

**U.G. 3rd Semester Examination - 2021**

**MATHEMATICS**

**[HONOURS]**

**Skill Enhancement Course (SEC)**

**Course Code : MATH-H-SEC-T-1A&B**

Full Marks : 40

Time : 2 Hours

*The figures in the right-hand margin indicate marks.*

*Symbols have their usual meaning.*

**Answer all the questions from selected Option.**

**OPTION - A**

**MATH-H-SEC-T-1A**

1. Answer any **five** questions: 2×5=10
- a) Write truth table of conjunction and disjunction of two statements.
  - b) What is a contradiction? Give an example.
  - c) Translate the following sentence into symbols, using no universal quantifiers: "Some people are either lazy or stupid".
  - d) A relation  $R$  on the set  $Z$  is defined by  $aRb$  if and only if  $ab > 0$  for  $a, b \in Z$ . Examine if  $R$  is an equivalence relation.

- e) Give example of a relation which is partial order and another example which is not.
- f) Find the equivalence classes determined by the equivalence relation  $R$  on  $Z$  defined by  $aRb$  if and only if  $a - b$  is divisible by 5 for  $a, b \in Z$ .
- g) Write the following sentence using symbolic logic: "Square of each non-zero real is positive".
- h) Let  $R$  be an equivalence relation on a set  $S$  and  $a, b \in S$ . Show that the equivalence classes  $Cl(a)$  and  $Cl(b)$  are either equal or disjoint.

2. Answer any **two** questions: 5×2=10

- a) Show that every truth function is determined by a statement form in which the only connectives occurring are amongst  $\sim$ , and.
- b) Find a conjunctive normal form which is logically equivalent to  $((\sim p)q) \rightarrow r$ .
- c) Show that an equivalence relation  $R$  on a set  $S$  determines a partition of  $S$ . Prove or disprove the converse.
- d) Prove that  $A \cap (B \Delta C) = (A \cap B) \Delta (A \cap C)$ .

[Turn over]

3. Answer any **two** questions: 10×2=20
- a) i) Let  $(S, \leq)$  be a poset. Show that if the pair  $a, b \in S$  have a greatest lower bound then it is unique.
- ii) Let  $A, B, C$  and  $D$  be subsets of a universal set  $S$ . Prove that  
 $(A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D)$ .  
5+5
- b) i) Show that for any statement form  $A$  and  $B$ ,  $(\sim (A \wedge B))$  is logically equivalent to  $((\sim A) \vee (\sim B))$ , and  $(\sim (A \vee B))$  is logically equivalent to  $((\sim A) \wedge (\sim B))$ .
- ii) Prove or disprove that if  $A$  and  $(A \rightarrow B)$  are tautologies, then  $B$  is a tautology. 5+5
- c) i) When an argument is called valid? Let  $A, B, C$  be statement forms. Is the argument  $(A \rightarrow (B \rightarrow C)), B; \therefore A \rightarrow C$  valid? Support your answer.
- ii) If  $(A, \leq)$  is a well ordered set, then prove that the class of all initial segments of  $A$  is well-ordered under inclusion relation.  
5+5

- d) i) Let  $(X, \leq)$  be a poset. Define a relation  $\geq$  on  $X$  by  $a \geq b$  if and only if  $b \leq a$  for  $a, b \in X$ . Show that  $(X, \geq)$  is a poset.
- ii) For any set,  $A$ , let  $|A|$  denote the cardinal number of  $A$ . Show that  $2^{\mathbb{N}} = \mathbb{R}$  where  $\mathbb{N}$  and  $\mathbb{R}$  are respectively the set of natural numbers and the set of real numbers.  
5+5

**OPTION - B**

**MATH-H-SEC-T-1B**

1. Answer any **five** questions: 2×5=10
- a) What is aspect ratio?
- b) Differentiate between parallel and perspective projections.
- c) Define ray tracing.
- d) Define spline curves.
- e) What is random scan?
- f) Define text clipping.
- g) Differentiate between HSV and CMY color models.
- h) Define animation.

2. Answer any **two** questions:  $5 \times 2 = 10$
- a) Write a short note on Raster Scan Display.
  - b) Explain the steps of midpoint circle generation algorithm.
  - c) Develop the transformation for finding the reflection of a point with respect to the line  $ax + by + c = 0$ .
  - d) Explain the DDA line drawing algorithm.
3. Answer any **two** questions:  $10 \times 2 = 20$
- a) Write and explain an algorithm for drawing an ellipse with proper illustration.
  - b) Explain a line clipping algorithm with the help of a suitable example.
  - c) Given a triangle  $ABC$  whose coordinates are  $A(1,1)$ ,  $B(5,3)$ ,  $C(4,3)$ . Answer the following with proper illustrations:
    - i) Reflect the triangle about  $X$ -axis.
    - ii) Reflect the triangle about  $Y$ -axis.
    - iii) Reflect the given triangle about  $y = x$  line.
  - d) Explain scaling, rotation and shearing with respect to 3D transformations with their 3D transformation matrices.
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