QUAID-I-AZAM UNIVERSITY
ISLAMABAD

PhD Admission Test, Fall 2020

Max Marks: **100**

SUBJECT: **MATHEMATICS** Pass Marks: **70**

CATEGORY: **Pure Mathematics** Time Allowed: **50 Minute**

---

(1) T_1 topology on X is also called .... on X
(a) Finite topology (b) Co-finite topology
(c) Discrete topology (d) Non of the these

(2) Let A be a subset of topological space X. The closure of A is the .... of closed superset of A.
(a) Union (b) Intersection (c) Complement (d) None of the these

(3) If $A = A^\circ$, where A° denote the interior of A, then A is ....
(a) Open (b) Closed (c) Clopen (d) Non of these

(4) Let $A = [0, 1)$ and $B = (1, 2]$ be the intervals on the real line $\mathbb{R}$. If d denotes the usual metric on $\mathbb{R}$, then $d(A, B) =$......
(a) 0 (b) 0.5 (c) 1 (d) 1.5

(5) If $I = [0, 1]$, then $\sup\{|f(x)|\}$ is a .... on $\mathsf{C}[0, 1]$
(a) Quasinorm (b) Norm (c) Pseudonorm (d) Non of these

(6) The group G of rigid motions of the prism has order ....
(a) 4 (b) 6 (c) 8 (d) 10

(7) The units in $\mathbb{Z}_4$ are .....
(a) 1 and 2 (b) 1 and 3 (c) 2 and 3 (d) Non of these

(8) Unity in an integral domain can be characterized as the nonzero ......
(a) Idempotent (b) Nilpotent (c) Commutent (d) Non of these

(9) All positive integers less than p^2 that are not divisible by p are relatively .... to p.
(a) Co-prime (b) Consonant (c) Prime (d) Non of these

(10) The elements of $\mathbb{Z}_n$ that are integers relative prime to n form a ..... of order $\phi(n)$ under multiplication modulo n.
(a) Semi-group (b) Group (c) Ring (d) Integral domain

(11) If $A \subseteq \mathbb{R}$ and $f : A \to \mathbb{R}$ has a limit at $c \in \mathbb{R}$, then f is ..... on some neighborhood of c.
(a) Bounded (b) Un-bounded (c) Continuous (d) Differentiable

(12) If $f : A \to \mathbb{R}$ and if c is a cluster point of A, then f can have ...... limit at c.
(a) No (b) Only one (c) Two (d) Non of these

(13) A continuous function on a closed bounded interval is ...... on that interval
(a) Bounded (b) Conditionally bounded
(c) Unbounded (d) Non of these

(14) If $f : A \to \mathbb{R}$ is a Lipschitz function, then f is ...... on A.
(a) Discontinuous (b) Uniformly continuous
(c) Differentiable (d) Non of these

(15) Let $I \subseteq \mathbb{R}$ be an interval and let $f : I \to \mathbb{R}$ be monotone on I. Then the set of points $D \subseteq I$ at which f is discontinuous is a ..... set.
(a) Uncountable (b) Countable (c) Denumerable (d) Non of these

(16) The .... of any number of subspaces of a vector space V is a subspace of V.
(a) Union (b) Intersection (c) Complement (d) Non of these

(17) The nonzero rows of a matrix in echelon form are linearly ....
(a) Dependent (b) Independent (c) Pivot (d) Non of these

(18) Let W be a subspace of an n-dimensional vector space V. Then ....
(a) $\dim W \leq n$ (b) $\dim W > n$ (c) $\dim W \geq n$ (d) Non of these

(19) Suppose V has finite dimension and $\dim V = \dim U$. Suppose $F : V \to U$ is linear. Then F is an .... if and only if F is nonsingular.
(a) Endomorphism (b) Metamorphism
(c) Isomorphism (d) Homomorphism

(20) Suppose $\dim V = m$ and $\dim U = n$. Then $\dim[\mathrm{Hom(V, U)}] =$ ....
(a) m (b) n (c) m/n (d) mn

(21) A parameterized curve is a smooth (C^∞) function $\gamma : I \to \mathbb{R}^n$. A curve is regular if ....
(a) $\gamma' \neq 0$ (b) $\gamma' = 0$ (c) $\gamma' = \infty$ (d) Non of these

(22) Let $\gamma : I \to \mathbb{R}^n$. be a regular curve. For any compact interval $[a, b] \subset I$, the arclength of γ over $[a, b]$ is given by...........
(a) $L_\gamma[a, b] = \int_a^b |\gamma| dt$ (b) $L_\gamma[a, b] = \int_a^b |\gamma'| dt$
(c) $L_\gamma[a, b] = \int_a^b |\gamma''| dt$ (d) $L_\gamma[a, b] = \int_a^b |\gamma'''| dt$

(23) A curve γ on a parametric surface X is called an asymptotic line if it has .... normal curvature.
(a) Negative (b) Zero (c) Positive (d) Non of these

(24) Let $\gamma : [0, L] \to \mathbb{R}^2$ be a piecewise smooth, regular, simple, closed curve, and assume that none of the exterior angles are equal to π. Then $n_\gamma =$ ......
(a) 0 (b) ± 1 (c) ± 2 (d) ± 3

(25) The torsion of a curve is ....
(a) Signed (b) Unsigned (c) Curved (d) Non of these

Dr. Amjad Hussain (Focal Person for PhD Admission Test)