AJKPSC 2019
For Lecturer, Assistant Professor, Subject Specialist (Mathematics)

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1. For $E \subset S$ and $\alpha \in E, \beta \in S$, then β is a lower bound of E if ...
   A. $\beta \leq \alpha, \forall \alpha \in E$
   B. $\alpha < \beta$
   C. $\alpha \neq \beta$
   D. $\alpha = \beta$

2. If $P \neq 1$ is a prime number, then $x^2 = P$ has solution of numbers.
   A. Rational
   B. Odd
   C. Natural
   D. Irrational

3. Every infinite sequence in a compact metric space X has a subsequence which:
   A. Diverges in X
   B. Converges in X
   C. bounded
   D. not bounded

4. Let $f : G \to Y$. If $c \in G$ and $\lambda \in Y$, then there exist:
   A. $f^{-1}(\lambda) = \frac{1}{f'(c)}$
   B. $f'(\lambda) = \frac{1}{f(c)}$
   C. $f'(c) = \frac{1}{f'(c)}$
   D. $f^{-1}(\lambda) = f'(c)$

5. If $x = r\cos\theta$ and $y = r\sin\theta$, then
   A. $(\frac{\partial x}{\partial r})_\theta = \cos\theta$
   B. $(\frac{\partial x}{\partial r})_\theta = \sin\theta$
   C. $(\frac{\partial x}{\partial r})_\theta = \frac{1}{\sec\theta}$
   D. Both A and C

6. $f(x) = \sqrt{x}$ on $[0, \infty)$ is:
   A. continuous
   B. zero
   C. discontinuous
   D. -1

7. A function f in Cauchy criterion is Riemann integrable if:
   - A. $\int_a^b x dx = \int_{\overline{a}}^b f dx$
   - B. $\int_a^b x dx \geq \int_{\overline{a}}^{\underline{b}} f dx$
   - C. $\int_a^{\underline{b}} f dx = \int_a^b f dx = \int_{\overline{a}}^b f dx$
   - D. None of these
8. If f is monotonic on $[a, b]$, then it is:
   - A. differentiable
   - B. not integerable
   - C. integrable
   - D. both A and C
9. $\int_0^\infty x^{\alpha-1} e^{-x} dx$ converges if:
   - A. $\alpha < 0$
   - B. $\alpha = 0$
   - C. $\alpha > 0$
   - D. $\alpha = -1$
10. The series $\sum (xe^{-x})^k$ on $[0, 1]$:
    - A. diverges
    - B. converges
    - C. Uniformly continuous
    - D. None of these
11. $\int_0^\infty \frac{e^{xt} \sin t}{t} dt$ converges uniformly for all:
    - A. $x = 0$
    - B. $x < 0$
    - C. $x > 0$
    - D. $x = 1$
12. Function $f : A \to B$ is (on-to) if
    - A. Range $f \neq A$
    - B. Range $f = A$
    - C. Range $f \neq B$
    - D. Range $f = B$

13. Square root of 2 has no
    - A. Irrational number
    - B. Rational number
    - C. Odd number
    - D. Even number

14. An element a of a group G is said to be idempotent:
    - A. $a^2 = e$
    - B. $a^2 = a$
    - C. $a^2 = 0$
    - D. $a^2 = a^{-1}$

15. Every permutation can be written as the
    - A. Product of transposition
    - B. Addition of transposition
    - C. Difference of transposition
    - D. Both (a) and (b)

16. Let $\Phi : G \to G'$ and $\text{Ker}\Phi = \{g \in G : \Phi(g) = e'\}$ is:
    - A. Normal in G
    - B. Abelian
    - C. Conjugate
    - D. Center of G

17. If H and K are normal subgroup of G and $H \subseteq K$ then $\frac{H}{K}$ and $\frac{G}{H}$ are
    - A. Normal
    - B. Abelian
    - C. Commute
    - D. Centralize

18. Every group of order p, p a prime number, is?
    - A. Decompossable
    - B. Indecompossable
    - C. Normal
    - D. None or these

19. $\text{Hom}(V, V)$ is an algebra over F, then V is:
    - A. Vector Space
    - B. Not Vector Space
    - C. Metric Space
    - D. Both A and C

20. Every integral domain can be embedded in the field of
    - A. Ideals
    - B. Quotient
    - C. Prime ideals
    - D. None of these

21. A mapping $I_A : A \to A$ is the identity mapping if:
    - A. $I_A = \{(a,a) : a \in A\}$
    - B. $I_A = \{(a,b) : a,b \in A\}$
    - C. $I_A = \{a \in A\}$
    - D. $I_A = \{(a,b) : a \in A\}$

22. A function $f : X \to Y$ called surjective if
    - A. $R_f = X$
    - B. $R_f = constant$
    - C. $R_f = R$
    - D. $R_f = Y$

