The Bodwad Sarvajanik Co-Op. Education Society Ltd., Bodwad

Arts, Commerce and Science College Bodwad

Question Bank

Class:-SYBSc **Sem:-IV**

Subject: Complex Variables **Paper Name:- MTH 401**

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1) $if\ z = \cos 3\theta + isin\ 3\theta\ then\ z^5 = \cdots$
   a) $\boldsymbol{\cos 15\theta + isin\ 15\theta}$
   b) $\cos 15\theta - isin\ 15\theta$
   c) $\cos 8\theta + isin\ 8\theta$
   d) $\cos 8\theta - isin\ 8\theta$ ANS: A

2) A Complex number whose real part is zero, is called as ….
   a) Real number
   b) Complex number
   c) Purely imaginary number
   d) Purely real number ANS: C

3) Two complex numbers $x_1 = iy_1 + z_2\ and\ x_2 = iy_2 + x_2 + iy_2$ are equal if
   a) $x_1 \leq x_2$
   b) $\boldsymbol{x_1 = x_2\ and\ y_1 = y_2}$
   c) $x_1 = x_2$
   d) $None\ of\ these$ ANS: B

4) A number of the type $z = x + iy$ is called as
   a) Real number
   b) Complex number

c) Integer
d) Irrational number ANS: B

5) In a complex number $z - 7 - 3i$ the imaginary part of z is …
a) -3
b) 3i
c) 7
d) 7 ANS: A

6) The conjugate of complex number $1 + i\ is$
a) $\boldsymbol{1 - i}$
b) $1 + i$
c) 0
d) None of these ANS: A

7) $If\ z = 1 - \sqrt{3i}\ then\ modulus\ of\ z\ is\ equal\ to$
a) 1
b) 2
c) 3
d) 4 ANS: B

8) $If\ z = i + \ i^2 + i^3\ then\ real\ part\ of\ z\ is$
a) -1
b) 0
c) 3
d) None of these ANS: A

9) $If\ z\ is\ complex\ number\ then\ \frac{e^z - e^{-z}}{2} = \cdots$..
a) $\boldsymbol{sinhz}$
b) $isinhz$
c) $tanhz$
d) None of these ANS: A

10) $If\ x = cos\theta + isin\theta\ then\ x - \frac{1}{x} = \cdots.$

a) $\boldsymbol{2isin\theta}$

b) $2cos\theta$

c) 2

d) 2 ANS: A

11) The value of $\lim_{z \to i} \frac{z^5 - i}{z+1}\ is$

a) 1

b) 5

c) 0

d) 4 ANS: C

12) The Value of $\lim_{z \to i} \frac{z^5 - i}{z+1}\ is$

a) 1

b) 5

c) 4

d) **0** ANS: D

13) $If\ z = x + iy$ is any complex number then value of $|z^2| =$

a) $x^2 - y^2$

b) $\boldsymbol{x^2 + y^2}$

c) $A\ and\ B$

d) None of these ANS: B

14) The value of $i + \ i^2 + i^3 + i^4\ is$

a) -1

b) i

c) 1

d) **0** ANS: D

15) Modulus of complex number $i^7 + i^B$

a) $\sqrt{\mathbf{2}}$
b) $-\sqrt{2}$
c) 1
d) None of these ANS: A

16) If $z = 1 + i\ then\ \arg(z) = \cdots.$
a) $\boldsymbol{\frac{\pi}{4}}$
b) $\frac{\pi}{2}$
c) $\frac{\pi}{3}$
d) None of these ANS: A

17) For any two complex numbers $z_1\ and\ z_2$
a) $\boldsymbol{|z_1 - z_2| \geq\ |z_1 - z_2|}$
b) $|z_1 - z_2| = |z_1 - z_2|$
c) $|z_1 - z_2| > |z_1 - z_2|$
d) $None\ of\ these$ ANS: A

18) Let $\emptyset = \emptyset\ (x, y)$be a function of two real variables $x\ and\ y$ then the Laplace differential equation is given by
a) $\frac{a^2\emptyset}{ax^2} - \ \frac{a^z\emptyset}{ax^2} = 0$
b) $\frac{a^2\emptyset}{ax^2} +\ 3\frac{a^z\emptyset}{ax^2} = 0$
c) $\frac{a^2\emptyset}{ax^2} -\ 2\frac{a^z\emptyset}{ax^2} = 0$
d) $\boldsymbol{\frac{a^2\emptyset}{ax^2} + \ \frac{a^z\emptyset}{ax^2} = 0}$ ANS: D

