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

FIRST STATE PRIVATE UNIVERSITY IN RAJASTHAN
A+ NAAC
3.28 SCORE

B.TECH SECOND YEAR

ACADEMIC YEAR: 2022-2023

COURSE NAME: ENGINEERING MATHEMATICS-III

COURSE CODE : MA 2101

LECTURE SERIES NO :

CREDITS : 3

MODE OF DELIVERY : ONLINE (POWER POINT PRESENTATION)

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PROPOSED DATE OF DELIVERY:

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

"DEGREE OF A VERTEX IN A GRAPH, ADJACENCY AND INCIDENCE. "

ASSESSMENT CRITERIA'S

ASSIGNMENT

QUIZ

MID TERM EXAMINATION –I & II

END TERM EXAMINATION

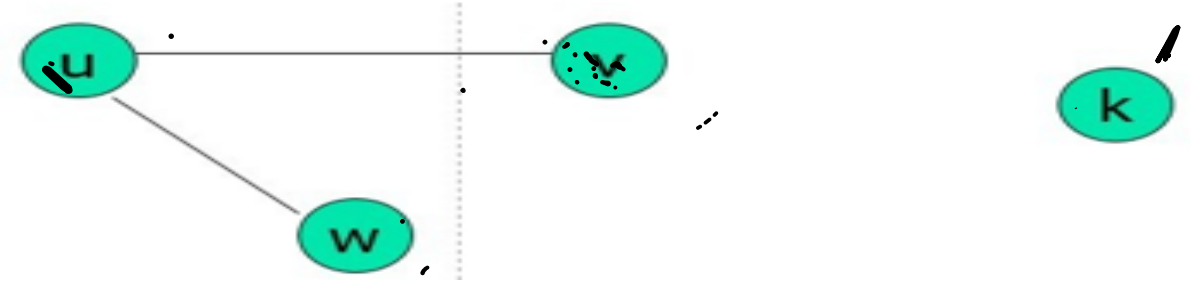
PROGRAM OUTCOMES MAPPING WITH CO2

PO 1

ENGINEERING KNOWLEDGE: APPLY THE KNOWLEDGE OF MATHEMATICS, SCIENCE, ENGINEERING FUNDAMENTALS, AND AN ENGINEERING SPECIALIZATION TO THE SOLUTION OF COMPLEX ENGINEERING PROBLEMS.

Terminology – Undirected graphs

- u and v are **adjacent** if {u, v} is an edge, e is called **incident** with u and v. u and v are called **endpoints** of {u, v}
- **Degree of Vertex (deg (v)):** the number of edges incident on a vertex. A loop contributes twice to the degree (why?).
- **Pendant Vertex:** deg (v) =1
- **Isolated Vertex:** deg (v) = 0
- **Representation Example:** For V = {u, v, w} , E = { {u, w}, {u, w}, (u, v) }, deg (u) = 2, deg (v) = 1, deg (w) = 1, deg (k) = 0, w and v are pendant , k is isolated

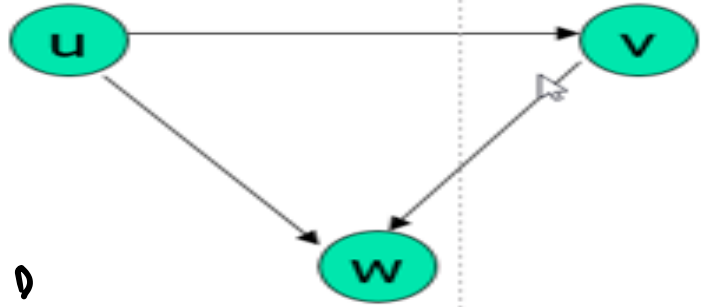


Terminology — Directed graphs

- For the edge (u, v), u is **adjacent to** v OR v is **adjacent from** u, u – **Initial vertex**, v – **Terminal vertex**
- **In-degree ($deg^-(u)$):** number of edges for which u is terminal vertex
- **Out-degree ($deg^+(u)$):** number of edges for which u is initial vertex

Note: A loop contributes 1 to both in-degree and out-degree (why?)

Representation Example: For V = {u, v, w} , E = { (u, w), (v, w), (u, v) }, $deg^-(u) = 0$, $deg^+(u) = 2$, $deg^-(v) = 1$, $deg^+(v) = 1$, and $deg^-(w) = 2$, $deg^+(u) = 0$



Theorems: Undirected Graphs

Theorem 1

The Handshaking theorem:

$$2e = \sum_{v \in V} v$$

(why?) Every edge connects 2 vertices

Theorems: Undirected Graphs

Theorem 2:

An undirected graph has even number of vertices with odd degree

Pr*oof* $V1$ is the set of even degree vertices and V2 refers to odd degree vertices

$$2e = \sum_{v \in V} \deg(v) = \sum_{u \in V_1} \deg(u) + \sum_{v \in V_2} \deg(v)$$

$\Rightarrow$ deg (v) is even for $v \in V_1$.

$\Rightarrow$ The first term in the right hand side of the last inequality is even.

$\Rightarrow$ The sum of the last two terms on the right hand side of the last inequality is even since sum is 2e.

Hence second term is also even

$\Rightarrow$ second term $\sum_{v \in V_2} \deg(v) = even$

Definitions – Graph Type

Type	Edges	Multiple Edges Allowed ?	Loops Allowed ?
Simple Graph	undirected	No	No
Multigraph	undirected	Yes	No
Pseudograph	undirected	Yes	Yes
Directed Graph	directed	No	Yes
Directed Multigraph	directed	Yes	Yes