A-053

Roll No. ________

21N501 /

Total No. of Pages: 04

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B.Tech. II Sem Main/Back (New Scheme) Acad. Session 2023-24

All Branch

(2FY1-01) – Engineering Mathematics-II

Time : 3 Hours

Maximum Marks: 70
Min. Passing Marks:

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 10x2 marks = 20 marks. All 10 questions are compulsory.

Part – B: Analytical/Problem Solving questions 5x4 marks = 20 marks. Candidates have to answer 5 questions out of 7.

Part – C: Descriptive/Analytical/Problem Solving Design questions 3x10 marks = 30 marks. Candidates have to answer 3 questions out of 5.

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 materials is permitted during examination. (Mentioned in form No **205)**

1. ________________

2. ________________

P.T.O.

[4]

Q.4. Using Green's theorem, evaluate $\oint_C x^2 y\,dx + x^2\,dy$

Where C is the boundary (described counter clockwise) of the triangle with vertices

(0, 0), (1, 0) and (1, 1).

Q.5. Find the equation of the cone whose vertex is (3, 1, 2) and base is the circle

[4]

$2x^2 + 2y^2 = 1, z = 1.$

[4]

Q.6. Reduce the matrix

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

in its normal forms.

Q.7. Investigate the value of λ and μ so that the equations [4]

$2x + 3y + 5z = 9,\ 7x + 3y - 2z = 8,\ 2x + 3y + \lambda z = \mu$

have 1 No solution

2 Unique solution

PART- C

Q.1. Evaluate the following integral by changing to polar co-ordinates [10]

$$\int_0^1 \int_0^{\sqrt{2x-x^2}} (x^2 + y^2)\,dx\,dy.$$

Q.2. Find the values of a, b and c such that $\vec{A} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ is irrotational vector field. Also, find its scalar potential. [10]

Q.3. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ taken round the rectangle bounded by the lines $x = \pm a,\ y = 0,\ y = b.$ [10]

P.T.O.

PART-A

Q.1. Evaluate $I = \int_0^{\pi/2} \sin^5 x \cos^8 x \, dx$. **[2]**

Q.2. Change the order of integration $\int_0^1 \int_x^1 e^{y^2} \, dy dx$. [2]

Q.3. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then show that $\nabla\left(\frac{1}{r}\right) = -\frac{\vec{r}}{r^3}$ [2]

Q.4. State the Gauss divergence theorem. [2]

Q.5. The acceleration of a particle at any time t>0 is given by $\vec{a} = 12\cos 2t\hat{i} - 8\sin 2t\hat{j} + 16t\hat{k}$ if velocity $\vec{v}$ and displacement $\vec{r}$ are at t=0, find $\vec{v}$ at any time. [2]

Q.6. Show that the field defined by $\vec{a} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$ is irrotational [2]

Q.7. Find the centre and radius of the sphere $2x^2 + 2y^2 + 2z^2 - 3x + 5y - 4z = 13$ [2]

Q.8. Define Cone and Right Circular Cone. [2]

Q.9. Find the rank of the matrix. [2]

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

Q.10. Write the statement of Cayley- Hamilton's theorem. **[2]**

PART-B

Q.1. Find the surface of the solid generated by the revolution of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$ about the x-axis **[4]**

Q.2. Find the volume in the first octant bounded by the parabolic cylinders **[4]**

$z = g - x^2, x = 3 - y^2$

Q 3. Evaluate the line integral $\int_C (x^2 + xy)dx - (x^2 - y^2)dy$. **[4]**

Where C is the square formed by the lines $x = \pm 1$, $y = \pm 1$.

Q.4. Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at the point $(1, -2, 1)$ and cuts the sphere $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$ orthogonally [10]

Q.5. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

Hence find A [10]

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