19) The Value of $i +\ i^2 + i^3 + i^4\ is$
a) 0
b) i
c) 1
d) 4 ANS: A

20) If $f\ (z) is\ analytic\ function\ with\ constant\ modulus, then$
a) $f(z) is\ zero$
b) $f(z) is\ non - zero$
c) $\boldsymbol{f(z) is\ constant}$
d) None of these ANS: C

21) Let u and v are real valued function of variables x and y, then Cauchy-Riemann equations are represented as

a)$u_x = v_y\ and\ u_y = v_x$
b) $u_x = -v_y\ and\ u_y = -v_x$
c) $\boldsymbol{u_x = v_y\ and\ u_y = -v_x}$
d) $u_x = v_y\ and\ u_y = 2v_x$ ANS: C

22) If $z = c + iy$ is any complex number and $a > 0$ be any real number then the equation $|z| = a$ represents
a) Circle
b) Halfcircle
c) Parabola
d) None of these ANS: A

23) If $z_1\ and\ z_2\ are\ any\ two\ complex\ number\ then$ $\arg\left(\frac{z_1}{z_1}\right) =..$
a) $\arg(z_1) + \arg(z_2)$
b) $\boldsymbol{\arg(z_1) - \arg(z_2)}$
c) $\frac{\arg z_1}{\arg z_2}$
d) None of these ANS: B

24) If n is the rational number then $(\cos\theta + isin\ \theta\ ) is$
a) $(\cos\theta - isinn\ \theta\ )$
b) $\boldsymbol{(\cos n\,\theta + isinn\ \theta\ )}$
c) A and B
d) None of these ANS: B

25) Product of two roots of unity is a

a) Root of unity

b) 1

c) -1

d) None of these ANS: A

26) $If\ \omega^3 = 1\ then\ 1 + \omega + \omega^2 = \cdots$

a) N

b) 1

c) 0

d) -1 ANS: C

27) The sum of all the $n - n^{th}$ roots of unity is….

a) 1

b) 0

c) 2

d) None of these ANS: B

28) $If\ i = \sqrt{-1}\ then\ e^{ix} - e^{-ix} is$

a) 2isinx

b) 2cosx

c) 2icosx

d) None of these ANS: A

29) If z is complex number then $e^z - e^{-z} =$

a) 2 coshz

b) 2sinhz

c) 2isinz

d) None of these ANS: A

30) If z is any complex number then sin)iz) =…

a) Tanhz

b) Coshz

c) Sinhz

d) None of these ANS: C

31) If $z = x + iy \; then \; cosz =$

a) Cosxcoshy + isinxsinhy

b) Cosxcoshy – isinxsinhy

c) A and B

d) None of these ANS: B

32) If $i \; = \; \sqrt{-1} \; then \; cosix \; is$

a) Icoshx

b) Coshx

c) A and B

d) None of these ANS: B

33) If $lim \, z \to z \, f(z) exist \; then \; it \; is$

a) Unique

b) Not unique

c) Finite

d) None of these ANS: A

34) A function which is differential at every point of region is said to be … in that region.

a) Analytic

b) Not analytic

c) Harmonic

d) None of these ANS: A

35) If $\lim_{z \to a} f(z) = u + iv \; then \; \lim_{z \to a} f(z) =$

a) $u + iv$

b) $\boldsymbol{u - iv}$

c) A and B
d) None of these ANS: B

36) $Let\ u\ and\ v\ are\ real\ valued\ function\ of\ variables\ x, y\ and\ f(z) = u + iv\ is\ analytic\ function. If\ u = x^2 + y\ then\ find\ value\ of\ v_y$
A) 2y
B) 2x
C) x
D) y ANS: B

37) $Let\ u\ and\ v\ are\ real\ valued\ function\ of\ variables\ x, y\ and\ f(z) = u + iv\ is\ analytic\ function. If\ u = x^2 + y^2\ then\ find\ value\ of\ u_x$
A) 2y
B) 2x
C) -2x
D) -2y ANS: B

38) If f(z) is continuous at $z_0\ then\ it\ is\ not\ differentiable\ at\ z_0$
a) True Statement
b) False Statement
c) A and B
d) None of these ANS: A

39) If f is analytic at z_0 then is not differential at z_0
a) False Statement
b) True statement
c) A and B
d) None of these ANS: A

40) If $f(z) = u + iv\ is\ function\ of\ complex\ variable\ the\ Cauchy - Riemann\ equations\ are$

a) $u_x = -v_y \; and \; u_y = v_x$

b) $u_y = v_x$

c) $\boldsymbol{u_x = -v_y \; and \; u_y = -v_x}$

d) $None \; of \; these$ ANS: C

41) The function f(z) = z not is analytic function.

