Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. A./M. Sc. (Second Semester)
(NEP) EXAMINATION, 2025-26

MATHEMATICS

(Fuzzy Set Theory) (Elective)

Paper Code							
B	0	3	0	8	0	6	T

Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. Necessity measure represents :

(A) probability of event

(B) certainty of event

(C) distribution

(D) randomness

2. Which of the following is the range of possibility distribution ?

(A) [–1, 1]

(B) [0, 1]

(C) $(0, \infty)$

(D) {0, 1}

3. Possibility theory is mainly used to deal with :

(A) Exact information

(B) Deterministic systems

(C) Uncertainty and vagueness

(D) Randomness

4. Which of the following is true for fuzzy measure g for $A \subseteq B$?

(A) $g(A) \leq g(B)$

(B) $g(A) \geq g(B)$

(C) $g(A) \subseteq g(B)$

(D) $g(A) \supseteq g(B)$

5. The concept of fuzzy measure was introduced by :

(A) Sugeno

(B) Zadeh

(C) Keema

(D) Natrajan

6. Composition of fuzzy relations satisfies :

(A) Associative property

(B) Commutative property

(C) Distributive property

(D) None of the above

7. The membership value of an edge in fuzzy graph must satisfy :

(A) $\mu(x, y) = 1$

(B) $\mu(x, y) = 0$

(C) $\mu(x, y) > 1$

(D) $\mu(x, y) \leq \min \{\sigma(x), \sigma(y)\}$

8. A typical fuzzy relation equation is :

(A) P o Q = R

(B) P + Q = R

(C) PQ = R

(D) P – Q = R

9. Compatibility relation may not satisfy :

(A) Reflexivity

(B) Symmetry

(C) Transitivity

(D) None of the above

10. A fuzzy relation is transitive if :

(A) $R(x, y) = 0$

(B) $R(x, z) = 1$

(C) $R(x, z) = 0$

(D) $R(x, z) \geq \max \{\min (R(x, y), R(y, z)\}$

11. A fuzzy relation R is reflexive if :

(A) $R(x, y) = 0$

(B) $R(x, x) = 1$ for all x

(C) $R(x, x) = 0$

(D) $R(x, y) = 1$

12. The composition of two fuzzy relations is also :

(A) Crisp relation

(B) Empty relation

(C) Fuzzy relation

(D) Universal relation

13. The composition of two fuzzy relations is based on :

(A) Sum

(B) Difference

(C) Product

(D) Max-min operation

14. A fuzzy relation on sets X and Y is a fuzzy subset of :

(A) X

(B) Y

(C) $X \cup Y$

(D) $X \times Y$

15. Which of the following is true for fuzzy numbers ?

(A) It must be a normal fuzzy set.

(B) α-cut must be a closed interval for every $\alpha \in (0, 1]$.

(C) The support of A must be bounded.

(D) All of the above

16. The image of the interval [2, 7] is :

(A) [2, 7]

(B) $(-\infty, 2)$

(C) $(7, \infty)$

(D) [–7, –2]

17. For the intervals A = [1, 6] and B = [3, 7], the distance between A and B is :

(A) 2

(B) 1

(C) 5

(D) 4

18. If A = [2, 5], then A^{-1} is :

(A) $\left[\frac{1}{2}, \frac{1}{5}\right]$

(B) $\left[\frac{1}{5}, \frac{1}{2}\right]$

(C) $(-\infty, 2)$

(D) $(5, \infty)$

19. For the intervals A = [2, 3], B = [4, 5], the value of A.B is :

(A) [8, 15]

(B) [2, 3]

(C) [4, 5]

(D) [6, 8]

20. For the intervals A = [2, 3], B = [4, 5], the value of A – B is :

(A) [–2, –1]

(B) [2, 2]

(C) [–3, –1]

(D) None of the above

21. For the intervals A = [2, 3], B = [1, 6], the value of A + B is :

(A) [3, 9]

(B) [1, 6]

(C) [2, 3]

(D) None of the above

22. A space with fuzzy norm is called :

(A) metric space

(B) linear space

(C) topological space

(D) fuzzy normed linear space

23. In fuzzy norm, N(x, t) is non-decreasing in :

(A) x

(B) t

(C) Both (A) and (B)

(D) None of the above

24. The term

$$d_{\omega}(A, B) = \left[\Sigma \mid A(x) - B(x) \mid^{\omega}\right]^{\frac{1}{\omega}},$$

$$\omega \in [1, \infty)$$

is :

