Reg. No. : ....

Name : ....

K21U 0884

IV Semester B.Sc. Degree (CBCSS – Sup./Imp.) Examination, April 2021
(2014 – '18 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
4C04MAT-PH : Mathematics for Physics and Electronics – IV

Time : 3 Hours

Max. Marks : 40

SECTION – A

All the first **4** questions are **compulsory**. They carry **1** mark **each**.

1. Find the velocity of the particle with position vector $r(t) = (1+3t)\hat{i} + (3-4t)\hat{j} + (1+2t)\hat{k}$
2. Evaluate $\int_C (x+y)\,dy$ where C is the curve $x = 2t$, $y = 3t^2$, $0 \le t \le 1$.
3. Give the Newton-Raphson Formula to find a root of the equation.
4. Write the modified Euler Formula to solve an ordinary differential equation.

SECTION – B

Answer **any 7** questions from among the questions 5 to 13. These questions carry **2** marks **each**.

5. Find the unit vector normal to $z^2 = 4(x^2 + y^2)$ at P(1, 0, 2).
6. Find Curl $\vec{F}$ for $\vec{F} = e^{xy}\hat{i} - 2\cos y\hat{j} + \sin^2 z\hat{k}$.
7. Find the arc length of the curve x = 2cost, y = 2sint from t = 0 to $t = \frac{\pi}{2}$.
8. If C is a closed curve and $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then use Stoke's theorem to evaluate $\int_C \vec{r}.d\vec{r}$.
9. Evaluate $\int_C (x - 2y)\,dx + (3x - y)\,dy$ where C is the boundary of a unit square.
10. If S is the surface of the sphere $x^2 + y^2 + z^2 = 1$, use Gauss divergence theorem to evaluate $\iint_S (x\hat{i} + 2y\hat{j} + 3z\hat{k}).\hat{n}\,ds$.
11. Find a real root of the equation $x = e^{-x}$ that lies between 0 and 1 correct to two decimal places using bisection method.

P.T.O.

12. Use Trapezoidal rule to evaluate $\int_1^2 \frac{dx}{x}$ correct to 3 decimal places. (Take h = 0.25)

13. If $y_1 = 4$, $y_3 = 12$, $y_4 = 19$ and $y_x = 7$, find x.

SECTION – C

Answer **any 4** questions from among the questions 14 to 19. These questions carry **3** marks **each**.

14. Find the constants a, b, c so that $\vec{F} = (axy + bz^3)\hat{i} + (3x^2 - cz)\hat{j} + (3xz^2 - y)\hat{k}$ may be irrotational.

15. Show that $\int_{(0,0)}^{(3,2)} 3x^2 e^y \, dx + x^3 e^y dy$ is independent of path. Hence evaluate the integral.

16. Find a real root of the equation $x^3 - 2x - 5 = 0$ by using the method of false position correct to 3 decimal places.

17. Evaluate $\int_0^2 xe^x \, dx$ using Simpson's 1/3rd rule with 8 subintervals.

18. Solve the equation $y' = x + y^2$, subject to the condition y = 1, when x = 0 using Picard's method.

19. From the Taylor series of y(x), find y(0.1) correct to four decimal places if y(x) satisfies $y' = x - y^2$ and y(0) = 1.

SECTION – D

Answer **any 2** questions from among the questions 20 to 23. These questions carry **5** marks **each**.

20. Find $\vec{v} \cdot \left[\left(\text{curl } \vec{u}\right) \times \vec{v}\right]$ if $\vec{u} = y^2\hat{i} + (y^2 - x^2)\hat{j} + 2z^2\hat{k}, \vec{v} = 4z\hat{i} + 2y\hat{j} + (x - z)\hat{k}$.

21. Evaluate the surface integral $\iint_\sigma f(x, y, z) \, ds$ where f(x, y, z) = xy and σ is the portion of the plane x + y + z = 2 lying in the first octant.

22. Using Newton's interpolation formula, find y(2), given y(1) = 24, y(3) = 120, y(5) = 336 and y(7) = 720.

23. Using Runge-Kutta method of fourth order, solve the initial value problem $\frac{dy}{dx} = -2xy^2$, y(0) = 1 with h = 0.02 in the interval [0, 0.02].