23. Every Subgroup of an abelian group A in A is
    - A. Conjugate
    - B. Center
    - C. Normal
    - D. Equlvalent

24. If H is subgroup of G and $a \in G$, the complex $aH = \{ah : h \in H\}$ is called
    - A. Right coset
    - B. Coset
    - C. Left coset
    - D. None of these

25. If $a, b \in G$ (group) then commutator of a and b is denoted by
    - A. (a, b)
    - B. $[a, b]$
    - C. $[a/b]$
    - D. None of these

26. For abelian group under binary operation + and if for every $\alpha, \beta \in F$, $v \in V$, we can have
    - A. $\alpha\beta(v) = \alpha v$
    - B. $(\alpha - \beta)v = (\alpha + \beta)b$
    - C. $vv = v$
    - D. $1(v) = v$

27. If $\dim_f V = m$ then $\dim_f(V, F)$

   A. m^2

   B. $m-1$

   C. m

   D. $m+1$

28. $|z| = 0$ for complex number is equal to

   A. $|z| = r^2$

   B. $|z| = r = \sqrt{x^2+y^2}$

   C. $|z| = z$

   D. none of these

29. If $f(z)$ is a constant number of Cauchy equation

   A. Does not hold

   B. Not Satisfied

   C. Hold

   D. zero

30. For log of a complex number z, we have

   A. $\log z = \log|z|$

   B. $\log z = \log|z| + \iota\theta$

   C. $\log z = |z|$

   D. $\log z = i\theta$

31. For a complex number z, $\frac{d}{dz}(\cos^{-1} z)$=

   A. $\frac{-1}{\sqrt{1-z^2}}$

   B. $\frac{1}{\sqrt{1-z^2}}$

   C. $\frac{1}{\sqrt{1+z^2}}$

   D. $\frac{-1}{\sqrt{1+z^2}}$

32. A series $\sum U_n$ is said to be absolutely convergent if

   A. $\sum |U_n|$ is convergent

   B. $\sum U_n$ is convergent

   C. $\sum |U_n| = 0$

   D. None of these

33. The residue of $f(x) = \tan k(z)$ is

A. 0

B. -1

C. π

D. 1

34. A function which has poles as its only singularities in the finite part of plane is called

A. Meromorphic

B. Analytic

C. Entire

D. Non integral

35. Transformation of the form $W = AZ + B$ is called linear if

A. $A = 0$

B. $B = 0$

C. $A \neq 0$

D. $A = 1$

36. $e^{\frac{\pi}{2}i}=$

A. -1

B. i

C. 0

D. 2

37. Complex number has two parts namely

A. Real

B. Imaginary

C. None of these

D. Both A and B

38. The angle of rotation by the transformation $W = \frac{1}{z}$ at the point $z = 1$ is

A. 0

B. $-\pi$

C. π

D. -1

39. For the space curve C, number of family of evaluates are

A. Finite

B. 2

C. Infinite

D. One

40. Each characteristic touches the

    A. Edge of regression
    B. Circle
    C. Sphere
    D. Straight line

41. A surface is developable iff its specific curvature at all points is

    A. One
    B. Zero
    C. -1
    D. None of these

42. If $\hat{i}, \hat{j}$ and $\hat{k}$ are unit vectors along X, Y and Z respectively, then

    A. $\hat{i} \times \hat{j} = \hat{k}$
    B. $\hat{j} \times \hat{k} = \hat{i}$
    C. $\hat{i} \times \hat{i} = \hat{0}$
    D. All A, B and C

43. The necessary condition for three points with position vectors $\vec{a}, \vec{b}, \vec{c}$ is

    A. $p\vec{a} + q\vec{b} - r\vec{c} = \vec{0}$
    B. $\vec{a} + q\vec{b} + r\vec{c} = \vec{0}$
    C. $p\vec{a} + q\vec{b} = \vec{0}$
    D. None of these

44. The altitude of a triangle are

    A. Concurrent
    B. Go to vertices
    C. Parallel
    D. Perpendicular

45. There is bisection of diagonals in

    A. Triangle
    B. Parallelogram
    C. Square
    D. Both b and c

46. If ψ is a scalar point function, then the notation $\psi(x, y, z) = c$(constant) represents:

    A. circle
    B. straight line
    C. surface
    D. vector

47. The formation $\frac{\partial\psi}{\partial x}\hat{i} + \frac{\partial\psi}{\partial y}\hat{j} + \frac{\partial\psi}{\partial z}\hat{k}$ is called the:

