UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

CORE COURSE

B.Sc. MATHEMATICS

V SEMESTER

(2011 Admission onwards)

BASIC MATHEMATICAL ANALYSIS

QUESTION BANK

1. Find the number of elements in the power set of the set { positive divisors of 12 }
   (a) 6 (b) 2
   (c) 64 (d) 16

2. Find the value of 1 + 4 + 7 + …….. + (3n-2)
   (a) $n(n+1)$ (b) $\frac{n(3n-1)}{2}$
   (c) $\frac{1}{2n+1}$ (d) 2n (3n + 1)

3. Find the No. of element in the set (A × B)∩ (A × C) where A= {1, 2 }, B = {a, b, c }, C = { c, d }
   (a) 12 (b) 2
   (c) 8 (d) 24

4. Find the No of relations from A = {a, b, c} to B = {1, 2}
   (a)6 (b) 2^6
   (c) 2^3 (d) 2^2

5. For sets X ={1, 2, 3, ……., 10}, A = {1, 2, 5, 6}, -B = {6, 7} which of the following is correct.
   (a)A\B $\neq A \cap B^1 = B^1 - A^1$ (b) $A \setminus B = A \cap B^1 \neq B^1 \setminus A^1$
   (c) $A \setminus B = A \cap B^1 = B^1 \setminus A^1$ (d) $A \setminus B = A^1 \cap B = B^1 \setminus A^1$

6. Let $f: \mathbb{R} \longrightarrow \mathbb{R}$ and $g: \mathbb{R} \longrightarrow \mathbb{R}$ be defined by f(x) = x^2 and g(x) = x + 3. Then $(g\ o\ f)$ (2) is
   (a) 7 (b) 25
   (c) 0 (d) 3

7. Let A and B be any sets A ⊆ B if f
   (a) $A \cap B^C \neq \emptyset$ (b) $A^C \subseteq B$
   (c) $A^C \cup B = B$ (d) $A \setminus B = \emptyset$

8. The function $f: \mathbb{R} \longrightarrow \mathbb{R}$ defined by f(x) = x^3 is
   (a) One-one but not onto
   (b) Both one-one and onto
   (c) Neither one-one nor onto
   (d) Onto but not one-one

9. Let the function $f: \mathbb{R} \longrightarrow \mathbb{R}$ be defined as
   f(x) $\begin{cases} 3x-1 & if\ x > 3 \\ x^2-2 & if\ -x \leq x \leq 3 \\ 2x+3 & if\ x < -2 \end{cases}$; find $f(-1)$
   (a) -4 (b) 1
   (c)-1 (d) 0

10. Find the deomain of the function f on $\mathbb{R}$ defined by $f(x) = \frac{1}{x-2}$
    (a) $\mathbb{R}$ (b) $\{-2 \leq x \leq 2\}$
    (c) $\mathbb{R}$ □ {2} (d) $\mathbb{R}/_{\{2\}}$

11. Let $f: \mathbb{R} \longrightarrow \mathbb{R}$ defined by f(x) = x^2 + 2x find (fof) (2)
    (a) 80 (b) 82
    (c) 8 (d) 64

12. Let g(x) = $\frac{5x-7}{2x-3}$ find $g^{-1}(x)$

(a) = $\frac{5x-7}{2x-3}$ (b) = $\frac{1}{5x-7}$

(c) == $\frac{7x-3}{5x-2}$ (d) None of these

13. Let R – h(1,5), (4,5) (3,7), (7,6)} Then the range of R is

(a) {5,6,7} (b) { 1,4,3,7}

(c) {1,4,3,7, □} (d) □

14. Let f: A→ B and g: B →A be functions such that gof =I_A, the identify function of A. Then which of the following is true.

(a) g=g^{-1} (b) f is an onto function

(c) f is a one-one function (d) g is a one – one function.