a) May of may not true

b) True Statement

c) False Statement

d) None of these ANS: B

42) The $\lim_{z \to i} \frac{z+i}{z^3} = \cdots$

a) -2

b) 2

c) i

d) –i ANS: A

43) $The \; function \; f(z) \; = e^z \; is$

a) Analytic for all Z

b) Not analytic

c) Not continuous

d) None of these ANS: A

44) If $\emptyset = \emptyset \; (x, y) then \; \frac{a^2 \emptyset}{a x^2} + \frac{a^2 \emptyset}{a y^2} = 0 \; is \; called$

A) Laplace differential equation

B) C – R equation

C) C – Linear

D) None of these ANS: A

45) Example of harmonic function is f(z) =

a) $\boldsymbol{e^z}$

b) z

c) Conjugate of z
d) None of these ANS: A

46) $If\ f(z) = u + iv\ i$s analytic function of Z, then f(z) not is independent of Z
a) True
b) False
c) A and B
d) None of these ANS: B

47) $If\ u = x, then\ an\ analytic\ function\ f(z) = u + iv\ is.$
a) $\boldsymbol{x + iy + c}$
b) $X + iy$
c) $X - iy$
d) None of these ANS: A

48) If $\emptyset\ (x, y) = x + y\ then\ \frac{a^2\emptyset}{ax^2} - \frac{a^z\emptyset}{ay^2} = 0$
a) True Statement
b) No
c) A and B
d) None of these ANS: A

49) The imaginary part of e^z is
a) e^z Cosy
b) $\boldsymbol{e^z}$ siny
c) e^z cosx
d) None of these ANS: B

50) If real part u of analytic function $f(z) = u + iv$ is given then $f(z) =$
a) $u_x(x, y) + iu_y(x, y)$
b) $\boldsymbol{u_x(x, y) - iu_y(x, y)}$

c) $u_x(x,y) - u_y(x,y)$
d) None of these ANS: B

51) If c is a st. line segment from 0 to 1 then $\int_c x^2 dx =$
a) 1
b) 0
c) $\frac{1}{3}$
d) -1 ANS: C

52) The line segment z=0 to z=1 +1 joins points
a) (0,0) and (1,-1)
b) (0,0) and (1,1)
c) (0,0) and (1,1)
d) None of these ANS: A

53) If f(z) is an analytic function in and on closed contour C then $\int_c f(z)dz \;\; is$
a) Zero
b) Non zero
c) One
d) Two ANS: A

54) If C : $|z| = 1$ is circle traced in anticlockwise direction then $\int_c zdz =$
a) 10
b) 0
c) -1
d) None of these ANS: B

55) The region of validity for Taylor's series about Z = 0 of f(z) = $e^z \; is \ldots\ldots$

a) $|z| = 0$
b) $|z| < 1$
c) $|z| < \infty$
d) None of these ANS: B

56) If $|z| < 1$ $then\ 1 - z + z^2 - z^3 + \cdots is\ expansion\ of$ ..
a) Sinz
b) $\frac{1}{1+z}$
c) $\frac{1}{1-z}$
d) None of these ANS: B

57) If f(z) be analytic in simply connected region bounded by closed curve, C, then $\int_c f(z)dz =$
a) -1
b) 1
c) 0
d) None of these ANS: C

58) If f(z) = $\frac{z^2+1}{(z-3)(z-5)}$ $then\ \int_c f(z)dz\ is\ \ldots \ldots.\ where\ C\ is\ |Z| = 2$
a) 0
b) 2
c) 3
d) 1 ANS: A

59) If f(z) = z+1 then $\int_c f(z)dz = \cdots \ldots where\ C: |z| = 1$
a) 0
b) 1
c) -1
d) None of these ANS: A

