



# **SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY)**

(Established under Section 3 of the UGC Act, 1956 )  
Re-accredited by NAAC with 'A' Grade (3.58/4) Awarded Category – I by UGC

**Seat No.** \_\_\_\_\_

Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

**Programme: (070121) BACHELOR OF TECHNOLOGY  
Computer Science and Engineering, Information Technology**

Batch: 2013-17

Semester: III

Course: Industrial Management

Course Code: 0701210306CS, 0701210306IT

ESE - April - 2019

## CS - Sem - III

Date: 10/05/2019

Maximum Marks: 45

**Day: Friday**

**Time: 01:30 pm - 03:00 pm**

## Instructions:

1. All questions are compulsory.
  2. Draw neat diagrams wherever necessary.

## PART A

- |      |   |   |
|------|---|---|
| Q. 1 | a) Explain types of managerial skills and the Organizational Hierarchy.                         | 5 |
|      | b) State and explain fourteen general principles of management.                                 | 5 |
| Q. 2 | a) Describe the factors to be considered in designing an IT infrastructure.                     | 5 |
|      | b) Describe the traditional as well as revised work flow process model and their pros and cons. | 5 |
| Q.3  | a) What is a balance sheet? Describe its contents.  | 5 |
|      | b) What is an alternative source of staffing and how is it done?                                | 5 |
| Q.4  | a) What is Total Quality management?  | 5 |
|      | b) How to educate executives on the value of system management?                                 | 5 |
| Q.5  | What are the tools used for financial management?   | 5 |





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Seat No. [ ] [ ] [ ] [ ] [ ] [ ]

Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070122) BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

(070124) BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY)

Batch: 2017-21

Semester: III

Course: Digital Electronics and Logic Design

Course Code: 0701220307, 0701240307

Date: 08/05/2019

Maximum Marks: 45

Day: Wednesday

Time: 01:30 pm - 03:00 pm

## Instructions:

1. All questions are compulsory.
2. Draw neat diagrams wherever necessary.
3. Use of non-programmable calculators is allowed.
4. Make suitable assumptions wherever required.

**Q.1** Perform the following. 6

- i)  $(24)_8 / (8)_{10} = ( )_2$  Binary division.
- ii)  $(ABC)_{16} - (CBA)_{16} = ( )_{16}$  Hexadecimal subtraction using 16's complement.
- iii)  $(827)_{10} - (123)_{10} = ( )_{10}$  BCD subtraction using 9's complement.

**Q.2** a) Simplify the given expression using Boolean laws. Also mention the name of the laws. 4

$$Y = (A + B + \bar{C})(A + \bar{B} + \bar{C})(\bar{A} + B + \bar{C})(\bar{A} + \bar{B} + \bar{C})$$

b) State and prove DeMorgan's Theorem. 2

**Q.3** a) Simplify the Boolean function using K-map. 4

$$Y = A'B'CD + A'BCD' + A'B'C' + A'B'D' + AC' + B'$$

b) Convert the following expression into standard SOP form. 3

$$Y = A'B + AC' + BD + A'D$$

**Q.4** a) Explain with example BCD adder using 4 bit parallel adder IC 7483. Also write truth table and K-map for the same. 6

b) Design with Truth Table 16:1 multiplexer using 8:1 multiplexers. 4

**Q.5** a) Draw and explain the circuit diagram of 4-bit SISO shift register. Show the timing diagram for specified data input 1010. Assume register initially clear all (0s). **7**

b) What is the drawback of JK flip flop? How it can be avoided? **6**

c) Differentiate D and T flip flops. **3**

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Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070121) BACHELOR OF TECHNOLOGY  
Information Technology, Computer Science and Engineering  
Batch: 2013-17,2014-18  
Semester: III  
Course: Digital Electronics & Logic Circuits  
Course Code: 0701210305IT, 0701210305CS

Date: 08/05/2019

Maximum Marks: 60

Day: Wednesday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. All questions are compulsory.
2. Draw neat diagrams wherever necessary.
3. Use of non-programmable calculators is allowed.
4. Make suitable assumptions wherever required.

