INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, SRI CITY

TERM-III EXAMINATION – MONSOON 2024

Real Analysis Numerical Analysis and Calculus

CSE/ECE:UG2(IC) Date: 22-11-2024

Duration: 90 Mins (02:45-4:15 PM) **Max. Marks: 25**

Instructions:Roll No:________________

1. All questions are compulsory.
2. Write the answers legibly.
3. Rough Work should be done separately, not with the answer.
4. Answers should be reasoned and derived clearly, not a single word answer.
5. Be short and precise. Provide an answer to exactly what is asked for.
6. The exam is not open book and student(s) are not allowed to bring Text book(s)/ Photocopies / Hand-written notes / laptops. Calculators are allowed.
7. Return the question paper along with your answer sheet before leaving the exam hall.

1	a. Find the maximum value of directional derivative of $\phi = x^2yz$ at $(1, 4, 1)$.	[1 Mark]
	b. If $\overline{F} = (x + 3y)\,\overline{i} + (y - 2z)\,\overline{j} + (x + pz)\,\overline{k}$ is a solenoidal. Find the value of p.	[1 Mark]
	c. If $\overline{F} = (4xy - 3x^2z^2)\,\overline{i} + 2x^2\,\overline{j} - 2x^3z\,\overline{k}$, Prove that work done by $\overline{F}$ is independent of the path joining two points.	[2 Marks]
2	a. Verify Green's theorem for $\int_C (xy + y^2)dx + x^2dy$ where C is bounded by y = x and $y = x^2$.	[4 Marks]
	b. Evaluate $\int\int_S \overline{F}.\hat{n}\, ds$ where $\overline{F} = y\overline{i} + 2x\overline{j} + (z - 8)\,\overline{k}$ and S is the surface of a solid bounded by a plane 4x+2y+z=8 located in the first octant.	[3 Marks]
3	a. Find the minimum value of the function $F = x^2 - xy + y^2 - 2x + y$.	[2 Marks]
	b. The temperature u(x,y,z) at any point in space is $u = 400\, xyz^2$. Find the highest temperature on the surface of the sphere $x^2 + y^2 + z^2 = 1$.	[3 Marks]
	c. Prove that $\nabla.(\nabla\times \overline{F}) = 0$	[2 Marks]

4	**a.** Evaluate the integral by changing its order of integration $$\int_0^2 \int_0^{4-x^2} \frac{x e^{2y}}{4-y}\, dy\, dx$$	[3 Marks]
	b. Find the volume of the tetrahedron in space cut from the first octant by the plane $6x + 3y + 2z = 1$.	[4 Marks]