Karnatak University, Dharwad
Department of Mathematics
Mathematics MCQ Model Paper 2020-21
Answer ALL questions. Each question carries 1.5 marks. Maximum Marks: 75 (= 50 x 1.5)

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1. Let p be an element of $A \subseteq N$, where $A \neq \phi$. Then p is an least element of A if

(A) $p \geq a, \forall\ a \in A$ (B) $p \leq a, \forall\ a \in A$

(C) $p > a, \forall\ a \in A$ (D) None of the above

2. If $(A, \leq)$ is the poset in which every totally ordered subset of $(A, \leq)$ has upper bound, then

(A) A has minimal element (B) A has maximal element

(C) A has no element (D) None of the above

3. Let Q^+ be the set of positive rational numbers and binary operation * is defined as a*b = ab/2 for all a, $b \in Q^+$. then the identity element in Q^+ is

(A) ab (B) 2/ab

(C) 2 (D) 1/2

4. Let G be a group and N be a normal subgroup of G and G/n is the set of all cosets of n in G. Then for any Na, Nb $\in$ G/N,

(A) (Na)(Nb) = Nab (B) (Na)(Nb) = Na

(C) (Na)(Nb) = Nb (D) (Na)(Nb) = ab

5. If $f(x) = |x| - x$ then it has

(A) Discontinuity at $x = 1$ (B) Discontinuity at $x = -1$

(C) No discontinuity (D) Discontinuity at $x = 0$

6. The condition that the function $f(a + h)$ can be expressed in power series by Taylor's theorem are :

(A) $f(x)$ is continuous in $[a, a + h]$ and derivable in $(a, a + h)$.

(B) $f(x)$ and its derivatives upto $(n - 1)^{th}$ order are continuous in $(a, a + h)$ and $f^{(n)}(x)$ exists in $(a, a + h)$

(C) $f'(x), f''(x), \ldots\ldots, f^{(n)}(x)$ are all continuous in $[a, a + h]$

(D) None of these

7. If f is bounded on [a, b] and P be a partition of [a, b] then $L(P, f)$ is

(A) $\leq m(b - a)$ (B) $\geq m(b - a)$

(C) $\leq M(b - a)$ (D) $\geq M(b - a)$

8. If f : [a, b] $\to$ R is bounded function and $P_1, P_2 \in \int [a, b]$ such that $P_1 \subset P_2$ then

(A) $U(P_1, f) \geq U(P_2, f)$ (B) $U(P_1, f) \leq U(P_2, f)$

(C) $L(P_1, f) \geq L(P_2, f)$ (D) None of the above

9. If (X,τ) is a topological space and $A \subset X$, then which of the following is true?

(A) $\bar{A}$ is a closed set contained in A (B) $\bar{A}$ is an open set containing A

(C) $\bar{A}$ is a closed set containing A (D) $\bar{A}$ is an open set contained in A

10. If X = {a, b, c}, $\tau = P(X) = \mathcal{D}$, $B_1 = \{\{a\}, \{b\}, \{c\}\}$ and $B_2 = \{\{a\}, \{b\}, \{c\}, \{a, b\}\}$, then which of the following is true?

(A) B_1 is basis for τ but not B_2 (B) Both B_1 and B_2 are basis for τ

(C) B_2 is basis for τ but not B_1 (D) Neither B_1 is basis for τ nor B_2

11. A function f: X $\to$ Y is continuous, then which of the following is not true?

(A) $\overline{f(A)} \subset f(\bar{A}), \forall A \subset X$ (B) $\overline{f^{-1}}(B) \subset f^{-1}(\bar{B}), B \subset Y$

(C) $f^{-1}(B^0) \subset [f^{-1}(B)]^0, \forall B \subset Y$ (D) None of the above