**Q.1 a) Solve the given expression using algebraic simplification and K-map.**

8

$$Y = A'B'CD + A'BCD' + A'B'C' + A'B'D' + AC' + B'$$

**b) Which logic gates are known as universal gates? Realize all the basic gates and special gates using any one universal gate.**

6

**Q.2 Define fan-in, fan-out, propagation delay.**

6

**Q.3 a) Perform the followings.**

6

- i)  $(A65)_{16} - (777)_{16} = ( )_{16}$  Hexadecimal subtraction using 16's complement.
- ii)  $(599)_{10} + (984)_{10} = ( )_{10}$  BCD addition.
- iii)  $(699)_{10} - (432)_{10} = ( )_{10}$  BCD subtraction using 10's complement.

**b) Design and explain with Truth Table 1:16 demultiplexer using 1:4 demultiplexers.**

6

**c) Design full adder using half adders along with truth table and K-map.**

4

**Q.4** a) Describe 4-bit Parallel In/Serial Out shift register (PISO). Show the waveform for serial output with the data input bits 1011 and clock shift/load. 6

b) Explain JK flip flop with preset and clear input. Also draw the truth table. What is the major drawback of JK flip flop? 5

c) Compare latches and flip flops. 4

**Q.5** Draw and explain ASM chart for mod 4 up counter with the condition that there exist an input signal W and if  $W=1$ , the count is incremented by 1 otherwise it remains same. 5

**Q.6** Explain the internal architecture of a PLA. 4



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Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070121) BACHELOR OF TECHNOLOGY  
Computer Science and Engineering, Information Technology

Batch: 2014-18,2015-19,2016-20

Semester: III

Course: Digital Electronics & Logic Design

Course Code: 0701220305CS, 0701240305IT

Date: 08/05/2019

Maximum Marks: 60

Day: Wednesday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. All questions are compulsory.
2. Draw neat diagrams wherever necessary.
3. Use of non-programmable calculators is allowed.
4. Make suitable assumptions wherever required.

**Q.1 a) Solve the given expression using algebraic simplification and K-map.** 8

$$Y = A'B'CD + A'BCD' + A'B'C' + A'B'D' + AC' + B'$$

**b) Which logic gates are known as universal gates? Realize all the basic gates and special gates using any one universal gate.** 6

**Q.2 Define fan-in, fan-out, propagation delay.** 6

**Q.3 a) Perform the followings.** 6

i)  $(A65)_{16} - (777)_{16} = ( )_{16}$  Hexadecimal subtraction using 16's complement.

ii)  $(599)_{10} + (984)_{10} = ( )_{10}$  BCD addition.

iii)  $(699)_{10} - (432)_{10} = ( )_{10}$  BCD subtraction using 10's complement.

**b) Design and explain with Truth Table 1:16 demultiplexer using 1:4 demultiplexers.** 6

**c) Design full adder using half adders along with truth table and K-map.** 4

**Q.4** a) Describe 4-bit Parallel In/Serial Out shift register (PISO). Show the waveform for 6 serial output with the data input bits 1011 and clock shift/load.

- b) Explain JK flip flop with preset and clear input. Also draw the truth table. What is 5 the major drawback of JK flip flop?
- c) Compare latches and flip flops. 4

**Q.5** Draw and explain ASM chart for mod 4 up counter with the condition that there 5 exist an input signal W and if  $W=1$ , the count is incremented by 1 otherwise it remains same.

**Q.6** Explain the internal architecture of a PLA. 4



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Programme: (070121) BACHELOR OF TECHNOLOGY  
Computer Science and Engineering

Batch: 2013-17, 2014-18, 2015-19, 2016-20

Semester: III

Course: Computer Organization

Course Code: 0701220304CS

Date: 06/05/2019

Maximum Marks: 60

Day: Monday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. All questions are compulsory.
2. Make suitable assumptions wherever required.
3. Neat diagram must be drawn whenever necessary.

