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Erasmus+ Programme  
of the European Union

# EVNS 501: Geographical Information System eLearning Module *Course Teacher* Prof. S Jayakumar

Dept. of Ecology & Environmental Sciences

Pondicherry University

Puducherry, India



Pondicherry University, India

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# Content

1. General Information
2. Course description
3. Course goal
4. Course outcome
5. Course structure
6. Course assessment
7. References

# 1. General Information

Course Code	: EVNS - 501
Course Title	: Geographical Information
System Number of Credits	: 4.5 ECTS
Course duration	: 18 Weeks
Level	: Postgraduate
Course Teacher	: Prof. S. Jayakumar
Prerequisite	: Required courses (or equivalents): Basic understanding on Mathematics (school higher level), English language skill, computer operation (Windows/Mac).

## 2. Course description

This course provides the fundamentals and basic concepts of Geographical Information System. The basic methods and procedures in Quantum GIS is also taught in the course. The basic operations such as downloading of open source satellite data, geometric correction of topo maps, digitization, head-up interpretation and map composition are also being taught as part of this course.

### 3. Course goals

The main course objective is to provide a basic understanding on What is GIS and how it can be used to various fields. This course allows the students to acquire hands-on knowledge and skills on GIS software, data handling, spatial analysis.

## 4. Course outcome

By the end of the course, successful students will:

1. Know the basic concepts and fundamentals of geographic information system
2. Handle GIS software independently
3. Know the different between spatial and non- spatial data, data quality and analysis
4. Approach the environmental problems spatially to find suitable solutions.
5. Handle raster and vector maps and other spatial data to integrate into GIS domain
6. Apply the spatial methods and procedures to find solutions to the environmental problem
7. Be able to identify the root cause for the problem
8. Be able to prepare strategic solution to the environmental problem

# 5. Course

## 5.a. Course Content

Week 1	1. Introduction to GIS
	2. How does GIS work?
	3. Components of GIS
Week 2	4. Cartography and Nature of Maps - 1
	5. Cartography and Nature of Maps - 2
	6. Essential Map elements
Week 3	7. Coordinate system and projection
	8. Attribute data and Thematic Mapping
Week 4	9. Vector data model
	10. Creating thematic map
Week 5	11. Data classification
Week 6	12. Arc Node topology
	13. Polygon arc topology
Week 7	14. Introduction to QGIS
Week 8	15. GIS terms and definitions - 1
	16. GIS terms and definitions - 2
Week 9	17. Topology and Shape files
	18. Selection methods in GIS
Week 10	19. Generalization Problem
Week 11	20. Overlay methods
Week 12	21. Raster data model 1
Week 13	22. Raster data model 2
Week 14	23. Raster data analysis 1
	24. Raster data analysis 2
Week 15	25. QGis Elements - 1
	26. QGis Elements – 2
Week 16	27. Grass gis Elements

## 5. Course

### 5.b. Mode of delivery – Hybrid



In-Class Lectures



On-line Lectures



Microsoft One Drive

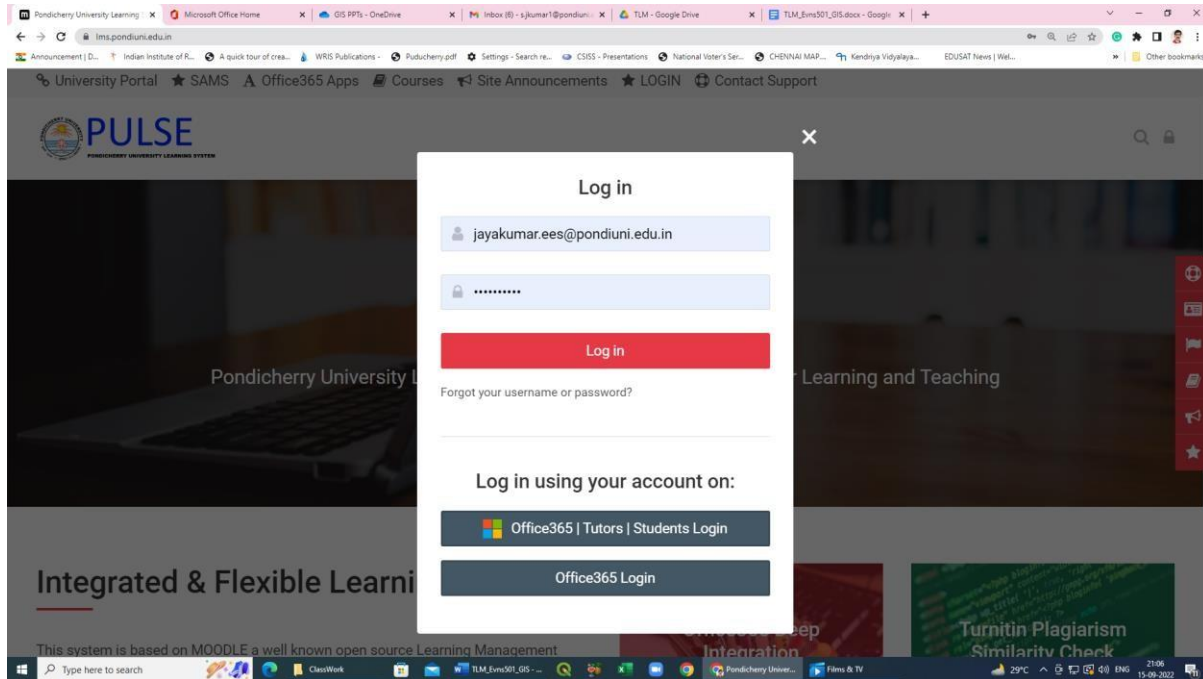


Microsoft Teams

Students will get enrolled in Pondicherry University Learning Management System and the classes will be handled in hybrid mode



