CHECK YOUR GRASP — MATHEMATICAL REASONING — EXERCISE-I

1. The inverse of the statement $(p \wedge \sim q) \rightarrow r$ is-
(1) $\sim(p \vee \sim q) \rightarrow \sim r$ (2) $(\sim p \wedge q) \rightarrow \sim r$
(3) $(\sim p \vee q) \rightarrow \sim r$ (4) None of these

2. $(\sim p \vee \sim q)$ is logically equivalent to-
(1) $p \wedge q$ (2) $\sim p \rightarrow q$ (3) $p \rightarrow \sim q$ (4) $\sim p \rightarrow \sim q$

3. The equivalent statement of $(p \leftrightarrow q)$ is-
(1) $(p \wedge q) \vee (p \vee q)$ (2) $(p \rightarrow q) \vee (q \rightarrow p)$
(3) $(\sim p \vee q) \vee (p \vee \sim q)$ (4) $(\sim p \vee q) \wedge (p \vee \sim q)$

4. If the compound statement $p \rightarrow (\sim p \vee q)$ is false then the truth value of p and q are respectively-
(1) T, T (2) T, F (3) F, T (4) F, F

5. The statement $(p \rightarrow \sim p) \wedge (\sim p \rightarrow p)$ is-
(1) a tautology
(2) a contradiction
(3) neither a tautology nor a contradiction
(4) None of these

6. Negation of the statement $(p \wedge r) \rightarrow (r \vee q)$ is-
(1) $\sim(p \wedge r) \rightarrow \sim(r \vee q)$ (2) $(\sim p \vee \sim r) \vee (r \vee q)$
(3) $(p \wedge r) \wedge (r \wedge q)$ (4) $(p \wedge r) \wedge (\sim r \wedge \sim q)$

7. The dual of the statement $\sim p \wedge [\sim q \wedge (p \vee q) \wedge \sim r]$ is-
(1) $\sim p \vee [\sim q \vee (p \vee q) \vee \sim r]$
(2) $p \vee [q \vee (\sim p \wedge \sim q) \vee r]$
(3) $\sim p \vee [\sim q \vee (p \wedge q) \vee \sim r]$
(4) $\sim p \vee [\sim q \wedge (p \wedge q) \wedge \sim r]$

8. Which of the following is correct-
(1) $(\sim p \vee \sim q) \equiv (p \wedge q)$
(2) $(p \rightarrow q) \equiv (\sim q \rightarrow \sim p)$
(3) $\sim(p \rightarrow \sim q) \equiv (p \wedge \sim q)$
(4) $\sim(p \leftrightarrow q) \equiv (p \rightarrow q) \vee (q \rightarrow p)$

9. The contrapositive of $p \rightarrow (\sim q \rightarrow \sim r)$ is-
(1) $(\sim q \wedge r) \rightarrow \sim p$ (2) $(q \rightarrow r) \rightarrow \sim p$
(3) $(q \vee \sim r) \rightarrow \sim p$ (4) None of these

10. The converse of $p \rightarrow (q \rightarrow r)$ is-
(1) $(q \wedge \sim r) \vee p$ (2) $(\sim q \vee r) \vee p$
(3) $(q \wedge \sim r) \wedge \sim p$ (4) $(q \wedge \sim r) \wedge p$

11. If p and q are two statement then $(p \leftrightarrow \sim q)$ is true when-
(1) p and q both are true (2) p and q both are false
(3) p is false and q is true (4) None of these

12. Statement $(p \wedge q) \rightarrow p$ is-
(1) a tautology (2) a contradiction
(3) neither (1) nor (2) (4) None of these

13 If statements p, q, r have truth values T, F, T respectively then which of the following statement is true-
(1) $(p \rightarrow q) \wedge r$ (2) $(p \rightarrow q) \vee \sim r$
(3) $(p \wedge q) \vee (q \wedge r)$ (4) $(p \rightarrow q) \rightarrow r$

14. If statement $p \rightarrow (q \vee r)$ is true then the truth values of statements p, q, r respectively-
(1) T, F, T (2) F, T, F
(3) F, F, F (4) All of these

15. Which of the following statement is a contradiction-
(1) $(p \wedge q) \wedge (\sim(p \vee q))$ (2) $p \vee (\sim p \wedge q)$
(3) $(p \rightarrow q) \rightarrow p$ (4) $\sim p \vee \sim q$