- |     |   |
|-----|---|
| Q.1 | a) Outline a flowchart of restoring binary division. Perform 11 / 3. 6  |
|     | b) Demonstrate $99.625_{(10)}$ in single precision floating point format. 4   |
|     | c) Illustrate single bus structure with neat diagram. 6   |
| Q.2 | a) Summarize instruction pipelining. 6  |
|     | b) Explain block diagram of 8086 microprocessor. 4  |
| Q.3 | a) Outline structure of micro-programmed control unit. 6  |
|     | b) Explain need for grouping of control signals. 4  |
| Q.4 | a) Main memory has 3 page frames and processor requires pages from virtual memory in following Order:<br><br>1    2    3    2    4    3    5    2    5    2    3    4<br>Show implementation of First-In First Out, Least Recently Used and Optimal algorithm. Compare page faults. 6 |
|     | b) Explain the following: 4<br>i)PROM<br>ii)EEPROM  |
|     | c) With suitable diagram explain how mapping is performed in direct mapping cache organization. 4   |
| Q.5 | a) Demonstrate working mechanism of Scanner. 6  |
|     | b) Compare Programmed I/O and Interrupt driven I/O. 4   |

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Programme: (070122) BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

Batch: 2017-21

Semester: III

Course: Computer Organization

Course Code: 0701220306

Date: 06/05/2019

Maximum Marks: 45

Day: Monday

Time: 01:30 pm - 03:00 pm

## Instructions:

1. All questions are compulsory.
2. Make suitable assumptions wherever required.
3. Neat diagram must be drawn whenever necessary.

- |     |  |   |
|-----|--|---|
| Q.1 | a) Explain different computer components.  | 4 |
|     | b) Demonstrate $22^* (-5)$ using Booth's algorithm.  | 4 |
| Q.2 | a) Outline different types of machine instructions.  | 6 |
|     | b) Illustrate bus interface unit of 8086 microprocessor.   | 7 |
| Q.3 | Summarize delay element method for design of hardwired control unit.   | 4 |
| Q.4 | a) Main memory has 3 page frames and processor requires pages from virtual memory in following order:<br>1 2 3 3 4 2 3 1 4 2 5 4<br>Show implementation of First-In First Out, Least Recently Used and Optimal Algorithm. Compare page faults. | 6 |
|     | b) Compare RAM & ROM.  | 3 |
|     | c) With suitable diagram explain how mapping is performed in block set associative mapping cache organization.   | 4 |
| Q.5 | a) Explain program controlled I/O transfer technique.  | 4 |
|     | b) Demonstrate working mechanism of keyboard.  | 3 |

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Programme: (070121) BACHELOR OF TECHNOLOGY  
Computer Science and Engineering

Batch: 2016-20

Semester: III

Course: Fundamentals of Data Structures

Course Code: 0701220303CS

Date: 04/05/2019

Maximum Marks: 45

Day: Saturday

Time: 01:30 pm - 03:00 pm

## Instructions:

1. All questions are compulsory.
2. Neat diagrams must be drawn wherever necessary.
3. Make suitable assumptions wherever required.

Q.1 a) What is an actual and formal arguments in function calling? Explain with 4 example.  
b) Explain recursive functions. Write C-program for factorial of a number using 6 recursion.

Q.2 a) What are types of data structure? 4  
b) Write C-function for insertion sort. Apply insertion sort to following input and 6 show passes.

9, 6, 5, 0, 8, 2, 7, 1, 3

Q.3 a) What is a queue data structure? State its types. 4  
b) Write 'C' program to implement following operations on a linear queue using 6 appropriate data structure.  
i) Insert an element  
ii) Delete an element  
iii) Display queue contents  
iv) Queue full  
v) Queue empty

- Q.4** a) What is stack? Explain its basic operations. 4
- b) Select and apply appropriate data structure to following problem statements. Show all steps. 6
- Convert infix expression to postfix : (  $B^2 - 4 * A * C )^{1/2}$
  - Evaluate prefix expression:  $* + 3 5 - 6 4$

- Q.5** What is the difference between text and binary file? State and explain the different modes of opening a file in C using fopen( ) function. 5

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Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070122) BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

Batch: 2017-21, 2013-17, 2014-18, 2015-19

Semester: III

Course: Fundamentals of Data Structures

Course Code: 0701220304, 0701210303CS

Date: 04/05/2019

Maximum Marks: 60

Day: Saturday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. All questions are compulsory.
2. Neat diagrams must be drawn wherever necessary.
3. Make suitable assumptions wherever required.