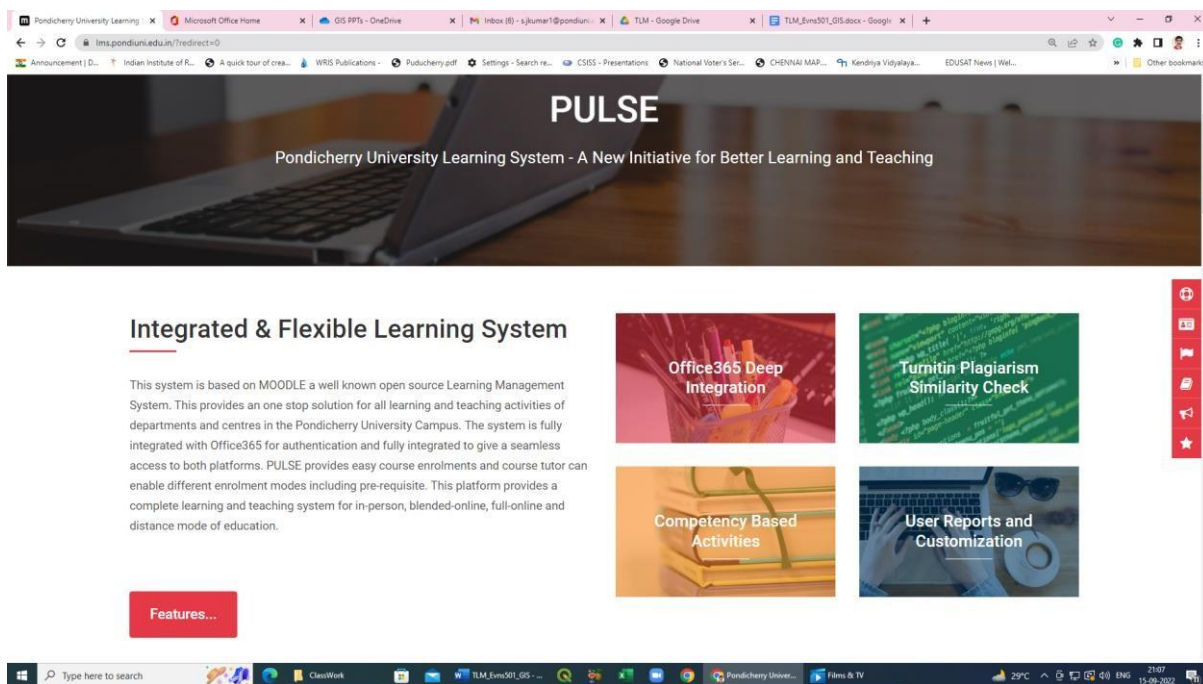
## Pondicherry University Learning Management System (<https://lms.pondiuni.edu.in/>)



The screenshot shows the LMS login page with a modal window for user authentication. The modal contains the following elements:

- Log in** header
- Username field: `jayakumar.ees@pondiuni.edu.in`
- Password field: `*****`
- Log in** button
- Link: [Forgot your username or password?](#)
- Section: **Log in using your account on:**
- Buttons: **Office365 | Tutors | Students Login** and **Office365 Login**

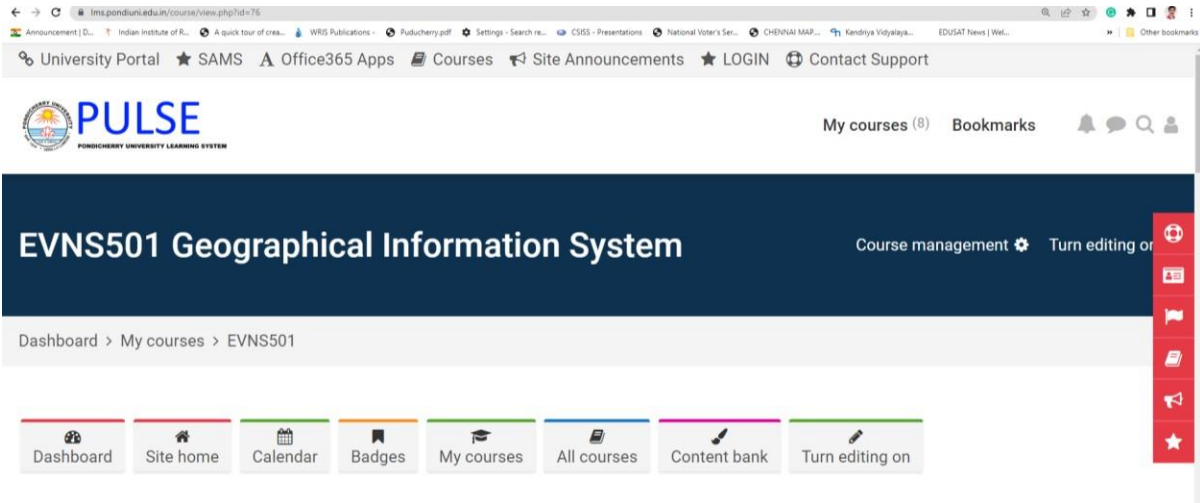
The background page features the **PULSE** logo and navigation menu including University Portal, SAMS, Office365 Apps, Courses, Site Announcements, LOGIN, and Contact Support. A sidebar on the right contains icons for home, search, and other functions.



The screenshot displays the LMS home page with the following content:

- PULSE** logo and tagline: **Pondicherry University Learning System - A New Initiative for Better Learning and Teaching**
- Integrated & Flexible Learning System** section with a descriptive paragraph:
 

This system is based on MOODLE a well known open source Learning Management System. This provides an one stop solution for all learning and teaching activities of departments and centres in the Pondicherry University Campus. The system is fully integrated with Office365 for authentication and fully integrated to give a seamless access to both platforms. PULSE provides easy course enrolments and course tutor can enable different enrolment modes including pre-requisite. This platform provides a complete learning and teaching system for in-person, blended-online, full-online and distance mode of education.
- Features...** button
- Four feature cards:
  - Office365 Deep Integration
  - Turnitin Plagiarism Similarity Check
  - Competency Based Activities
  - User Reports and Customization
- Navigation sidebar on the right with icons for home, search, and other functions.