15. Which of the following set is bounded ?

(a) {x □ ℝ: x < 3} (b) {x □ ℝ □ $x = 2^k$} for a positive number of k}

(c) {1,3,5,.....} (d) {1, -1, $^1/_2$, $^{-1}/_2$, $^1/_3$, $^{-1}/_3$ }

16. Let A = [-1,1] Then which of the following function defined on A has inverse?

(a) $f(x) = Sin\pi x$ (b) $f(x) = Sin\, 2\pi x$

(c) $f(x) = Sin\, 2x$ (d) $f(x) = Sin\, x$

17. Which of the following set is non-denumerable ?

(a) Set of all polynomials with integer coefficients.

(b) The set of all algebraic numbers

(c) The closed interval [0,1]

(d) The set of all points in the plane with rational co0ordinaters.

18. Two sets A and B have same cardinality if

(a) There exist an injection from A to B.

(b) There exist a bijection from A to B.

(c) There exist a surjection from A to B.

(d) There exist a surjection from B to A.

19. The power set of Z is

(a) Countable (b) Uncountable

(c) Finite (d) countably infinite

20. Let $\mathbb{N}$ be the set of natural numbers and let $\mathbb{R}$ be the set of real numbers, then

(a) Every function from $\mathbb{N}$ to $\mathbb{R}$ is one-one.

(b) Every function from $\mathbb{N}$ to $\mathbb{R}$ is onto.

(c) No function from $\mathbb{N}$ to $\mathbb{R}$ is one-one.

(d) No function from $\mathbb{N}$ to $\mathbb{R}$ is onto.

21. Let A = {all real numbers that are not integers}

B = {all integers that are multiple of 3} then

(a) There is a one-one function from A to B but not from B to A
(b) There is a one-one function from B to A but not from A to B.
(c) There is a one-one function from A to B and also from B to A.
(d) There is a one-one function neither from A to B nor from B to A.

22. Every closed interval of $\mathbb{R}$ is

(a) Uncountable (b) Countable
(c) Finite (d) Infinite

23. Which of the following sets is uncountable ?

(a) The set of all natural numbers
(b) The set of all irrational numbers
(c) The set of all integers
(d) The set of all finite subsets of the set of all rationales.

24. Let f: X→ Y be a function, A □ x and B □ Y which of the following is true?

(a) $f^{-1}a\,(f(A))$ □ A

(b) B ⊑ $f(\,f^{-1}(B)]$

(c) $f(\,f^{-1}(B))]$ = B if f is onto

(d) $f(\,f^{-1}(B))]$ = B if f one to one.

25. The set of all real numbers n satisfying the inequality $|x^2-1| \leq 3$ is given by

(a) $\{x \in \mathbb{R} \mid -2 \leq x \leq 2\}$

(b) $\{x \in \mathbb{R} : -2 \leq x \leq 1\}$

(c) $\{x \in \mathbb{R} \mid -1 \leq x \leq 2$

(d) $\{x \in \mathbb{R} : -2 \leq x \leq 3\}$

26. Let A = [−3, 1], B=[−1, 2] Theb A ∩ B = _____

(a) [−3, 2],

(b) [−1, 1],

(c) [−3, 1],

(d) = □

27. Give two sets R and S are unbounded. Then R ∩ S is

(a) Unbounded always

(b) bounded always

(c) either unbounded or bounded

(d) None of these

28. If two sets W and V are bounded. Then W□V is

(a) bounded

(b) Unbounded

(c) either unbounded or bounded

(d) cannot be determine.

29. If $E_n = (\frac{-1}{n}, \frac{1}{n})$ $n \in \mathbb{N}, then \cap E_n$ = _____

(a) (-1, 1)

(b) {0}

(c) (0, 1)

(d) {1}

30. $\lim_{n \to \infty} \left(2 + \frac{1}{n}\right)^2$ = _____

(a) e^2

(b) 2e

(c) 4

(d) 2

31. $\lim_{n \to \infty} \left(1 + \frac{2}{n}\right)^n$ = _____

(a) e^2

(b) 2e

(c) 4

(d) 2

32. Countable union of Countable sets is

(a) Countable (b) Uncountable

(c) Cannot be determine (d) finite

33. Every Cauchy sequence of real numbers _____

(a) diverges (b) Oscillates

(c) Converges (d) None

34. The set of natural numbers has ___

(a) Upper bound (b) Lower bound

(c) Maximal element (d) None of these

35. The set of positive integer have the greatest lower bound

(a) 1 (b) 0

(c) ∞ (d) None

36. Every integer n>1 is

(a) Prime number (b) Prime number or product of Prime numbers

(c) Product of Prime numbers (d) Sum of prime numbers

37. Are the following statements always true ?

(a) If A is finite, A is bounded

(b) If A is a subset of $[-6,10]$, A is finite.

