No. of Printed Pages : **5**

BCS-012

BACHELOR IN COMPUTER APPLICATIONS

Term-End Examination

06260

December, 2011

BCS-012 : BASIC MATHEMATICS

Time : 3 hours *Maximum Marks : 100*

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

1. (a) Show that 5

$$\Delta = \begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = 4a^2b^2c^2$$

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

(c) Use the principle of Mathematical Induction to prove that $\rightarrow$ 5

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

(d) Find the Sum to n terms of the series 5

$5+55+555+------+n$ Terms

(e) Find the points of local maxima and local minima. If any of the function 5

$f(x)=x^3-6x^2+9x+1$

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

(g) Find the value of λ for which the vectors 5

$\vec{a}=\hat{i}-4\hat{j}+\hat{k}$

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

are coplaner.

(h) Find the equation of line passing through the point $(-1, 3, -2)$ and perpendicular to the two lines. 5

$$\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$$

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

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

$x+2y-z=-1$

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

$4x+9y+z=14$

(b) If $A = \begin{bmatrix} 3 & 2 \\ 4 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 4 & 5 \\ 2 & 5 \end{bmatrix}$ 5

Verify $(AB)^{-1} = B^{-1}A^{-1}$

(c) Reduce the Matrix 10

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

form and hence find its Rank.

3. (a) If Sum of three Numbers in G.P is 38 and their product is 1728. Find the Numbers. 5

(b) If 1, w, w^2 are Cube roots of unity then show that. 5

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

(c) If α, β are the roots of the equation $2x^2 - 3x + 1 = 0$, form an equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$. 5

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

4. (a) If $x = a\left(t - \frac{1}{t}\right)$ and $y = a\left(t + \frac{1}{t}\right)$. 5

Find $\frac{dy}{dx}$.

(b) Sand is being poured in to a conical pile at constant rate 50 cm^3/ minute. Frictional forces in sand are such that the height of cone is always one half of the radius of its base. How fast is the height of the pile. Increasing when the sand is 5cm deep ? 5

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

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

5. (a) Find a unit vector perpendicular to each of the vector $\left(\vec{a} + \vec{b}\right)$ and $\left(\vec{a} - \vec{b}\right)$ where $\vec{a} = \hat{i} + 2\hat{j} - 4\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ 5

(b) Find 'k' so that the lines are at Right Angle **5**

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

$$\frac{x-1}{3k} = \frac{y-5}{1} = \frac{z-6}{-5}$$

(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 for assembling. Type B require 8 minutes each for cutting and 8 minutes 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 for type B. How many gift packs of each type should the company manufacture in order to maximise the profit. **10**

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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

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

(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 $\rightarrow$ 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 $1, \omega, \omega^2$ 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 $\lim\limits_{x \to 3} \dfrac{x^3-27}{x^2-9}$ **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

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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.*

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 $(2, -3)$, $(\lambda, -1)$ 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. 5
$x + 2y - z = -1,\quad 3x + 8y + 2z = 28,$
$4x + 9y + z = 14.$

(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

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

(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 : $\lim\limits_{x\to 0}\dfrac{\sqrt{1+x}-1}{x}$ 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 : $\displaystyle\int\frac{dx}{1+\cos^2 x}$ 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 : $3x + 5y \leq 15$

$5x + 2y \leq 10$

$x, y \geq 0$

No. of Printed Pages : **4**

BCS-012

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 $x, y \geq 0$

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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.*

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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) 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 $\alpha^2 + \beta^2 = \dfrac{7}{9}$, 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 $f(x)=x^2 ln(\dfrac{1}{x})$, $x>0$ 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**

No. of Printed Pages : 4

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

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

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

(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 $\left(\sqrt{3}+i\right)^3$ in the form $a+bi$. **5**

(b) Find the sum to n terms of the series $0.7+0.77+0.777+\ldots\ldots\ldots+$ 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

BACHELOR OF COMPUTER APPLICATIONS (Revised)

07824

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.*

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.*

1. (a) Show that

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

$$2 + 2^2 + \ldots + 2^n = 2^{n+1} - 2. \ \forall\ n \in \mathbf{N}$$ 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 $\left(\sqrt{3} + i\right)^3$. *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

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

(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*

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BCS-012

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

08955

December, 2016

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.*

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1. (a) Evaluate the determinant

$$\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix},$$ where ω 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 $2 + 2^2 + \dots + 2^n = 2^{n+1} - 2$ 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

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

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 $1, \omega, \omega^2$ 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

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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.*

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

$0{\cdot}4 + 0{\cdot}44 + 0{\cdot}444 + \ldots$ 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

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

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 5

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

(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

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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

$3 + 33 + 333 + \dots$ 5

(d) If 1, ω, ω^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 $y = 1 + \ln\left(x + \sqrt{x^2 + 1}\right)$, prove that $(x^2 + 1)\dfrac{d^2y}{dx^2} + x\dfrac{dy}{dx} = 0$. 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 $1, \omega, \omega^2$ 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

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

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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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 $3^{2n} - 1 \; \forall n \in \mathbb{N}$. [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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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 : $\left|\dfrac{2x-3}{4}\right| \leq \dfrac{2}{3}$ [5]

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

(c) Evaluate $\int_{-1}^{2} \dfrac{x}{(x^2+1)^2}\, dx$ [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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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:

$$\underbrace{11 \cdots\cdots 1}_{91}$$

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:

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

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

10

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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 ω² 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

(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