60) Let C : $|z-a| = 2, the\ value\ of\ integral\ \int_c \frac{1}{z-a}dz =$

a) $2\pi i$

b) 2π

c) 2

d) 0 ANS: A

61) Caushy's integral formula for f(a) =

a) $\frac{1}{2\pi i}\int_c \frac{f(z)}{z-a}dz$

b) $\frac{1}{2\pi i}\int_c \frac{f(z)}{z}$

c) $\frac{1}{2\pi i}\int_c \frac{f(a)}{z-a}dz$

d) All of the above ANS: A

62) The Value of $\int_{|z|=1} e^z dz = \cdots$

a) -1

b) 1

c) 0

d) None of these ANS: C

63) The Cauchy's Integral formula for $f^n(a) =$

a) $\frac{n!}{2\pi!}\int_c \frac{f(z)}{(z-a)^{n+1}}dz, n\epsilon\ N$

b) $\frac{n!}{2\pi!}\int_c \frac{f(z)}{(z-a)^{n}}dz, n\epsilon\ N$

c) A and B

d) None of these ANS: A

64) The geometric series $1 + z + z^2 + z^3 + \cdots =$

a) $\frac{1}{1+z}, |z| < 1$

b) $\frac{1}{1-z}, |z| < 1$

c) A and B

d) None of thses ANS: B

65) The Series $1+\frac{z}{1!}+\frac{z^2}{2!}+\frac{z^3}{3!}+\cdots=\cdots,$

a) $\boldsymbol{e^z}$

b) e^{2z}

c) e^{3z}

d) 1 ANS: A

66) In Laurent's series, Coefficient $a_n=\cdots.$ (n=0,1,2,3..)

a) $\boldsymbol{\frac{n!}{2\pi!}\int_c \frac{f(z)}{(z-a)^{n+1}}}$

b) $\frac{n!}{2\pi!}\int_c \frac{f(z)}{(z-a)^{n}}$

c) $A\ and\ B$

d) None of these ANS: A

67) The series $1-\frac{z^2}{2!}+\frac{z^4}{4!}-\cdots..=\cdots$

a) Cosz

b) Sinz

c) Tanz

d) -1 ANS: A

68) The series $\frac{1}{z}+\frac{1}{1!}+\frac{z}{2!}+\cdots.$ is the Laurent^' s expansion of function $f(z)=$

a) $\boldsymbol{\frac{e^z}{z}}$

b) $\frac{e^z}{2z}$

c) 2

d) 0 ANS: A

69) $1+z+z^2+\cdots z^{n-1}=$

a) $\frac{1+z^n}{1+z}$

b) $\boldsymbol{\frac{1-z^n}{1-z}}$

c) $\frac{1+z^n}{1-z}$

d) None of these ANS: B

70) If function f of complex variable is not analytic at $z = a$, then the point $z = a \; is \; called$.

a) Singular point

b) Limit point

c) Boundary point

d) None of these ANS: A

71) The function f(z) = $e^{\left(\frac{1}{z}\right)}$ has essential singularity at Z =

a) 2

b) 1

c) -1

d) **0** ANS: D

72) A pole of order one is called

a) Simple pole

b) Double pole

c) Triple pole

d) None of these ANS: A

73) A pole of order two is called

a) Simple Pole

b) Double Pole

c) Triple Pole

d) None of these ANS: B

74) $If\ z = a\ is\ a\ simple\ pole\ of\ f\ (z)\ then\ the\ residue\ at\ pole\ z = a\ of\ f(z)\ is\ given\ by$

a) $\lim_{z \to a}(z - a^2)f(z)$

b) $\boldsymbol{\lim_{z \to a}(z - a)f(z)}$

c) A and B
d) None of these ANS: B

75) If f (z) = $\frac{1}{z(z-1)}$ $is\ function\ of\ complex\ variable\ then\ poles\ of\ f(z) are\ at$

a) 0,1
b) 0, 2
c) 0,5
d) None of these ANS:A

76) $If\ f(z) = \frac{1}{(z(z-1)^2)}$ is function of complex variable then doubles poles of $f\ (z) is\ at$

a) -1
b) 1
c) 0
d) None of these ANS: B

77) Residue of function f(z) = $\frac{1}{z}$ at pole z = 0 is

a) 1
b) 2
c) 2π
d) 0 ANS: A

78) If $f(z) = \frac{ze^z}{z-1}$ $then\ residue\ of\ f(z) at\ \ z = 1\ is$

a) e
b) e^2
c) 2
d) 0 ANS: A

79) If f is analytic inside and on closed contour C, Except at finite number of singular points $\sum R$ $d$enotes sum of residues at its poles inside C then $\int_c f(z)dz =$

a) $\boldsymbol{2\,\pi!\,\sum R}$

b) $\sum R$

c) $2\sum R$

d) $\pi\sum R$ ANS: A

80) The value of integral $\int_{|z|=2}\frac{dz}{z} = \cdots$.