(c) If A is infinite, A is bounded

(d) If A is subsets of $[-6,10]$, A is unbounded.

38. Which of these are closed under the operations of addition

$A = \{ x / x = 2^n ; n \in \mathbb{N} \}$

$B = \{ x / x = 3^n ; n \in \mathbb{N} \}$

$C = \{ x / x = 3^n ; n \in \mathbb{N} \}$

(a) C (b) B and C

(c) A, B and C (d) None

39. Write which of the following set/sets are unbounded

$E = \{ x / x = (1/n) ; n \in \mathbb{N} \}$

$F = \{ x / x = 3^n ; n \in \mathbb{N} \}$

$G = \{ x / x = (1/2)^n ; n \in \mathbb{N} \}$

$H = \{ x / x \in \mathbb{N} , x < 2576 \}$

(a) E (b) G

(c) H (d) F

40. Let A = { a, b, c } and B = { 1, 0 } How many different functions are there from A into B and what are they ?

(a) 2^3 (b) 3^2

(c) 6 (d) 4

41. Let $f : \mathbb{R}^+ \to \mathbb{R}^+$ is a bijection defined as $f(x) = x^3+5$ Then f^{-1} is

(a) $3\sqrt{x^3+5}$ (b) $\sqrt[3]{(x-5)}$

(c) $\sqrt{x-5}$ (d) None

42. If a,b ∈ $\mathbb{R}$ and $a^2+b^2 = 0$ Then

(a) a=b=0 (b) a = -b

(c) a + b = 0 (d) None.

43. The sequence $(-1)^n n^2$ is

(a) converges to 0 (b) converges to 1

(c) converges to -1 (d) not convergent

44. $(1-\frac{1}{4})\ (1-\frac{1}{5})\ (1-\frac{1}{6})$.....$(1-\frac{1}{n+3})$ = _____

(a) $\frac{n+3}{n+3}$ (b) $\frac{3}{n+3}$

(c) $\frac{n-1}{n+3}$ (d) None of these

45. The sequence (a_n) where $a_n = \frac{1}{n}+\frac{1}{n+1}+$ .....$+\frac{1}{2n}$ is

(a) divergent (b) convergent to the limit $\frac{1}{4}$

(c) convergent with limit lying in $\left[\frac{1}{2},1\right]$ (d) None of these

46. The sequence (a_n) where a_n=1- $\frac{1}{2}+\frac{1}{3}-$ .....$+\frac{(-1)^{n-1}}{n}$

(a) Coverages to 1 (b) coverages to $\frac{1}{2}$

(c) is a cavely sequence (d) is not convergent.

47. The limit of the sequence $\left(\frac{(-1)^n n}{n^2+1}\right)$ is

(a) 1 (b) -1

(c) 0 (d) ∞

48. The set Q of rational numbers is

(a) Open (b) closed

(c) neither open nor closed. (d) None of the above

49. $\bigcap_{n \in \mathbb{N}} (0, 1+\frac{1}{n})$ is equal to

(a) {0} (b) [0, 1]

(c)) [0, 1] (d) (0,1)

50. The sequence $((-1)^n n)$is

(a) bounded below (b) bounded above

(c) bounded above and bounded below (d) None of the above

51. Which of the following is not true about the cantor set?

(a) It is connected (b) It is compact

(c) It is closed in the space of reats (d) It is uncountable

52. If A is a subset of real number sequence space }, given by

A= { $(x_n)_{n=1}^{\infty}$ } ; $\sum_{n=1}^{\infty} n x_n = 0$ } then

(a) The sequence (0, 0, 1, 0, 0, ...) is not in the $\bar{A}$
(b) The sequence (0, 1, 0, 0, ...) is not in the $\bar{A}$
(c) The sequence (1, 0, 0, ...) is in $\bar{A}$
(d) A is closed