University Portal SAMS Office365 Apps Courses Site Announcements LOGIN Contact Support

**PULSE** PONDICHERY UNIVERSITY LEARNING SYSTEM

My courses (8) Bookmarks

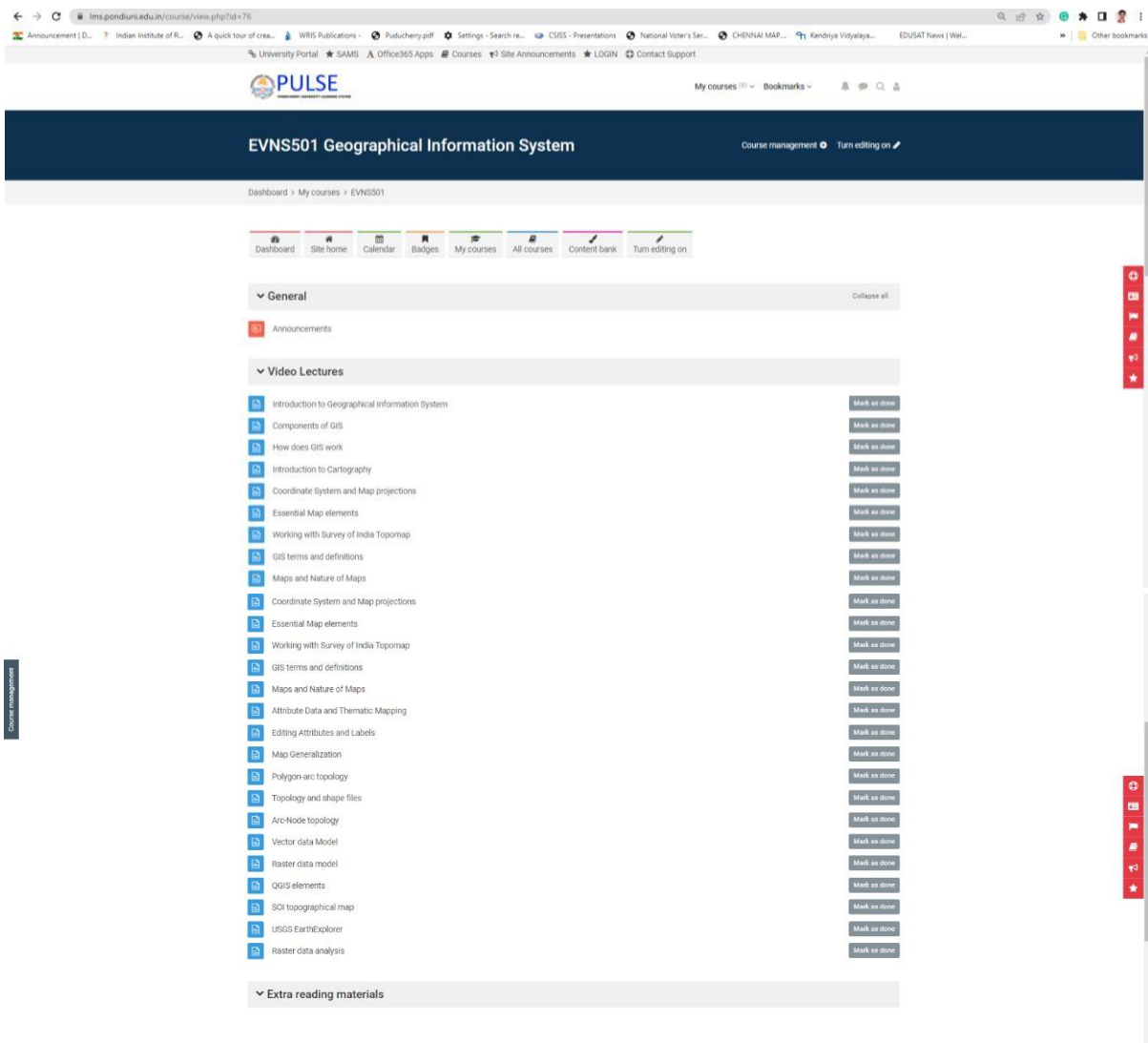
# EVNS501 Geographical Information System

Course management Turn editing on

Dashboard > My courses > EVNS501

Dashboard Site home Calendar Badges My courses All courses Content bank Turn editing on

## Video Lectures linked to PULSE



Announcement | D... Indian Institute of R... A quick tour of crea... WRS Publications - Puduchery.pdf Settings - Search re... CSIS - Presentations National Voter's Ser... CHENNAI MAP... Kandiya Vidyalaya... EDUSAT News | Wel...

University Portal SAMS Office365 Apps Courses Site Announcements LOGIN Contact Support

**PULSE** PONDICHERY UNIVERSITY LEARNING SYSTEM

My courses (8) Bookmarks

# EVNS501 Geographical Information System

Course management Turn editing on

Dashboard > My courses > EVNS501

Dashboard Site home Calendar Badges My courses All courses Content bank Turn editing on

