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D3BMT2102 (PAGES 2) Reg.No............................

Name: ....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(Regular/Improvement/Supplementary)

MATHEMATICS: COMPLEMENTARY COURSE FOR PHYSICS, CHEMISTRY & C S

GMAT3C03T: MATHEMATICS - 3

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 Marks)

1. Define order of a differential equation. Solve $y' = cos\pi x$.
2. Solve $y'sin\pi x = ycos\pi x$.
3. Write the standared form of a second order linear differential equation. Also state the Fundamental Theorem for the Homogeneous Linear ODE.
4. Solve $y" - 6y' + 9y = 0$.
5. Solve $y" + 0.4y' + 9.04y = 0$.
6. Let $a = [1,1,1], b = [2,3,1], c = [-1,1,0]$. Find the angle between: $a - c$ and $b - c$.
7. Find the length of the curve $r(t) = [2cost, 2sint, 6t]$ from $(2,0,0) to (2,0,24\pi)$.
8. Find $div\vec{F}$ and $curl\ \vec{F}$ where $\vec{F} = grad(x^2 + y^2 - 3xy)$.
9. Define gradient of a scalar field and also find $grad(\sqrt{(x^2 + y^2 + z^2)})$.
10. Explain the physical interpretation of curl.
11. Write a parametric representation of a sphere.
12. Define the terms smooth surface, surface normal.

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 Marks)

13. Solve $\frac{dy}{dx} + \frac{x}{1-x^2}y = x\sqrt{y}$.
14. Solve $(cosxtany + \cos(x + y))dx + (sinxsec^2y + \cos(x + y))dy = 0$.
15. Solve $y" + 4y' + 5y = 25x^2 + 13sin2x$.
16. Solve $y" + 4y = 4sec^2 2x$.
17. Prove that $curl(gradf) = \vec{0}$ and $div(curl\vec{v}) = 0$
18. Verify Green's theorem for $F_1 = y^2 - 7y, F_2 = 2xy + 2x$ where C is the circle $x^2 + y^2 = 1$.
19. Compute the flux of water through the parabolic cylinder S: $x + y + z = 4, x \geq 0, y \geq 0), z \geq 0$, if velocity is $\vec{F} = [x^2, y^2, z^2]$.

(PTO)

SECTION C: Answer any *one* question. Each carries *ten* marks.

20. a. If $\vec{v} = 3x^2y^2z^4i + 2x^3yz^4j + 4x^3y^2z^3$, find its scalar potential.

b. Prove that $curl(f\vec{v}) = \nabla f \times \vec{v} + f curl\vec{v}$

21. a. State Gauss divergence theorem, and use it to evaluate $\iint_S \vec{F}.\vec{n}dA$, where $\vec{F} = [x, y, z]$ and S the sphere $x^2 + y^2 + z^2 = 9$.

b. State Stokes theorem and Calculate this line integral by Stokes's theorem, clockwise as seen by a person standing at the origin, for the following F and C. Assume the Cartesian coordinates to be right handed where $\vec{F} = [4z, -2x, 2x]$, C is the intersection of$x^2 + y^2 = 1$ and $z = y + 1$

(1× 10 = 10 Marks)