M.Sc. (Physics) (CBCS Pattern) First Semester

PSCPHYT02 - Core-II - Complex Analysis and Numerical Methods Paper-II

P. Pages : 2 **GUG/W/18/11180**

Time : Three Hours * 3 2 8 3 * Max. Marks : 80

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1. Either

a) Find the modulus and argument of the following complex numbers: **8**

i) $\frac{1+2i}{1-(1-i)^2}$ ii) $\frac{(1+i)^2}{1-i}$

b) The centre of a regular hexagon is at the origin and one vertex is given by $\sqrt{3}+i$ on the Argand diagram. Find the complex number represented by the other vertices. **8**

OR

e) State and prove Cauchy integral formula. **8**

f) Test the analyticity of the function w = sin z and hence derive that : $\frac{d}{dz}(\sin z)=\cos z$ **8**

2. Either

a) Determine the poles and the residue at each pole of the function: **8**

i) $f(z)=\frac{z^2}{(z-1)^2(z+2)}$ ii) $f(z)=\cot z$

b) If f (z) is of the form $f(z)=\frac{\phi(z)}{\Psi(z)}$ **8**

Where, $\Psi(a)=0$ but $\phi(a)\neq 0$

then prove that Res (at z = a) = $\frac{\phi(a)}{\Psi'(a)}$

OR

e) How one can find the residue – **8**

i) At simple pole ii) At pole of order n

f) Evaluate the following integral using residue theorem: **8**

i) $\int_c \frac{1+z}{z(2-z)}\,dz$, Where C is the circle $|z|=1$

ii) $\int_c \frac{z^2 e^{zt}}{z^2+1}\,dz$, Where $C:|Z|=2$

3. Either

a) Find the real root of the following equation, correct to three decimal places, using Newton – Raphson method: **8**

$$x^3 - 2x - 5 = 0$$

b) Obtain the secant general formula for finding the root of the equation. **8**

OR

e) The tables of values are: **8**

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

Using Newton's interpolation formula,
Find $y(3.58)$ and $y(4.25)$

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

4. Either

a) Explain Simpson's $\frac{1}{3}^{rd}$ rule and obtain the formula for it. **8**

b) Obtain the general formula for trapezoidal rule and show it graphically. **8**

OR

e) Using Euler's method, Find an approximate value of y corresponding to $x = 2$, given that $\frac{dy}{dx} = x + 2y$ and $y = 1$ when $x = 1$. **8**

f) Deduce the Formula for linear least squares. **8**

5. Answer all the following:

a) Define complex number. Show that the sum and product of complex number and its conjugate complex are both real. **4**

b) Explain branch points. **4**

c) Explain Bisection method. **4**

d) Derive the formula for Lagrange's interpolation formula. **4**

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