MS – 768

II Semester B.C.A. Examination, June 2009
(Y2K8 Scheme) (2008-09 & Onwards)
COMPUTER SCIENCE
BCA 203 : Mathematics

Time : 3 Hours

Max. Marks : 90

***Instruction** : Answer **all** Sections.*

SECTION – A

I. Answer **any ten** of the following : **(10×2=20)**

a) Define symmetric matrix with an example.

b) If $A=\begin{bmatrix}2 & -1\\ 4 & 2\end{bmatrix}, B=\begin{bmatrix}4 & 3\\ -2 & 1\end{bmatrix}$. Find AB.

c) Define order of a Group.

d) Construct the composition table of multiplication mod 10 for the set {1, 3, 7, 9}.

e) Find the projection of $\vec{a}=2\hat{i}+3\hat{j}+2\hat{k}$ on $\vec{b}=\hat{i}+2\hat{j}+\hat{k}$.

f) Find $\vec{a}.(\vec{b}\times\vec{c})$ where, $\vec{a}=2\hat{i}+\hat{j}+3\hat{k}, \vec{b}=-\hat{i}+2\hat{j}+\hat{k}, \vec{c}=3\hat{i}+\hat{j}+2\hat{k}$.

g) Find $\frac{d^n}{dx^n}[\sin 3x \sin 2x]$.

h) If $y=(\sin^{-1}x)^2$ show that $(1-x^2)y_2-xy_1-2=0$.

i) Evaluate : $\int \tan^{-1}x\,dx$.

j) Evaluate : $\int_0^1 3x^2+2x+1\,dx$.

k) Find the integrating factor of the equation $(1+x^2)\frac{dy}{dx}+y=\tan^{-1}x$.

l) Test the equation for exactness : $(2xy+3y)dx+(x^2+3x)dy=0$.

m) Find the direction cosines of a line which makes angles 90°, 60° and 30° with the co-ordinate axis.

n) Find the centroid of the triangle with the vertices (4, 7, –6), (0, –5, 7) and (7, –8, 9).

o) Find a vector normal to the plane $x+2y+3z-6=0$.

P.T.O.

SECTION – B

II. Answer **any four** of the following : (4×5=2

1) Solve using Cramer's rule :

$$2x + 5y + z = -1, \quad x + 7y - 6z = -18, 3y + 6z = 9.$$

2) Solve using matrix method :

$$2x - 3y = 1, 3x - y = 3.$$

3) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

4) Find n^{th} derivative of $\sin(ax + b)$.

5) Find $\frac{d^n}{dx^n}\left[\frac{1}{(x+2)(x-1)}\right]$.

6) If $y = e^{m\sin^{-1}x}$, 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=2

7) Show that the cube roots of unity form an abelian group with respect to multiplication.

8) Show that set of square roots of unity is a subgroup of the group of fourth roots of unity under multiplication.

9) Show that G = {1, 2, 3, 4} is an abelian group under multiplication modulo 5.

10) Find the sine of the angle between the vectors $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}, \vec{b} = -2\hat{i} + 2\hat{j} + 2\hat{k}$.

11) Show that the points A(2, 3, –1), B(1, –2, 3), C(3, 4, –2) and D(1, –6, 6) are coplanar.

12) Find the unit vector coplanar with $\vec{b}$ and $\vec{c}$ but perpendicular to $\vec{a}$, where $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j} + \hat{k}, \vec{c} = \hat{i} + 2\hat{j} - \hat{k}$.

SECTION – D

IV. Answer **any four** of the following : **(4×5=20)**

13) Evaluate : $\int \frac{dx}{2x^2 + x - 1}$.

14) Evaluate : $\int x \cos^2 x dx$.

15) Prove that $\int_0^{\frac{\pi}{2}} \frac{\sin^3 x}{\sin^3 x + \cos^3 x} dx = \frac{\pi}{4}$.

16) Solve : $y(1 + \log x)dx - x\log x dy = 0$.

17) Solve : $\frac{dy}{dx} - xy = x^3y^2$.

18) Verify the equation $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$, for exactness and hence solve.

SECTION – E

V. Answer **any two** of the following : **(2×5=10)**

19) Find the angle between the diagonals of a cube.

20) Find the image of the point (1, 2, 3) in the plane $x + y + z = 9$.

21) Find $\vec{a} \times (\vec{b} \times \vec{c})$ and $(\vec{a} \times \vec{b}) \times \vec{c}$, if $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{c} = 2\hat{i} + \hat{j} + 4\hat{k}$.

22) Find the point of intersection of the lines $\frac{x-1}{-3} = \frac{y-2}{2} = \frac{z-3}{2}$ and $\frac{x-1}{3} = \frac{y-5}{1} = \frac{z}{-5}$.