(201MAT17/201APM17)

M.Sc. DEGREE EXAMINATION, APRIL 2018

SECOND SEMESTER

Branch — Mathematics / Applied Mathematics

DISCRETE MATHEMATICS

(New Syllabus for batch 2017)

Time : 3 Hours *Max. Marks : 80*

SECTION – A

Answer any FOUR of the following questions.

(Marks : 4 × 5 marks = 20 marks)

1. Obtain disjunctive normal form of $P \wedge (P \rightarrow Q)$.

2. Describe Rules of inference.

3. Symbolize the expression "All men are giants".

4. Negate the statement "Ottawa is a small town".

5. Prove that every chain is a Distributive Lattice.

6. Obtain the sum-of-products canonical form of the Boolean expression $x_1 \oplus \left(x_2 * x_3^1\right)'$.

7. If $S_i \equiv S_j$, then prove that for any input sequence $x, \delta(s_i, x) \equiv \delta(s_j, x)$.

8. Define a Graph. Give an example.

SECTION – B

Answer FOUR of the following questions choosing One from each Unit.

(Marks : 4 × 15 marks = 60 marks)

UNIT – I

9. (a) (i) Show that $Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ is a tautology.

(ii) Obtain the principal conjunctive normal form of $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$.

Or

(b) (i) Prove that $R \rightarrow S$ is derived from the premises $P \rightarrow (Q \rightarrow S)$, $\neg R \vee P$ and Q.

(ii) Show that $P \wedge \neg P \wedge Q \Rightarrow R$, by using automatic theorem proving.

[P.T.O]

UNIT – II

10. (a) Indicate the variables that are free and bound and also show the scope of the quantifie
$(x)(P(x) \wedge R(x)) \to (x)P(x) \wedge Q(x)$.

Or

(b) (i) Explain the theory of inference for the predicate calculus.

(ii) Prove that $(x)(P(x) \to Q(x)) \wedge (x)(Q(x) \to R(x)) \Rightarrow (x)(P(x) \to R(x))$.

UNIT – III

11. (a) Let $\langle L, \leq \rangle$ be a lattice in which $*$ and $\oplus$ denote the operations of meet and joi
respectively. Then prove that for any $a, b \in L$, $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$.

Or

(b) (i) Obtain the product-of-sums canonical form of the expression $[(x_1 + x_2)(x_3 x_4)']'$.

(ii) Use the Karnaugh map representation to find a minimal sum-of-produc
expression of the function $f(a,b,c) = \sum(0,1,2,3,13,15)$.

UNIT – IV

12. (a) Let s be any state in a finite-state machine and x and y be any words. Then pro
that $\delta(s, xy) = \delta(\delta(s, x), y)$ and $\lambda(s, xy) = \lambda(\delta(s, x), y)$.

Or

(b) For any $n \times n$ Boolean matrix A, show that $(I + A)^{(2)} = (I + A) \wedge (I + A) = I + A + A$
where I is the $n \times n$ identity matrix and $A^{(2)} = A \wedge A$. Also show that for any positi
integer $r, (I + A)^{(r)} = I + A + A^{(2)} + \cdots + A^{(r)}$.
