MAHATMA GANDHI UNIVERSITY
M.C.A DEGREE EXAMINATION
MODEL QUESTION PAPER
(2011 Revised Syllabi)
First Semester

MCA101 Mathematical Foundations of Computer Science

Time: 3 hours **Maximum: 75Marks**

Part A

Answer any ten questions.
Each question carries 3 marks.

1. If A, B, C are sets such that A Ụ B=A Ụ C and A∩B=A∩C then show that B=C
2. Prove that the relation" congruence modulo m" given by
   R ={ (x,y) / x-y is divisible by m} over the set of positive integers is an equivalence relation
3. Define L ỤB and GLB of subset of a poset. Give examples.
4. Define distributive lattice
5. Define the following
   i) DFA
   ii) NFA
   iii) Transition diagram
6. Construct the truth table for $(p \wedge (p \rightarrow q)) \rightarrow q$
7. With the help of examples explain free and bound variables
8. Define incidence matrix . Give an example
9. Define a complete bipartite graph. Draw the complete bipartite graphs $K_{2,3}$, $k_{2,4}$ and $K_{2,5}$

10.Draw a

   a) Hamiltonian graph which is not Eulerian

   b) Euler graph which is not Hamiltonian

   c) Graph which is both Hamiltonian and Eulerian

11. Explain rooted and binary trees with examples
12. State kuratowskis theorem.

(10 x 3 = 30 marks)

Part B

All questions carry equal marks.

13 a)
   i) State and prove De-Morgans laws on set theory 5marks

ii) Using mathematical induction, show that

(n^3+2n) is divisible by 3, for n>=1 4marks

OR

(b)

i) Let R be a relation on the set of all ordered pairs of natural numbers defined by (x,y) R (u,v) iff xv=yu. Show that R is an equivalence relation 5marks

ii) Consider the functions f,g : R → R Defined by $f(x) = x^2+3x+1$, $g(x) = 2x-3$, find the composition functions of

i) fof ii) fog iii) gof iv) gog 4marks

14. a).

. Let A={1,2,3,6,9,18} Define R on A by xRy if x/y.Prove that A is a poset. Draw the Hasse diagram for the poset (A,R) 9marks

OR

b)Construct a deterministic finite automata accepting the set of all strings ending in 00 over the alphabet {0,1} 9marks

15. a) Show that (Эx) M(x) follows logically from the premises (x) (H(x) → M(x)) and (Эx) H(x) 9marks

OR

b) Show that R^(P v Q) is a valid conclusion from the premises P v Q → R, P-→ M and 7M 9marks

16. a) Show that a given connected graph G is an Euler graph if and only if all vertices of G are of even degree 9marks

OR

b) Prove that a simple graph with n vertices and k components can have at most

$$\frac{(n-k)(n-k+1)}{2}$$ edges 9marks

17 a) State and prove Euler's formula 9marks

OR

b)

i) Prove that the minimum possible height of an n vertex binary tree is $[\log_g(n+1) - 1]$ 4marks

ii) Explain Prim's algorithm to find the shortest spanning tree of a graph with an example 5marks

(5 x 9 = 45 marks)