Roll No. .....

Total No. of Questions : 9] [Total No. of Printed Pages : 7

(2021)

BCA (CBCS) RUSA Ist Semester Examination

4037

MATHEMATICS–I

BCA-0101

Time : 3 Hours] **[Maximum Marks : 70**

Note :– Attempt *five* questions in all, selecting *one* question each from Sections–A, B, C and D. Section E is compulsory and carries 30 marks. All other questions carry equal marks (10).

Section–A

1. (a) Find the solution of equation $\sqrt{x-3}+x=3$. $9\frac{1}{2}$

   (b) Which term of the sequence 90, 87, 83, ... is zero. 5x2=10

2. (a) If $A=\begin{bmatrix}2 & 1 & 3\\ 1 & 1 & 2\end{bmatrix}$, $B=\begin{bmatrix}1 & 3 & 4\\ 5 & 6 & 7\end{bmatrix}$, verify that :

$$(A + B)' = A' + B'.$$

(b) Using Binomial theorem, find the value of $(10.1)^5$ upto 3 decimal places. 5×2=10

Section–B

3. (a) Find the area of the triangle with vertices (1, 2), (−1 4) and (0, 8).

(b) Find the equation of line passing through point (3, 5) and is perpendicular to the line $x + 5y - 4 = 0$. 5×2=10

4. (a) Find the equation of circle whose centre lies on x-axis and passing through point (2, 3) with radius 5 units.

(b) For what value of k, the line passing through points $(k, 4)$, $(1, 2)$ is parallel to the line passing through points $(3, -1)$, $(2, -2)$? 5×2=10

Section–C

5. (a) Prove that :

$$(\sec\theta + \tan\theta)^2 = \frac{1+\sin\theta}{1-\sin\theta}$$

(b) Prove that :

$$\frac{\cos 25^\circ + \sin 25^\circ}{\cos 25^\circ - \sin 25^\circ} = \tan 70^\circ$$ 5×2=10

6. (a) If $A + B + C = \pi$, then prove that :

$$\tan A + \tan B + \tan C = \tan A \tan B \tan C$$

(b) From the cliff of a hill 1000 meter high, the angles of depression of two buildings on same side of hill are at level 30° and 60°. Find the distance of each building from the foot of hill. 5×2=10

Section–D

7. (a) For what value of k, the function :

$$f(x) = \begin{cases} kx + 5, & x \le 2 \\ x - 1, & x > 2 \end{cases}$$

is continuous at $x = 2$.

(b) If $e^x + e^y = e^{x+y}$, prove that :

$$\frac{dy}{dx} = \frac{e^x(e^y - 1)}{e^y(e^x - 1)}$$

5×2=10

8. (a) Find the area under the curve $y = x^2 + 1$, bounded by x-axis and ordinates $x = 2$ and $x = 3$.

(b) Evaluate :

$$\int x \log x \, dx$$

5×2=10

Section–E

(Compulsory Question)

9. (A) (i) Find the coefficient of x^5 in the expansion of e^{2x}.

(ii) Write the value of the expression :

$$\cos(A - B) - \cos(A + B)$$

(iii) Write the centroid of triangle ΔABC, with vertices A(1, 4), B(3, 2) and C(2, 3).

(iv) Construct matrix of order 2 × 3, s.t. $A = [a_{ij}]$, when $a_{ij} = \frac{i}{j}$.

(v) Find the domain and range of the function :

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

(vi) Find the derivative :

$$\frac{dy}{dx}$$

when $y = 10^x + x^{10}$.

(vii) What is a singular matrix ?

(viii) Evaluate :

$$\frac{6!}{3!}$$

Is it equal to 2! ?

(ix) Let ABC be a triangle with sides a, b and c. Write down the law of sines.

(x) Evaluate :

$$\int \frac{(\log x)^3}{x} dx$$

1×10=10

(B) (i) Evaluate the determinant $\begin{vmatrix} 15 & 5 & 20 \\ 1 & 0 & 2 \\ 3 & 1 & 4 \end{vmatrix}$, without expanding it.

(ii) Find a point on y-axis, which is equidistant from the points $(7, -6)$ and $(-3, -4)$.

