B.SC. MATHEMATICS
MODEL QUESTION PAPER PATTERN

VECTOR ANALYSIS

Time: 3 Hours **Marks: 75**

Section – A

Answer All Questions

1. If Ø (x, y, z) = $x^2 y + y^2 x + z^2$ then find ∇Ø at (1,1,1)
2. Find the unit normal to the Surface $xyz^2 = 1$ at (1,1,-1)
3. Define irrotational Vector.
4. Find the Value $\nabla . \bar{r}$
5. Prove that $\nabla.(Ø\ \bar{u}) = \nabla Ø.\ \bar{u} + Ø\ (\nabla.\bar{u})$
6. Find the Value of $\nabla.(r\ \bar{r})$
7. Define line Integral of a vector print Function
8. Show that $\int_C \nabla Ø.dr=0$ for any closed Curve C.
9. State Stoke's Theorem
10. Prove that $\int_c \bar{r}\ .\bar{dr}=0$

Section – B

Answer All Questions

11. a. Prove that i) $\nabla r^n = nr^{n-2}\ \bar{r}$ ii) $\nabla f(r) \times \bar{r} = 0$.

Or

b. Find the directional derivative of Ø(x,y,z) = $x^3 + y^3 + z^3$ at (1,-1,2) in the Direction of the Vector i+2j+k and find the Maximum directional derivative of the function.

12. a. Provethat

$$\nabla \circ \left(\frac{f(r)}{r} \bar{r} \right)$$

Or

b. A field is of the form $\overline{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$
Show that $\overline{F}$ is conservative field and find Ø
such h that $\overline{F} = \nabla$ Ø

13. a. Prove that $\nabla \cdot (\nabla \times \overline{F}) = 0$

Or

b. Show that $\nabla^4 (e^r) = e^r + \frac{4}{r} e^r$.

14. a. Evaluate $\int_c F.dr$ Where $\overline{F} = xy\bar{i} + yz^2\bar{j} + y^2 z\bar{k}$ from (0,0,0) to (1,1,1)
along the curve $x=t^2$, $y=t^3$, $z=t^4$.

Or

b. Evaluate $\iint F.nds$ Where $\overline{F} = Z\bar{i} + x\bar{j} + 3y^2 z\bar{k}$ and S is the Surface of the Cylinder $x^2 + y^2 = 16$ included in the first octanct between z=0 and z=5.

15. a, If $\bar{n}$ is a unit normal drawn normal to any closed surface area S
show that

$$\iint_s \bar{r}.\bar{n}/r^2 = \iiint dv/r^2$$

Or

b. Find the area between the parabola $y^4 = 4x$ and $x^2 = 4y$.

Section – C

16. Find the equation of the tangent plave and normal lime to the surface $xz^2 + x^2 y = z-1$ at (1,-3,2)

17. Find a,b,c such that $\overline{F} = (x+2y+az)\bar{I} + (bx-3y-z)\bar{j} + (4x+cy+2z)\bar{k}$ is Irrotational, for theses values of a,b,c find its scalar potential function Ø

18. Prove that curlcurl $\bar{f}$ = grad (div$\bar{F}$) - $\nabla^2 \bar{F}$

19. Evaluate $\int_c \bar{F} x d\bar{r}$ along the curve x=cost, y=2sint, z=cost form t=0 to t =$\pi/2$; given $\bar{F} = 2x\bar{i}+y\bar{j}+z\bar{k}$.

20. Verify Gauss Divergence theorem for $F = x^2 i+y^2\bar{j}+z^2\bar{k}$.taken over the cube bounded by the planes x=0. x=1, y=0,y=1,z=0 and z=1

COMPLEX ANALYSIS

Time: 3 Hours **Marks: 75**

Section – A

Answers All Questions **(10x2) = 20**

1. Define limit of a function f(Z)
2. Prove that u= $x^3 – 3xy^2$ is a harmonic function
3. Define Bilinear Transformation
4. Find the fixed point for the transformation w = z/z-2
5. Define contour integral
6. Prove that $\int_c dz/z\text{-}a = 2\pi I$ where C is $|z-a| = re^{i\Phi}$
7. Define Taylor Series
8. Expand $z\text{-}1/z^2$ about z=1 in Laurent's Serious
9. Find the order of the pole z=0 for f(Z) = $\text{Sin}Z/z^4$
10. Find the residue of the function f(Z) = $1/z^3\,(z+4)$ at the point z=0.