(A) Hamming distance

(B) Relative Hamming distance

(C) Euclidean distance

(D) Minkowski distance

25. Second power of fuzzy set A is defined by :

(A) $[A(x)]^2$

(B) $[A^2(x)]^2$

(C) $[\bar{A}(x)]^2$

(D) $[\bar{A}^2(x)]^2$

26. For a fuzzy norm, $N(x, t) = 1$ if and only if :

(A) $x = 0$

(B) $x = 1$

(C) $t = 0$

(D) $t = 1$

27. A fuzzy norm is a function defined on :

(A) $X \times \mathbf{R}$

(B) $X \times (0, \infty)$

(C) $X \times [0, 1]$

(D) $X \times X$

28. Which of the following is not a *t*-conorm ?

(A) Maximum operator

(B) Algebraic sum

(C) Bounded sum

(D) Minimum operator

29. The dual operator of *t*-norm is :

(A) Difference

(B) *t*-conorm

(C) Intersection

(D) Complement

30. The boundary condition for *t*-conorm is :

(A) $S(a, 0) = a$

(B) $S(a, a) = 0$

(C) $S(1, 1) = 0$

(D) $S(a, 1) = a$

31. The algebraic *t*-conorm of *a* and *b* is :

(A) $a + b - a \cdot b$

(B) $\max(a, b)$

(C) $\min(a, b)$

(D) $a \cdot b$

32. A *t*-conorm is also called :

(A) Intersection operator

(B) Union operator

(C) Complement operator

(D) Different operator

33. For a fuzzy set A, the relation $A \cup A = A$ is called :

(A) Absorption law

(B) Complement law

(C) Involuntary law

(D) Idempotent law

34. The property $A \cup B = B \cup A$ is called :

(A) Commutative law

(B) Distributive law

(C) Identity law

(D) Associative law

35. The algebraic product of fuzzy set A and B is :

(A) $\mu(A(x)) \cdot \mu(B(x))$

(B) $\mu(A(x)) + \mu(B(x))$

(C) $\max \{\mu(A(x)\}, \mu(B(x))\}$

(D) $\min \{\mu(A(x), \mu(B(x))\}$

36. If $\mu(A(x) = 0{\cdot}2$ and $\mu\ (B(x) = 0{\cdot}4$, then $\mu\ (A \cup B)$ is :

(A) 0·2

(B) 0·4

(C) 0·6

(D) 0·8

37. Which of the following is not true for $f : X \rightarrow Y$ as an orbitrary crisp function ?

(A) $\alpha + [f(A)] = f(\alpha^{+}_{A})$

(B) $\alpha^{+} [f(A)] \supseteq f(\alpha^{+}_{A})$

(C) $\alpha^{+} [f(A)] \subseteq f\ (\alpha^{+}_{A})$

(D) $\alpha^{+} [f(A)] \neq f(\alpha^{+}_{A})$

38. If $A = \frac{0{\cdot}4}{v} + \frac{0{\cdot}2}{w} + \frac{0{\cdot}5}{x} + \frac{0{\cdot}5}{y} + \frac{1{\cdot}0}{z}$, then relative cardinality of A is :

(A) 0·6

(B) 0·9

(C) 0·5

(D) 1

39. If $B = \{2, 0, 3\} \subset X = \{a, b, c\}$ is a crisp set, then scalar cardinality of fuzzy set B is :

(A) 2

(B) 0

(C) 3

(D) 5

40. For two fuzzy sets A and B defined on a universal set X, which of the following holds ?

(A) $|A| + |B| = |A \cup B| + |A \cap B|$

(B) $|A| - |B| = |A \cup B| - |A \cap B|$

(C) $|A| + |A \cup B| = |B| + |A \cap B|$

(D) None of the above

41. Law of contradiction for fuzzy sets :

(A) Holds good

(B) Does not hold good

(C) Cannot say

(D) $\text{Min } \{A(x), \bar{A}(x)\} = 1$

42. A quasi fuzzy number A is a fuzzy set of real line with :

(A) Normal set

(B) Fuzzy convex set

(C) Continuous membership function

(D) All of the above

43. The set of all levels $\alpha \in [0, 1]$ that represents distinct α-cuts of a fuzzy set A is called :

(A) Level set of A

(B) Complement of A

(C) Fuzzy sub-normal set

(D) None of the above

44. A fuzzy set A is a subset of B if :

(A) $\mu(A(x)) \geq \mu(B(x))$

(B) $\mu(A(x)) \leq \mu(B(x))$

(C) $\mu(A(x)) = \mu(B(x))$

(D) None of the above

45. A fuzzy singleton has :

(A) One element with membership function = 1

(B) Infinite support

(C) All elements with membership function = 1

(D) None of the above

46. α-cut of a fuzzy set is :

