B. Tech (Common for all Branches) (NEP Pattern) Semester-II

STBSC201 - Engineering Mathematics-II

P. Pages : 2 **GUG/S/25/16791**

Time : Three Hours * 4 3 7 9 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Assume suitable data wherever necessary.
3. Use of non-programmable calculator is permitted.
4. All questions are compulsory.

1. a) Solve the equation $ye^{y}dx = \left(y^3 + 2xe^{y}\right)dx$ **8**

b) Solve D. E. : $y\frac{dy}{dx} = \frac{4x}{3} + \frac{y^2}{3x}$ **8**

OR

2. a) Solve : $\left(\sec x + \tan x \tan y - e^{x}\right)dx + \sec x \sec^2 y \, dy = 0$ **8**

b) Solve : $\left(D^4 - 2D^3 + D^2\right)y = x^3$ **8**

3. a) Solve : $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^{x}$ **8**

b) Solve : $(3x+2)^2\frac{d^2y}{dx^2} + 3\left(3x^2+2\right)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$ **8**

OR

4. a) Solve : $\frac{dx}{dt} + 2x - \frac{dy}{dt} = 10\cos t, \frac{dx}{dt} + \frac{dy}{dt} + 2y = 4e^{-2t}$. **8**

b) Solve the equation $\frac{d^2y}{dx^2} = \frac{1}{\sqrt{ay}}$, given that at $x = 0,\ y = 0,\ \frac{dy}{dx} = 0$. **8**

5. a) Evaluate : $\iint e^{2x+3y}dx\,dy$, over the triangle bounded by x = 0, y = 0 and x + y = 1. **8**

b) Evaluate by changing the order of integration $\int_0^a \int_{\sqrt{ax}}^a \frac{y^2\,dy\,dx}{\sqrt{y^4 - a^2x^2}}$ **8**

OR

6. a) Evaluate $\int_1^e \int_1^{\log y} \int_1^{e^x} \log z \, dz \, dx \, dy$ **8**

b) Find the mass of the area bounded by the curves $y = x^2$ and $x = y^2$, if the density at any point is $p = \lambda\left(x^2 + y^2\right)$. **8**

7. a) Show that for any Scalar λ, the vectors $\vec{x}, \vec{y}$ given by **8**

$$\vec{x} = \lambda a + \frac{q\left(\vec{a} \times \vec{b}\right)}{a^2}, \vec{y} = \frac{(1 - p\lambda)}{q}\vec{a} - \frac{p\left(\vec{a} \times \vec{b}\right)}{a^2}$$

satisfies the equations $p\vec{x} + q\vec{y} = \vec{a}, \vec{x} \times \vec{y} = \vec{b}$.

b) Find the directional derivatives of $\phi = 4e^{2x-y+z}$ at the point (1, 1, -1) in the direction towards the point (-3, 5, 6) **8**

OR

8. a) Evaluate : $\int_C \left[\left(x^2 - \cosh y\right)dx + \left(y + \sin x\right)dy\right]$ by Green's theorem where C is the rectangle with vertices (0,0), $(\pi,0),(\pi,1),(0,1)$. **8**

b) Apply Stoke's Theorem to evaluate. , **8**

$\int_C \left(\sin z \, dx - \cos x \, dy + \sin y \, dz\right)$ where C is the boundary of the rectangle

$0 \le x \le \pi,\ 0 \le y \le 1,\ z = 3$ oriented Clockwise as viewed from the origin.

9. a) Using divergence Theorem, evaluate $\iint_S \vec{F} \cdot \hat{n} \, ds$ of the cylinder bounded by $z = 0, z = 1,$ **8**

and $x^2 + y^2 = 4$.

b) Evaluate : $\iint_S \bar{A} \cdot \bar{n} \, ds$, where $\bar{A} = yi + 2xj - zk$ and S is the surface of the plane $2x + y = 6$ **8**

in the first octant cut by the plane z = 4.

OR

10. a) Find the work done by the variable force $\vec{F} = 2yi + xyi$ on a particle when it is displaced from the origin to the point $\bar{r} = 4i + 2i$ along the parabola $y^2 = x$ **8**

b) Show that **8**

i) Curl grad $\phi = 0$ ii) Div curl $\bar{A} = 0$

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