Section – B

Answer all Questions

11. a, Show that the functions

$$f(Z) = \begin{cases} \text{Re}\, z/|Z| , & z\neq 0 \\ =0 , & z=0 \end{cases} \quad \text{Is not continues}$$

and not different able at the oligin.

Or

b. Find the analytic Function f(z) if its real part is $u(x,y) = e^x\,(x\cos y - y\sin y)$

12. a. Find the bilinear transformation which maps the z points –i, 0, i into the w points -1, i,1

Or

b. Prove that a biliner transformation transform a circle into circle and inverse points into inverse points

13. a. State and prove Cauchy's Integral formula
b. Verify cauchy's integral theorem for $f(Z)=z^2$ along the unit circle.

14. a. State and prove fundamental theorem of algebra,

Or

b. Show that
$f(z) = e^{(z-1/z)} = {}^{\infty}\sum_{n=-\infty} a_n z^n$ where $a_n = 1/2\pi\ {}^{2\pi}\int_0 \cos(n\text{Ø}- c\sin\text{Ø})d\text{Ø}$

15. a. State and prove residue theorem

or

b. Evaluate $\int_0^{2\Pi}$ $_d$ dØ/2+cosØ

Section – C **(3x10=30)**

Answer any three.

16. State and prove the necessary and sufficient condition for the function f(z) to be analytic.
17. Find the bilinear transformation which map Rez ≥ 0 into |w| ≤ 1.
18. State and prove Cauchy's integral theorem
19. State and prove Laurent's theorem.
20. Evaluate ${}^{\infty}\int_0 \cos mx/x^2 + a^2\, dx$, m>0, a>0.

Skill Based Elective Course VI

C Programming – Praticals

Time: 3 Hours

Marks :60
Record :15
Practical :45

Part – A **(2x15=30)**

Answer any two

1. Write a program to find the largest of given three numbers
2. Write a program to generate the Fibonacci Sequence
3. Write a program to find mean and standard deviation
4. Write a Program to find the Simple and compound interest

Part – B **(1x15=15)**

1. Write a Program to find the roots of the equation by bijection method
2. Write a Program to solve the first order differential equation by Euler's method

Allied Mathematics – Practical's

Time: 3 Hours **Marks: 60**

Answer any three (3x15=45)

1.a. Find the Characteristic equation of the matrix

$$A= \begin{bmatrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{bmatrix}$$

b. Verify cayley Hamilton Theorem for the Given matrix

$$A= \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$$

2.a. Find the n^{th} derivative of $1/ax+b$

b. If $y = \sin^{-1} x$, Prove that $(1-x^2)\, y_2 - xy_1 = 0$ and $(1-x^2)\, y_{n+2} - (2n+1)\, xy_{n+1} - n^2 y_n=0$

3.a. Verify Euler's Theorem for the given function

$U= \sin^{-1} (x^3 + y^3 / \sqrt{x}+\sqrt{y})$

b. Verify that $\delta^2 u/\delta x\delta y = \delta^2 u/\delta x\delta y$, given that $u= \log (x^2 + y^2 /xy)$

4.a. Compute the divergent and curl of the vector $x^2\bar{i}+y^2\,\bar{j}+ z^2\bar{k}$ at (1,2-3)

b. If $\bar{V}= \bar{w}\times\bar{r}$ where $\bar{w}$ is a constants vector, prove that $\bar{W} = ½$ cure $\bar{V}$ ($\bar{r}$ is the Position vector)

5.a. Using Laplace Transform, solve

$$d^2 y/dt^2 + 6dy/dt + 5y = e^{-2t}$$

Given that y=0, dy/dt =1 When t=0