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18103330

QP CODE: 18103330

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Reg No : .....

Name : .....

B.Sc. DEGREE (CBCS) EXAMINATION, NOVEMBER 2018

Third Semester

COMPLEMENTARY COURSE - MM3CMT01 - MATHEMATICS - VECTOR CALCULUS, ANALYTIC GEOMETRY AND ABSTRACT ALGEBRA

(Common to B.Sc Chemistry Model I, B.Sc Chemistry Model II Industrial Chemistry, B.Sc Chemistry Model III Petrochemicals, B.Sc Electronics and Computer Maintenance Model III, B.Sc Food Science & Quality Control Model III, B.Sc Geology and Water Management Model III, B.Sc Geology Model I, B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III Electronic Equipment Maintenance)

2017 Admission Onwards

A222C884

Maximum Marks: 80 **Time: 3 Hours**

Part A

Answer any **ten** questions.

Each question carries **2** marks.

1. Find the velocity and acceleration of the particle whose position is given by $r(t) = e^t i + \frac{2}{9}e^{2t} j$ at $t = ln(3)$.
2. Define gradient vector of a function defined on a plane region.
3. Find the gradient of $f(x, y, z) = x^3 - xy^2 - z$at $(1, 1, 0)$.
4. Evaluate $\int_C \mathbf{F}.\mathbf{T}ds$ for the vector field $\mathbf{F} = x^2 i - yj$ along the curve $x = y^2$ from $(4, 2)$ to $(1, -1)$.
5. Find a parametrization of the paraboloid $z = x^2 + y^2$, $z \leq 4$.
6. State Stoke's Theorem.
7. Express the curve $r \sin\theta = -1$ in cartesian co-ordinates.
8. Write the standard form of the equation of an ellipse. Also write the co-ordinates of the foci.
9. Find the eccentricity of the hyperbola $9x^2 - 16y^2 = 144$.
10. Is Q under addition is a cyclic group.
11. Give an example of a non-abelian group of order 10.
12. Define group homorphism.

(10×2=20)

Part B

Answer any **six** questions.

Each question carries 5 marks.

13. Find the length of one turn of the helix $r(t) = cost\, i + sint\, j + t\, k$.

14. Find the equation of tangent to curve $x^2 - xy + y^2 = 7$ at the point $(-1, 2)$.

15. Evaluate $\int_C y\,dx - x\,dy$ along the square with vertices $(0,0)$, $(1,0)$, $(1,1)$, $(0,1)$ in the counter clockwise direction.

16. Use Green's Theorem to find the counterclockwise circulation and outward flux for the field $\mathbf{F} = \left(y^2 - x^2\right) i + \left(x^2 + y^2\right) j$ where C is the triangle bounded by the lines $y = 0. y = x$, $x = 3$.

17. Find the flux of the field $\mathbf{F} = 4xi + 4yj + 2k$ outward through the surface cut from the bottom of the paraboloid cylinder $z = x^2 + y^2$ by the plane $z = 1$.

18. Find the vertices, focii, length of the semimajor axis and the length of the semiminor axis of the hyperbola $25x^2 - 16y^2 = 400$.

19. Find the standard equation of the ellipse with focus $(-4, 0)$ and directrix $x = -16$.

20. Define the group U_n and find the subgroup of U_6 generated by $\frac{1}{2} + \frac{\sqrt{3}}{2}i$.

21. If p and q are distinct prime numbers, find the number of generators of Z_{pq}.

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **15** marks.

22. (a) Find the unit tangent, principal normal and curvature of the curve $r(t) = acost\, i + asint\, j + btk$. $a,\ b \geq 0$ and $a^2 + b^2 \neq 0$.
(b) Find the directions in which $f(x, y) = x^2 + xy + y^2$ increases most rapidly and decreases most rapidly at the point $(-1, 1)$.

23. Verify Stoke's Theorem for $\mathbf{F} = (z - y)i + (z + x)j - (x + y)k$ where S is the portion of the paraboloid $z = 4 - x^2 - y^2$ above the xy-plane with upward orientation.

24. (a) Find the equation of the ellipse when $9x^2 + 16y^2 = 144$ is shifted 4 units to the right and 3 units up. Also find the center,vertices, foci and directrix of the new ellipse. Sketch the new ellipse with all these details.
(b) Find the polar equation of the hyperbola $9y^2 - x^2 = 36$.

25. Define deheral group D_n. Find all subgroups of D_4 and draw its sub group diagram.

(2×15=30)