MCA.I/12.15.1098 Reg.No. [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

C

MCA DEGREE I SEMESTER EXAMINATION DECEMBER 2015

CAS 2104 DISCRETE MATHEMATICAL STRUCTURES

(*Supplementary*)

Time : 3 Hours Maximum Marks : 50

PART A

(Answer *ALL* questions)

($15 \times 2 = 30$)

I. (a) What is a tautology? Give an example.

(b) State Fermat's last theorem. Is it diophantine?

(c) Define a poset.

II. (a) Define inverse of a function. Give an example.

(b) Prove that $C(n,r) = C(n,n-r)$.

(c) Solve the congruence $8p \equiv 4 \ (mod\ 12)$

III. (a) Write recurrence form of finding GCD of two integers. What is the stopping condition?

(b) Find the nth term of the sequence 3, 8, 15, 24, 35, 48, ...

(c) Given an example of a non homogeneous linear recurrence relation.

IV. (a) State and explain DeMorgan's laws.

(b) Illustrate the procedure of finding minimal-sum-of-products using K-Map.

(c) Draw a diagram of full adder using half adders.

V. (a) Define finite state machine.

(b) What is a reguiar grammar?

(c) State pumping lemma. Is the converse of lemma true?

PART B

(5 × 4 = 20)

VI. State and explain principle of mathematical induction. Show that $n^3 - 7n + 3$ is divisible by 3 for all positive integers.

OR

VII. (i) State Warshall's algorithm. Let $A = \{1; 2; 3; 4\}$, and let $R = \{(1,2); (2;3); (3;4); (2;1)\}$. Find the transitive closure of R.
(ii) Draw the Hasse diagram of the lattice L of all subsets of $\{x, y, z\}$ under intersection and union.

VIII. Outline the round robin tournament. Find such a one for 12 teams

OR

IX. Bring out the use of congruence by illustrating RSA cryptosystem.

X. Formulate Tower-of-Hanoi problem as a recurrence relation and solve it.

OR

XI. (i) State master method to solve a recurrence relation.
(ii) Solve $a_n - 2a_{n-1} - 3_{n-2} = 5n$ for $n \geq 2$ with $a_0 = -1$ and $a_1 = 1$.

XII. (i) In a Boolean algebra $(B, +, ., ')$ $\forall a, b, c \in B$, prove DeMorgan's laws hold.
(ii) Determine which product terms are adjacent

$$WXY + W'XY'Z + W'X'Y + WX'Y.$$

OR

XIII. Find a minimal-sum-of-products representation for
$F(w, x, y, z) = \sum m(1, 3, 5, 7, 9) + d(10, 11, 12, 13, 14, 15)$.

XIV. Show that the language L is not CFL where
$L = \{\{a^n b^n c^n \mid n \geq 1\}$ over $\sum\{a, b, c\}$.

OR

XV. Find a right-linear grammar for the language
$L = \{\{a^n\ b \in \{a, b\}^* \mid n \text{ is a positive integer}\}$.

***