# Maulana Azad National Institute of Technology, Bhopal-462003
## End Term Examination (Session: July-December 2024)

Section: All

B.Tech.  Semester - I

Subject: Mathematics-I  Subject Code: MTH-24101

Time: 120 Minutes

Max. Marks: 40

**Note:**
- All questions are compulsory. Usual notations are used.
- Assume missing data if any.

1. Discuss the maximum and minimum values of the given function  **[6 marks]**

$$u = a(x^3y^2 - x^4y^2 - x^3y^3)$$

2. Trace the curve $r^2 = a^2 \sin 2\theta$ by describing the necessary properties.  **[6 marks]**

3. Evaluate the double integral $\iint_R \sqrt{x^2 + y^2}\,dxdy$, where $R$ is the region in the $xy$ plane bounded by the circles $x^2 + y^2 = 4$ and $x^2 + y^2 = 9$.  **[6 marks]**

4. Verify Stokes theorem for the surface $S$ given by $x^2 + y^2 + z^2 = 9, z \geq 0$ and the vector field $\vec{v} = y\hat{i} - x\hat{j}$.  **[6 marks]**

5. Find the work done by the force $\vec{F} = (x^2 - y^3)\hat{i} + (x + y)\hat{j}$ in moving a particle along the closed path $C$ containing the curves $x + y = 0$, $x^2 + y^2 = 16$ and $y = x$ in the first and fourth quadrants.  **[5 marks]**

6. Find the general solution of the given linear differential equation  **[6 marks]**

$$\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} = x^2 + 3e^{2x} + 4\sin x$$

7. Solve the differential equation satisfying the initial condition $y(1) = 2$  **[5 marks]**

$$(x^2 + y^2)dx - 2xydy = 0$$

**\*\* End of the question paper \*\***