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Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.
Mid Semester Examination (September-October, 2019)

Branch	**: CSE, ECE, EEE**	**Semester**	**: 1st**
Title of the Course	**: Advanced Calculus**	**Course Code**	**: MAL 101**

Time: 2 Hours **Maximum Marks: 25**

Note: All questions are compulsory.

Q.1. A person running the 26.2 km Delhi Marathon completes it in 2.2 hours. Show that at least twice the runner was running at exactly 11 km/hr, assuming that the initial and final speeds are exactly zero. **2 Marks**

Q.2. By considering different paths of approach, show that the function $f(x,y)=\frac{x^2-y}{x-y}$ has no limit at origin. **2 Marks**

Q.3. Let $f(x, y) = x^2 + y^3$. Find the slope of the line tangent to this surface at the point (–1, 1) and lying in the plane $x = -1$. **2 Marks**

Q.4. What are the dimensions of the lightest open top right circular cylindrical CAN that will hold a volume of 1000 cm^3?. **3 Marks**

Q.5. Let $f(x,y)=\begin{cases}\frac{xy^2}{x^2+y^4}, & (x,y)\neq(0,0)\\ 0, & (x,y)=(0,0)\end{cases}$. Show that $f_x(0,0), f_y(0,0)$ exist, but $f(x,y)$ is not differentiable at (0, 0). **4 Marks**

Q.6. Find the domain, symmetry, intervals where function is increasing and decreasing, intervals of concave down and concave up, Identify the inflection points, local maxima and minima, the asymptotes and finally use them to sketch the curve for the function $f(x)=\frac{x-1}{x^2(x-2)}$. **6 Marks**

Q.7. Assume that you are in-charge of erecting a radio telescope on a newly discovered planet. To minimize interference, you want to place it where the magnetic field of the planet is weakest. The planet is spherical, with a radius of 6 units. Based on a coordinate system whose origin is at the center of the planet, the strength of magnetic field is given by $M(x,y,z)=6x-y^2+xz+60$. Where should you locate the telescope? **6 Marks**