 - \mu)\hat{j} + (-1 + 2\mu)\hat{k}$. 5

(b) Find the area lying between two curves

$$y = 3 + 2x, \; y = 3 - x, \; 0 \le x \le 3,$$

using integration. 5

(c) If $y = 1 + ln(x + \sqrt{x^2 + 1})$, prove that

$$(x^2 + 1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0.$$ 5

(d) Find the angle between the lines

$\vec{r_1} = 2\hat{i} + 3\hat{j} - 4\hat{k} + t(\hat{i} - 2\hat{j} + 2\hat{k})$ and

$\vec{r_2} = 3\hat{i} - 5\hat{k} + s(3\hat{i} - 2\hat{j} + 6\hat{k})$. 5

5. (a) If $A = \begin{bmatrix} -1 & 2 & 3 \\ 4 & 5 & 7 \\ 5 & 3 & 4 \end{bmatrix}$, show that A(adj A) = 0. *5*

(b) Use De-Moivre's theorem to find $(\sqrt{3} + i)^3$. *5*

(c) Show that $|\vec{a}|\vec{b} + |\vec{b}|\vec{a}$ is perpendicular to $|\vec{a}|\vec{b} - |\vec{b}|\vec{a}$, for any two non-zero vectors $\vec{a}$ and $\vec{b}$. *5*

(d) If $y = ln\left[e^x\left(\frac{x-2}{x+2}\right)^{3/4}\right]$, find $\frac{dy}{dx}$. *5*

No. of Printed Pages : 6 **BCS-012**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (REVISED)

Term-End Examination

December, 2022

BCS-012 : BASIC MATHEMATICS

Time : 3 Hours *Maximum Marks : 100*

Note : *Question number **1** is compulsory. Attempt any **three** questions from the remaining questions.*

1. (a) If $A = \begin{bmatrix} 3 & 4 & -5 \\ 1 & 1 & 0 \\ 1 & 1 & 5 \end{bmatrix}$, show that A is row equivalent to I_3. 5

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(b) Find the sum of an infinite G. P., whose first term is 28 and fourth term is $\frac{4}{49}$. 5

(c) Solve the inequality $\frac{5}{|x-3|} < 7$. 5

(d) Evaluate $\int \frac{x^2}{(x+2)^3} dx$. 5

(e) For any vectors $\vec{a}$ and $\vec{b}$, show that $\left|\vec{a} + \vec{b}\right| \le |\vec{a}| + |\vec{b}|$. 5

(f) Find the area bounded by the curves $y = x^2$ and $y^2 = x$. Also draw graph for the same. 5

(g) If z is a complex number such that $|z - 2i| = |z + 2i|$, show that Im $(z) = 0$. 5

(h) Find the quadratic equation whose roots are $(2 - \sqrt{3})$ and $(2 + \sqrt{3})$. 5

2. (a) Show that : 5

$$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (y - x)(z - x)(z - y)$$

(b) Find $(\sqrt{3} + i)^3$ by using De Moivre's theorem. 5

(c) If $y = ax + \frac{b}{x}$, show that : 5

$$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0$$

(d) Find the points of discontinuity of the following function : 5

$$f(x) = \begin{cases} x^2 \ , & \text{if } x > 0 \\ x + 3, & \text{if } x \leq 0 \end{cases}$$

3. (a) Solve the following system of linear equations using Cramer's rule : 5

$$x + y = 0$$

$$y + z = 1$$

$$z + x = 3$$

(b) If the first term of an A. P. is 22, the common difference is – 4, and the sum of n terms is 64, then find n. 5

(c) Find the length of the curve $y = 3 + \frac{x}{2}$ from (0, 3) to (2, 4). 5

(d) If $\vec{a}, \vec{b}, \vec{c}$ are coplanar vectors, then prove that $\vec{a} + \vec{b}, \vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are also coplanar vectors. 5

4. (a) A child is holding string a flying kite, which is at the height of 50 m, from the ground. The wind carries away the kite horizontally, from the child, at the rate of 6.5 m/s. Determine the rate at which the kite string must be let out when the string is 130 m. 5

(b) Using determinants, find the area of triangle whose vertices are (1, 2), (–2, 3) and (–3, –4). 5

(c) Using the principle of mathematical induction, prove that :

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

for every natural number n. 5

(d) Reduce the matrix $A = \begin{bmatrix} 5 & 3 & 8 \\ 0 & 1 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ to normal form and hence find its rank. 5

5. (a) Find the vector and Cartesian equations of the line passing through the points (–2, 0, 3) and (3, 5, –2). 5

(b) If $y = \ln\left[e^x \left(\frac{x-2}{x+2}\right)^{3/4}\right]$, find $\frac{dy}{dx}$. 5

(c) A person wishes to invest at most ` 12,000 in ' option A' and 'option B'. He must invest at least ` 2,000 in 'option A' and at least ` 14,000 in 'option B'. If 'option A' gives return of 8% and 'option B' gives return of 10%, determine how much investment should be done in respective options to maximize the returns. 10