53. Which of the following is not true ?

(a) $A \subseteq \bar{A}$ (b) $\overline{A \cup B} \subseteq \bar{A} \cup \bar{B}$

(c) $\overline{A \cap B} = \bar{A} \cap \bar{B}$ (d) $\overline{A \cup B} = \bar{A} \cup \bar{B}$

54. Which of the following is a cauchy sequence ?

(a) $((-1)^n)$ (b) $(\log n)$

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

55. Which of the following sequence are convergent ?

(a) $(1 - (-1)^n + 1/n)$ (b) $\left(\sin \frac{n\pi}{n}\right)$

(c) $(1 + \frac{1}{2!} + \frac{1}{3!} + \cdots + \frac{1}{n!})$ (d) $(\frac{1+n^2}{n})$

56. The n^{th} term of the sequence $\{1/2, 1/4, 1/6 \ldots\ldots\ldots\ldots\}$ is ?

(a) $\frac{1}{n-1}$ (b) $\frac{1}{2n}$

(c) $\frac{1}{2(n+1)}$ (d) *None of these*

57. The n^{th} term of the sequence ($2, {}^{-3}/_{2}, {}^{4}/_{3}, {}^{-5}/_{4} \ldots\ldots\ldots\ldots\ldots$) is ?

(a) $1 + {}^{1}/_{n}$ (b) $(-1)^{n-1}(k - \frac{1}{n})$

(c) $(-1)^{n-1}(1 + {}^{1}/_{n})$ (d) *None of these*

58. The sequence $\{0,1,0, {}^{1}/_{2}, 0, {}^{1}/_{3}, \ldots\ldots\ldots\ldots\ldots\}$ has n^{th} term?

(a) $\frac{1-(1)^n}{n}$ (b) $\frac{1+(1)^n}{n}$)

(c) $\frac{n+(-1)^n}{n}$ (d) *None of these*

59. The sequence $\left(\frac{\cos\frac{n\pi}{2}}{n}\right)^{\infty}$ is ?

(a) convergent to '1' (b) convergent to 'o'

(c) divergent (d) None of these

60. The sequence $\{a_n\}_{n=1}^{\infty}$ is bounded if there is a real number '*S*' such that?

(a) $|a_n| \leq S \; \square n$ (b) $|a_n| \geq S \; \square n$

(c)) $|a_n| = S \; \square n$ (d) None of these

61. If $\{a_n\}_{n=1}^{\infty}$ converges to both A and B then ?

(a) $A > B$ (b) $A = B$

(c) $A \leq B$ (d) None of these

62. The sequence $\{(-1^n)\}_{n=1}^{\infty}$ is ?

(a) bounded and convergent (b) Unbounded and convergent

(c) bounded and divergent (d) Unbounded and divergent

63. If A and B are two no-empty set of $\mathbb{R}$. If C= h $x + y : x \; \square \; A \; , y \in B \}$ then ?

(a) $Inf\ C = Inf\ A + Inf\ B$ (b) $Inf\ C \neq Inf\ A + Inf\ B$

(c)) $Inf\ C < Inf\ A + Inf\ B$ (d) $Inf\ C > Inf\ A + Inf\ B$

64. If $S, T \subset \mathbb{R}$ and $\forall S \; \square \; S$ and $t \; \square \; T, S \leq t$ if S and T have *Supremum* Then