Q.1 a) Explain concept recursion. Write a C-program for finding factorial of a number 6 using recursion.

b) Define ADT. State and explain different types of data structure. 8

Q.2 a) Apply insertion sort techniques for following set of input, show all the passes. 6  
9, 6, 5, 0, 8, 2, 7, 1, 3

b) Write function code for quick sort. Apply quicksort on following input, show 8 passes.

9, 6, 5, 0, 8, 2, 4, 7

Q.3 a) Explain stack data structure with its basic operations. 4

b) Write an algorithm to convert prefix expression to infix. Convert following 8 prefix expression to infix and postfix expression.

+ / + A B - C D E

**Q.4** a) State and explain different types queue data structure. 6

b) Write 'C' program to implement following operations on a priority queue using arrays. 8

- i) Insert an element
- ii) Delete an element
- iii) Display queue contents
- iv) Queue full
- v) Queue empty

**Q.5** What is the difference between text and binary file? State and explain the different modes of opening a file in C using fopen( ) function. 6

**OR**

**Q.5** Explain collision. How hashing techniques applied to resolve collision. 6

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Programme: (070122) BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)  
(070124) BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY)

Batch: 2017-21, 2013-17, 2014-18, 2015-19, 2016-20

Semester: III

Course: Programming Paradigms

Course Code: 0701220302, 0701240302, 0701220302CS, 0701240302IT

Date: 02/05/2019

Maximum Marks: 45

Day: Thursday

Time: 01:30 pm - 03:00 pm

## Instructions:

1. All questions are compulsory.
2. Support answer with relevant examples wherever applicable.
3. Draw necessary diagrams wherever applicable.

Q.1	a) Contrast between procedural and object oriented programming using eight differences among them.	4
	b) Elaborate different types of programming paradigms in detail.	4
Q.2	a) Model storage of floating point numbers in different formats.	4
	b) Classify between structured and non-structured data types on the basis of their properties and examples.	4
	c) Explain steps to create Abstract Data Type (ADT) in C and difference between ADT and objects.	5
Q.3	Justify setprecision and setw manipulators in C++ using a program.	2
Q.4	a) Explain multiple inheritances in C++ using a program.	5
	b) Develop a program in C++ for runtime polymorphism.	5
Q.5	Inspect backward and forward search structures, syntax and control structures in prolog with suitable examples.	8
Q.6	Utilize any four built-in tuple functions, list methods in Python with their respective examples.	4

OR

Q.6 Explain type checking with LISP programming. 4

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Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070121) BACHELOR OF TECHNOLOGY  
Computer Science and Engineering, Information Technology

Batch: 2013-17, 2014-18, 2015-19, 2016-20

Semester: III

Course: Discrete Structures

Course Code: 0701220301CS, 0701240301IT

Date: 30/04/2019 Maximum Marks: 60

Day: Tuesday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. Draw neat labeled diagrams wherever necessary.
2. All questions are compulsory.

- Q.1** a) State whether the following are propositions or not. Give explanation for your answer. 3  
i) What time is it?  
ii)  $x + y = z$ .  
iii)  $2 + 2 = 3$ .
- b) Construct a truth table for the given compound proposition. 4  
i)  $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$
- c) Translate the given English statement into a logical expression. 3  
i) "You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old."
- Q.2** a) In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there? 4  
b) In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together? 3  
c) A pack contains 4 blue, 2 red and 3 black pens. If 2 pens are drawn at random from the pack, NOT replaced and then another pen is drawn. What is the probability of drawing 2 blue pens and 1 black pen? 3
- Q.3** a) If  $U$  is any set, then show that  $(P(U), \subseteq)$  is a lattice. 3  
b) Which elements of the poset  $(\{1, 2, 3, 4, 6, 8, 12\}, |)$  are maximal, and which are minimal? 4  
c) Consider the following relations on  $\{1, 2, 3, 4\}$ :  
 $R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$ ,  
 $R_2 = \{(1, 1), (1, 2), (2, 1)\}$ ,  
 $R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$ ,  
 $R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$ ,  
 $R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$ ,  
 $R_6 = \{(3, 4)\}$ . Which of these relations are transitive? Give reasons for your answer. 3