(A) Crisp subset

(B) Complement

(C) Union

(D) Fuzzy subset

47. Normal fuzzy set has height :

(A) 0

(B) 1

(C) 0·5

(D) ∞

48. A classical set is also called :

(A) Vague set

(B) Rough set

(C) Soft set

(D) Crisp set

49. In a fuzzy set, membership values lie in :

(A) {0, 1}

(B) [0, 1]

(C) **Z**

(D) **R**

50. Who introduced fuzzy set theory ?

(A) Zadeh

(B) Cantor

(C) Toponogrov

(D) Turning

51. Fuzzy graph adjacency matrix contains :

(A) integers

(B) vectors

(C) probabilities

(D) membership values

52. Which of the following is true for equivalence matrix ?

(A) Equivalence matrix is symmetric.

(B) Diagonal elements are 1.

(C) Off diagonal elements are ≤ 1.

(D) All of the above

53. Equivalence relation produces :

(A) partitions

(B) graphs

(C) vectors

(D) numbers

54. Which of the following are true ?

(A) Composition is associative.

(B) Composition is not commutative.

(C) Intermediate value is eliminated.

(D) All of the above

55. If $\mu(R(x, y)) = 1$, then the relation R is :

(A) Weakest

(B) Strongest

(C) Absent

(D) Random

56. The relation

$$\min [\text{Nec}(A), \text{Nec}(\overline{A})] = 0$$

is :

(A) always true

(B) may not be true

(C) may be true

(D) no such relationship exists

57. For $A \subseteq B$, the Belief measure satisfies :

(A) $\text{Bel}(A) \leq \text{Bel}(B)$

(B) $\text{Bel}(\phi) = 0$

(C) $\text{Bel}(A) + \text{Bel}(\overline{A}) \leq 1$

(D) All of the above

58. A fuzzy relation R(X, X) is called asymmetric if $R(x, y) \neq R(y, x)$ for :

(A) some $x, y \in X$

(B) for all $x, y \in X$

(C) $x = 0, y = 1$

(D) None of the above

59. Domain of a binary fuzzy relation is :

(A) Fuzzy set

(B) Crisp set

(C) $[0, \infty]$

(D) $\mathbb{R}$

60. The properties MIN (A, A) = A and MAX (A, A) are called :

(A) Absorption

(B) Commutative

(C) Idempotent

(D) Inverse

61. The properties $h(0,0) = 0$ and $h(1, 1) = 1$ satisfied by a binary aggregation operation h on [0, 1] are called :

(A) norm operations

(B) parametric operations

(C) super flow

(D) All of the above

62. The bounded difference of two fuzzy sets A and B is :

(A) $\max [0, A(x) - B(x)]$

(B) $\min [0, A(x) - B(x)]$

(C) $\min [1, A(x) - B(x)]$

(D) $\max [1, A(x) - B(x)]$

63. The simple difference of two fuzzy sets A and B is defined by ;

(A) $(A \cap B)(x)$

(B) $(A \cap \overline{B})(x)$

(C) $(\overline{A} \cap B)(x)$

(D) $(\overline{A} \cap \overline{B})(x)$

64. The bounded sum of a and b is defined by :

(A) $\max (a, b)$

(B) $\min (a, b)$

(C) $\max (1, a + b)$

(D) $\min (1, a + b)$

65. The only idempotent t-norm is :

(A) standard fuzzy union

(B) standard fuzzy intersection

(C) standard fuzzy difference

(D) All of the above

66. If the edges are between every pair, then the graph is called :

(A) sparse fuzzy graph

(B) complete fuzzy graph

(C) path graph

(D) None of the above

67. Fuzzy graph is introduced by :

(A) Markaram

(B) Rosenfield

(C) De'morgan

(D) Cantor

68. If the edge is absent, then $\mu(x, y)$ is :

(A) 1

(B) 0

(C) –1

(D) < 0

69. Edge membership cannot exceed :

(A) vertex membership

(B) 1

(C) 2

(D) ∞

70. Edge membership function belongs to :

(A) integers

(B) vectors

(C) {0, 1}

(D) [0, 1]

71. Graph representation uses :

(A) nodes

(B) edges

(C) {0, 1}

(D) Both (A) and (B)

72. Transitive closure uses ;

(A) repeated composition

(B) union

(C) complement

(D) difference

73. Binary fuzzy relation is defined as :

(A) A

(B) B

(C) $A \cup B$

(D) $A \times B$

74. Image membership value is :

(A) supremum of membership function

(B) infimum

(C) average

(D) difference

75. Core of triangular fuzzy number (1, 4, 6) is :

(A) 4

(B) 1

(C) 6

(D) 5

76. Support of triangular fuzzy number (1, 4, 6) is :

(A) [1, 6]

