

**R18**

Code No: 152AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech I Year II Semester Examinations, January/February - 2024

MATHEMATICS-II

(Common to CE, EEE, ME, ECE, EIE, MCT, MMT, ECM, 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 exact equation. [2]
- b) State law of natural growth and give its mathematical form. [3]
- c) Solve  $(D+1)(D-1)y=0$ . [2]
- d) Find the PI of  $(D+1)^2y=x \sin x$ . [3]
- e) Evaluate  $\int_1^6 \int_0^x xy \, dydx$ . [2]
- f) Write the area bounded by a closed curve as a double integral. [3]
- g) Define the gradient of a scalar point function  $f(x, y, z)$ . [2]
- h) Define a solenoidal vector and give an example. [3]
- i) State Green's theorem in plane. [2]
- j) State Gauss divergence theorem. [3]

**PART - B**

**(50 Marks)**

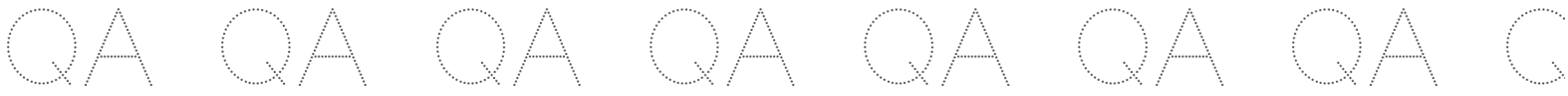
2. Solve  $x \frac{dy}{dx} + y = x^3 y^6$ . [10]
3. If the temperature of the air is  $30^\circ\text{C}$ , and the substance cools from  $100^\circ\text{C}$  to  $80^\circ\text{C}$  in 10 minutes, find the temperature of the substance after 20 minutes. [10]

**OR**

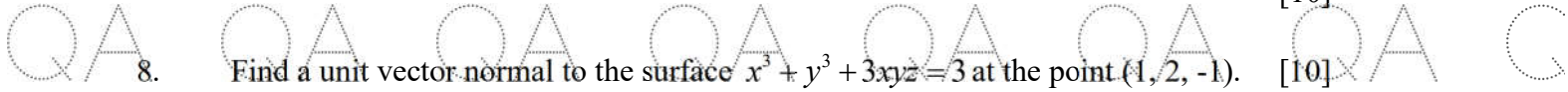
5. Solve by method of variation of parameters  $\frac{d^2y}{dx^2} + a^2y = \sec ax$ . [10]

- 6 Evaluate  $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dydx}{1+x^2+y^2}$ . [10]

**OR**



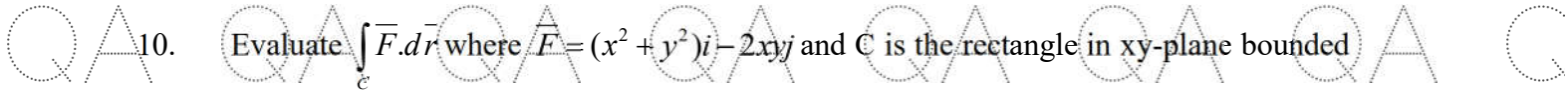
7. Evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz \, dx dy dz$ . [10]



8. Find a unit vector normal to the surface  $x^3 + y^3 + 3xyz = 3$  at the point  $(1, 2, -1)$ . [10]

**OR**

9. Find the value of  $a$  if the vector  $(ax^2y + yz)i + (xy^2 - xz^2)j + (2xyz - 2x^2y^2)k$  has zero divergence. Find the curl of the above vector which has zero divergence. [10]

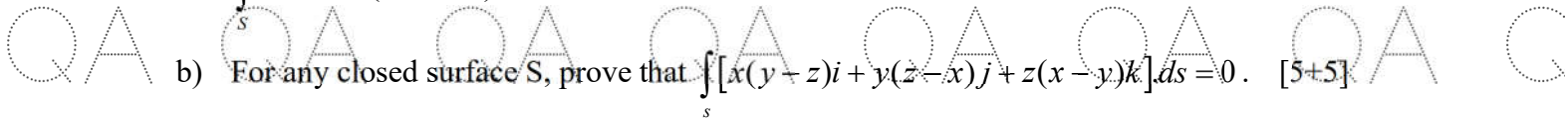


10. Evaluate  $\int_C \vec{F} \cdot d\vec{r}$  where  $\vec{F} = (x^2 + y^2)i - 2xyj$  and  $C$  is the rectangle in  $xy$ -plane bounded by  $y=0, x=a, y=b, x=0$ . [10]

**OR**

11.a) If  $S$  is any closed surface enclosing a volume  $V$  and  $\vec{F} = axi + byj + czk$  prove that

$$\int_S \vec{F} \cdot \vec{N} ds = (a + b + c)V$$



b) For any closed surface  $S$ , prove that  $\int_S [x(y-z)i + y(z-x)j + z(x-y)k] \cdot ds = 0$ . [5+5]

**---ooOoo---**