12. A subset Y of $\mathbb{R}$ having more than one point is an connected if and only if

(A) Y is closed set (B) Y is an open set

(C) Y is infinite set (D) Y is an interval

13. The solution of a transportation problem is

(A) always unbounded (B) never unbounded

(C) bounded or unbounded (D) none of these

14. The number of basic feasible solutions to an LPP is

(A) finite (B) infinite

(C) countable (D) uncountable

15. If the k^{th} constraint of a primal be an equation, then the k^{th} dual variable will be

(A) non-negative (B) non-positive

(C) unrestricted in sign (D) zero

16. State whether the following pay- off matrix $\begin{pmatrix} 0 & 2 \\ -1 & 4 \end{pmatrix}$, the game is

(A) strictly determinable (B) fair

(C) both (A) and (B) (D) none of these

17. In the ring Z of integer the ideal generated by 7 is

(A) Not Prime ideal (B) Maximal ideal

(C) Not maximal (D) Ideal

18. The number of proper ideals of a field is

(A) 0 (B) 1

(C) 2 (D) 4

19. Commutative ring satisfying cancellation law is a

(A) Field (B) Skew ring

(C) Integral domain (D) Euclidean ring

20. Let R is a non zero ring so that $a^2 = a$, $\forall\ a \in R$, then characteristic of R is

(A) 0 (B) 1

(C) 2 (D) prime

21. If $f(z) = |z|^2$ and

I : $f(z)$ is differentiable at $z = 0$

II: $f(z)$ is analytic at $z = 0$,

Then which of the following is right option ?

(A) I is true but not II (B) Both I and II are true

(C) II is true but not I (D) Neither I nor II is true

22. The radius of convergence of $\sum \frac{n!}{n^n} z^n$ is

(A) 1 (B) ∞

(C) e (D) 0

23. For the function $f(z) = \frac{1-\cos z}{z^2}$, z = 0 is

(A) Pole of order 5 (B) Pole of order 3

(C) Essential singularity (D) Removable singularity

24. The function $f(z) = z^6 - 5z^4 + 7$ has

(A) one zero in $|z| < 1$ (B) two zeros in $|z| < 1$

(C) three zeros in $|z| < 1$ (D) no zeros in $|z| < 1$

25. Let V be a vector space over a field F. If $\alpha u = 0$, where $\alpha \in F$ and $u \in V$, then

(A) $\alpha = 0$ or $u = 0$ (B) $\alpha = 0$ but $u \neq 0$

(C) $\alpha \neq 0$ but $u = 0$ (D) None of the above

26. If V is a vector space over a field F. Then the set of all linear transformation L(V,F), from V in to F is a

(A) bidual space of V (B) dual space of V

(C) Not a vector space (D) None of the above

27. The eigenvalues of a matrix $\begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix}$ are

(A) 1 and – 2 (B) 0 and 3

(C) 1 and 2 (D) – 1 and 2

28. A complex bilinear form f on V is said to be Hermitian form if

(A) $f(u,v) = f(v,u)$ (B) $f(u,v) = \overline{f(v,u)}$

(C) $f(u,v) = \overline{f(u,v)}$ (D) $f(u,v) = f^{-1}(u,v)$

29. If m*(A) is the outer measure of a set A and A $\subseteq$ B then

(A) m*(A) $\geq$ m*(B) (B) m*(A) $\leq$ m*(B)

(C) m*(A) > m*(B) (D) m*(A) = 2m*(B)

30. If E is a countable set then its measure is

(A) zero (B) non zero

(C) infinity (D) one

31. Let f and g be the measurable functions defined on the set E of finite measure. If $f = g$ almost everywhere then

(A) $\int_E f < \int_E g$ (B) $\int_E f > \int_E g$

(C) $\int_E f = \int_E g$ (D) $\int_E f \neq \int_E g$

32. Let f be an integrable function on [a, b]. A point x in [a, b] is a Lebesgue point of f if

$\lim_{h\to 0} \frac{1}{h} \int_x^{x+h} | f(t) - f(x) | dt = ...$

(A) h (B) 1

(C) x (D) 0

33. The maximum modulus of sinz in $|z| \leq 3$ attains at

(A) i (B) $2i$

(C) $-2i$ (D) $-3i$

34. If f(z) is analytic and univalent in a domain D, then

(A) $f'(z) \neq 0, \forall\ z \in D$ (B) $f'(z_0) \neq 0$ only for some $z_0 \in D$

