IV Semester B.Sc. Degree (CBCSS-Reg./Sup./Imp.) Examination, April 2020
(2014 Admn. Onwards)
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. Write the parametric representation of the circle $x^2 + y^2 = 4$.

2. Evaluate $\int_c x^2 dy + y^2 dx$ where C is the path $y = x$ from $(0, 0)$ to $(1, 1)$.

3. Give the Newton – Raphson Formula to find a root of the equation.

4. Write the general formula to find the numerical solutions of ordinary differential equations using Euler's method. **(4×1=4)**

SECTION – B

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

5. Find the gradient of $f(x, y, z) = ye^{xz} + z^3$ at $(0, 2, 3)$.

6. Find div curl $\vec{F}$, where $\vec{F} = xz^3 \hat{i} - 2x^2 yz \hat{j} + 2yz^4 \hat{k}$.

7. Find the arc length of the curve $\vec{r}(t) = a\cos t \hat{i} + a\sin t \hat{j}$ from $t = 0$ to $t = \pi$.

8. Evaluate by Stoke's theorem $\int_c yz dx + zx dy + xy dz$, where c is the curve $x^2 + y^2 = 1$.

9. Evaluate $\int_c (x - 2y)dx + (3x - y)dy$ where c is a unit square.

10. If S is a closed surface enclosing a volume 3 cubic unit and if
$\vec{F} = x\hat{i} + 2y\hat{j} + 3z\hat{k}$, then evaluate $\iint\limits_{s} \vec{F}.\hat{n}\,ds$.

11. Find a real root of the equation $f(x) = x^3 - x - 1 = 0$ that lies between 1 and 1.5 using bisection method correct to 2 decimal places.

12. Find a Lagranges polynomial for the following data : $y(1) = 1$ $y(3) = 27$, $y(4) = 64$.

13. Use trapezoidal rule to evaluate $\int\limits_{0}^{2} e^{x^2}\,dx$ by taking the number of intervals as 10. $(7\times2=14)$

SECTION – C

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

14. Find the potential function for
$\vec{F} = (6xy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (3xz^2 - y)\hat{k}$.

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

16. Using Regula Falsi method find a root of the equation $2x = \log_{10}x + 7$ that lies between 3 and 4, correct to 3 decimal places.

17. Compute $\int\limits_{0}^{1} \frac{1}{1+x^2}\,dx$ using Simpson's $\frac{1}{3}^{rd}$ rule with step size $h = 0.25$.

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

19. Use Euler method with $h = 0.025$ to compute the value of $y(0.1)$ for $y^1 = x - y^2$, $y(0) = 1$.
$(4\times3=12)$

SECTION – D

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

20. Find a unit vector in the direction along which the function $f(x, y) = 4x^3y$ is increasing rapidly at (−1, 1).

21. Evaluate the surface integral $\iint_s \vec{F}.\hat{n}\,ds$ where $\vec{F} = [x^2, 0, 3y^2]$ and S is the portion of the plane $x + y + z = 1$ in the first octant.

22. Use Newtons interpolation formula to estimate the value of sin8° from the following data :

θ	5	10	15	20	25	30
sinθ	0.0871	0.1736	0.2588	0.3420	0.4226	0.5

23. Use Runge-Kutta method of order four to find y(0.1) and y(0.2) correct to four decimal places, given $\dfrac{dy}{dx} = y - x$ where y(0) = 2. **(2×5=10)**