16. The negative of the statement "If a number is divisible by 15 then it is divisible by 5 or 3"
(1) If a number is divisible by 15 then it is not divisible by 5 and 3
(2) A number is divisible by 15 and it is not divisible by 5 or 3
(3) A number is divisible by 15 or it is not divisible by 5 and 3
(4) A number is divisible by 15 and it is not divisible by 5 and 3

17. Which of the following is a statement-
(1) Open the door
(2) Do your home work
(3) Hurrah! we have won the match
(4) Two plus two is five

18. The negation of the statement "$2 + 3 = 5$ and $8 < 10$" is-
(1) $2 + 3 \neq 5$ and $8 \not< 10$ (2) $2 + 3 \neq 5$ or $8 > 10$
(3) $2 + 3 \neq 5$ or $8 \geq 10$ (4) None of these

19. For any three simple statement p, q, r the statement $(p \wedge q) \vee (q \wedge r)$ is true when-
(1) p and r true and q is false
(2) p and r false and q is true
(3) p, q, r all are false
(4) q and r true and p is false

20. Which of the following statement is a tautology-
(1) $(\sim p \vee \sim q) \vee (p \vee \sim q)$ (2) $(\sim p \vee \sim q) \wedge (p \vee \sim q)$
(3) $\sim p \wedge (\sim p \vee \sim q)$ (4) $\sim q \wedge (\sim p \vee \sim q)$

21. Which of the following statement is a contradiction-
(1) $(\sim p \vee \sim q) \vee (p \vee \sim q)$ (2) $(p \rightarrow q) \vee (p \wedge \sim q)$
(3) $(\sim p \wedge q) \wedge (\sim q)$ (4) $(\sim p \wedge q) \vee (\sim q)$

22. The negation of the statement $q \vee (p \wedge \sim r)$ is equivalent to-
(1) $\sim q \wedge (p \rightarrow r)$ (2) $\sim q \wedge \sim(p \rightarrow r)$
(3) $\sim q \wedge (\sim p \wedge r)$ (4) None of these

23. Which of the following is not a statement-
(1) every set is a finite set
(2) every square is a rectangle
(3) The sun is a star
(4) Shut the window

24. The statement $\sim(p \to q) \leftrightarrow (\sim p \vee \sim q)$ is-
(1) a tautology
(2) a contradiction
(3) neither a tautology nor a contradiction
(4) None of these

25. Which of the following is equivalent to $(p \wedge q)$
(1) $p \to \sim q$ (2) $\sim(\sim p \wedge \sim q)$
(3) $\sim(p \to \sim q)$ (4) None of these

26. The dual of the following statement "Reena is healthy and Meena is beautiful" is-
(1) Reena is beaufiful and Meena is healthy
(2) Reena is beautiful or Meena is healthy
(3) Reena is healthy or Meena is beutiful
(4) None of these

27. If p is any statement, t and c are a tautology and a contradiction respectively then which of the following is not correct-
(1) $p \wedge t \equiv p$ (2) $p \wedge c \equiv c$
(3) $p \vee t \equiv c$ (4) $p \vee c \equiv p$

28. If S*(p, q) is the dual of the compound statement S(p, q) then S*($\sim$p, $\sim$q) is equivalent to-
(1) S($\sim$p, $\sim$q) (2) $\sim$S(p, q)
(3) $\sim$S*(p, q) (4) None of these

29. Which of the following is a statement-
(1) I am Lion
(2) Logic is an interesting subject
(3) A triangle is a circle and 10 is a prime number
(4) None of these

30. If p is any statement, t is a tautology and c is a contradiction then which fo the following is not correct-
(1) $p \wedge (\sim c) \equiv p$
(2) $p \vee (\sim t) \equiv p$
(3) $t \vee c \equiv p \vee t$
(4) $(p \wedge t) \vee (p \vee c) \equiv (t \wedge c)$

31. If p, q, r are simple statement with truth values T, F, T respectively then the truth value of $((\sim p \vee q) \wedge \sim r) \to p$ is-
(1) True (2) False
(3) True if r is false (4) True if q is true

32. Which of the following is wrong-
(1) $p \vee \sim p$ is a tautology
(2) $\sim(\sim p) \leftrightarrow p$ is a tautology
(3) $p \wedge \sim p$ is a contradiction
(4) $((p \wedge p) \to q) \to p$ is a tautology

