Printed Pages: 02 **Sub Code:RAS103**

Paper Id: 199106 **Roll No.**

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

Time: 3 Hours ***Total Marks: 70***

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

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. For a given matrix A of order 3, $|A| = 32$ and two of its Eigen values are 8 and 2 find the sum of the Eigen Values.

b. Find the curl of $\bar{A} = e^{xyz}\ (\hat{\imath} + \hat{k} + \hat{k}\ )$ at the point (1, 2, 3)

c. If y = $\frac{x}{(x+1)^4}$, find y_n

d. If u(x, y) = Sin$^{-1}\left(\frac{x}{y}\right)$ + tan$^{-1}\left(\frac{x}{y}\right)$ find the value$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$.

e. Evaluate $\int_2^a \int_z^b \frac{dxdy}{xy}$

f. If u = $\frac{y-x}{1+xy}$ and v = $tan^{-1}\ y = tan^{-1}x$, find $\frac{\partial(u,v)}{\partial(x,y)}$

g. Find the divergence of the vector $\vec{R}$ =$(x^2 + yz)\hat{\imath} + (y^2 + zx)\hat{\jmath} + (z^2 + xy)\hat{k}$.

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. (I) If y = $\sqrt{\frac{1+x}{1-x}}$, prove that (1-x^2) $y_n - [2(x-1)x+1]\ y_{n-1} - (x-1)(x-2)y$

(II) Show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial x} = 2u\log u, where\ logu = \frac{x^3+y^3}{3x+4y}$.

b. Find the rank of the following matrix

(I) By reducing it to normal form A = $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$

(II) Show that the vectors $x_1 = (1,2,4)\ x_2 = (2,-1,3), x_3 = (0,1,2)$ and $x_4 = (-3,7,2)$ are linearly dependent.

c. (I) If u = $xyz, v = x^2 + y^2 + z^2, w = x + y + z,$ find the Jacobean $\frac{\partial(x,y,z)}{\partial(u,v.w)}$

(II) In estimating the cost of a pile of bricks measurement as 6mx50mx4m, of the tape is stretched 1 % beyond the standard length. If the count is 12 bricks in $1m^3$ and bricks cost Rs. 100 per 1000, find the approximate error in the cost.

d. (I) Evaluate $\int_0^{2a} \int_{\frac{x^2}{4a}}^{3a-x} (x^2 + y^2) dy\, dx$

(II) Show that $\int_0^1 x^3(1-x)^{10}\, dn = \frac{1}{396}$

e. (I) If $\vec{f} = x^2\hat{\imath} + xy\hat{\jmath}$ evaluate $\int_c \vec{f}.d\vec{c}$ along the straight line $y = x$ $from$ A (0, 0) to B (1, 1)

(II) Find the directional derivative of $f(x, y, z) = xy^2 + yz^3$ at (2,-1, 1) in the direction of $\hat{\imath} + 2\hat{\jmath} + 2\hat{x}$.

SECTION C

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

(a) If y = $e^{msin^{-1}x}$ calculate $y_{n(0)}$

(b) Trace the curve r = a (1−Cos θ)

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

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

(b) If u = $x + 2y + z, v = x - 2y + 3z$ and $w = 2xy - xz + 4yz - 2z\ ^2,$ show that they are not independent find the relation between u, v and w.

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

(a) Solve the system of equations using matrix method:

$2x_1 + x_2 + 3x_3 + x_4 = 6, 6x_1 + 6x_3 + 12x_4 = 36$

$4xy + 3x_2 + 3x_3 - 3x_4 = -1, 2x_1 + 2x_2 - x_3 + x_4 = 10$

(b) Verify cayley – Hamilton theorem for the matrix A= $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$

Hence find A^{-1}

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

(a) Evaluate by changing the order of integration $\int_0^1 \int_{2y}^2 e^{x^2}\ dx\, dy$.

(b) Evaluate the integral $\iiint x^2yz\ dx\, dy\, dz$ over the volume enclosed by the region $x \geq 0$, $y \geq 0$, $z \geq 0$, and $x + y + z\ \leq$

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

(a) Evaluate $\iint\ (y^2z^2\hat{\imath} + z^2x^2\hat{\jmath} + z^2y^2x^2)\ \hat{n}\ dx$ where s is the part of the sphere $x^2 + y^2 + z^2 =$ Above the $xy -$ plane and bounded by this plane

(b) A flied motion is given by $\vec{V} = (y + z)\hat{\imath} + (2 + x)\hat{\jmath} + (x + y)\hat{k}$ is this motion Irrigational? If so, find

(I) the velocity potential

(II) Is this motion possible for an incompressible flied.

CORRECTION IN RAS 103: ENGINEERING MATHEMATICS I

MORNING SHIFT: Jan 05, 2019

Section A

Q1 b Find the curl of $\vec{A}$ = e^{xyz} ˆ+ˆ+ˆ at the point (1, 2, 3)

Q1 e. Evaluate $\int_0^a \int_0^b \frac{dxdy}{xy}$

Q1 f. If u = $\frac{y-x}{1+xy}$ and v = $tan^{-1}\left(\frac{x}{y}\right)$, find $\frac{\partial(u,v)}{\partial(x,y)}$

Section B

Q2 a. (I) If y = $\sqrt{\frac{1+x}{1-x}}$, prove that (1-x^2) $y_n - [2(x-1)x+1]\, y_{n-1} - (x-1)(x-2)y_{n-2} = 0$

Q2 d. (II) Show that $\int_0^1 x^3(1-x)^{10}\, dx = \frac{1}{396}$

Q2 e. (I) If $\vec{f} = x^2\hat{\imath} + xy\hat{\jmath}$ evaluate $\int_c \vec{f}.d\vec{}$ along the straight line $y = x$ *from* A (0, 0) to B (1, 1)

Section C

3 (a) If y = $e^{msin^{-1}x}$ calculate $y_{n(0)}$

6 (b) Evaluate the integral $\iiint x^2yz\ dx\ dy\ dz$ over the volume enclosed by the region $x \geq 0$, $y \geq 0$, $z \geq 0$, and $x + y + z \leq 1$.

7(a) Evaluate $\iint (y^2z^2\hat{\imath} + z^2x^2\hat{\jmath} + x^2y^2\hat{k})\ \hat{n}\ ds$ where s is the part of the sphere $x^2 + y^2 + z^2 = 1,$ above the $xy-$ plane and bounded by this plane *x>0, y>0*.

A (b) A fluid motion is given by $\vec{V}$ = $(y+z)\hat{\imath}$ + $(z+x)\hat{\jmath}$ +$(x+y)\hat{k}$ is this motion Irrigational? If so, find

(I) the velocity potential

(II) Is this motion possible for an incompressible flied.