Reg. No... Name.. **19U339**

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER – 3: MATHEMATICS (COMPLEMENTARY COURSE FOR B SC PHYSICS & CHEMISTRY)

COURSE: 15U3CPMAT3 – VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND ANALYTICAL GEOMETRY

(For Regular - 2018 Admission and Improvement 2017 / Supplementary 2017, 2016 & 2015 Admissions)

Time: Three Hours Max. Marks: 75

Part A
Each Question carries 1 Mark
Answer All Questions

1. The curvature of a straight line is ____________
2. The rule for finding $\nabla(f/g)$, $g \neq 0$ is ____________
3. Define the term Flow Integral.
4. State Divergence theorem.
5. Find a potential function for the field $F = 2x\ i + 3y\ j + 4z\ k$.
6. Solve $dx - x^2 dy = 0$.
7. Find the degree of the homogeneous function $x^2y^4 + x^3y^3 - \frac{x^7}{y}$.
8. Give the standard form of a Bernoulli's differential equation.
9. Find the directrix of the parabola $y^2 = 10x$.
10. Find the polar equation of the circle with center $(-1, \pi/2)$ and radius 1.

(10 X 1 = 10)

Part B
Each Question carries 2 Marks
Answer any Eight

11. Find $\int_0^{\pi} (\cos t\ i + \ j - 2t\ k)\ dt$.
12. Find the gradient of the function $f(x, y) = \ln(x^2 + y^2)$ at $(1,1)$.
13. Evaluate $\int_C (x - y + z - 2)$, where C is the straight-line segment $x = t, y = (1-t), z = 1$, from $(0, 1, 1)$ to $(1, 0, 1)$.
14. Check whether the field $F = (e^x \cos y)\ i - (e^x \sin y)\ j + z\ k$ is conservative or not.
15. Show that the differential form in the integral $\int_{(0,0,0)}^{(1,2,3)} 2xy\ dx + (x^2 - z^2)\ dy - 2yz\ dz$ is exact.

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16. Find an equation for the hyperbola with eccentricity 3/2 and directrix $x = 2$.

17. Draw the graph of the polar coordinates satisfying $\frac{2\pi}{3} \leq \theta \leq \frac{5\pi}{6}$ with no restriction on r.

18. Find the order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^2 = \left(\frac{d^2y}{dx^2}\right)^3$.

19. Solve $(x + \sin y)dx + (y^2 + x\cos y)dy = 0$.

20. Find the slope and intercept of $r\cos\theta = r\sin\theta$ by finding its equivalent Cartesian equation.

(8 X 2 = 16)

Part C
Each Question carries 5 Marks
Answer Any Five

21. Show that the curvature of a circle of radius a is $\frac{1}{a}$.

22. Find the directions in which the derivative of the function $f(x, y) = \frac{(x^2 - y^2)}{(x^2 + y^2)}$ at $P(1, 1)$ equal to zero.

23. Find the circulation of the field $F = (x - y)\ i + x\ j$ around the circle $r(t) = (\cos t)i + (\sin t)\ j,\ 0 \leq t \leq 2\pi$.

24. Let F be a differentiable vector field and let $g(x, y, z)$ be a differentiable scalar function. Show that $\nabla \cdot (gF) = g\nabla \cdot F + \nabla g \cdot F$.

25. Solve the differential equation $x\left(\frac{dy}{dx}\right)^3 - 12\frac{dy}{dx} - 8 = 0$ for x.

26. Check for exactness and solve $\cos x\ dx + \left(1 + \frac{2}{y}\right)\sin x\ dy = 0$.

27. Find the eccentricity, foci and directrices of the ellipse $169x^2 + +25y^2 = 4225$.

(5 X 5 = 25)

Part D
Each Question carries 12 Marks
Answer Any Two.

28. Use the surface integral in Stokes' Theorem to calculate the circulation of the field $F = (y^2 + z^2)\ i + (x^2 + y^2)\ j + (x^2 + y^2)\ k$ around C, where C is the square bounded by the lines $x = \pm 1, y = \pm 1$ in the xy-plane, counter clockwise when viewed from above.

29. Use Green's Theorem to find the counterclockwise circulation and outward flux for the field $F = (x + y)\ i - (x^2 + y^2)\ j$ and the curve C, where C is the triangle bounded by $y = 0, x = 1$ and $y = x$.

30. What is the standard form of Clairaut's equation. Solve $\left(\frac{dy}{dx} - 1\right)\left(y - x\frac{dy}{dx}\right) = \frac{dy}{dx}$.

31. Identify the conic ...