M.Sc.(Physics) (NEP Pattern) Semester-I

NEP-236-1 / 01MSCPH4.1 - (DSE 4.1) Paper-IV : Complex Analysis and Numerical Methods

P. Pages : 3 **GUG/W/23/15137**

* 8 0 6 4 *

Time : Three Hours Max. Marks : 80

Either

1. a) Show that the following equations are analytic and find their derivatives? **8**

i) e^z and ii) sinhz

b) Perform the indicated operation and write the answers in standard form: **8**

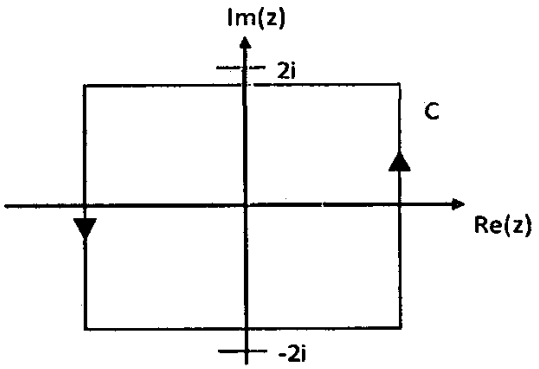
i) $(4-5i)\,(12+11i)$ ii) $8i\,(10+2i)$

iii) $(1+4i)-(-16+9i)$ and iv) $\dfrac{(7-i)}{(2+10i)}$

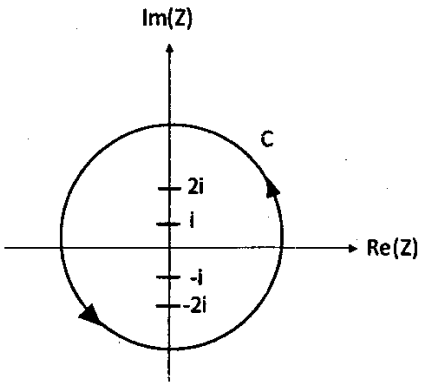
OR

e) If $x=\cos\theta+i\sin\theta,\ y=\cos\phi+i\sin\phi$, then prove that: $\dfrac{x-y}{x+y}=i\tan\left(\dfrac{\theta-\phi}{2}\right)$. **8**

f) i) Compute $\int_C \dfrac{\cos(z)dz}{z(z^2+0)}$ over the contour shown below: **4**



ii) Compute $\int_C \dfrac{z\,dz}{(z^2+4)}$ over the curve C shown below: **4**



Either

2. a) Using Residue theorem evaluate: **8**

i) $\int_C \frac{1}{\sin h\, z}$ where 'C' is circle |z| = 4 and

ii) $\frac{1}{2\pi i}\oint_C \frac{e^{zt}dz}{z^2(z^2+2z+2)}$ where, 'C' is the circle |z| = 3.

b) Evaluate : $\int_C \frac{z-1}{(z+1)^2(z-2)}\,dz$ where, C is $|z-i|=2$. **8**

OR

e) Explain pole of order 'm'? Further find the poles of following functions: **8**

i) $f(z)=\sin\left(\frac{1}{z-a}\right)$ and ii) $f(z)=\frac{\sin(z-a)}{(z-a)^4}$

f) Find the pole as well as Residue of the following functions at each pole of: **8**

i) $\frac{z^2}{(z-1)(z-2)^2}$ and ii) $\frac{1-e^{2z}}{z^4}$

Either

3. a) Find the root of the equation $x^3-x-4=0$ using false position method corrected to three decimal places. **8**

b) Find the root of the equation $x^3-4x-9=0$ using Bisection Method corrected to four significant places. **8**

OR

e) From the following table of values find y(2.7) and y(3.9) using Newtons Forward difference Interpolation formula. **8**

x	2.5	3.0	3.5	4.0	4.5
y(x)	9.75	12.45	15.70	19.52	23.75

f) Define finite difference. Explain the different types of finite difference. **8**

Either

4. a) Evaluate f(9) using Newtons Divided difference Formula. **8**

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpsons $\frac{1}{3}$rd and $\frac{3}{8}$th rule divided into 6 interval points. **8**

OR

e) Find the solution of the differential equation: $\frac{dy}{dx} = \sin(x+y) - e^x$, with y(0) = 4 and h = 0.1 using Eulers method. **8**

f) Find y(1) using Runge-Kutta method of order two by solving the equation: $\frac{dy}{dx} = -2xy^2$, y0) with step size 0.1. **8**

5. Answer all the followings.

a) If n is real, then show that $r^n(\cos n\theta + i\sin n\theta)$ is analytic. **4**

b) Use Cauchy Integral formula to evaluate: $\int_C \frac{z\,dz}{(z^2-3z+2)}$ where Z is the circle and $|z-2| = \frac{1}{2}$. **4**

c) Find the real root of the equation $x^3 + x^2 - 1 = 0$ on the interval (0, 1) corrected up to three decimal places using Iteration Method. **4**

d) Given the table of values, find x(0.390) using Lagrange's Interpolation formula corrected up to five significant digits. **4**

x	20	25	30	35
f(x)	0.342	0.423	0.500	0.650

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