

2018

CBCS

3rd Semester

MATHEMATICS

PAPER—SEC1T

(Honours)

Full Marks : 40

Time : 2 Hours

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

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

*Illustrate the answers wherever necessary.*

**Logic and Sets**

**UNIT—I**

1. Answer any one question : 1×2

(a) Construct the truth table for  $(p \rightarrow q) \rightarrow (q \rightarrow p)$ .

(Turn Over)

(b) Let  $P(x)$  denotes the statement " $x = x^2$ ". If the domain consists of the integers what is the truth values of

(i)  $\exists x P(x)$  and (ii)  $\forall x P(x)$

2. Answer any *three* questions : 3×5

(a) (i) Define conditional propositions with truth table.

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(ii) What are the contra positive, converse and Inverse of the conditional proposition

"If it is raining then the home team wins". 3

(b) Show that  $p \vee (q \wedge r)$  and  $(p \vee q) \wedge (p \vee r)$  are logically equivalent. 5

(c) Translate each of these statements into logical expressions using predicates quantifies and logical connectivities

(i) No Physics students know  $C^{++}$

(ii) All Mathematics students know  $C^{++}$

- (iii) Not every Physics student knows C<sup>++</sup>
- (iv) At least one Mathematics student know C<sup>++</sup>
- (v) No Physics students nor Mathematics students know C<sup>++</sup>. 5

(d) Determine the truth value of these statements if the domain for all variables consists of all integers

- (i)  $\forall n \exists m (n^2 < m)$
- (ii)  $\exists n \forall m (n < m^2)$
- (iii)  $\forall n \exists m (n + m = 0)$
- (iv)  $\exists n \exists m (n^2 + m^2 = 5)$
- (v)  $\exists n \exists m (n + m = 4 \wedge n - m = 1)$  5

(e) What is tautology? Show that  $(p \wedge q) \rightarrow (p \vee q)$  is a tautology. 1 + 4

### Unit—II

3. Answer any one question : 1×2

- (a) If  $n(A) = 5$  and  $n(B) = 3$ . Then find the maximum and minimum value of  $n(A \cup B)$ .

- (b) Find the numbers between 1 and 500 that are divisible by 2, 3 and 5.

4. Answer any *one* question :

1×5

- (a) (i) If  $a\mathbb{N} = \{ax : x \in \mathbb{N}\}$ , then find  $3\mathbb{N} \cap 7\mathbb{N}$  where  $\mathbb{N}$  is the set of natural numbers. 3

- (ii) Show that  $f$  is the subset of every set. 2

- (b) (i) Define power set. If a finite set has  $n$  elements then show that the power set has  $2^n$  elements.

1+2

- (ii) Differentiate between proper subset and subset with suitable examples. 2

### Unit—III

5. Answer any *one* question :

1×10

- (a) (i) For any three sets  $A$ ,  $B$  and  $C$ , prove that

$$A \times (B \cup C) = (A \times B) \cup (A \times C). \quad 5$$

- (ii) Define symmetric difference between two sets.

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(iii) If  $A$  and  $B$  be two subsets of a set  $X$ , then prove that  $A \subset B \Leftrightarrow X - B \subset X - A$ . 4

(b) (i) A relation  $\rho$  is defined on the set  $\mathbb{Z}$  by " $a\rho b$  iff  $2a + 3b$  is divisible by 5  $\forall a, b \in \mathbb{Z}$ ". Show that  $\rho$  is an equivalence relation. 5

(ii) Define partial order relation. Show that the relation ' $\subseteq$ ' (subset) defined on the power set  $P(S)$  is a partial order relation. 1+4

6. Answer any three questions : 3×2

(a) Let  $\rho$  and  $\rho'$  be two equivalence relations then show that  $\rho \cap \rho'$  is also equivalence relation.

(b) Define partition of a set.

(c) Let  $A$  be a set with 2 elements How many reflexive relations can be defined on  $A$ ?

(d) Give an example of a relation which is symmetric but not reflexive and transitive.

**Object Oriented Programming in C++**

1. Answer any *five* questions : 5×2

- (a) What are the different features of C++?
- (b) Differentiate between pointer and reference variable.
- (c) What are the different types of inheritance in C++?
- (d) Explain Inline function.
- (e) What do you mean by enumeration?
- (f) What is implicit and explicit type conversion in C++?
- (g) Differentiate between global and local object.
- (h) What is friend function?

2. Answer any *four* questions : 4×5

- (a) Discuss how data and functions are organized in an object oriented paradigm. List the major areas of application of OOP.

- (b) What do you mean by member access modifiers in C++? Explain exception handling with example.
- (c) Define copy constructor. Explain various types of constructors with examples.
- (d) Explain Multi-level and Multiple inheritances with examples.
- (e) Write different uses of scope resolution operator (::) in C++.
- (f) Write a program to calculate area of rectangle using inline functions.

3. Answer any *one* question :

1×10

- (a) Discuss the features of a function template. Write a C++ program to create a function template for finding minimum number out of given numbers.

- (b) What is polymorphism? Elaborate the statement "Overloading is a type of polymorphism" with the help of suitable example and using the concept of function overloading.