**Q.4** a) Show that:  $1+4+7+\dots+(3n-2) = \frac{n(3n-1)}{2}$  using mathematical induction. **5**

b) Determine whether the function  $f(x) = x^2$  from the set of integers to the set of integers is one-to-one. **2**

c) What is the Cartesian product  $A \times B \times C$ , where  $A = \{0, 1\}$ ,  $B = \{1, 2\}$ , and  $C = \{0, 1, 2\}$ ? **3**

**Q.5** a) Form a binary search tree for the given list of elements: **4**

12, 5, 15, 6, 25, 78, 40, 1, 10, 24, 46, 59, 100, 33, 87, 9, 20

b) Use Huffman coding to encode the following symbols with the frequencies listed: A: 0.25, B: 0.1, C: 0.2, D: 0.15, E: 0.26, F: 0.04. **6**

**Q.6** a) Mention the necessary conditions for an algebraic system to be a group. List the properties of a group. **6**

b) Explain semigroup and monoids with examples **4**

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(070124) BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY)

Batch: 2017-21

Semester: III

Course: Discrete Mathematics and Probability Theory

Course Code: 0701220301, 0701240301

Date: 30/04/2019

Maximum Marks: 60

Day: Tuesday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. All Questions are compulsory.
2. Non programmable calculator is allowed.

**Q. 1** a) A survey of 500 television watchers produced the following information: 4

285 watch football games, 195 watch hockey games, 115 watch basketball games, 45 watch football and basketball games, 70 watch football and hockey games, 50 watch hockey and basketball games, and 50 do not watch any game. Using Venn diagram find the number of people (i) watching exactly one game (ii) all three games.

b) Let  $U = \{a, b, c, d, e, f, g, h, k\}$ ,  $A = \{a, b, c, e, g\}$ ,  $B = \{d, e, f, g, h\}$  2  
Verify  $(\bar{A} \cap \bar{B}) = \overline{(A \cup B)}$

**Q.2** a) Show that  $(p \rightarrow q) \wedge (p \rightarrow r)$  and  $p \rightarrow (q \wedge r)$  are logically equivalent. 4

b) Using method of induction, prove that 4

$$1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n+1)(2n-1)}{3}$$

**Q.3** a) Let  $m$  be an integer with  $m > 1$ , show that the relation 4

$R = \{(a, b) | a \equiv b \pmod{m}\}$  defined on a set of integers is an equivalence relation.

b) Find the general solution of recurrence relation  $a_n - 5a_{n-1} + 6a_{n-2} = 7^n$  4

c) Using Euclidean algorithm find the GCD of 678 and 3987. 4

d) Show that the set of all positive integers less than 9 and relatively prime to 9 forms a group under multiplication modulo 9. 4

**OR**

- d) Show that  $(Z_n, \oplus_n, \odot_n)$  is a ring, where  $\oplus_n$  is addition (mod n) and  $\odot_n$  is multiplication (mod n). 4
- Q.4** a) Five figure number is formed by digits 0, 1, 2, 3, 4 without repetitions. Find the probability that the number formed is divisible by 4. 4
- b) In a factory, machines A, B, C manufacture 25%, 35% and 40% of the total bulbs. Out of their output 5%, 4% and 2% bulbs produced by A, B and C are found to be defective respectively. At the end of a day, one bulb is selected at random and found to be defective. What is the probability that it was manufactured by machine B? 4
- c) The probability density function of a random variable X is 4
- |      |     |      |      |      |      |       |       |
|------|-----|------|------|------|------|-------|-------|
| x    | 0   | 1    | 2    | 3    | 4    | 5     | 6     |
| P(x) | $k$ | $3k$ | $5k$ | $7k$ | $9k$ | $11k$ | $13k$ |
- (i) Find  $P(X < 4), P(X \geq 5), P(3 < X \leq 6)$   
(ii) What will be the minimum value of k so that  $P(X \leq 2) > 3$  5
- Q.5** a) In sampling large number of parts manufactured by a machine the mean number of defectives in a sample of 20 is 2. Out of 1000 such samples, how many would be expected to contain at least 3 defective parts. 4
- b) A radioactive source emits on an average 2.5 particles per second. Find the probability that 3 or more particles will be emitted in an interval of 4 seconds. 5
- Q.6** a) The time required to repair the machine is exponentially distributed with  $\lambda = \frac{1}{2}$ . What is the probability that the repair time exceed 2 hours? 4
- b) A manufacturer of air-mail envelops knows from experience that the weight of the envelop is normally distributed with mean 1.95 gm and standard deviation 0.05 gm. From a given packet of 1000 envelops, how many envelopes weighing (i) 2 grams are more (ii) between 1.9 and 2.05 grams. 5
- $A(z = 1) = 0.3413, A(z = 2) = 0.4772$
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Computer Science and Engineering, Information Technology