(C) $f'(z_0) \neq 0$ only in the nbd of z_0 (D) None of the above

35. Every bilinear transformation maps circle or straight lines into

(A) straight lines or circles respectively (B) circle or straight lines respectively

(C) circle (D) straight lines

36. A natural boundary for the function $f(z) = \sum_{n=0}^{\infty} z^{n!}$ is circle of convergence

(A) $|z|=1$ (B) $|z|=2$

(C) $|z|=3$ (D) none of these

37. A sub space of a completely regular space

(A) Normal (B) Regular

(C) Completely Regular (D) None of the above

38. Which one of the following not is true

(A) (R, u) first countable (B) (R,u) is second countable

(C) (R, u) is separable (D) (R,u) is compact

39. Which one of the following is not true?

(A) A topological space is sequentially compact if every sequence in it has a convergent subsequence

(B) Every sequentially compact space is countably compact

(C) Continuous image of a sequentially compact space is sequentially compact

(D) None of the above

40. Which one of the following is always true?

(A) Every metric space is a topological space

(B) Every topological space is a metric space

(C) A metric space is not a Hausdorff Space

(D) None of the above

41. A metric on X is a real valued function $d : X \to R$ then for $x, y, z \in X$, which of the following is true

(A) $d(x, y) \geq 0$ (B) $d(x, y) = d(y, x)$

(C) $d(x, y) \leq d(x, z) + d(y, z)$ (D) All above

42. Which of the following is not true

(A) Convergent sequence in a normed linear space is a Cauchy sequence

(B) Cauchy sequence is always convergent

(C) If a Cauchy sequence has a convergent subsequence then whole sequence is convergent

(D) A normed linear space N is called complete if every Cauchy sequence in N converges to an element in N.

43. If T: N $\rightarrow$ N′ is a bounded linear transformation the ||T|| = …..

(A) inf $\left\{ \frac{\| Tx \|}{\| x \|} \quad : \quad x \in N \quad and \quad x \neq 0 \right\}$

(B) sup $\left\{ \frac{\| Tx \|}{\| x \|} \quad : \quad x \in N \quad and \quad x \neq 0 \right\}$

(C) inf $\{ \| Tx \| \quad : \quad x \in N \}$

(D) sup $\{ \| Tx \| \quad : \quad x \in N \}$

44. An operator T on a Hilbert space H is called self adjoint if

(A) T = T* (B) T′ = T**

(C) T = T^{-1} (D) T = (T^{-1})*

45. The truth values of crisp theory is _____ and that of fuzzy set is _____

(A) either 0 or 1, between 0 and 1 (B) between 0 and 1, either 0 or 1

(C) between 0 and 1, between 0 and 1 (D) either 0 or 1, either 0 or 1

46. The height h(A) of a fuzzy subset A = {(a, 0.1), (b,0.6), (c,0.2), (d, 0.7), (e, 0.8)} is

(A) h(A) = 0.1 (B) h(A) = 0.7

(C) h(A) = 1.0 (D) h(A) = 0.8

47. A set of pair wise independent edges of a graph G is called

(A) Matching (B) vertex-covering

(C) edge-covering (D) none of these

48. The number of crossing in a planar graph is -------

(A) 1 (B) 2

(C) 0 (D) 3

49. If orders of meromorphic functions f_1 and f_2 are ρ_1 and ρ_2 respectively with $\rho_1 < \rho_2$, then the order of $f_1 + f_2$ is

(A) ρ_1 (B) $\rho_1 + \rho_2$

(C) $\rho_1\rho_2$ (D) ρ_2

50. There do not exist two non-constant entire functions f and g such that $f^n + g^n \equiv 1$ in $\mathbb{C}$ if

(A) $n \geq 2$ (B) $n \geq 3$

(C) $n \geq 1$ (D) n is prime

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Key Answers

Question	Answer
1	B
2	B
3	C
4	A
5	C
6	B
7	C
8	A
9	C
10	B
11	A
12	D
13	B
14	A
15	C
16	B
17	B
18	A
19	C
20	C
21	A
22	C
23	B
24	D
25	A

