R18

Code No: 152AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech I Year II Semester Examinations, February - 2025

MATHEMATICS-II

(Common to CE, EEE, ME, ECE, EIE, MCT, MMT, AE, MIE, PTM, CSE(AI&ML), CSE(IOT), AI&DS, AI&ML)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Define an integrating factor. [2]

b) Show that the differential equation $e^x(\cos y\,dx - \sin y\,dy) = 0$ is exact. [3]

c) Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0$. [2]

d) Find the particular integral of $(D^2 - 4D + 4)y = x^3e^{2x}$. [3]

e) Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} f(x,y)\,dy\,dx$. [2]

f) Evaluate $\iiint_R (x + y + z)\,dx\,dy\,dz$, where $R: 0 \le x \le 1, 1 \le y \le 2, 2 \le z \le 3$. [3]

g) Define the gradient of scalar function. [2]

h) Find the curl of $\vec{V} = (xyz)\bar{i} + (3x^2y)\bar{j} + (xz^2 - y^2z)\bar{k}$ at $(2,-1,1)$. [3]

i) State the Gauss's divergence theorem. [2]

j) If a force $\vec{F} = 2x^2y\bar{i} + 3xy\bar{j}$ displaces a particle in the xy-plane from $(0,0)$ to $(1,4)$ along a curve $y = 4x^2$, then find the work done. [3]

PART - B

(50 Marks)

2. Determine for what values of a and b, the following differential equation is exact and obtain the general solution of the exact equation: $(y + x^3)\,dx + (ax + by^3)\,dy = 0$. [10]

OR

3. Solve the differential equation $\frac{dy}{dx} + 4xy + xy^3 = 0$. [10]

4. Find the complete solution of $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = xe^{3x} + \sin 2x$. [10]

OR

5. Solve $(3x + 2)^2\frac{d^2y}{dx^2} + 3(3x + 2)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$. [10]

6. Evaluate $\int_0^2 \int_0^{\sqrt{2x-x^2}} \frac{x\,dy\,dx}{\sqrt{x^2+y^2}}$ by changing to polar coordinates. [10]

OR

7. A pyramid is bounded by the three coordinate planes and the plane $x + 2y + 3z = 6$. Compute this volume by double integration. [10]

8. Let $\vec{r} = x\bar{i} + y\bar{j} + z\bar{k}, r = |\vec{r}|$ and $\vec{a}$ is a constant vector. Find the value of $div\left(\frac{\vec{a}\times\vec{r}}{r^n}\right)$. [10]

OR

9. Is the vector field $\vec{F} = (x^2 - y^2 + x)\bar{i} - (2xy + y)\bar{j}$ irrotational? If so, find the scalar potential. [10]

10. Apply Green's theorem to evaluate $\oint_C[(2x^2 - y^2)\,dx + (x^2 + y^2)\,dy]$, where C is the boundary of the area enclosed by the x –axis and the upper half of circle $x^2 + y^2 = a^2$. [10]

OR

11. Evaluate $\oint_C \vec{F}.\overrightarrow{dr}$ by the Stoke's theorem where $\vec{F} = y^2\bar{i} + x^2\bar{j} - (x + z)\bar{k}$ and c is the boundary of triangle with vertices at $(0,0,0)$, $(1,0,0)$ and $(1,1,0)$. [10]

---ooOoo---