

Roll No:

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

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.	State Cayley-Hamilton theorem.
b.	Reduce the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ into the normal form and find its rank.
c.	What error in the logarithm of a number will be produced by an error of 1% in the number
d.	Find n^{th} derivative of $x^3 e^{ax}$.
e.	Find first order partial derivative of $u = \log(x^2 + y^2)$.
f.	Evaluate $\int_0^3 \int_1^2 xy(1+x+y) dy dx$
g.	If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then show that $\text{curl } \vec{r} = 0$.

SECTION B

2. Attempt any three of the following:

7 x 3 = 21

a.	Find the inverse of the matrix $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$ by using elementary operation.
b.	If $y = (\sin^{-1}x)^2$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2y_n = 0$.
c.	If $u = f(y-z, z-x, x-y)$ then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.
d.	Evaluate by changing order of integration $\int_0^1 \int_{e^x}^x \frac{1}{\log y} dy dx$.
e.	Verify Green's theorem to evaluate $\int_C 2y^2 dx + 3x dy$ where C is the boundary of the closed region bounded by $y = x$ and $y = x^2$.

SECTION C

3. Attempt any one part of the following:

7 x 1 = 7

(a)	Verify Cayley- Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$
(b)	Find the values of λ and μ for which the system of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ have μ (i) No solution (ii) Unique Solution (iii) Infinite Solutions

4. Attempt any one part of the following:

7 x 1 = 7

(a)	If $y = e^{\tan^{-1}x}$ then prove that $(1+x^2)y_{n+2} + [(2n+2)x-1]y_{n+1} + n(n+1)y_n = 0$.
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(b)	Trace the curve $r = 2a \cos \theta$
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5. Attempt any *one* part of the following:

7 x 1 = 7

(a)	If $u = \log_e \left[\frac{x^4 + y^4}{x + y} \right]$ then find the value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$.
(b)	If $u = \cos^{-1} \frac{x+y}{\sqrt{x} + \sqrt{y}}$ then prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + \frac{1}{2} \cot u = 0$.

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

7 x 1 = 7

(a)	Evaluate $\iint_R y \, dx \, dy$, where R is the region bounded by the parabolas $y^2 = 4x$ and $x^2 = 4y$
(b)	Calculate the volume of the solid bounded by the surface $x = 0, y = 0, x + y + z = 1$ and $z = 0$

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

7 x 1 = 7

(a)	Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ taken round the rectangle bounded by the lines $x = a, x = -a, y = 0, y = b$
(b)	Find the total work done by a force $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ in moving a point from $(0,0)$ to (a, b) along the rectangle bounded by the lines $x = 0, x = a, y = 0, y = b$