(B) [4]

(C) [0, 6]

(D) [1, 4]

77. Image of fuzzy set is defined using :

(A) probability

(B) extension principle

(C) algebraic product

(D) complement

78. The extension principle uses :

(A) sup operator

(B) inf operator

(C) union

(D) complement

79. Fuzzy relation matrix values lie in :

(A) $\{0, 1\}$

(B) $[0, 10]$

(C) $[0, 1]$

(D) $\mathbb{R}$

80. If $R = \begin{bmatrix} 0.2 & 0.6 \\ 0.8 & 0.4 \end{bmatrix}$, then max value of relation R is :

(A) 0.6

(B) 0.8

(C) 0.4

(D) 0.2

81. If a fuzzy relation is reflexive and symmetric, then it is called :

(A) Partial order relation

(B) Compatibility relation

(C) Noor relation

(D) Levi-Civita relation

82. A fuzzy relation R is transitive if :

(A) $R \circ R \subseteq R$

(B) $R \circ R = R$

(C) $R \cap R = R$

(D) $R \cup R = R$

83. If $A \cap B = \phi$, then :

(A) $Bel(A) + Bel(B) = Bel(A \cup B)$

(B) $P(A) + P(B) = P(A \cup B)$ for probability measure P

(C) Probability measure is special type of Belief measure

(D) All of the above

84. Plausibity measures are :

(A) Additive

(B) Suboditive

(C) Superoditive

(D) None of the above

85. If Pos (A) < 1, then Nec (A) is :

(A) < 0

(B) 0

(C) 1

(D) > 1

86. If Nec (A) > 0, then Pos (A) is :

(A) < 0

(B) 0

(C) 1

(D) < 1

87. If Necessity measure is Nec (A) and Possibility measure is Pos (A), then which of the following is not true ?

(A) Nec (A) + Nec $(\overline{A}) \leq 1$

(B) Pos (A) + Pos $(\overline{A}) \geq 1$

(C) max [Pos (A), Pos $(\overline{A})$] = 1

(D) max [Pos (A), Pos $(\overline{A})$] = 0

88. The commonality function Q(A) is :

(A) $\sum_{B \subseteq A} m(B)$

(B) $\sum_{A \in P(X)} m(A)$

(C) $\sum_{B \subseteq A \cap B} m(B)$

(D) None of the above

89. Possibility theory is useful when :

(A) data is incomplete

(B) probability unknown

(C) information vague

(D) All of the above

90. In probability theory, $P(A) + P(\overline{A})$ is :

(A) 0

(B) 1

(C) ≥ 1

(D) ≤ 1

91. Belief function represents :

(A) Lower probability

(B) Upper probability

(C) Mean probability

(D) Variance

92. Belief and Plausibility measures can be characterized by a function *m* such that $\sum_{A \in P(X)} m(A)$ is :

(A) 0

(B) 1

(C) ∞

(D) 2

93. If N(A) = 0.4 and N(B) = 0.8, then N(A $\cap$ B) is :

(A) 0.4

(B) 0.8

(C) 1.2

(D) 0.6

94. If P(A) = 0.8, then event A is :

(A) impossible

(B) partially possible

(C) necessary

(D) random

95. If P(A) = 0.9, $P(\overline{A})$ = 0.3, then the value of N(A) is :

(A) 0.7

(B) 0.9

(C) 0.3

(D) 0.1

96. Suppose possibility distributions $P(x_1) = 0.2$, $P(x_2) = 0.7$ and $P(x_3) = 0.9$. Find P(A), where A = $\{x_1, x_2\}$.

(A) 0.2

(B) 0.7

(C) 0.9

(D) 0.5

97. Evidence theory is also called :

(A) Measure theory

(B) Chaos theory

(C) Probability theory

(D) Dempster-Shafer theory

98. Which of the following is true for fuzzy measure g :

(A) $g(A \cup B) = \max [g_{(A)}, g_{(B)}]$

(B) $g(A \cup B) \leq \max [g_{(A)}, g_{(B)}]$

(C) $g(A \cap B) \geq \min [g_{(A)}, g_{(B)}]$

(D) $g(A \cap B) \leq \min [g_{(A)}, g_{(B)}]$

99. If P(A) = 1, then :

(A) A is possible

(B) A is impossible

(C) A is necessary

(D) A is random

100. Relation between necessity and possibility is :

(A) N(A) = 1 – P(A)

(B) N(A) = $P(\overline{A})$

(C) N(A) = P(A)

(D) N(A) = 1 – $P(\overline{A})$

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।