(iii) Find the values of p and q in equation $x^2 + px + q = 0$, when p and q are its roots.

(iv) If $x = 5t$ and $y = \frac{3}{t}$, find $\frac{dy}{dx}$ = ?

(v) Find the maximum and minimum value of function $y = \sin x$, $x \in [0, 2\pi]$. 4×5=20

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(1109)

BCA UG (CBCS) RUSA Ist Semester

Examination

3595

MATHEMATICS-I

BCA-0101

Time: 3 Hours] **[Maximum Mark : 70**

Note :- Attempt five questions in all, selecting one question from each Section A, B, C and D. Section E is compulsory and carries 30 marks. All other questions carry equal marks (10).

Section-A

1. (a) If the roots of the quadratic equation $2x^2 - 3x + k = 0$ are equal, then find the value of k.

(b) The third term of an A.P. is 5 and seventh term is 9. Find its 17^{th} term. 5,5

2. (a) If $A=\begin{bmatrix}2 & 1\\ 1 & 0\end{bmatrix}$, $B=\begin{bmatrix}2 & 3\\ 1 & -1\end{bmatrix}$, verify that:
$(A+B)^2 \neq A^2 + 2AB + B^2$.

(b) Using Binomial expansion, expand $(1 + x + x^2)^3$.
5, 5

Section-B

3 .(a) Using section formula show that the points (1, 2),(3, 3), (4, 2) are not collinear.

(b) Find the perpendicular distance from the point (-1, 2) from the line $x + 3y - 4 = 0$. 5, 5

4.(a) If the area of the triangle with vertices (x, 0), (1, 1) and (0, 2) is 4 units. Then find the value of x.

(b) Find the equation of the circle passing through origin and makes intercept 3 and 2 on x-axis and y-axis, respectively. 5, 5

Section-C

5.(a) Prove that :

$$\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta} = 2\,\text{cosec}\,\theta$$

(b) Find the value of tan 105°. 5, 5

6.(a) Prove that :

$$(\cos 4x + \cos 2x)^2 + (\sin 4x - \sin 2x)^2 = 4\cos^2 3x$$

(b) Solve the equation : $2\sin^2\theta - 3\sin\theta + 1 = 0$ 5, 5

Section-D

7. (a) Find the derivative of e^{2x} by first principle.

   (b) Find two positive numbers whose sum is 30 and the product is maximum. 5, 5

8. (a) Evaluate the integral :

$$\int \frac{logx}{x}\, dx \ (x>0)$$

   (b) Find the area enclosed by the curve $f(x)= e^x$ on the x-axis and ordinates x = 0 and x = 2. 5, 5

Section-E

Compulsory Question

9. (a) (i) If n(A) = 36, n(B) = 44 and n(A ∪ B)=70. Find n(A ∩ B) ?

   (ii) Are x = ± 2 the solution of equations $3^{2+x} + 3^{2-x} = 82$?

   (iii) Write the sum of 1st 100 numbers.

   (iv) $\lfloor 5 + \lfloor 3 = \lfloor 8$? (Yes/No)

   (v) Is matrix $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ is non-symmetric. (Yes/ No)

   (vi) Write the relation between the slopes of two lines, when they are perpendicular to each other.

(vii) Write the equation of circle, whose diameter's end points are (a, 0) and (0, b).

(viii) If $\tan x = \frac{4}{x}$, $x \in$ IIIrd Quadrant. Find the value of $\cos x = ?$

(ix) Evaluate the integral $\int cotx\ dx = ?$

(x) If $f(x) = 3x + 5$. Find $f^{-1}(x) = ?$ $10 \times 1 = 10$

(b) (i) With the help of an example, show that $A - B = A \cap B^C$, where A and B are non-empty sets.

(ii) Obtain the equation of straight line which intersect x-axis at a distance 3 units to the right of the origin at point (3, 0) and having slope equal to 2.

(iii) Find the middle term in the expansion of $(x + 8y)^{10}$?

(iv) Find the maximum and minimum value of $f(x) = x^2 - 4x + 3\ \forall\ x \in [0, 4]$.

