21N501

Roll No. ____________

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# 21N501

**B. Tech. II - Sem. (New Scheme) (Main) Exam., (Academic Session 2021- 2022)**

**All Branch**

**2FY1 – 01 Engineering Mathematics – II**

**Common to all Branches**

**Time: 2 Hours**

**Maximum Marks: 70**

***Instructions to Candidates:***

***Part – A:*** *Short answer questions (up to 25 words) 5 × 3 marks = 15 marks. Candidates have to answer five questions out of* ***ten.***

***Part – B:*** *Analytical/Problem solving questions 3 × 5 marks = 15 marks. Candidates have to answer* ***three*** *questions out of* ***seven.***

***Part – C:*** *Descriptive/Analytical/Problem Solving questions 2 ×20 marks = 40 marks. Candidates have to answer* ***two*** *questions out of* ***five.***

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL ____________ 2. NIL ____________

## PART – A

Q.1 Evaluate -

$$\Gamma\left(\frac{-9}{2}\right)$$

Q.2 Evaluate -

$$\int_0^{\pi}\int_0^{a\sin\theta} r\,d\theta\,dr$$

Q.3 Evaluate -

$$\int_0^{\infty} x^3 e^{-2x^2} dx$$

Q.4 Determine the constant b such that

$\vec{A} = (bx^2y + yz)i + (xy^2 - xz^2)j + (2xyz - 2x^2yz - 2x^2y^2)k$ is solenoidal vector.

Q.5 Find a unit vector normal to the surface $x^2y+2xz = 4$ at the point $(2, -2, 3)$.

Q.6 State Gauss divergence theorem.

Q.7 Define right circular cone.

Q.8 Find the equation of the sphere through the circle $x^2 + y^2 + z^2 = 9$, $x + y - 2z + 4 = 0$ and the origin.

Q.9 Find the eigenvalues of the matrix $\begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$.

Q.10 Are the following vectors linearly independent.

$X_1 = (1,1,1,3)$, $X_2 = (1,2,3,4)$, $X_3 = (2,3,4,9)$

## PART – B

Q.1 Evaluate by changing the order of integration:

$$\int_0^1 \int_{e^x}^{e} \frac{1}{\log y} dx\, dy$$

Q.2 Prove that –

$$\int_0^1 \frac{dx}{\sqrt{1-x^3}} = \frac{[\Gamma(1/3)]^3}{2^{1/3}\sqrt{3}\pi}$$

Q.3 If $\vec{r} = xi + yj + zk$ and $r = |\vec{r}|$, then find (a) div $(r^n \vec{r})$ (b) Curl $(r^n \vec{r})$.

Q.4 Use Green's theorem to evaluate the integral $\int_c [-y^3dx + x^3dy]$ where C is the circle $x^2 + y^2 = 1$.

Q.5 Find the equation of right circular cone generated by rotation of the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ about the line $\frac{x}{-1} = \frac{y}{1} = \frac{z}{2}$.

Q.6 Determine the rank of matrix.

$$\begin{bmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 0 \end{bmatrix}$$

Q.7 For what values of $\lambda$ and $\mu$ does the system of equation $2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$ and $2x + 3y + \lambda z = \mu$ has

(i) No Solution

(ii) Unique solution

(iii) Infinite number of solutions

## PART – C

Q.1 Find the volume and surface area of the solid generated by the revolution of the astroid $x = a\cos^3 t$, $y = a\sin^3 t$ about the x-axis.

Q.2 If $\vec{F} = xi - yj + (z^2-1)k$ find $\iint_s \vec{F}.\hat{n}ds$, where S is the closed surface bounded by the planes $z = 0$, $z = 1$ and the cylinder $x^2 + y^2 = 4$.

Q.3 Find the equation of the right circular cylinder described on the circle through the point (1,0,0), (0,1,0) and (0,0,1) as the guiding curve.

Q.4 Verify Cayley - Hamilton theorem for the matrix -

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

Hence, find $A^{-1}$.

Q.5 Find the constant $\lambda$ so that $\vec{F}$ is a conservative vector field, where

$\vec{F} = (\lambda xy - z^3)i + (\lambda-2)x^2 j + (1-\lambda)xz^2 k$.

Find the work done in moving particle from $(1, 2, -3)$ to $(1, -4, 2)$

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