**General** Collapse all

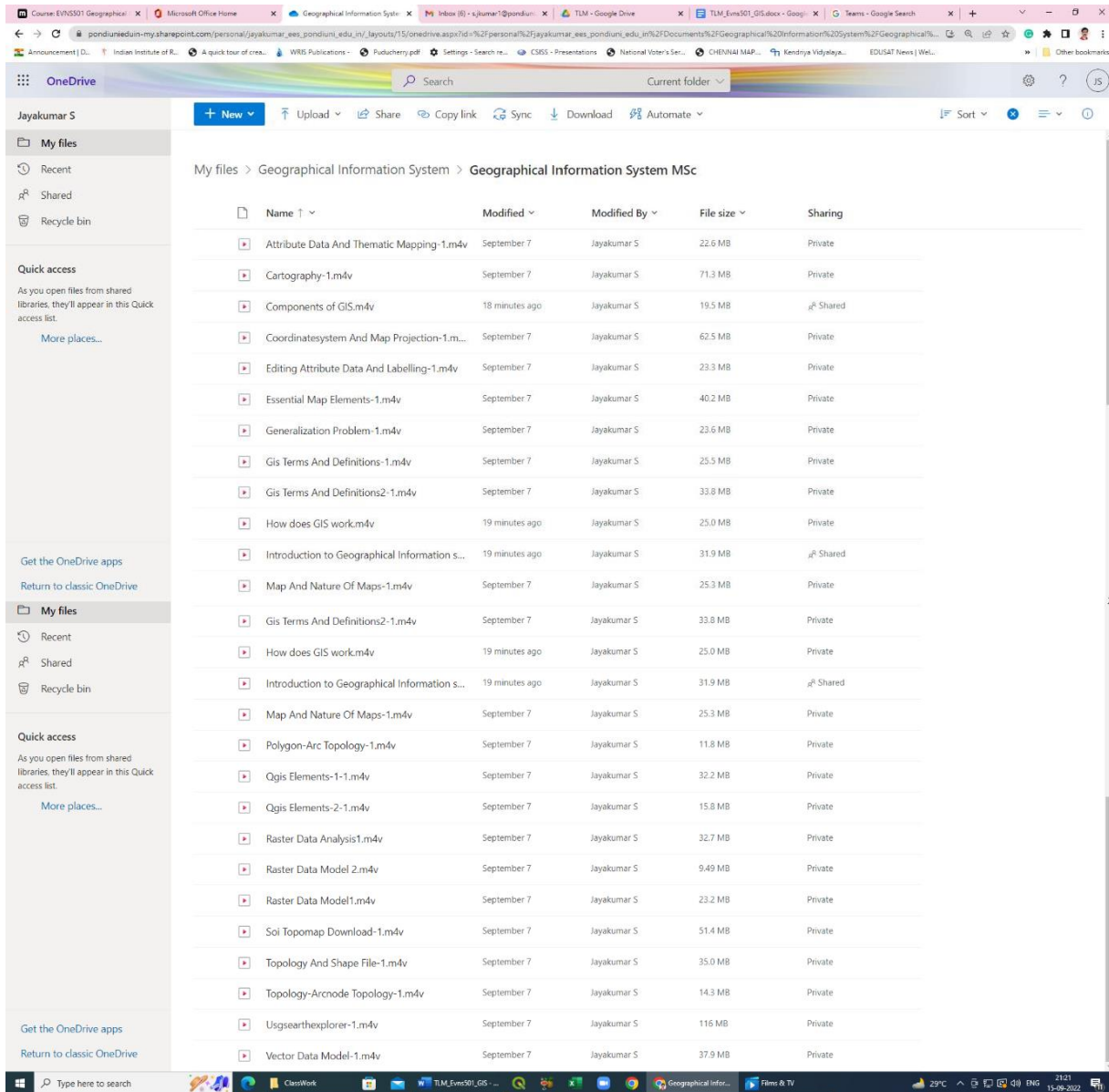
Announcements

**Video Lectures**

- Introduction to Geographical Information System [Mark as done](#)
- Components of GIS [Mark as done](#)
- How does GIS work [Mark as done](#)
- Introduction to Cartography [Mark as done](#)
- Coordinate System and Map projections [Mark as done](#)
- Essential Map elements [Mark as done](#)
- Working with Survey of India Topomap [Mark as done](#)
- GIS terms and definitions [Mark as done](#)
- Maps and Nature of Maps [Mark as done](#)
- Coordinate System and Map projections [Mark as done](#)
- Essential Map elements [Mark as done](#)
- Working with Survey of India Topomap [Mark as done](#)
- GIS terms and definitions [Mark as done](#)
- Maps and Nature of Maps [Mark as done](#)
- Attribute Data and Thematic Mapping [Mark as done](#)
- Editing Attributes and Labels [Mark as done](#)
- Map Generalization [Mark as done](#)
- Polygon-arc topology [Mark as done](#)
- Topology and shape files [Mark as done](#)
- Arc-Node topology [Mark as done](#)
- Vector data Model [Mark as done](#)
- Raster data model [Mark as done](#)
- OGIS elements [Mark as done](#)
- SCI topographical map [Mark as done](#)
- USGS EarthExplorer [Mark as done](#)
- Raster data analysis [Mark as done](#)

**Extra reading materials**

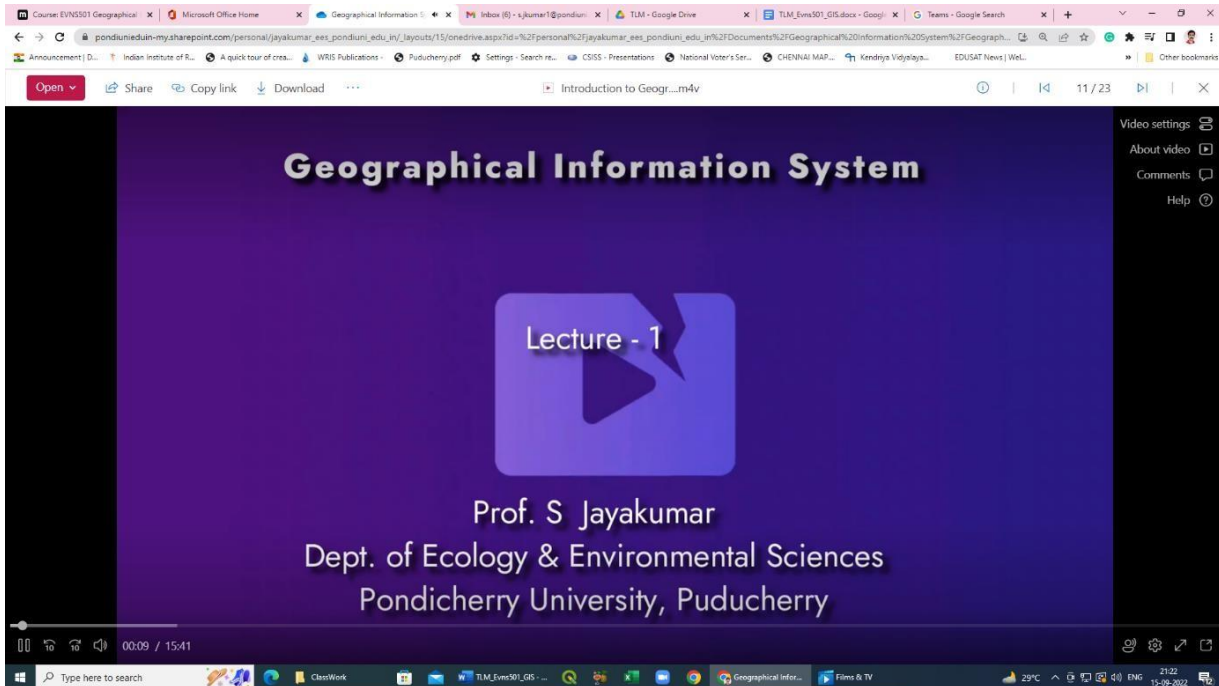
## Video Lectures stored in Microsoft One drive



