2019

B.Sc.

3rd Semister Examination

MATHEMATICS (Honours)

Paper - SEC1T

Full Marks : 40 Time : 2 Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practiable.
Illustrate the answers wherever necessary.

Logic and Sets

Unit - I

1. Answer any *one* question : 1×2

   (a) Write the negation of each of the following statements :

      (i) He swims if and only if the water is warm.

      (ii) This computer program is correct if and only if, it produces the correct answer for all possible sets of input data.

[Turn Over]

(b) What do you mean by argument and valid argument in propositional logic ?

2. Answer any *three* questions : 3×5

(a) What do you mean by principal disjunctive normal form ? Obtain the principal disjunctive normal form of the followings :

(i) $p \Rightarrow q$, (ii) $q \vee (p \vee \sim q)$ 1+2+2

(b) (i) Prove the validity of the following argument

'If I get the job and work hard, then I will get promoted. If I get promoted, then I will be happy, otherwise I will not be happy. Therefore, either I will not get the job or I will not work hard'. 3

(ii) Prove that if $\sqrt{2}$ is irrational by giving a proof of contradiction. 2

(c) Prove that the following proposition is Tautology (without truth table)

$$\left[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)\right] \rightarrow r \qquad 5$$

(d) Let D = {1, 2, 3, ..., 9}. Determine the truth value of the following statements.

(i) $(\forall x \in D)x+4<15$

(ii) $(\forall x \in D)x+4>15$

(iii) $(\forall x \in D)x+4 \leq 10$

(iv) $(\exists x \in D)x+4>15$

(v) $(\exists x \in D)x+4=10$ 1+1+1+1+1

(e) (i) Show that $\exists x\, Q(x)$ is a valid conclusion from the premises : $\forall(x)(P(x) \rightarrow Q(x))$ and $\exists x\, P(x)$.

(ii) Write down the negation of the following proposition "for every number x there is a number y such that y < x". 3+2

Unit - II

3. Answer any *one* question : 1×2

(a) (i) Find the following set in set - builder form

A = {3, 6, 9, 12, 15}. 1

(ii) Represent the following set in tabular form

$$A = \{x : x^2 - 3x + 2 = 0\}$$ 1

(b) Let $A_n = \{x : x \text{ is a multiple of n, } n \in N\}$. Find (i) $A_2 \cup A_7$ (ii) $A_4 \cap A_6$.

4. Answer any *one* question : 1×5

(a) Show that the set of real numbers in [0, 1] is uncountable set. 5

(b) For the sets A = {1, 3, 5, 7, 9}, B = {2, 4, 6, 8} and C = {3, 6, 9}, verify the distributive laws. 5

Unit - III

5. Answer any *one* question : 1×10

(a) (i) Find how many integers between 1 and 60 that are not divisible by 2 nor by 3 and nor by 5. Also determine the number of integers divisible by 5, not by 2, not by 3. By set theoretic approach. 5

(ii) What are the concept of partial ordered relation ? Explain with two examples. 5

(b) (i) Let A_0, A_1 and A_2 be three subsets of Z defined by $A_i = \{3n+i : n \in Z\}$ for i = 0, 1, 2. Show that A_0, A_1 and A_2 form a partition of the set Z.

(ii) Determine the nature of the following relations R on the set Z.

(A) $a\ R\ b$ if and only if $a, b \in Z$ and $ab \geq 0$

(B) $a\ R\ b$ if and only if $a, b \in Z$ and $|a-b| \leq 3$. 4+3+3

6. Answer any *three* questions : 3×2

(a) Prove that $A - B = A \cap B'$

(b) Let S be a set containing three elements. How many different binary relations can be defined on S ?

(c) Give an example of anti-symmetric relation.

(d) Define 'domain' and 'range' of a relation.

(e) Define n-ary relation.

[Turn Over]

Object Oriented Program in C++

Group - A

Answer any ***five*** questions out of eight questions carrying 2 marks of each. 5×2=10

1. What is constructor ? Explain.
2. What do you mean by object and class ?
3. Write a brief note on 'C out'.
4. What is the function of dynamic memory allocation?
5. What do you mean by preprocessor directive ?
6. Explain the array in C++.
7. Differentiate between looping and branching ?
8. What is conditional operator in C++ language ?

Group - B

Answer any ***four*** questions out of six questions carrying 5 marks of each. 5×4=20

9. What is public access specifier ? How is it different from private access specifier ?
10. Which features are included in C++ from C ?

11. What are the differences between object oriented programming and procedural oriented programming ?

12. Write a brief note on function polymorphism.

13. Explain dynamic binding with an example.

14. Distinguish between private and public inheritance.

Group - C

Answer any ***one*** question out of two questions carrying 10 marks of each. 1×10=10

15. Write a C++ program to overload addition (+) and multiplication (*) operators to perform addition and multiplication of two complex numbers. 10

16. (a) What is encapsulation ? Why is it important in C++ ?

    (b) Write a C++ program to find the factorial of a given integer. 5+5