Printed pages: 02 **Sub Code: EAS 103**

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B.TECH
(SEM - I) THEORY EXAMINATION 2018-19
ENGINEERING MATHEMATICS - I

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x10 = 20**

a. If $u(x,y)=(\sqrt{x}+\sqrt{y})^5$, find value of $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$.

b. Find all symmetry of the curve $y^2(2a-x)=x^3$.

c. If $x=r\cos\theta, y=r\sin\theta$ find value of $\frac{\partial(x,y)}{\partial(r,\theta)}$.

d. Find the percentage error in the area of an ellipse when an error of +1% is made in measuring the major and minor axes.

e. Find rank of the matrix $\begin{bmatrix}1&2&3\\2&4&7\\3&6&10\end{bmatrix}$.

f. Show that the matrix $\begin{bmatrix}2&3-4i\\3+4i&5\end{bmatrix}$ is Hermitian.

g. Change the order of integration in $\int_0^\infty\int_x^\infty f(x,y)dydx$.

h. Use triple integral to find volume of a sphere of unit radius.

i. Find $grad\phi$ when ϕ is given by $\phi=3x^2y-y^3z^2$ at the point $(1,-2,-1)$.

j. If $\vec{r}=x\hat{i}+x\hat{j}+x\hat{k}$ find $div\vec{r}$ and $curl\vec{r}$.

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. If $y=e^{a\sin^{-1}x}$, find $(y_n)_0$.

b. If $u^3+v^3+w^3=x+y+z, u^2+v^2+w^2=x^3+y^3+z^3$ and $u+v+w=x^2+y^2+z^2$, then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.

c. Diagonalise the matrix A= $\begin{bmatrix}1&-1&2\\0&2&-1\\0&0&3\end{bmatrix}$.

d. Evaluate $\iint_R(x^2+y^2)dxdy$ where R is the region in the first quadrant bounded by $x^2-y^2=a, x^2-y^2=b, 2xy=c, 2xy=d, 0<a<b, 0<c<d$.

e. Verify Green's theorem for $\int_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy]$ where C is the boundary of the region bounded by the lines $x = 0, y = 0, x + y = 1$.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Expand $\tan^{-1}\frac{y}{x}$ in the neighbourhood of $(1,1)$ upto and inclusive of second degree terms. Hence compute $f(1.1, 0.9)$ approximately.

(b) Trace the curve $r = a(1 + \cos\theta)$.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) In estimating the number of bricks in a pile which is measured to be $(5m \times 10m \times 5m)$, the count of bricks is taken as 100 bricks per m^3. Find the error in the cost when the tape is stretched 2% beyond its standard length. The cost of the bricks is Rs. 2000 per thousand bricks.

(b) Find the volume of largest rectangular parallelopiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Determine the values of λ and μ such that the system $2x - 5y + 2z = 8$, $2x + 4y + 6z = 5,$, $x + 2y + \lambda z = \mu$.

(b) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$, Hence compute A^{-1}.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Determine the area of region bounded by the curves $xy = 2, 4y = x^2, y = 4$.

(b) Find the volume of the solid surmounted by the surface $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} + \left(\frac{z}{c}\right)^{2/3} = 1$.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Show that the vector field $\vec{F} = \frac{\vec{r}}{r^3}$ is irrotational as well as solenoidal.

(b) Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\,\hat{j}$ taken round the rectangle bounded by the lines $x = \pm a, y = 0, y = b$.