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Reg. No..................................

Name..................................

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Third Semester

Branch : Computer Science/Information Technology

EN 010 301 B—ENGINEERING MATHEMATICS–II (CS, IT)

(New Scheme—Regular/Improvement/Supplementary)

Time : Three Hours

Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 3 marks.

1. Write in symbolic form :
   (a) All the world loves a lover.
   (b) It is not true that London is in India.
   (c) It is false that 7 + 6 = 13 and 5 + 5 = 7.
2. Differentiate between one-to-one and onto functions.
3. Define equivalence relation.
4. Let A be any subset of the real number system R with the usual order. Under what conditions is A a lattice ?
5. Draw a diagram for the graph G = G (V, E), V = {A, B, C, D}, E = {{A, B}, {D, A}, {C, A}, {C, D}}.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 marks.

6. State and explain duality law. Write the dual of $\neg(P \vee Q) \wedge \left(P \vee \neg\left(Q \wedge \neg S\right)\right)$.
7. The functions $f : A \to B, g : B \to C$ and $h : C \to D$. Prove that $h \circ (g \circ f) = (h \circ g) \circ f$.
8. Suppose R and S are transitive relations on a set A. Show that $R \cap S$ is also transitive.
9. Consider the power set P(A) of A = {*a*, *b*, *c*} which is a bounded lattice under the operations of intersection and union. Find the complement of X = {*a*, *b*} if it exists.
10. Draw a diagram of the following directed graph G where V(G) = {A, B, C, D, E} and E(G) = {[A, D], [B, C], [C, E], [D, B], [D, D], [D, E], [E, A]}.

(5 × 5 = 25 marks)

Turn over

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. (a) Find the truth tables for :

   (i) $p \wedge (q \vee r)$ and

   (ii) $(p \wedge q) \vee (p \wedge r)$. (6 marks)

   (b) Verify that the proposition $p \vee \sim (p \wedge q)$ is a tautology. (6 marks)

Or

12. (a) Negate the following :

   (i) $\forall x \, \exists y \left(p(x) \vee q(y) \right)$.

   (ii) $\exists x \forall y \left(p(x, y) \rightarrow q(x, y) \right)$. (6 marks)

   (b) Let A = {1, 2, 3, 4} be the universal set. Determine the truth value of each statement :

   (i) $\forall x, x + 3 < 6$.

   (ii) $\exists x, x + 3 < 6$,

   (iii) $\exists x, 2x^2 + x = 15$. (6 marks)

Module 2

13. (a) Suppose $f : \mathrm{A} \rightarrow \mathrm{B}$ and $g : \mathrm{B} \rightarrow \mathrm{C}$ are into functions. Show that $g \circ f : \mathrm{A} \rightarrow \mathrm{C}$ is an onto function.

   (6 marks)

   (b) Solve each of the following linear congruence equations :

   (i) $3x \equiv 2 \pmod{8}$.

   (ii) $6x \equiv 5 \pmod{9}$.

   (iii) $4x \equiv 6 \pmod{10}$. (6 marks)

Or

14. (a) State and explain Euclidean algorithm. Use it to find the gcd of 1052 and 356. (6 marks)

   (b) Using Pigeonhole principle show that the decimal expansion of a rational number, must, after some point, become periodic.

   (6 marks)

Module 3

15. (a) Let A = {1, 2, 3,.......13, 14, 15}. Let R be the relation on A defined by congruence modulo 4. Find the equivalence classes determined by R.

(6 marks)

(b) Determine whether or not each of the following is a partition of the set N of positive integers :

(i) $[\{n : b > 5\}, \{n : n < 5\}]$.

(ii) $[\{n : n > 5\}, \{0\}, \{1, 2, 3, 4, 5\}]$.

(iii) $[\{n : n^2 > 11\}, \{n : n^2 < 11\}]$. (6 marks)

Or

16. (a) Suppose R and S are reflexive relations on a set A. Show that $R \cap S$ is reflexive. (6 marks)

(b) Give examples of relations R on A = {1, 2, 3} having the stated property :

(i) R is both symmetric and antisymmetric.

(ii) R is neither symmetric nor antisymmetric.

(iii) R is transitive but $R \cup R'$ is not transitive. (6 marks)

Module 4

17. (a) Let C be a collection of sets which are closed under intersection and union. Verify that $(C, \cap, \cup)$ is a lattice.

(6 marks)

(b) Consider the power set P(A) of A = {*a*, *b*, *c*} which is a bounded lattice under the operations of intersection and union. Find the complement of X = {*a*, *b*} if it exits.

(6 marks)

Or

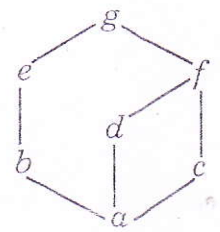
18. (a) Suppose L is a bounded lattice with lower bound O and upper bound I. Show that O and I are complements of each other.

(6 marks)

(b) Consider the lattice M in the figure shown below :

(i) Find the nonzero join-irreducible elements and the atoms of M.

(ii) Is M distributive ? (6 marks)



Module 5

19. (a) Let a, b and c be three distinct vertices in a graph. There is a path between a and b and also there is a path between b and c. Prove that there is a path between a and c.

(6 marks)

(b) Prove that any two simple connected graphs with n vertices, all of degree two, are isomorphic.

(6 marks)

Or

20. (a) Show a tree in which its diameter is not equal to twice the radius. Under what condition does this inequality hold ? Elaborate.

(6 marks)

(b) Prove that a pendant edge (an edge whose one end vertex is of degree one) in a connected graph G is contained in every spanning tree of G.

(6 marks)

[5 × 12 = 60 marks]