A. Gradeψ

B. Divψ

C. Curlψ

D. None of these

48. Unit tangential $\vec{T}$ of the curve $\vec{r}(t) = \cos t\hat{i} + \sin t + t\vec{k}$ is:

A. $\frac{1}{2}(\hat{j} \times \hat{k})$

B. $-\frac{1}{2}(\hat{i} + \hat{j})$

C. $\frac{1}{2}(-\hat{j} + \hat{k})$

D. $\vec{i} + \hat{j} + \hat{k})$

49. $\{e'_1, e'_2, e'_3\}$ denotes unit basis

A. Orthonormal

B. Parallel

C. Tangent

D. Both A and C

50. e_3(tangential vector) is given by:

A. $\frac{\nabla u_3}{|\nabla u_3|}$

B. $\frac{\nabla u_2}{|\nabla u_2|}$

C. $\frac{\nabla u_1}{|\nabla u_1|}$

D. $(\frac{\nabla u}{\nabla u_3})$

51. For relation cylindrical coordinates (r, ϕ, z) and Cartesian Coordiates (x, y, z) is given

A. $y = rcos\phi$

B. $y = z$

C. $y = rsin\phi$

D. None of these

52. Gauss's Divergence theorem is given by?

A. $\int_S \vec{A} \cdot \vec{ds} = \int_V \nabla \cdot \vec{A} dv$

B. $\int_S \vec{A} \cdot \vec{ds} = \int_R \nabla \cdot \vec{A} ds$

C. $\int_S \vec{A} \cdot \vec{ds} = \int_V \nabla \times \vec{A} dv$

D. None of these

53. Tensor equation under coordinate transformation is
   A. Invariant
   B. Not same
   C. Zero
   D. Both B and C

54. If A_iB_i is scalar and A_i arbitrary vector then B_i is a?
   A. Scalar
   B. Zero
   C. Vector
   D. 1

55. The Moment of inertia of a thin uniform rod of length "l" and mass "M" about one of its end is
   A. $\frac{1}{4}Ml^2$
   B. $\frac{1}{2}Ml^2$
   C. $\frac{1}{3}Ml^2$
   D. Zero

56. The circular area of uniform disc of radius a is
   A. πa^3
   B. $\frac{1}{2}\pi a^2$
   C. πa^2
   D. $\pi^2 a^2$

57. Volume of ellipsoid with a, b and c itercepts on X-axis, Y-axis and Z-axis is?
   A. a^2bc
   B. ab^2c
   C. abc^2
   D. abc

58. Members of τ(topology) are called
   A. Open sets
   B. Compliment sets
   C. Empty sets
   D. Subsets

59. The ordered pair (X, τ) is called
    - A. Topological space
    - B. Cartesian prduct
    - C. Metric space
    - D. None of these

60. $\{X, \phi\}$ is a topology on X and is called ... topology.
    - A. Indiscrete
    - B. Discrete
    - C. Complete
    - D. None of these

61. Let (X, τ) be a topological space and $A \subseteq X$, then
    - A. $A^\circ \subseteq A$
    - B. $A^\circ = A$
    - C. $A \neq A^\circ$
    - D. $A^\circ = A'$

62. In a topological space (X, τ), $Ext(A)$ is a(an)
    - A. Open set
    - B. Closed set
    - C. Empty set
    - D. Subset

63. If A is both open and closed subset of (X, τ), then A has empty
    - A. Frontier
    - B. Closed set
    - C. Open set
    - D. Subset

64. Let A be a subset of (X, τ), then $\overline{A}$=
    - A. $A \cap A^d$
    - B. $A - A^d$
    - C. $A \cup A^d$
    - D. $A - \{Open\ set\}$

65. A space (X, τ) is separable if there is a subset A of X which is countable and
    - A. $A = X$
    - B. $\overline{A} \neq X$
    - C. $\overline{A} = X$
    - D. $\overline{A} = \phi$

66. Every finite subset of topological space is
    - A. Complete
    - B. Compact
    - C. Sequentiallly compact
    - D. None of these

67. A topological space (X, τ) is a T_1 space iff every singleton subset of X is
    - A. Open
    - B. Closed
    - C. Base
    - D. Sub-base

68. Every countably compact metric space is
    - A. Bounded
    - B. Totally Bounded
    - C. Subspace
    - D. None of these

69. Every Tychonoff space is
    - A. Housroff
    - B. Complete
    - C. Normal
    - D. $T_0 - space$

70. $\mathbb{R}$ (real nos.) is a
    - A. $T_0 - space$
    - B. $T_1 - space$
    - C. Connected space
    - D. $T_2 - space$

71. A topological space x in which there does not exist a continuous mapping of X onto the two points discrete space $\{0, 1\}$ is called
    - A. $T_0 - space$
    - B. $T_1 - Space$
    - C. Connected
    - D. $T_2 - space$

