Roll No: | | | | | | | | | | | | | | |

BTECH
(SEM I) THEORY EXAMINATION 2021-22
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.	Find nth differential of $y = x^2 e^{2x}$.
b.	Find the Jacobian $J\left(\frac{u,v}{x,y}\right)$ *for* $u = e^x \sin y$ *and* $v = x \log \sin y$.
c.	Prove that matrix $\begin{bmatrix} (a+ic) & (-b+id) \\ (b+id) & (a-ic) \end{bmatrix}$ is unitary if $a^2 + b^2 + c^2 + d^2 = 1$
d.	Find percent error in the area of an ellipse when an error of +1% is made in measuring its length of major and minor axis.
e.	Write the formula for area by double integration in polar coordinates.
f.	Examine the following vectors for linearly independent $X_1 = [1, 2, -2], X_2 = [-1, 3, 0], X_3 = [0, -2, 1]$
g.	Write formula for flux.

SECTION B

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

a.	Trace the curve $y^2(a+x) = x^2(a-x)$.
b.	Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube.
c.	Find the Eigen values and corresponding Eigen vectors of the matrix $A = \begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$
d.	Using Beta and Gamma function, evaluate $\int_0^1 x^5 \left(1 - x^3\right)^{10} dx$
e.	Verify Stoke's theorem for the field $\vec{F} = (2x - y)\hat{\imath} - yz^2\hat{\jmath} - y^2z\hat{k}$ taken over the upper half of the surface $x^2 + y^2 + z^2 = 1$ bounded by its projection on the xy-plane.

SECTION C

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

a.	If $y = (\sin^{-1} x)^2$, Find $y_n(0)$
b.	Verify the Euler's theorem for the function $u = log \frac{(x^2+y^2)}{xy}$

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

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a.	Verify Cayley-Hamilton theorem for the matrix $A=\begin{bmatrix}1 & 2\\ 2 & -1\end{bmatrix}$ and hence find A^{-1}.
b.	Solve the system of linear equations: - $x + 2y - z = 3$ $3x - y + 2z = 1$ $2x - 2y + 3z = 2$ $x - y + z = -1$

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

a.	If u, v, w are the roots of the cubic equation $(\lambda - x)^3 + (\lambda - y)^3 + (\lambda - z)^3 = 0$ in λ, Find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$
b.	Expand x^y in powers of $(x-1)$ and $(y-1)$ up to the third degree terms and hence evaluate $(1.1)^{1.02}$.

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

a.	Evaluate by change of variable, $\iint_R (x+y)^2 dxdy$ where R is the region bounded by the parallelogram $x+y = 0$, $x+y = 2$, 3x-2y = 0 and 3x-2y = 3
b.	Evaluate the integral $\iiint x^{l-1} y^{m-1} z^{n-1} dxdydz$ where x, y, z are all positive but limited by the condition $\left(\frac{x}{a}\right)^p + \left(\frac{y}{b}\right)^q + \left(\frac{z}{c}\right)^r \le 1$

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

a.	Show that the vector field $\bar{F} = \bar{r}/r^3$ is irrotational as well as solenoidal, where $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$.
b.	Find $div\overline{F}$ and $curl\overline{F}$, where $\overline{F} = grad(x^3 + y^3 + z^3 - 3xyz)$