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II Semester B.C.A. Degree Examination, April/May 2015  
(Y2K8 Scheme)

**COMPUTER SCIENCE**  
**BCA – 203 : Mathematics**  
(R 100- 2011-12 and Onwards, R – 90-Prior to 2011-12)

Time : 3 Hours

Max. Marks : 100/90

- Instructions :** 1) Section **A, B, C, D** and **E** is common to **all** students.  
2) Section **F** is applicable to the student **2011-12** onwards.

## SECTION – A

I. Answer **any ten** of the following :

(10×2=20)

1) Define eigen values and eigen vectors.

2) Find x, if 
$$\begin{vmatrix} x & 3 & -2 \\ 3 & -2 & 5 \\ 0 & 1 & 2 \end{vmatrix} = 0.$$

3) Define a semi group with example.

4) In a group of rational numbers \* is defined by  $a * b = a + b - ab$ . Find the identity and inverse.5) If  $\vec{a} = i - 2j + 3k$  and  $\vec{b} = 2i - j - 3k$ , Find the projection of  $\vec{a}$  on  $\vec{b}$ .6) If  $\vec{a} = 3i - j + 3k$  and  $\vec{b} = 3i + 2j - k$  Find  $|\vec{a} + 3\vec{b}|$ .7) Find the  $n^{\text{th}}$  derivative of  $e^{3x} \cdot \sin 2x$ .8) Find the  $n^{\text{th}}$  derivative of  $\sin 3x \cos x$ .9) Evaluate  $\int \log x \cdot dx$ .10) Evaluate  $\int \frac{dx}{(x+1)(x+3)}$ .



11) Write the order and degree of the differential equation

$$\left(\frac{d^3y}{dx^3}\right)^3 + \left(\frac{d^2y}{dx^2}\right)^5 + \frac{dy}{dx} + y = e^x.$$

12) Solve  $\frac{dy}{dx} + \frac{4y+3}{2x+1} = 0$ .

13) Find the distance between the points  $(3, 4, -2)$  and  $(-4, 2, 5)$ .

14) Find the direction cosine of the vector  $3i + 4j + k$ .

15) Find the centroid of a triangle with vertices  $(3, -2, 4)$ ,  $(5, -4, 5)$  and  $(1, 4, 2)$ .

### SECTION - B

II. Answer **any four** of the following :

(4×5=20)

16) Find the angle between diagonals of a cube.

17) Solve  $x + y - 2z = 0$ ,  $2x - y + z = 2$ ,  $x + 2y - z = 2$  by matrix method.

18) Using the Cayley-Hamilton theorem find the inverse of the matrix

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

19) Find the  $n^{\text{th}}$  derivative of  $e^{ax}\sin(bx + c)$ .

20) Find the  $n^{\text{th}}$  derivative of  $\frac{x+3}{(x+1)(2x+3)}$ .

21) If  $y = \sin(m\sin^{-1}x)$ , then prove that  $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2-m^2)y_n = 0$

### SECTION - C

III. Answer **any four** of the following :

(4×5=20)

22) Prove that  $G = \{2, 4, 6, 8\}$  is a group under multiplication modulo 10.

23) Prove that  $G = \{1, W, W^2\}$  forms an Abelian group under multiplication.

24) Prove that  $H = \{1, -1\}$  is a sub group of  $G = \{1, -1, i, -i\}$  under multiplication.

25) Find the area of the parallelogram whose diagonals are  $4i + 2j - k$  and  $3i + j + 4k$ .



26) Prove that points A(2, 3, -1) B(1, -2, 3) C(3, 4, -2) and D(1, -6, 6) are coplanar.

27) If  $\vec{a} = 3i + 2j - 3k$ ,  $\vec{b} = i + 2j - k$  and  $\vec{c} = i - 2j + 4k$ . Find  $\vec{a} \times (\vec{b} \times \vec{c})$ .

SECTION - D

IV. Answer **any four** of the following :

(4x5=20)

28) Evaluate  $\int \frac{dx}{2x^2 + 4x + 9}$ .

29) Evaluate  $\int x \cos 2x \, dx$ .

30) Evaluate  $\int_0^{\pi/2} \frac{\cos^6 x}{\cos^6 x + \sin^6 x} \, dx$ .

31) Solve  $\frac{dy}{dx} = \cos(x + y)$ .

32) Solve  $(x^2 + 2y^2) \, dx - xy \, dy = 0$ .

33) Verify the equation  $(4x + 3y + 1) \, dx + (3x + 2y + 1) \, dy = 0$  for exactness and hence solve.

SECTION - E

V. Answer **any two** of the following :

(2x5=10)

34) Find the angle between the lines whose direction ratios are 1, -1, 2 and 1, 0, -3.

35) Find the equation of the plane passing through (1, 1, 1) (1, -1, 1) and (-7, -3, -5).

36) Show that the points (1, 2, 3) and (-3, -1, -1) (5, 5, 7) are collinear. Also find the equation of the line through these points.

37) Find the length and equation of the shortest distance between the z-axis and

the line  $\frac{x+1}{3} = \frac{y-2}{4} = \frac{z}{5}$ .