

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 $\neg(P \vee Q) \wedge (P \vee \neg(Q \wedge \neg S))$.
7. The functions $f : A \rightarrow B$, $g : B \rightarrow C$ and $h : C \rightarrow D$. 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)

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) $\forall x \exists y (p(x) \vee q(y))$.

(ii) $\exists x \forall y (p(x, y) \rightarrow q(x, y))$.

(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 $f: A \rightarrow B$ and $g: B \rightarrow C$ are into functions. Show that $g \circ f: A \rightarrow C$ 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 $A = \{1, 2, 3, \dots, 13, 14, 15\}$. 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 :
- $\{n : n > 5\}, \{n : n < 5\}$.
 - $\{n : n > 5\}, \{0\}, \{1, 2, 3, 4, 5\}$.
 - $\{n : n^2 > 11\}, \{n : n^2 < 11\}$. (6 marks)

Or

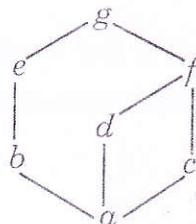
16. (a) Suppose R and S are reflexive relations on a set A . Show that $R \cap S$ is reflexive. (6 marks)
- (b) Give examples of relations R on $A = \{1, 2, 3\}$ having the stated property :
- R is both symmetric and antisymmetric.
 - R is neither symmetric nor antisymmetric.
 - R is transitive but $R \cup R'$ 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 exists. (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 :
- Find the nonzero join-irreducible elements and the atoms of M .
 - Is M distributive? (6 marks)



Turn over

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]