Batch: 2013-17,2014-18,2015-19,2016-20

Semester: III

Course: Discrete Structures

Course Code: 0701220301CS, 0701240301IT

Date: 30/04/2019

Maximum Marks: 60

Day: Tuesday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. Draw neat labeled diagrams wherever necessary.
2. All questions are compulsory.

- Q.1** a) State whether the following are propositions or not. Give explanation for your answer. 3  
i) What time is it?  
ii)  $x + y = z$ .  
iii)  $2 + 2 = 3$ .
- b) Construct a truth table for the given compound proposition. 4  
i)  $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$
- c) Translate the given English statement into a logical expression. 3  
i) "You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old."
- Q.2** a) In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there? 4
- b) In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together? 3
- c) A pack contains 4 blue, 2 red and 3 black pens. If 2 pens are drawn at random from the pack, NOT replaced and then another pen is drawn. What is the probability of drawing 2 blue pens and 1 black pen? 3
- Q.3** a) If  $U$  is any set, then show that  $(P(U), \subseteq)$  is a lattice. 3  
b) Which elements of the poset  $(\{1, 2, 3, 4, 6, 8, 12\}, |)$  are maximal, and which are minimal? 4  
c) Consider the following relations on  $\{1, 2, 3, 4\}$ :  
 $R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$ ,  
 $R_2 = \{(1, 1), (1, 2), (2, 1)\}$ ,  
 $R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$ ,  
 $R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$ ,  
 $R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$ ,  
 $R_6 = \{(3, 4)\}$ . Which of these relations are transitive? Give reasons for your answer. 3

SYMBIOSIS INTERCOLLEGE		
COURSE: DATA STRUCTURE & ALGORITHMS CLASS: SEMESTER-I EXAM: SEMESTER-I EXAMINATIONS YEAR: 2018-19 ROLL NO.: _____ NAME: _____ DEPARTMENT: _____ TELEPHONE NO.: _____ E-MAIL ID: _____		
<b>Q.4</b>	<p>a) Show that: <math>1+4+7+\dots+(3n-2) = \frac{n(3n-1)}{2}</math> using mathematical induction.</p> <p>b) Determine whether the function <math>f(x) = x^2</math> from the set of integers to the set of integers is one-to-one.</p> <p>c) What is the Cartesian product <math>A \times B \times C</math>, where <math>A = \{0, 1\}</math>, <math>B = \{1, 2\}</math>, and <math>C = \{0, 1, 2\}</math>?</p>	5
<b>Q.5</b>	<p>a) Form a binary search tree for the given list of elements: 12, 5, 15, 6, 25, 78, 40, 1, 10, 24, 46, 59, 100, 33, 87, 9, 20</p> <p>b) Use Huffman coding to encode the following symbols with the frequencies listed: A: 0.25, B: 0.1, C: 0.2, D: 0.15, E: 0.26, F: 0.04.</p>	2 3 4 6
<b>Q.6</b>	<p>a) Mention the necessary conditions for an algebraic system to be a group. List the properties of a group.</p> <p>b) Explain semigroup and monoids with examples</p>	6 4
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# SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY)