33. The statement "If $2^2 = 5$ then I get first class" is logically equivalent to-
(1) $2^2 = 5$ and I donot get first class
(2) $2^2 = 5$ or I do not get first class
(3) $2^2 \neq 5$ or I get first class
(4) None of these

34. If statement $(p \vee \sim r) \to (q \wedge r)$ is false and statement q is true then statement p is-
(1) true (2) false
(3) may be true or false (4) None of these

35. Which of the following statement are not logically equivalent-
(1) $\sim(p \vee \sim q)$ and $(\sim p \wedge q)$ (2) $\sim(p \to q)$ and $(p \wedge \sim q)$
(3) $(p \to q)$ and $(\sim q \to \sim p)$ (4) $(p \to q)$ and $(\sim p \wedge q)$

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	3	4	2	2	4	3	2	1	1	3	1	4	4	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	4	3	4	1	3	1	4	3	3	3	3	2	3	4
Que.	31	32	33	34	35										
Ans.	1	4	3	3	4										

1. The statement $p \rightarrow (q \rightarrow p)$ is equivalent

[AIEEE-2008]

(1) $p \rightarrow (p \rightarrow q)$ (2) $p \rightarrow (p \vee q)$

(3) $p \rightarrow (p \wedge q)$ (4) $p \rightarrow (p \leftrightarrow q)$

2. Let p be the statement "x is an irrational number", q be the statement "y is a trascendental number", and r be the statement "x is a rational number iff y is a transcendental number". [AIEEE-2008]

Statement –1 : r is equivalent to either q or p.

Statement –2 : r is equivalent to $(p \leftrightarrow \sim q)$

(1) Statement –1 is false, Statement –2 is true

(2) Statement–1 is true, Statement–2 is false

(3) Statement–1 is true, Statement–2 is true; Statement–2 is a correct explanation for Statement–1

(4) Statement–1 is true, Statement–2 is true; Statement–2 is not a correct explanation for Statement–1

3. **Statement–1 :** $\sim(p \leftrightarrow \sim q)$ is equivalent to $p \leftrightarrow q$.
Statement–2 : $\sim(p \leftrightarrow \sim q)$ is a tautology.

[AIEEE-2009]

(1) Statement–1 is true, Statement–2 is false.
(2) Statement–1 is false, Statement–2 is true.
(3) Statement–1 is true, Statement–2 is true ; Statement–2 is a correct explanation for Statement–1.
(4) Statement–1 is true, Statement–2 is true ; Statement–2 is not a correct explanation for statement–1.

4. Let S be a non-empty subset of R.
Consider the following statement :
p : There is a rational number $x \in S$ such that $x > 0$
which of the following statements is the negation of the statement p ?

[AIEEE-2010]

(1) There is a rational number $x \in S$ such that $x \leq 0$
(2) There is no rational number $x \in S$ such that $x \leq 0$
(3) Every rational number $x \in S$ satisfies $x \leq 0$
(4) $x \in S$ and $x \leq 0 \Rightarrow$ x is not rational

5. Consider the following statements
p : Suman is brilliant
q : Suman is rich
r : Suman is honest
The negation of the statement "Suman is brilliant and dishonest if and only if Suman is rich" can be expressed as :- [AIEEE-2011]
(1) $\sim q \leftrightarrow \sim p \wedge r$
(2) $\sim (p \wedge \sim r) \leftrightarrow q$
(3) $\sim p \wedge (q \leftrightarrow \sim r)$
(4) $\sim (q \leftrightarrow (p \wedge \sim r))$

6. The only statement among the followings that is a tautology is : [AIEEE-2011]
(1) $q \rightarrow [p \wedge (p \rightarrow q)]$
(2) $p \wedge (p \vee q)$
(3) $p \vee (p \wedge q)$
(4) $[p \wedge (p \rightarrow q)] \rightarrow q$

7. The negation of the statement
"If I become a teacher, then I will open a school", is

[AIEEE-2012]

(1) I will not become a teacher or I will open a school.
(2) I will become a teacher and I will not open a school.
(3) Either I will not become a teacher or I will not open a school.
(4) Neither I will become a teacher nor I will open a school.

ANSWER KEY

Que.	1	2	3	4	5	6	7								
Ans.	2	1	1	3	2,4	4	2								