GATE CSE 2027 – Today's Learning (Day 1)

Date: 03 February 2026 (Tuesday)
Subject: Engineering Mathematics – Discrete Mathematics
Topic: Propositional Logic

Concept Summary

A proposition is a declarative statement that is either TRUE or FALSE, but not both. Logical connectives include NOT, AND, OR, Implication, and Biconditional. Implication $p \rightarrow q$ is false only when p is TRUE and q is FALSE. Important concepts include tautology, contradiction, contingency, and De Morgan's laws. For GATE, implication removal ($p \rightarrow q \equiv \neg p \vee q$) is heavily used.

30 GATE-Level MCQs (With Answers & Explanations)

Q1. If p is TRUE and q is FALSE, what is the value of $(p \rightarrow q)$?

Answer: FALSE
Explanation: Implication is false only when antecedent is TRUE and consequent is FALSE.

Q2. Which of the following is a tautology? A) $p \wedge \neg p$ B) $p \vee \neg p$ C) $p \rightarrow \neg p$ D) $\neg(p \vee q)$

Answer: B
Explanation: $p \vee \neg p$ is always true for any truth value of p.

Q3. $\neg(p \wedge q)$ is logically equivalent to:

Answer: $\neg p \vee \neg q$
Explanation: This follows directly from De Morgan's law.

Q4. If $p \leftrightarrow q$ is TRUE, then:

Answer: p and q have same truth value
Explanation: Biconditional is true when both propositions are either true or false.

Q5. Which is NOT a proposition?

Answer: $x + 2 = 5$
Explanation: Its truth depends on x, so it is not fixed.

Q6. $p \rightarrow q$ is equivalent to:

Answer: $\neg p \vee q$
Explanation: Standard implication elimination rule.

Q7. Which is a contradiction?

Answer: $p \wedge \neg p$
Explanation: A statement and its negation cannot be true together.

Q8. If p = F and q = T, then $p \rightarrow q$ = ?

Answer: TRUE
Explanation: Implication is true when antecedent is false.

Q9. Truth value of $(p \vee q) \wedge \neg p$ when p=F, q=T?

Answer: TRUE

Explanation: (F∨T)=T and ¬F=T, so T∧T=T.

Q10. Which law converts ¬(p ∨ q)?

Answer: De Morgan's Law
Explanation: ¬(p∨q)=¬p∧¬q.

Q11. Number of rows in truth table for 3 variables?

Answer: 8
Explanation: Number of rows = 2■ = 2^3.

Q12. p → q is false when:

Answer: p=T, q=F
Explanation: This is the only false case of implication.

Q13. (p ∧ q) → p is:

Answer: Tautology
Explanation: If p∧q is true, p must be true.

Q14. Which connective has highest precedence?

Answer: NOT (¬)
Explanation: Negation is evaluated first.

Q15. If p is TRUE, ¬p is:

Answer: FALSE
Explanation: Negation flips the truth value.

Q16. (p → q) ∧ (q → p) equals:

Answer: p ↔ q
Explanation: Definition of biconditional.

Q17. Which is logically equivalent to p ∨ q?

Answer: ¬(¬p ∧ ¬q)
Explanation: De Morgan's law.

Q18. If p ↔ q is FALSE, then:

Answer: p ≠ q
Explanation: Truth values are different.

Q19. Which is a contingency?

Answer: p ∧ q
Explanation: Sometimes true, sometimes false.

Q20. Value of ¬(TRUE)?

Answer: FALSE
Explanation: Negation of TRUE is FALSE.

Q21. (p ∨ q) ∨ r is equivalent to:

Answer: p ∨ (q ∨ r)
Explanation: Associative law.

Q22. p ∧ T = p represents:

Answer: Identity law
Explanation: TRUE does not affect AND.

Q23. $p \vee F = ?$

Answer: p
Explanation: FALSE does not affect OR.

Q24. $p \wedge F = ?$

Answer: FALSE
Explanation: AND with FALSE is always FALSE.

Q25. $p \vee T = ?$

Answer: TRUE
Explanation: OR with TRUE is always TRUE.

Q26. Which removes double negation?

Answer: $\neg(\neg p) = p$
Explanation: Double negation law.

Q27. $(p \rightarrow q) \vee (q \rightarrow p)$ is:

Answer: Tautology
Explanation: At least one implication is always true.

Q28. Which is logically strongest?

Answer: $p \wedge q$
Explanation: Requires both propositions to be true.

Q29. Which is logically weakest?

Answer: $p \vee q$
Explanation: Requires only one proposition to be true.

Q30. Main GATE use of propositional logic?

Answer: Proofs, equivalence, reasoning
Explanation: Forms the base for TOC and Discrete Mathematics.