a) $\boldsymbol{2\,\pi}$

b) $\pi!$

c) $\frac{2}{\pi}$

d) $\frac{1}{\pi}$ ANS: A

81) By Cauchy's integral formula, $\int_c \frac{f(z)}{((z-a)^2)}dz =$

a) $2\,\pi\,if\,(a)$

b) $\boldsymbol{2\,\pi\,if'(a)}$

c) $\frac{2\pi i}{2!}f''(a)$

d) $\frac{2\pi i}{2!}f^n(a)$ ANS: B

82) A zero of an analytic function f(z) is the value of z such that f(z) is equal to …

a) 1

b) 2

c) 0

d) 3 ANS: C

83) If f(z) = $\frac{z-2}{z^2(z-1)}$ $then\ the\ order\ of\ pole\ z = 0\ is$ …

a) 0

b) 1

c) 2
d) 3 ANS: C

84) The poles of f(z) = $\frac{e^z}{z^2+a^2}$ are
a) $\pm 2\, i$
b) $\pm 3\, i$
c) $\boldsymbol{\pm\, a\, i}$
d) $\pm 2\, a\, i$ ANS: C

85) If $|z| = 1, then\ 2\ cos\theta =$
A) $z - \frac{1}{z}$
B) $\boldsymbol{z + \frac{1}{z}}$
C) $A\ and\ B$
D) None of these ANS: B

86) If f (z) = $\frac{z^2}{(z-1)(z-2)(z-3)}$ $then\ poles\ of\ f(z) are$
a) Z = 1,2,3
b) Z = 4,2,3
c) Z = 1,4,3
d) Z = 4,5,3 ANS: A

87) The singular points of f(z) = $\frac{1}{(z-2)(z-3)}$ are ...
a) 2, 4
b) -2, - 3
c) 2, 5
d) **2, 3** ANS: D

88) The value of integral $\int_0^{\infty} \frac{dx}{x^2+1} =$
a) 3
b) $\boldsymbol{\frac{\pi}{2}}$

c) -1

d) 2 ANS: B

89) The real and imaginary part of an analytic function… Laplace differential equation.

a) Satisfy

b) Does not satisfy

c) May or may not be satisfy

d) None of these ANS: A

90) The simple poles of f (z) = $\frac{z^2-4}{z^2+5z+4}$ are

a) 1, 4

b) -1, 4

c) -1, -4

d) 2, 3 ANS: C

91) If $\lim_{z\to i}\frac{z^2+1}{z+i} = a\ then\ the\ value\ of\ a\ is$

a) i

b) 0

c) –i

d) 1 ANS: B

92) $If\ u\ =\ u\ (x, y)\ s$atisfy Laplace equation $u_{xx} + u_{yy} = 0$ then $u\ is\ called\ as$

a) Analytic

b) Non analytic

c) Harmonic

d) None of these ANS: C

93) The integral I = $\int_0^{2\pi}\frac{d\theta}{5+3cos\theta}$ $is\ evaluated\ by\ substitution$

a) 2

b) $z\ =\ e^{i\theta}$

c) $Z = e^{i\theta}$

d) $Z = 0$ ANS: B

94) The region of validity of $\frac{1}{1+z}$ for its Taylor series expansion about $z = 0$ *is*

A) $|\boldsymbol{z}| < \boldsymbol{1}$

B) $|z| > 1$

C) $|z| = 1$

D) None of these ANS: A

95) If the function f(z) is not analytic at the point z = a then such point is known as ….

a) Singular point

b) Non singular point

c) Analytic point

d) None of these ANS: A

96) $Let\ u\ and\ v\ are\ real\ valued\ function\ of\ variables\ x, y\ and\ f(z) = u + iv\ is\ analytic\ function. If\ v = 2x^3 + y^2\ then\ find\ value\ of\ u_y$

A) 6y

B) 6x

C) -6x

D) -6y ANS: C

97) An analytic function f(z) = u + iv be such that u and v must satisfy Laplace differential equation then u and v are …

a) Analytic

b) Non analytic

c) Harmonic

d) None of these ANS: C

98) If If $\lim_{z \to 1+i} \frac{z^4-4}{z^2+2i} = A\ then\ the\ value\ of\ A\ is$

a) $\boldsymbol{4i}$

b) 0

c) -4i

d) 1 ANS: A

99) $If\ f(z) = z + 1\ and\ C\ is\ unit\ circle\ |z| = 1\ then\ \int f(z)dz =$

a) 1

b) 0

c) -1

d) None of these ANS: B

100) Let f(z) = $\frac{p(z)}{Q(z)}$ $such\ that\ P\ (z) and\ Q\ (z)$are polynomials in z having no common factor $deg\ Q(z) - \ deg\ P\ (z) \geq 2, and\ Q\ (z) = 0$ has no real roots then $\int_{-\infty}^{\infty} f(z)dz =$

a) $\pi i \sum R^{+}$

b) $\boldsymbol{2\ \pi\ i\ \sum R^{+}}$

c) $A\ and\ B$

d) None of these ANS: B