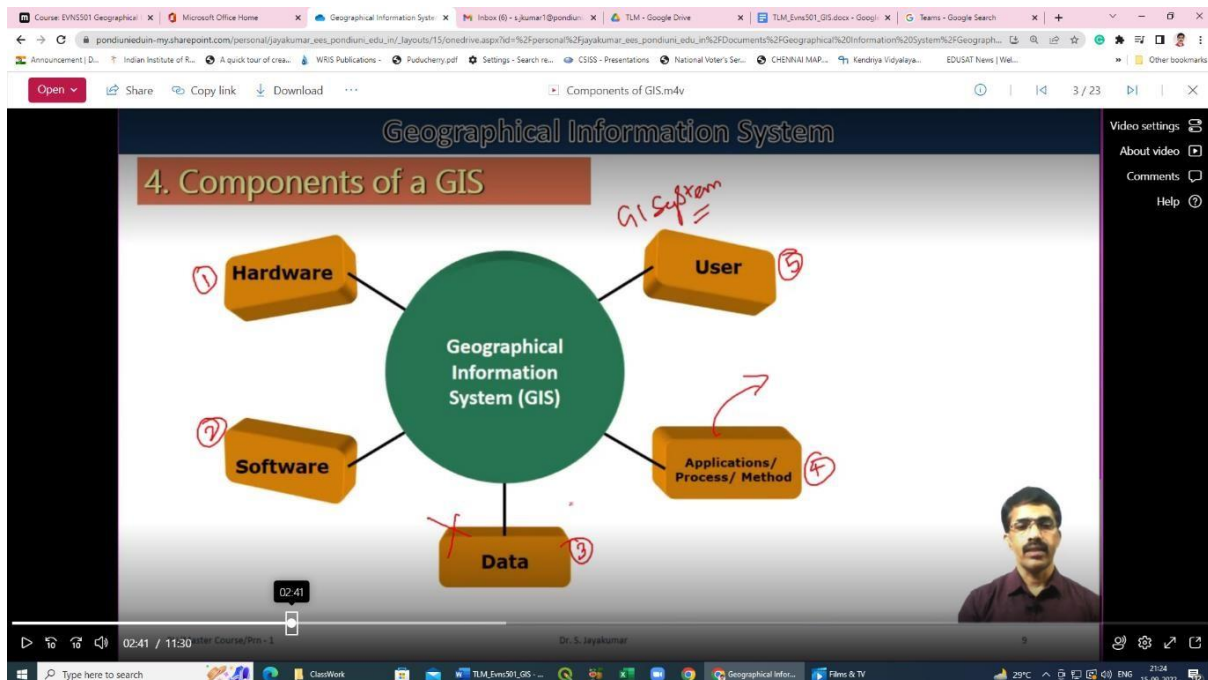
The screenshot shows a OneDrive interface for user Jayakumar S. The current folder is 'Geographical Information System' > 'Geographical Information System MSc'. It contains a list of 28 video files, all in .m4v format, covering various GIS topics. The files are sorted by name and include details on modification date, file size, and sharing status.

Name	Modified	Modified By	File size	Sharing
Attribute Data And Thematic Mapping-1.m4v	September 7	Jayakumar S	22.6 MB	Private
Cartography-1.m4v	September 7	Jayakumar S	71.3 MB	Private
Components of GIS.m4v	18 minutes ago	Jayakumar S	19.5 MB	Shared
Coordinatesystem And Map Projection-1.m4v	September 7	Jayakumar S	62.5 MB	Private
Editing Attribute Data And Labelling-1.m4v	September 7	Jayakumar S	23.3 MB	Private
Essential Map Elements-1.m4v	September 7	Jayakumar S	40.2 MB	Private
Generalization Problem-1.m4v	September 7	Jayakumar S	23.6 MB	Private
Gis Terms And Definitions-1.m4v	September 7	Jayakumar S	25.5 MB	Private
Gis Terms And Definitions2-1.m4v	September 7	Jayakumar S	33.8 MB	Private
How does GIS work.m4v	19 minutes ago	Jayakumar S	25.0 MB	Private
Introduction to Geographical Information s...	19 minutes ago	Jayakumar S	31.9 MB	Shared
Map And Nature Of Maps-1.m4v	September 7	Jayakumar S	25.3 MB	Private
Gis Terms And Definitions2-1.m4v	September 7	Jayakumar S	33.8 MB	Private
How does GIS work.m4v	19 minutes ago	Jayakumar S	25.0 MB	Private
Introduction to Geographical Information s...	19 minutes ago	Jayakumar S	31.9 MB	Shared
Map And Nature Of Maps-1.m4v	September 7	Jayakumar S	25.3 MB	Private
Polygon-Arc Topology-1.m4v	September 7	Jayakumar S	11.8 MB	Private
Qgis Elements-1-1.m4v	September 7	Jayakumar S	32.2 MB	Private
Qgis Elements-2-1.m4v	September 7	Jayakumar S	15.8 MB	Private
Raster Data Analysis1.m4v	September 7	Jayakumar S	32.7 MB	Private
Raster Data Model 2.m4v	September 7	Jayakumar S	9.49 MB	Private
Raster Data Model1.m4v	September 7	Jayakumar S	23.2 MB	Private
Soi Topomap Download-1.m4v	September 7	Jayakumar S	51.4 MB	Private
Topology And Shape File-1.m4v	September 7	Jayakumar S	35.0 MB	Private
Topology-Arcnode Topology-1.m4v	September 7	Jayakumar S	14.3 MB	Private
Usgsearchexplorer-1.m4v	September 7	Jayakumar S	116 MB	Private
Vector Data Model-1.m4v	September 7	Jayakumar S	37.9 MB	Private

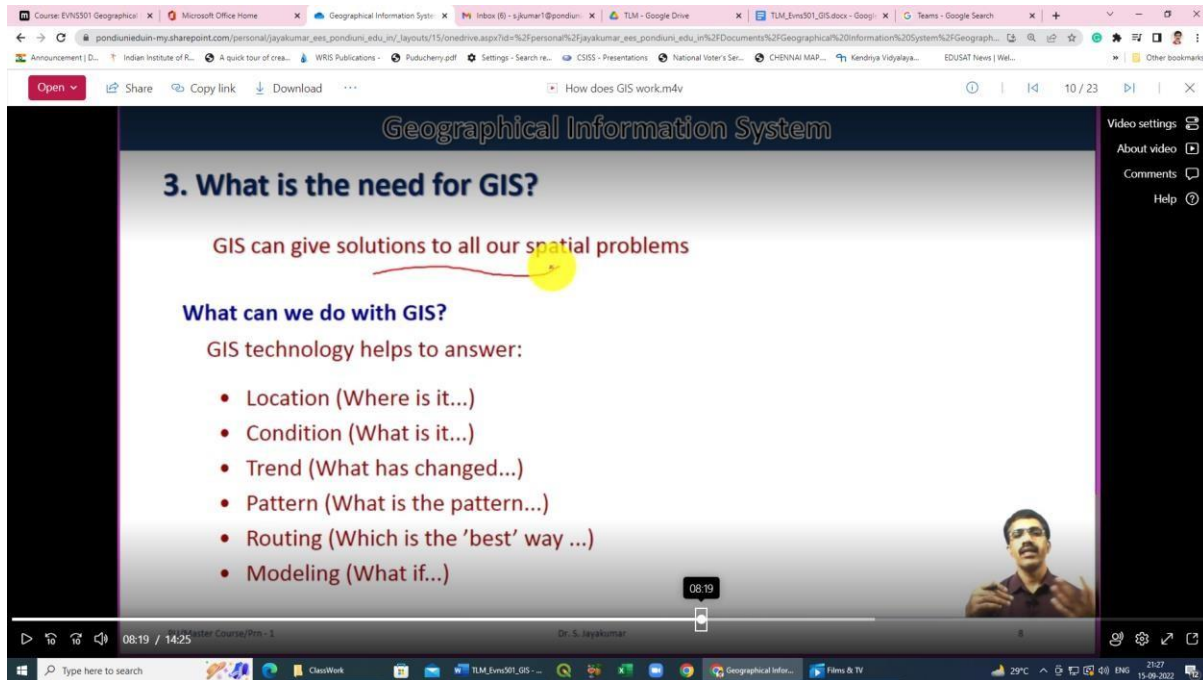
## Glimpse of Video Lectures: Introduction to Geographical Information System