(a) $Sup\ S \leq Sup\ T$ (b) $Sup\ S \geq Sup\ T$

(c) $Sup\ S = Sup\ T$ (d) None of these

65. If $a, b \in \mathbb{R}$ and $\forall S \in S$ and $|a + b| = |a| + |b|$ if f ?

(a) $ab < 0$ (b) $ab \geq 0$

(c) $a + b = 0$ *always* (d) None of these

66. Every Compact set of real number is

(a) closed (b) Open

(c) Open and unbounded (d) closed and bounded

67. A set F is closed if

(a) It contains all of its points of closure

(b) It contains all of its accumulation points

(c) (a) is true (b) is false

(d) (a) and (b) both true

68. If a sequence of real numbers has a cluster point then .....

(a) It is convergent (b) divergent

(c) Limit exist (d) Existence of limit not definite

69. If : $x \square S$ a set of real numbers, then

(a) Sup $(-x) = -Inf\ (x)$ (b) Sup $(-x) = Inf\ (-x)$

(c) Sup $(-x) = -Inf\ (-x)$ (d) Sup $(x) = Inf\ (x)$

70. The points of unit circle $|z| = 1$ forms

(a) Open set (b) Closed set

(c) Semi Open set (d) None of these

71. The set S is open then which of the following is true

(a) S does not contain if boundary points

(b) S contains its boundary points

(c) S have its boundary points

(d) None of these

72. A metrix Space X satisfies Bolzano wierstrass property then

(a) Every infinite sequence (x_n) in X has no cluster point

(b) Every infinite sequence (x_n) in X has atleast one cluster point

(c) X is not sequentially compact

(d) X is not compact.

73. Statement A : Set *S* of real number is bounded above if *Sup S* is finite.
Statement B : Set S of real number is unbounded above if Sup S = ∞
Then

(a) A and B both true
(b) A is true only
(c) B is false
(d) A and B both false

74. Number of onto functions from a3 element set to a 4 element set is ……

(a) 1
(b) 2
(c) 0
(d) 8

75. The Infimum and Supremum of the null set ∅ are ……

(a) $+\infty, -\infty$
(b) $-\infty, +\infty$
(c) 0, 1
(d) None of these

76. Re {z } = ----------

a) $\frac{z+\bar{z}}{2i}$
b) $\frac{z-\bar{z}}{2}$
c) $\frac{z-\bar{z}}{2i}$
d) $\frac{z+\bar{z}}{2}$

77. arg $(\frac{z_1}{z_2})$

a) $\frac{\arg z_1}{arg\, z_2}$
b) arg z_1 – arg z_2
c) arg z_1 + arg z_2
d) None

78. Find the real numbers x and y such that 3x + 2iy – ix + 5y = 7 + 5i

a) x = 1, y = 2
b) x = -1, y = -2
c) x = -1, y = 2
d) x = 1 y = -2

79. Re (z_1 z_2)

a) Re (z_1) Re (z_2) - Im (z_1) Im (z_2)
b) Re (z_1) Im (z_2) - Re (z_2) Im (z_1)
c) Re (z_1) Re (z_2) + Im (z_1) Im (z_2)
d) None of these

80. Find the area of the triangle ABC, where the position vectors A, B and C are (1 – 2i), (4 + 2i) and (1 + 6i) is

a) 0
b) 12
c) 10
d) 21

81. Let $z = x + iy$ then Im(z) is

a) $\frac{-y}{x+y}$ b) $\frac{-y}{x^2+y^2}$

c) $\frac{1}{x^2+y^2}$ d) $\frac{y}{x^2+y^2}$

82. In the polar co-ordinate (r, φ), for the complex number z = x + iy then

a) $x^2 + y^2 = r^2$ b) $(x^2 - y^2) = r$

c) x + y = r d) x – y = r

83. The complex conjugate of $\frac{i\sqrt{-9}+7i}{1+\sqrt{-1}}$ is

a) 2 – 5i b) 2

c) 2 + 5i d) -5i

84. Mark the wrong statement

a) $|-z_1| = -|z_1|$ b) $|z_1z_2| = |z_1|\ |z_2|$

c) $|z_1z_2| \leq |z_1| + |z_2|$ d) $|z_1z_2| = |z_1|\ |z_2|$

85. The square root of (3 – 4i) is

a) ± (2 + i) b) ± (2 - i)

c) 2 d) ± (2 + 3i)

