MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

B.TECH SECOND YEAR

ACADEMIC YEAR: 2020-2021

COURSE NAME: ENGINEERING MATHEMATICS-III

COURSE CODE : MA 2101

LECTURE SERIES NO : 28 (TWENTY-EIGHT)

CREDITS : 3

MODE OF DELIVERY : ONLINE (POWER POINT PRESENTATION)

FACULTY : DR. ALOK BHARGAVA

EMAIL-ID : alok.bhargava@jaipur.manipal.edu

PROPOSED DATE OF DELIVERY: 16 OCTOBER 2020

MANIPAL UNIVERSITY
JAIPUR

VISION

Global Leadership in Higher Education and Human Development

MISSION

- Be the most preferred University for innovative and interdisciplinary learning
- Foster academic, research and professional excellence in all domains
- Transform young minds into competent professionals with good human values

VALUES

Integrity, Transparency, Quality,
Team Work, Execution with Passion, Humane Touch

SESSION OUTCOME

"KNOWLEDGE OF VARIATIONS IN CONDITIONAL STATEMENT"

ASSIGNMENT

QUIZ

MID TERM EXAMINATION –I & II

END TERM EXAMINATION

ASSESSMENT CRITERIA'S

CONDITIONAL STATEMENTS AND VARIATIONS

Variations in Conditional Statement

Contrapositive: The proposition $\neg q \rightarrow \neg p$ is called contrapositive of $p \rightarrow q$

Converse: The proposition $q \rightarrow p$ is called the converse

Of the proposition $p \rightarrow q$

Inverse: The proposition $\neg p \rightarrow \neg q$ is called the inverse of $p \rightarrow q$

Biconditional or Equivalence

Statements of the form "if and only if" are called biconditional statements. It is denoted by $p \leftrightarrow q$ and read as "p if and only if q". The proposition $p \leftrightarrow q$ is true if both p and q have same truth value otherwise false. The name of biconditional comes from the fact that $p \leftrightarrow q$ is equivalent to $(p \rightarrow q) \wedge (q \rightarrow p)$. The truth table for biconditional proposition $p \leftrightarrow q$ can be constructed as

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

Equivalence of Propositions

Two propositions are said to be logically equivalent if they have exactly the same truth values under all circumstances.

Let us take the example $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$, which can be proved by the truth table as

$\boldsymbol{p}$	$\boldsymbol{q}$	$\boldsymbol{p \leftrightarrow q}$	$\boldsymbol{p \rightarrow q}$	$\boldsymbol{q \rightarrow p}$	$(p \rightarrow q) \wedge (q \rightarrow p)$
T	T	T	T	T	T
T	F	F	F	T	F
F	T	F	T	F	F
F	F	T	T	T	T

Tautology

A proposition P is a tautology if it is true under all circumstances.

Ex. Show that the statement $(p \to q) \leftrightarrow (\neg q \to \neg p)$ is a tautology.

Sol. To prove this, let us construct the truth table as

p	q	$p \to q$	$\neg q$	$\neg p$	$\neg q \to \neg p$	$(p \to q) \leftrightarrow (\neg q \to \neg p)$
T	T	T	F	F	T	T
T	F	F	T	F	F	F
F	T	T	F	T	T	T
F	F	T	T	T	T	T

Contradiction or Fallacy

A statement that is always false, is called a contradiction.

Ex. Find whether the following proposition is a tautology or fallacy.

$$(p \land q) \land \sim (p \lor q)$$

Sol. To identify, let us construct truth table as

p	q	$p \land q$	$p \lor q$	$\neg(p \lor q)$	$(p \land q) \land \sim (p \lor q)$
T	T	T	T	F	F
T	F	F	T	F	F
F	T	F	T	F	F
F	F	F	F	T	F

Hence, it's a fallacy.

Contingency

It is a compound statement whose truth values are mixture of true and false values.

Ex. Let us see the truth values of the compound proposition

$$P \equiv p \to (p \to q)$$

p	q	$p \to q$	$p \to (p \to q)$
T	T	T	T
T	F	F	F
F	T	T	T
F	F	T	T

So, it's a contingency.

Ex. $P \equiv ((p \to (q \land r)) \to \neg(p \to q)$

p	q	r	$q \land r$	$p \to (q \land r)$	$p \to q$	$\neg(p \to q)$	P
T	T	T	T	T	T	F	F
T	T	F	F	F	T	F	T
T	F	F	F	F	F	T	T
T	F	T	F	F	F	T	T
F	T	T	T	T	T	F	F
F	F	T	F	T	T	F	F
F	T	F	F	T	T	F	F
F	F	F	F	T	T	F	F

			Premises		Conclusion
p	q	r	$p \to q$	$q \to r$	$p \to r$
T	T	T	T	T	T
T	T	F	T	F	F
T	F	F	F	T	F
T	F	T	F	T	T
F	T	T	T	T	T
F	F	T	T	T	T
F	T	F	T	F	T
F	F	F	T	T	T

As all the critical rows has true values, so the argument is valid.

Thanks for your attention!!