## Components of GIS



## Need for GIS



**Geographical Information System**

### 3. What is the need for GIS?

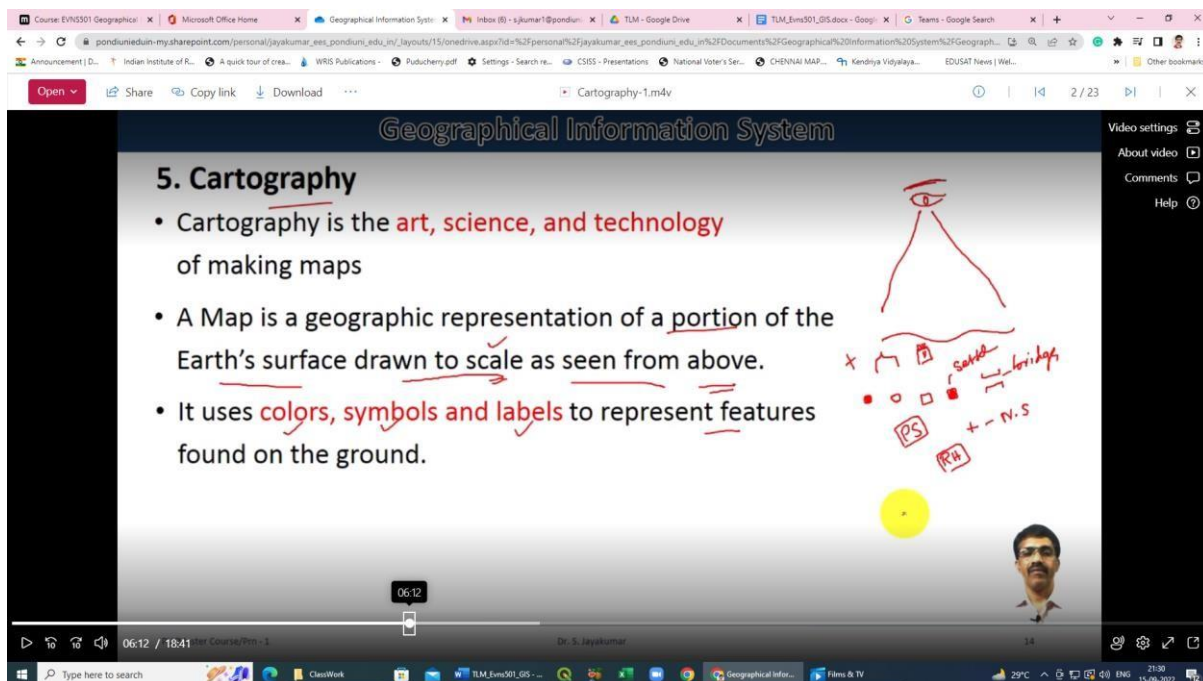
GIS can give solutions to all our spatial problems

**What can we do with GIS?**

GIS technology helps to answer:

- Location (Where is it...)
- Condition (What is it...)
- Trend (What has changed...)
- Pattern (What is the pattern...)
- Routing (Which is the 'best' way ...)
- Modeling (What if...)

## Cartography



**Geographical Information System**

### 5. Cartography

- Cartography is the **art, science, and technology** of making maps
- A Map is a geographic representation of a portion of the Earth's surface drawn to scale as seen from above.
- It uses **colors, symbols and labels** to represent features found on the ground.

*Handwritten notes on the slide include: 'Sahel', 'bridge', 'PS', 'Rw', and '+ - N.S.' with a small sketch of a map.*

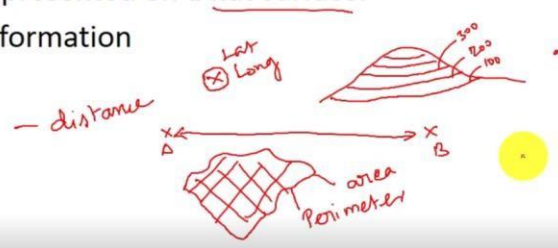
## Nature of Maps

Geographical Information System

### 6. What is a Map?

- Map is a visual representation of an entire area or a part of an area, typically represented on a flat surface.
- An abstracted information
- Advantages
  - Measurements
  - Direction
  - Location