86. Find the reciprocal of (1 – i) ----------

a) (1 + i) b) $\frac{1}{2}(1 + i)$

c) 2 + 2i d) -1 + i

87. $i^3 + i^{10} + i^6 – i^5$ is equal to

a) -2 – 2i b) 2 + 2i

c) 2 – 2i d) 2i

88. Mark the work statement.

a) $|\bar{z}| = |z|$ b) $|z_1 + z_2| \geq |z_1| - |z_2|$

c) $\left|\frac{z_1}{z_2}\right| = z_1\,\bar{z_2}$ d) $|z_1 - z_2| \geq |z_1| - |z_2|$

89. If z = x + iy, Real (Sin Z) =

a) sin x . cos hy
b) cos x. sin hy
c) sin x sin hy
d) cos x. cos hy

90. The value of $\sqrt{i}$ are

a) $\frac{1 \pm i}{\sqrt{2}}$
b) $\frac{1 \pm i}{\sqrt{3}}$
c) $\frac{-1 \pm i}{\sqrt{2}}$
d) $\frac{1 \pm i}{2}$

91. If $z_1 = 8 + 3i$ and $z_2 = 9 - 2i$, then the imaginary part of $z_1 z_2$ = --------

a) 78
b) 11
c) -78
d) - 11

92. The principal value of the argument of the complex number $3 + 3\sqrt{3}\,i$ is

a) $\pi/3$
b) $\pi/2$
c) $\pi/6$
d) $\pi/12$

93. If $z_1 \neq z_2$ and $|z_1| = |z_2|$ z_1 has a positive real part and z_2 has negative real part then $\frac{z1+z2}{z1-z2}$ will be

a) zero
b) real and positive
c) real and negative
d) purely imaginary

94. The principal value of i^i is

a) -1
b) $e^{\pi/2}$
c) $e^{-\pi/2}$
d) $e^{i\pi/2}$

95. The set of points of the plane satisfying $|z - 1| + |z + 1| = 0$ is

a) circle
b) straight line
c) pair of straight lines
d) None of these

96. The value of $(1 + i\sqrt{3})^3$ is

a) 0
b) 1
c) 8
d) -8

97. The polar form of the number $\sqrt{2}$ i is

a) $2e^{i\pi}$ b) $e^{i\pi}$

c) $2e^{i\pi/2}$ d) $\sqrt{2}\ e^{i\pi/2}$

98. The locus of the points represented by $|z - i| = 2$ is

a) ellipse b) circle

c) hyperboa d) None of these

99. Find the equation of a circle of radius 2 with centre at (-3, 4)

a) $|Z + 3 + 4i| = 2$ b) $|Z - 3 + 4i| = 2$

c) $|Z + 3 - 4i| = 2$ d) $|Z - 3 - 4i| = 2$

100. $\left(\frac{1+\sqrt{3}i}{1-\sqrt{3}i}\right)^{10}$ = ...

a) $\frac{-1+\sqrt{3}i}{2}$ b) $\frac{-1-\sqrt{3}i}{2}$

c) $\frac{1+\sqrt{3}i}{2}$ d) $\frac{1-\sqrt{3}i}{2}$

ANSWER KEY

1. c	21. d	41. b	61. b	81. b
2. b	22. a	42. a	62. c	82. a
3. b	23. b	43. d	63. a	83. c
4. b	24. c	44. b	64. a	84. a
5. c	25. a	45. c	65. b	85. b
6. a	26. b	46. d	66. d	86. b
7. d	27. c	47. d	67. d	87. a
8. b	28. a	48. c	68. d	88. c
9. c	29. b	49. c	69. a	89. a
10. b	30. c	50. d	70. b	90. d
11. a	31. a	51. a	71. a	91. b
12. c	32. a	52. d	72. b	92. a
13. a	33. c	53. c	73. a	93. d
14. c	34. b	54. c	74. c	94. c
15. d	35. c	55. c	75. a	95. b
16. c	36. b	56. b	76. d	96. c
17. c	37. a	57. c	77. b	97. d
18. b	38. b	58. b	78. c	98. a
19. b	39. d	59. a	79. a	99. c
20. d	40. a	60. a	80. b	100. a