Question	Answer
26	B
27	C
28	B
29	B
30	A
31	C
32	D
33	D
34	A
35	B
36	A
37	C
38	D
39	D
40	B
41	D
42	B
43	B
44	A
45	A
46	D
47	A
48	C
49	D
50	B

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Karnatak University, Dharwad
Department of Mathematics
Mathematics MCQ Model Paper 2020-21
Answer ALL questions. Each question carries 1.4 marks. Maximum Marks: 35 (= 25 x 1.4)

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1. Let $y_1(x)$ and $y_2(x)$ defined on [0,1] are twice differentiable functions satisfying $y'' + y' + y = 0$. Let W(x) be the Wronskian of $y_1(x)$ and $y_2(x)$ satisfying W(1/2) = 0 then,
   (A) $W(x) \neq 0$ for some $x \in [0, 1]$ (B) $W(x) = 0 \ \forall \ x \in [0, 1]$
   (C) $W(x) > 0$ for some $x \in (1/2, 1]$ (D) $W(x) < 0$ for some $x \in [0, 1/2)$

2. The Laplace transform of $t\cos(at)$ is
   (A) $\frac{s-a}{(s^2+a^2)^2}$ (A) $\frac{a-s}{(s^2+a^2)^2}$
   (A) $\frac{s^2-a^2}{s^2+a^2}$ (A) $\frac{s^2-a^2}{(s^2+a^2)^2}$

3. For any x in a Boolean algebra B, then $x \wedge 0 = \ldots..$
   (A) 1 (B) – 1
   (C) 0 D) none of these

4. The number of edges in a complete graph K_p is
   (A) $\frac{p(p-1)}{2}$ (B) $\frac{p(p+1)}{2}$
   (C) $\frac{-p(p-1)}{2}$ (D) none of these

5. In an assignment statement *a* = *b*; which of the following statement is true?
   (A) The variable *a* and the variable *b* are same.
   (B) The value of *b* is assigned to variable *a*, but if *b* changes later, it will not effect the value of variable *a*
   (C) The value of *b* is assigned to variable *a*, but if *b* changes later, it will effect the value of variable *a*
   (D) The value of *a* is assigned to variable *b*, and the value of variable *b* is assigned to variable *a*

6. Which of the following operator is not a valid in a relational operator
   (A) * (B) > =
   (C) < = (D) = =

7. A set of vectors B in a vector space V is called basis if

(A) V is linearly dependent and span(B) = V

(B) V is linearly independent and span(B) $\neq V$

(C) V is linearly dependent and span(B) $\neq V$

(D) V is linearly independent and span(B) = V

8. Cauchy-Schwarz inequality for $x, y \in V$, a vector space is given by

(A) $\left|\langle x, y\rangle\right| \leq \|x\| \cdot \|y\|$ (B) $\left|\langle x, y\rangle\right| \leq \|x\| \cdot \|y\| + 2\langle x, y\rangle$

(C) $\left|\langle x, y\rangle\right| < \|x\| \cdot \|y\| + 2\langle x, y\rangle$ (D) None of these

9. Cosine of the angle between the two vectors $x = (1, -1, 1)$ and $y = (1, 1, 1)$

(A) is equal to 1/9 (B) is equal to $1/\sqrt{3}$

(C) is equal to 1/3 (D) is equal to 1/6

10. For the Chebyshev polynomial, $T_{n+1}(x) - 2xT_n(x) + T_{n-1}(x)$ is

(A) 1 (B) 0

(C) $T_{n-1}(x)$ (D) $T_{n+1}(x)$

11. $\int_0^1 P_n(x)dx =$? , when n is even

(A) 1 (B) x

(C) 0 (D) 2

12. Let V_p be the tangent vector to E^3 for which $v = (2, -1, 3)$ and $p = (2, 0, -1)$. The directional derivative $V_p[f]$ for the function $f = x^7$ is

(A) 0 (B) 786

(C) 896 (D) -3

13. Let β be a unit-speed curve in E^3 with curvature $k > 0$ and torsion $\tau = 0$. Then β is a reparametrization of

(A) a straight line (B) a circle

(C) a Helix (D) None of these

14. Power Method is normally used for determining

(A) Largest Eigen value (B) Smallest Eigen value

(C) Both (A) and (B) (D) None of the above

15. If the given interval can be divided into 6 equal parts, then which of the following rules can be applied to find the approximate values of the given definite integral?