*Handwritten notes:* distance, Lat Long, area, Perimeter



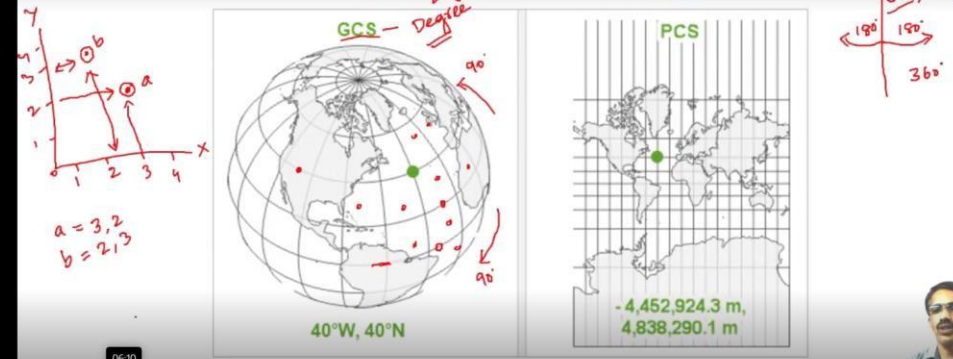
06:42

## Coordinate System

Geographical Information System

### 10. Coordinate System

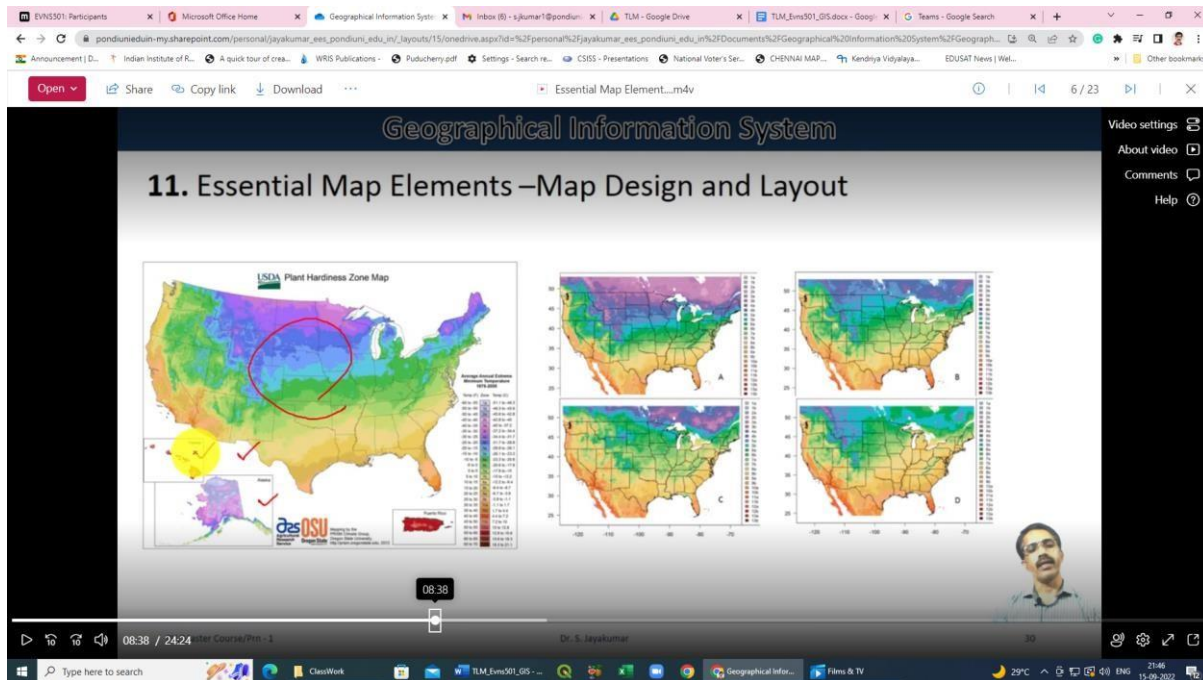
*Handwritten notes:* Geographic Coordinate System, 180° Latitudinal line, 90° S, 90° N, 180° Long, 360°



06:10

www.esri.com

## Essential Map elements

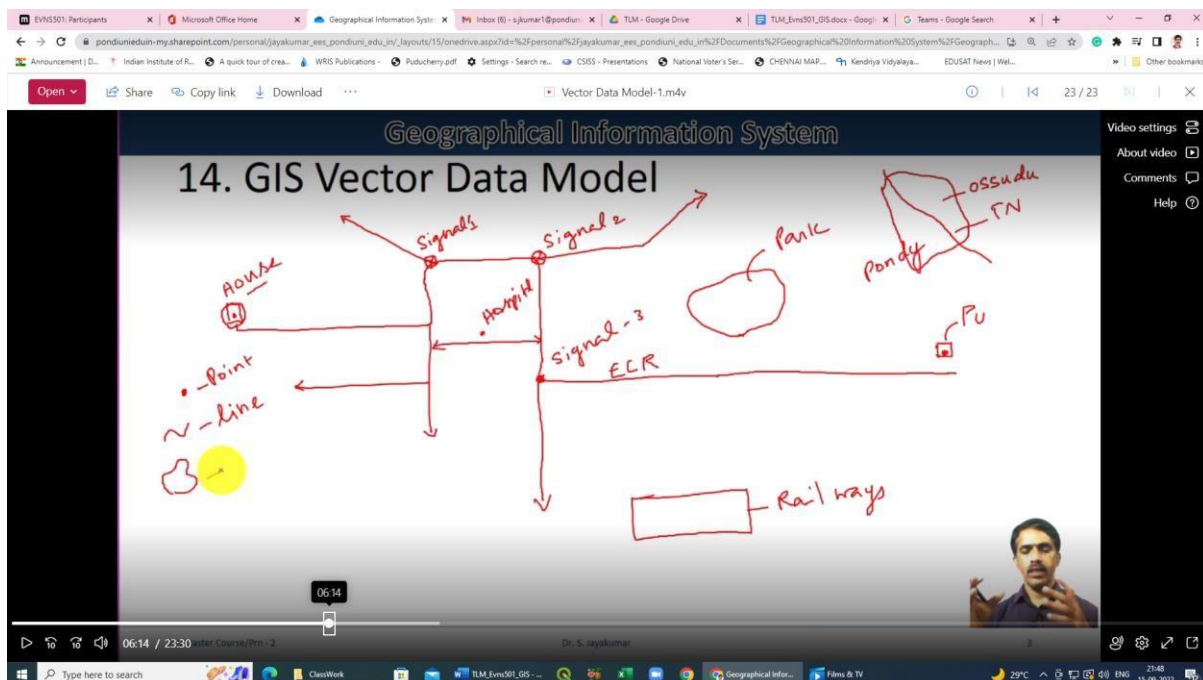


**Geographical Information System**

### 11. Essential Map Elements – Map Design and Layout

The slide displays several maps of the United States. On the left is the LSDA Plant Hardiness Zone Map, which uses color-coded regions to indicate different plant hardiness zones. To its right are four smaller maps labeled A, B, C, and D, each showing a different thematic map of the USA with various color schemes and data representations. A video feed of the presenter is visible in the bottom right corner of the slide.

