



Roll No:

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B. TECH
(SEM I) THEORY EXAMINATION 2020-21
MATHEMATICS-I

Time: 3 Hours

Total Marks: 100

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

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

Q no.	Question	Marks	CO
a.	Find the value of b for which the rank of the matrix $A = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ b & 13 & 10 \end{bmatrix}$ is 2	2	1
b.	Find the eigen values of the matrix $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$	2	1
c.	Find the envelope of the straight lines $ty - x = at$ where t is the parameter.	2	2
d.	What is the asymptote of the curve $y^2(2a - x) = x^3$	2	2
e.	If $x = u(1 + v), y = v(1 + u)$, then find the value of $\frac{\partial(u,v)}{\partial(x,y)}$	2	3
f.	If $V(x, y, z) = \cos 3x \cos 4y \sin 5z$ then find $V_{xx} + V_{yy} + V_{zz}$	2	3
g.	Evaluate $\int_0^2 \int_1^3 \int_1^2 xy^2 z dz dy dx$	2	4
h.	If $z = u^2 + v^2$ and $u = at, v = 2at$, then find $\frac{dz}{dt}$	2	3
i.	State Green's theorem for a plane region.	2	5
j.	Find curl $(yz\hat{i} + 3zx\hat{j} + z\hat{k})$ at $(2,3,4)$.	2	5

SECTION B

2. Attempt any three of the following:

10x3=30

Q no.	Question	Marks	CO
a.	Test for consistency of the following system of linear equation and hence find the solution if exists $4x - y = 12, -x + 5y - 2z = 0, -y + 4z = 10$	10	1
b.	If $y = \tan^{-1} \left(\frac{a+x}{a-x} \right)$ prove that $(a^2 + x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$	10	2
c.	The temperature T at any point (x, y, z) in space is $T = 400xy^2z$ Find the highest temperature at the surface of a unit sphere $x^2 + y^2 + z^2 = 1$.	10	3
d.	Change the order of integration $\int_0^1 \int_{x^2}^{2-x} f(x, y) dy dx$.	10	4
e.	Evaluate $\oint_C \vec{F} \cdot d\vec{r}$ by Stoke's theorem where $\vec{F} = y^2\hat{i} + x^2\hat{j} - (x+z)\hat{k}$ and C is the boundary of the triangle with vertices at $(0,0,0), (1,0,0)$ and $(1,1,0)$.	10	5



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SECTION C

3. Attempt any *one* part of the following:

10x1=10

Q no.	Question	Marks	CO
a.	Find the inverse of the matrix by elementary transformation $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$.	10	1
b.	Verify Cayley Hamilton Theorem for $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$.	10	1

4. Attempt any *one* part of the following:

10x1=10

Q no.	Question	Marks	CO
a.	Trace the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.	10	2
b.	Test the continuity of a function at $x=0$ which is defined as $f(x) = \begin{cases} \sin \frac{1}{x}, & x \neq 0 \\ 0, & x=0 \end{cases}$	10	2

5. Attempt any *one* part of the following:

10x1=10

Q no.	Question	Marks	CO
a.	Examine for extreme values of $u = x^3 + y^3 - 3xy$.	10	3
b.	Expand $f(x, y) = x^2y + 3y - 2$ in powers of $(x - 1)$ and $(y + 2)$ using Taylor's Theorem.	10	3

6. Attempt any *one* part of the following:

10x1=10

Q no.	Question	Marks	CO
a.	Find the mass of a plate in the shape of the curve $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$, the density being given by $\rho = \mu xy$.	10	4
b.	Find the volume of the cylindrical column standing on the area common to the parabolas $x = y^2, y = x^2$ as base and cut-off by the surface $z = 12 + y - x^2$.	10	4

7. Attempt any *one* part of the following:

10x1=10

Q no.	Question	Marks	CO
a.	Prove that $(y^2 - z^2 + 3yz - 2x)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$ is both Solenoidal and irrotational.	10	5
b.	Find the directional derivative of $\phi = (x^2 + y^2 + z^2)^{-\frac{1}{2}}$ at the point $P(3,1,2)$ in the direction of the vector $yz\hat{i} + zx\hat{j} + xy\hat{k}$.	10	5