K18U 1000

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.) Examination, May 2018
(2014 Admn. Onwards)
COMPLEMENTARY COURSE IN MATHEMATICS
4C04 MAT-PH : Mathematics for Physics and Electronics – IV

Time : 3 Hours Max. Marks : 40

Instruction : *Use of Non programmable scientific calculator may be permitted.*

SECTION – A

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

1. Find div $\vec{r}, \vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$.

2. State Stoke's theorem.

3. Define backward difference operator.

4. Give the iteration formula for modified Euler 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 arclength of circle of radius a.

6. Find the directional derivative of $F(x, y) = e^{xy}$ at (–2, 0) in the direction of the unit vector that makes an angle of $\frac{\pi}{3}$ with the positive X-axis.

7. Show that curl $(\nabla\phi) = 0$, where ϕ is a scalar function in x, y and z.

P.T.O.

8. Evaluate $\int_C 2xydx + (x^2 + y^2)dy$ along the circular arc C given by $x = \cos t$, $y = \sin t$

$0 \le t \le \frac{\pi}{2}$.

9. Using Green's theorem, evaluate $\int_C x^2ydx + xdy$ along the triangular path with vertices (0, 0) (1, 0) and (1, 2).

10. Find the outward flux of the vector field $F(x, y, z) = z\hat{k}$ across the sphere $x^2 + y^2 + z^2 = a^2$.

11. Show that $E = 1 + \Delta$.

12. Using Taylor series, solve $y' = x - y^2$, $y(0) = 1$. Also find y(0.1) correct to 4 decimal places.

13. Use Euler's method with h = 0.1, find y(1.1). $\frac{dy}{dx} - \sqrt{xy} = 2$, $y(1) = 1$. **(7×2=14)**

SECTION – C

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

14. If $F = f(x, y, z)$ is a differentiable vector fields and $\phi = \phi(x, y, z)$ is a scalar field. Then prove that curl $(\phi F) = \nabla\phi \times F + \phi$ Curl F.

15. Show that the differential form under the integral sign of

$I = \int_C 2xyz^2dx + (x^2z^2 + z\cos yz)dy + (2x^2yz + y\cos yz)dz$ is exact and find the value of I from A(0, 0, 1) to $B\left(1, \frac{\pi}{4}, 2\right)$.

16. Find the real root of the equation $x^3 - x - 1 = 0$ by bisection method.

17. Find the cubic polynomial which takes the following values y(0) = 1, y(1) = 0, y(2) = 1, y(3) = 10.

18. Find a formula for $\frac{dy}{dx}$ using Newton's forward formula.

19. $\frac{dy}{dx}=\frac{x^2}{y^2+1}$ with initial condition $y=0$ when $x=0$. Use Picard's method to obtain y for $x = 0.25$.

(4×3=12)

SECTION – D

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

20. Show that $f(x,y,z)=\frac{c}{(x^2+y^2+z^2)^{3/2}}(x\hat{i}+y\hat{j}+z\hat{k})$ is solenoidal.

21. Verify Gauss divergence theorem for $f(x, y, z) = 2x\hat{i}+3y\hat{j}+z^2\hat{k}$ across the unit cube.

22. Calculate the approximate value of $\int_0^{\pi/2} \sin x\,dx$ by Simpson's $\frac{1}{3}^{rd}$ rule.

23. Use Runge-Kutta method, solve $\frac{dy}{dx}=1+y^2$, $y=0$ when $x=0$. Find $y(0.2), y(0.4)$.

(2×5=10)
