

Code No: 152AA

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester Examinations, May - 2019

MATHEMATICS-II

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, AE, MIE, PTM)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.  
Part A is compulsory which carries 25 marks. Answer all questions in Part A.  
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) Solve  $y = a\sqrt{1+p^2}$ . [2]
- b) Solve  $\frac{1}{D^2}x^4$ . [2]
- c) Evaluate  $\int_{x=1}^3 \int_{y=0}^1 xy^2 dy dx$ . [2]
- d) If  $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$  then evaluate  $\nabla^2(r^2)$ . [2]
- e) Find the value of  $\int_V (\vec{i} + \vec{j} + \vec{k}) dV$ . [2]
- f) Find the integrating factor of  $\frac{dy}{dx} + 2xy = e^{-x^2}$ . [3]
- g) Solve  $(D^3 - 4D^2)y = 5$ . [3]
- h) Find the limits after changing the order of integration for  $\int_0^b \int_0^{a/b\sqrt{b^2-y^2}} f(xy) dy dx$ . [3]
- i) Find a unit vector normal to the surface  $x^3 + y^3 + 3xyz = 3$ . [3]
- j) If  $\vec{F}(t) = x\vec{i} + 2y\vec{j} + z\vec{k}$  then evaluate  $\int_1^2 \text{curl } \vec{F}(t) dt$ . [3]

PART-B

(50 Marks)

- 2.a) Solve  $(1+x^2)\frac{dy}{dx} + 2xy = 4x^2, y(0) = 0$ .
  - b) If 30% of a radioactive substance disappears in 10 days, how long will it take for 90% of it to disappear? [5+5]
- OR
- 3.a) Solve  $(y + y^2)dx + xy dy = 0$ .
  - b) Solve  $(x + 2y^3)\frac{dy}{dx} = y$ . [5+5]
- 4.a) Solve  $(D^2 + 4)y = \tan 2x$  by variation of parameters.
  - b) Solve  $(D^3 + 4D)y = 5 + \sin 2x$ . [5+5]
- OR
- 5.a) Solve  $(D^2 + 4D + 3)y = e^{e^x}$ .
  - b) Solve  $(D^2 + 1)y = x^2 \sin 2x$ . [5+5]

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6.a) Evaluate  $\int_0^\pi \int_0^{a(1+\cos\theta)} r^2 \cos\theta \, dr \, d\theta$ .

b) Evaluate  $\int_0^{\log 2} \int_0^x \int_0^{x+\log y} e^{x+y+z} \, dz \, dy \, dx$ . [5+5]

OR

7.a) Change into polar co-ordinates and evaluate  $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} \, dy \, dx$ .

b) Show that the area between the parabolas  $y^2 = 4ax$  and  $x^2 = 4ay$  is  $\frac{16}{3}a^2$ . [5+5]

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8.a) Find the angle between the normal to the surface  $xy = z^2$  at the points (4, 1, 2) and (3, 3, -3).

b) Prove that  $\nabla \cdot (\vec{A} \times \vec{B}) = \vec{B} \cdot (\nabla \times \vec{A}) - \vec{A} \cdot (\nabla \times \vec{B})$ . [5+5]

OR

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9.a) Find the angle of intersection of the spheres  $x^2 + y^2 + z^2 = 39$  and  $x^2 + y^2 + z^2 + 4x - 6y - 8z + 52 = 0$  at the point (4, -3, 2).

b) A vector field is given by  $\vec{A} = (x^2 + xy^2)\vec{i} + (y^2 + x^2y)\vec{j}$ . Show that the field is irrotational and find the scalar potential. [5+5]

10. Find the work done in moving a particle in the force field  $\vec{F} = 3x^2\vec{i} + (2xz - y)\vec{j} + z\vec{k}$  along the straight line from (0, 0, 0) to (2, 1, 3). [10]

OR

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11.a) Evaluate  $\iint_S \vec{F} \cdot \hat{n} \, ds$  if  $\vec{F} = 2xy\vec{i} + yz^2\vec{j} + xz\vec{k}$  over the parallelepiped  $x = 0, y = 0, z = 0, x = 2, y = 1, z = 3$ .

b) If  $\vec{F} = (3x^2 - 2z)\vec{i} - 4xy\vec{j} - 5x\vec{k}$ , Evaluate  $\int_V \text{curl } \vec{F} \, dv$ , where  $v$  is volume bounded by planes  $x = 0, y = 0, z = 0$  and  $3x + 2y - 3z = 6$ . [5+5]

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