72. Every finite topological space is

A. Normal space

B. Compact space

C. $T_0 - space$

D. $T_1 - space$

73. A set is said to be countable if it is

A. Finite

B. $xRx, \quad \forall x \in A$

C. $xRx = 1$

D. Both a and b

74. If $A = \{1, 3, 5, 7, ...\}$ and $B = \{2, 4, 6, 8...\}$ then "$A * B$" is

A. Countable

B. Uncountable

C. Number

D. Denumberable

75. Every algebra is a

A. Group

B. Ring

C. Subring

D. Metric

76. Sum and Scalar multiple $a > 0$ of a measure is:

A. Measure

B. Infinite

C. Finite

D. None of these

77. For a subset E of $\mathbb{R}$ and $\epsilon > 0$, there is an open set $O \supseteq E$ with

A. $F \supseteq E$

B. $f/E = O$

C. $F \subseteq F$

D. $F \cap E = \Phi$

78. If E_1 and E_2 are two measurable sets then

A. $m(E_1 \cup E_2) + m(E_1 \cap E_2) = 0$

B. $m(E_1 \cap E_2) + m(E_1 \cup E_2) = m(E_1) + m(E_2)$

C. $m(E_1 \cup E_2) = m(E_1 \cap E_2)$

D. None of these

79. The partial differential equation governing various partial phenomena in nature is the equation

A. Laplace

B. Linear

C. Nonlinear

D. Homogenous

80. $U_{xx} + U_{yy} = 0$ is differential equation

A. Non- Homogenous

B. Homogenous

C. Linear

D. Non-Linear

81. The differential form of Lagrange identity is

A. $(\phi L\chi - \chi L\phi) = \rho(\phi\chi' - \chi\phi')$

B. $\phi L\chi - \chi L\phi = 0$

C. $\phi L\chi - \chi L\phi = \rho\phi\chi$

D. $\phi L\chi - \chi L\phi = 1$

82. The Fourier transforms operator and its inverse are?

A. Linear

B. Non-Linear

C. Constant

D. Zero

83. The solid surface of revolution of given curve which for a given surface area has max value is?

A. Square

B. Rectangle

C. Sphere

D. Triangle

84. The value of common integral $\int_{-a}^{a} \frac{\sin x}{x} dx=$

A. π

B. 0

C. -1

D. 1

85. Every equation $f(x) = 0$ of degree n has only

A. 1 root

B. 2 roots

C. 0 roots

D. n roots

86. If $f(x) = 0$ is divisible by $x - a$, then $x = a$ is always a root?
   - A. Real
   - B. Imaginary
   - C. Complex
   - D. None of these

87. The method in which we can find the value of x in terms of function of x is known as simple?
   - A. Iterative method
   - B. Simpson method
   - C. Short method
   - D. None of these

88. Forward difference operator is denoted by
   - A. ∇
   - B. Δ
   - C. $\simeq$
   - D. $\approx$

89. Backward difference operator is denoted by
   - A. ∇
   - B. Δ^2
   - C. Δ
   - D. $\simeq$

90. Highest suffix-lowest suffix will given the diff-eq?
   - A. Degree
   - B. Order
   - C. Mode
   - D. None of these

91. For difference equation $f(x) = constant$ to find y particular solution we shall substitute
   - A. $y_n = 1$
   - B. $y_n = -1$
   - C. $y_n = c$
   - D. $y_n = 0$

92. $y_{n+1} = y_n + hf(x_n, y_n)$ is formula
   - A. R.K
   - B. Euler
   - C. Differential
   - D. None of these

93. Condition of the matrix A is defined as

A. $||A||$
B. $||A^{-1}||$
C. $||A||||A^{-1}||$
D. Zero

94. For shift operator E and forward operator Δ: $\frac{\Delta}{E^2}e^{ax}$=

A. $e^{a(n-h)}$
B. $e^{a(n+h)}$
C. $e^{a^2(n+h)} + e^{a^2(n+2h)}$
D. None of these

95. For forward and backward operator $\Delta\nabla$=

A. $(1 + \Delta)\nabla$
B. ∇^2
C. $\Delta - \nabla$
D. δ

96. For forward and backward operator δ^2=

A. $\Delta\nabla$
B. $\Delta - \nabla$
C. ∇^2
D. Both A and B

97. For forward and backward operator $(1 + \Delta)(1 - \nabla)$=

A. 1
B. -1
C. 0
D. 2

98. $E^{-\frac{1}{2}}$=

A. $\mu\delta$
B. $\mu - \delta$
C. $\frac{\mu}{\delta}$
D. ± 1

99. For central difference operator δ, it can be written as $\Delta(\Delta + 1)^{-\frac{1}{2}}$=

A. δ
B. ∇
C. ∇^2
D. Δ

100. According to trapezoidal rule for $n = 1$ we can write as $\int_{x_0}^{x_1} ydx=$

A. $\frac{h}{2}(y_0 - y_1)$

B. $\frac{h}{2}(y_0 + y_1)$

C. $\frac{h}{3}(y_0 - y_1)$

D. 0

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