

Model Question paper

Bsc. (Hons) Programme - Sem V

Paper code - DSE MATH 502 B

Subject - Mathematical Modeling
& Topology

Mathematics
prepared

by

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Answer from all section as directed

Q.No 1 is compulsory.

The figures in the right-hand margin
indicate marks.

Candidates are required to give their
answers in their own words as far as practicable.

Section - I

(compulsory)

1. Choose the correct answer of the following

$2 \times 10 = 20$

(a) Mathematical models provide —

(a) estimated results

(b) accurate results

(c) wrong results

(d) approximate results

(b) Mathematical models allow us to calculate

(a) different quantities

(b) area only

(c) Speed only

(d) distance & time

(c) Scientists used mathematical models to
predict the growth of world population
computer converted that data into a

(a) Sample (b) model (c) design (d) structure.

(d) To solve engineering problem, we have to formulate the pattern as math expression in term of variables, function & equations, such expression is called _____

- (a) function model (b) Math model
(c) variable model (d) math equation.

(e) Let (X, \mathcal{J}) be a topological space and A be any subset of X . Then A is \mathcal{J} -closed if and only if _____

- (a) $\bar{A} = A$ (b) $A^\circ = A$ (c) $A \subseteq \bar{A}$ (d) $\mathcal{J}(A) \subseteq \bar{A}$

(f) Finite topological spaces are never

- (a) connected (b) disconnected (c) none of these (d) both (a) & (b)

(g) Let (X, \mathcal{J}) be a topological space & A, B be any subset of X , then $A^\circ \cup B^\circ$ _____

- (a) $\subset (A \cup B)^\circ$ (b) $= (A \cup B)^\circ$ (c) $\subseteq (A \cup B)^\circ$
(d) $= (A \cap B)^\circ$

(h) In a topological space (X, \mathcal{J}) , let A° , $\text{ent}(A)$ & $\text{Fr}(A)$ are pairwise disjoint where $A \subset X$ then

$\text{Fr}(A) =$ _____

- (a) $\bar{A} \cap (\bar{A}^c)$ (b) $\bar{A} \cup \bar{A}^c$ (c) A° (d) \bar{A}

(i) Let (X, \mathcal{J}) be a topological space & let A, B be any subset of X . Then

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

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

(j) In any topological space (X, \mathcal{J}) every derived set is _____ set

(a) open set (b) closed set (c) compact set

(d) empty set

Group-B

(Answer any four questions)

$5 \times 4 = 20$

2. What is mathematical modeling? & what are the elements of mathematical model?

3. What is continuous single species population model? Explain?

4. What is Discrete Age-structured model? Explain?

5. Write mathematical modelling & analysis of a prey-predator system?

6. Prove that if \mathcal{J}_1 & \mathcal{J}_2 be two topologies defined for a non-empty set X , then their Intersection $\mathcal{J}_1 \cap \mathcal{J}_2$ is also a topology for X .

7. Let $X = \{a, b, c\}$ and
 $J = \{X, \emptyset, \{a\}, \{b\}, \{a, b\}\}$. Let $A = \{a, c\}$
 & $B = \{b\}$ then find \bar{A} and \bar{B}

8. Let $X = \{1, 2, 3, 4, 5\}$ and
 $J = \{X, \emptyset, \{2\}, \{3, 4\}, \{2, 3, 4\}, \{1, 3, 4\},$
 $\{1, 2, 3, 4\}\}$
 Find J -interior, J -frontier

9. What do you mean convergent
 sequence in topological space?

Group-C

(Answer any two questions)

$15 \times 2 = 30$

10. Explain how mathematical model
 is used for detecting Diabetes in
 the blood.

11. Write Short note:

(a) Urban waste water management
 planning models.

(b) cumulative & comparison voting models

12. Let X, J be a topological space &
 A and B be any two subsets of X .
 If \bar{A} denotes the closure of A then
 prove the following:

$$(i) \overline{A \cup B} = \overline{A} \cup \overline{B}$$

$$(ii) \overline{A \cap B} \supset \overline{A} \cap \overline{B}$$

$$(iii) (A \cap B)^{\circ} = A^{\circ} \cap B^{\circ}$$

$$(iv) \text{ext}(A \cup B) = \text{ext}(A) \cap \text{ext}(B)$$

$$(v) F_{\delta}(A \cup B) \subset F_{\delta}(A) \cup F_{\delta}(B)$$

$$(vi) F_{\delta}(A \cap B) \subset F_{\delta}(A) \cup F_{\delta}(B)$$

(13). (a) Let (X, J_1) and (X, J_2) be two topological spaces. Then a function $f: X \rightarrow Y$ is J_1 - J_2 continuous or simply continuous iff the inverse image under f of every J_2 -closed subset of Y is a J_1 -closed subset of X .

(b) let (X, J_1) and (Y, J_2) be two topological spaces defined as under
 $X = \{1, 2, 3, 4\}$ $Y = \{a, b, c, d\}$

$$J_1 = \{X, \emptyset, \{1\}, \{1, 2\}, \{1, 2, 3\} \text{ and } \{1, 2, 3, 4\}\}$$

$$J_2 = \{Y, \emptyset, \{a\}, \{b\}, \{a, b\}, \{b, c, d\} \}$$

$f: X \rightarrow Y$ defined as $f(1) = b, f(2) = c, f(3) = d, f(4) = c$. Find whether f is J_1 - J_2 continuous or not.

Answer Key of Objective Questions

(1) (a) \rightarrow a

(b) \rightarrow a

(c) \rightarrow b

(d) \rightarrow b

(e) \rightarrow a

(f) \rightarrow a

(g) \rightarrow c

(h) \rightarrow a

(i) \rightarrow c

(j) \rightarrow b