(v) Evaluate the integral

$$\int \frac{1}{9-x^2}\, dx \qquad 4 \times 5 = 20$$

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BCA (CBCS) RUSA Ist Semester Examination

4508

MATHEMATICS–I

BCA-0101

Time : 3 Hours] **[Maximum Marks : 70**

Note :– Attempt *five* questions in all, selecting *one* question each from Sections–A, B, C and D. Section E is compulsory and carries 30 marks. All other questions carry equal marks (10).

Section–A

1. (a) Solve the equation $4^{1+x} + 4^{1-x} = 10$.

   (b) The sum of three numbers in A.P. is 24 and the product is 440. Find the numbers. 5×2=10

2. (a) Find the coefficient of x^5 in the expansion of $(x + 3)^8$.

(b) If $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, $f(x) = x^2 - 2x - 3$, show that $f(A) = 0$. 5×2=10

Section–B

3. (a) Find the centroid of the triangle whose vertices are (1, –1), (4, 3), (1, 1).

(b) The perpendicular from the origin to the line $y = mx + c$ meets it at the point (–1, 2). Find the values of m and c. 5×2=10

4. (a) Find the distance between the parallel lines $3x - 4y + 7 = 0$ and $3x - 4y + 5 = 0$.

(b) Show that the line $x + y = 5$ touches the circle $x^2 + y^2 - 2x - 4y + 3 = 0$. Find the point of contact. 5×2=10

Section–C

5. (a) Prove that :

$$\frac{\tan\theta - \cot\theta}{\sin\theta\cos\theta} = \sec^2\theta - \operatorname{cosec}^2\theta$$

(b) Find the value of :

$$\frac{\tan 69° + \tan 66°}{1 - \tan 69° \tan 66°}$$ 5×2=10

6. (a) Solve $\sin x + \sin 3x + \sin 5x = 0$.

(b) Two trees A and B are on the same side of a river. From a point C in the river the distance of the trees A and B is 2.50 m and 300 m respectively. If the angle C is 45°, find the distance between the trees. $(\sqrt{2} = 1.414)$ 5×2=10

Section–D

7. (a) Evaluate the limit :

$$\lim_{n\to\infty} \frac{6x^2+2x+1}{6x^2-3x+1}$$

(b) Differentiate :

$$\frac{3x}{7x^2+8} \text{ w.r.t. } x.$$

5×2=10

8. (a) Integrate :

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

(b) Evaluate :

$$\int_1^2 \frac{x^2}{dx-1}\,dx$$

5×2=10

Section–E

(Compulsory Question)

9. (A) (i) Write the solution set of $x^2 + x + 2 = 0$ in roaster form.

(ii) Without solving the equation $3x^2 - 7x + 2 = 0$, find the sum and the product of its roots.

(iii) Find the 17^{th} and 20^{th} terms in the sequence whose n^{th} term is $a_n = 4n - 3$.

(iv) Insert 3 geometric means between 2 and 32.

(v) If a matrix has 8 elements, what are the possible orders it can have ?

(vi) Without expanding show that :

$$\begin{vmatrix} 5 & 15 & 3 \\ 7 & 21 & 5 \\ 8 & 24 & -7 \end{vmatrix} = 0.$$

(vii) Find the complement of the angle $67°30'$.

(viii) Show that the triangle whose vertices are (8, 2), (5, –3) and (0, 0) is an isosceles triangle.

(ix) Write the equation of the line with slope 3 and y intercept –5.

(x) Evaluate :

$$\int \sec x(\sec x + \tan x)\, dx \qquad 1\times10=10$$

(B) (i) If α, β are roots of $x^2 - 2x + 3 = 0$, form an equation whose roots are $\alpha + 2$, $\beta + 2$.

(ii) Find the term independent of x in the expansion of $\left(2x - \frac{1}{x}\right)^{10}$. Also find its value.

(iii) Without expanding show that :

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

(iv) Show that the lines : $5x - 3y - 1 = 0$, $2x + 3y - 23 = 0$, $42x + 21y - 257 = 0$ are concurrent. Also find the point of concurrence.

(v) Prove that :

$$\lim_{h\to0} \frac{(x+h)^m - x^m}{h} = mx^{m-1} \qquad 4\times5=20$$