(A) Simpson's (1/3)rd rule (B) Simpson's (3/8)th rule

(C) Weddle's rule (D) All of the above

16. The rate of convergence of Gauss-Seidel method _____that of Gauss-Jacobi method.

(A) Once (B) Twice

(C) Thrice (D) Reciprocal

17. Given an autonomous system $\begin{aligned} \frac{dx}{dt} &= P(x,y) \\ \frac{dy}{dt} &= Q(x,y) \end{aligned}$, then a point (x_0, y_0) is called as critical point if,

(A) $P(x_0, y_0) = 0$ and $Q(x_0, y_0) \neq 0$ (B) $P(x_0, y_0) \neq 0$ and $Q(x_0, y_0) = 0$

(C) both $P(x_0, y_0) \neq 0$ and $Q(x_0, y_0) \neq 0$ (D) both $P(x_0, y_0) = 0$ and $Q(x_0, y_0) = 0$

18. Nature of the critical point of the system $\begin{aligned} \frac{dx}{dt} &= x \\ \frac{dy}{dt} &= -x + 2y \end{aligned}$ is,

(A) Centre (B) Node

(C) Spiral (D) None of these

19. If the roots λ_1 and λ_2 of the characteristic equation $\lambda^2 - (a+d)\lambda + (ad - bc) = 0$ are purely imaginary then the nature of the critical point is,

(A) Node and stable (B) Node and unstable

(C) Centre and non-asymptotically stable (D) Centre and stable

20. An isometry F of E^3 is an orthogonal transformation if

(A) $F(0) = 0$ (B) $F(1) = 1$

(C) $F(0) = 1$ (D) $F(1) = 0$

21. If $\phi = xdx - ydy$ and $\psi = zdz + xdz$ are 1-forms of E^3. Then, which of the following are correct

(A) $\phi \wedge \psi = 0$ (B) $d(\phi \wedge \psi) = 0$

(C) $\phi \wedge \psi = -\psi \wedge \varphi$ (D) None of these

22. Let a closed disc $M : x^2 + y^2 \le 1,\ z = 0$ of E^3 is not a proper patch in M that will cover a neighbourhood of p in M ?

(A) all the point on the z-axis (B) all points on the circle $x^2 + y^2 = 1$

(C) the vertex (D) None of the above

23. The equation $\int_0^x \frac{y(t)}{(x-t)^{\alpha}} dt = f(x), \quad (0 < \alpha < 1)$ is referred as

(A) Fredholm integral equation (B) Maxwell integral equation

(C) Picard's integral equation (D) Able's integral equation

24. Any solution of homogeneous Volterra integral equations of the second kind $\phi(x) - \lambda \int_0^x K(x, y)\phi(x)\, dy = 0$ in L_2-space is

(A) Necessarily a zero function (B) Necessarily a non-zero function

(C) Absolute function (D) None of these

25.. The integral equation $y(x) = e^x + \lambda \int_0^1 2e^{x+t}\, y(t) dt$ is a

(A) Fredholm integral equation of the first kind

(B) Volterra integral equation of the first kind

(C) Fredholm integral equation of the second kind

(D) Volterra integral equation of the second kind

Sd/-

Chairman

Key Answers

Question	Answer
1	B
2	D
3	C
4	A
5	B
6	A
7	D
8	A
9	C
10	B
11	C
12	C
13	B
14	A
15	D
16	B
17	D
18	B
19	C
20	A
21	C
22	B
23	D
24	A
25	C

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