(Established under Section 3 of the UGC Act, 1956 )  
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Seat No.							
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Institute: (0701)SYMBIOSIS INSTITUTE OF TECHNOLOGY, PUNE

Programme: (070122) BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)  
(070124) BACHELOR OF TECHNOLOGY (INFORMATION TECHNOLOGY)

Batch: 2017-21

Semester: III

Course: Discrete Mathematics and Probability Theory

Course Code: 0701220301, 0701240301

Date: 30/04/2019

Maximum Marks: 60

Day: Tuesday

Time: 01:30 pm - 04:00 pm

## Instructions:

1. All Questions are compulsory.
2. Non programmable calculator is allowed.

**Q. 1** a) A survey of 500 television watchers produced the following information: 4

285 watch football games, 195 watch hockey games, 115 watch basketball games, 45 watch football and basketball games, 70 watch football and hockey games, 50 watch hockey and basketball games, and 50 do not watch any game. Using Venn diagram find the number of people (i) watching exactly one game (ii) all three games.

b) Let  $U = \{a, b, c, d, e, f, g, h, k\}$ ,  $A = \{a, b, c, e, g\}$ ,  $B = \{d, e, f, g, h\}$  2  
Verify  $(\bar{A} \cap \bar{B}) = \overline{(A \cup B)}$

**Q.2** a) Show that  $(p \rightarrow q) \wedge (p \rightarrow r)$  and  $p \rightarrow (q \wedge r)$  are logically equivalent. 4

b) Using method of induction, prove that 4

$$1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n+1)(2n-1)}{3}$$

**Q.3** a) Let  $m$  be an integer with  $m > 1$ , show that the relation 4

$R = \{(a, b) | a \equiv b \pmod{m}\}$  defined on a set of integers is an equivalence relation.

b) Find the general solution of recurrence relation  $a_n - 5a_{n-1} + 6a_{n-2} = 7^n$  4

c) Using Euclidean algorithm find the GCD of 678 and 3987. 4

d) Show that the set of all positive integers less than 9 and relatively prime to 9 forms a group under multiplication modulo 9. 4

**OR**

- d) Show that  $(Z_n, \oplus_n, \odot_n)$  is a ring, where  $\oplus_n$  is addition (mod n) and  $\odot_n$  is multiplication (mod n). 4
- Q.4** a) Five figure number is formed by digits 0, 1, 2, 3, 4 without repetitions. Find the probability that the number formed is divisible by 4. 4
- b) In a factory, machines A, B, C manufacture 25%, 35% and 40% of the total bulbs. Out of their output 5%, 4% and 2% bulbs produced by A, B and C are found to be defective respectively. At the end of a day, one bulb is selected at random and found to be defective. What is the probability that it was manufactured by machine B? 4
- c) The probability density function of a random variable X is 4
- |      |   |      |      |      |      |       |       |
|------|---|------|------|------|------|-------|-------|
| x    | 0 | 1    | 2    | 3    | 4    | 5     | 6     |
| P(x) | k | $3k$ | $5k$ | $7k$ | $9k$ | $11k$ | $13k$ |
- (i) Find  $P(X < 4), P(X \geq 5), P(3 < X \leq 6)$   
(ii) What will be the minimum value of k so that  $P(X \leq 2) > 3$  5
- Q.5** a) In sampling large number of parts manufactured by a machine the mean number of defectives in a sample of 20 is 2. Out of 1000 such samples, how many would be expected to contain at least 3 defective parts. 4
- b) A radioactive source emits on an average 2.5 particles per second. Find the probability that 3 or more particles will be emitted in an interval of 4 seconds. 5
- Q.6** a) The time required to repair the machine is exponentially distributed with  $\lambda = \frac{1}{2}$ . What is the probability that the repair time exceed 2 hours? 4
- b) A manufacturer of air-mail envelops knows from experience that the weight of the envelop is normally distributed with mean 1.95 gm and standard deviation 0.05 gm. From a given packet of 1000 envelops, how many envelopes weighing (i) 2 grams are more (ii) between 1.9 and 2.05 grams. 5

$$A(z=1) = 0.3413, A(z=2) = 0.4772$$

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