Roll No. **Total No. of Pages : 2**

Total No. of Questions : 09

B.Tech Only for CHS (2018 Batch) (Sem.–1)

MATHEMATICS-I

Subject Code : BTAM-106-18

Paper ID : [75368]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. Answer briefly :

a) If $A=\begin{bmatrix} 9 & 6 & 4 \\ 5 & 6 & 0 \\ 8 & 5 & 10 \end{bmatrix}$ and $B=\begin{bmatrix} 14 & 13 & -12 \\ -1 & -9 & 10 \\ 18 & 11 & 9 \end{bmatrix}$ then find A+B.

b) Find the determinants of the matrix $A=\begin{bmatrix} 1 & 6 & 5 \\ 7 & 0 & 6 \\ 2 & 7 & 3 \end{bmatrix}$.

c) Define rank of matrix.

d) Give an example of 3×3 symmetric matrix.

e) Find $\vec{v}+\vec{u}$ where $\vec{v}$ = (1,3,4) and $\vec{u}$ = (3,8,9).

f) Find eigen values of $A=\begin{bmatrix} 1 & 0 \\ 5 & 7 \end{bmatrix}$

g) What are orthogonal matrices? Give an example.

h) Find div $\vec{f}$, where $\vec{f}=3x^2y\hat{i}+z\hat{j}+x^2\hat{k}$.

i) Find curl $\vec{v}$ where $\vec{f}=6x^2y\hat{i}+2yz\hat{j}+7x^2\hat{k}$.

j) State Green's Theorem.

SECTION-B

2. a) Given that $A=\begin{bmatrix}2&6&7\\0&6&5\\8&8&9\end{bmatrix}$ and $B=\begin{bmatrix}0&4&1\\0&7&1\\9&3&2\end{bmatrix}$, is $AB=BA$?

   b) Find the rank of the matrix $A=\begin{bmatrix}1&3&4&2\\2&4&6&2\\-1&5&4&6\end{bmatrix}$.

3. a) Using elementary transformations, find the inverse of the matrix $A=\begin{bmatrix}2&1&-1\\0&3&-2\\2&4&-3\end{bmatrix}$

   b) By Cramer's rule, solve the system 3x+y+2z = 3, 2x–3y–z = –3, x+2y+z = 4.

4. Find the eigen values and corresponding eigen vectors of the matrix $A=\begin{bmatrix}6&-2&2\\-2&3&-1\\2&-1&3\end{bmatrix}$.

5. State Cayley-Hamilton theorem and verify for the matrix $A=\begin{bmatrix}1&1&3\\1&3&-3\\-2&-4&-4\end{bmatrix}$.

SECTION - C

6. a) Find the directional derivatives of $f(x,y,z)=xy^2+yz^3$ at (2,–1,1) in the direction of vector $\hat{i}+2\hat{j}+2\hat{k}$.

   b) Show that grad $(f+g)$ = grad (f) + grad (g) where f and g are two scalar point function.

7. a) Find the total work done in moving a particle in a force field given by $\vec{f}=3xy\hat{i}-5z\hat{j}+10x\hat{k}$, along the curve $x=t^2+1$, $y=2t^2$ and $z=t^3$ from $t=1$ to $t=2$.

   b) If $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$, show that curl $\vec{r}=\vec{0}$.

8. If $\vec{F}=2x^2y\hat{i}-y^2\hat{j}+4xz^2\hat{k}$ and S is the closed surface of the region in the first octant bounded by the cylinder $y^2+z^2=9$ and the planes $x=0$, $x=2$, $y=0$ and $z=0$, show that $\int_s \vec{F}\cdot\vec{N}ds=180$

9. Verify Green's theorem in the plane for If $\oint_c \left[\left(3x^2-8y^2\right)dx+\left(4y-6xy\right)dy\right]$, where C is the boundary bounded by $x=0$, $y=0$ and $x+y=1$.