## Vector Data Model

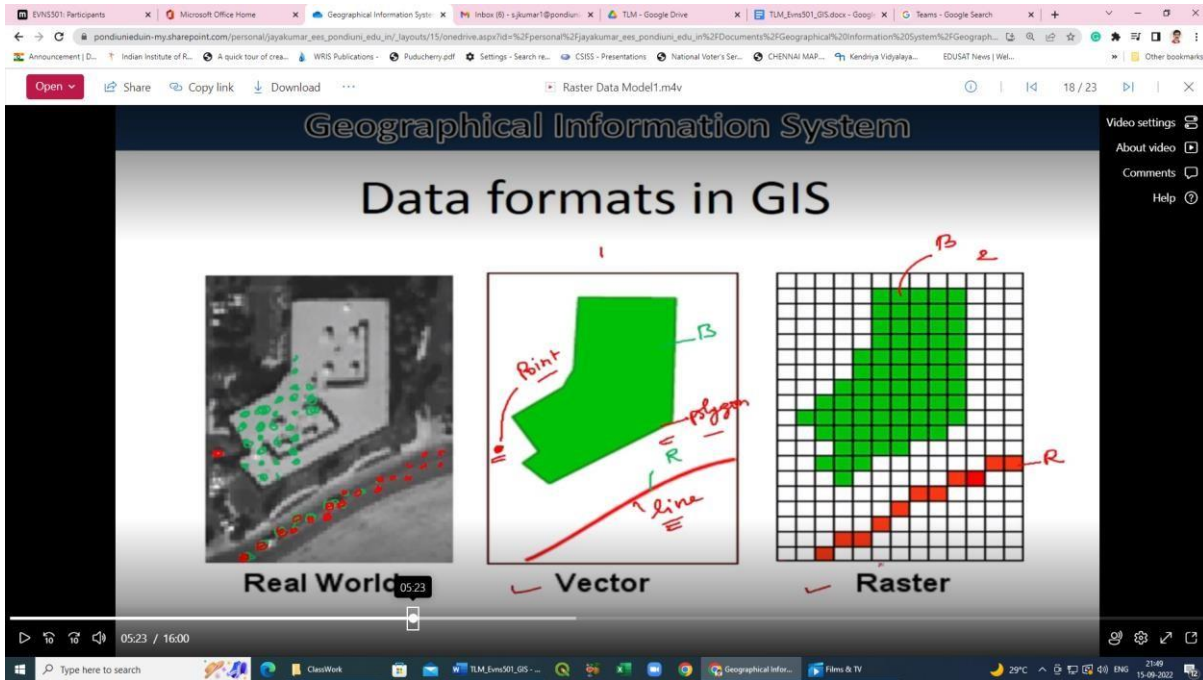


**Geographical Information System**

### 14. GIS Vector Data Model

The slide features a hand-drawn diagram illustrating the vector data model. It shows various geographical features represented by lines and points. Labels include 'Signals', 'Hospital', 'Park', 'Pond', 'Rail ways', 'Point', and 'Line'. A legend on the left side of the diagram defines symbols for a point (a dot) and a line (a wavy line). The diagram also shows a 'Rail ways' feature represented by a rectangle and a 'Pond' represented by an irregular shape. A video feed of the presenter is visible in the bottom right corner of the slide.

## Raster data formats



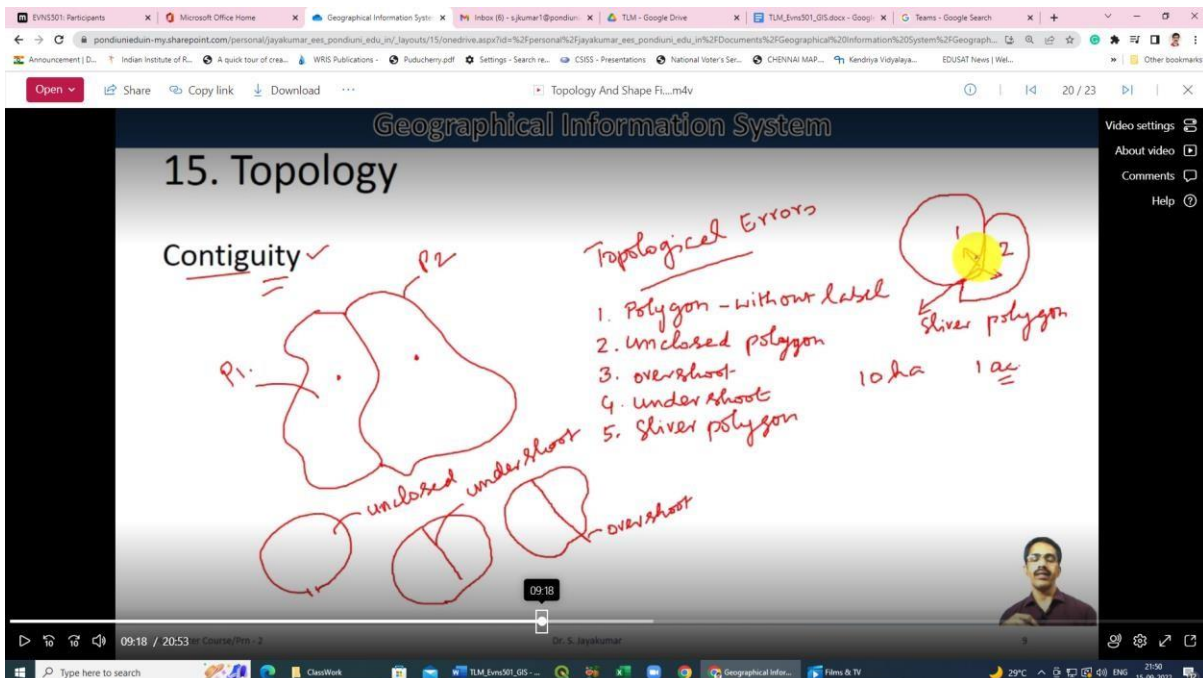
**Geographical Information System**

### Data formats in GIS

The video illustrates three data formats:

- Real World:** A satellite image showing a building and a road with various points marked.
- Vector:** A green polygon representing a building, a red line representing a road, and a point labeled 'Point'. Other labels include 'B' and 'R'.
- Raster:** A grid where the building area is filled with green pixels and the road area with red pixels. Labels 'B' and 'R' indicate the corresponding data values.

## Topology



**Geographical Information System**

### 15. Topology

**Contiguity** ✓

**Topological Errors**

1. Polygon - without label
2. Unclosed polygon
3. overshoot
4. Under shoot
5. Sliver polygon

Handwritten diagrams illustrate these errors: a polygon with a missing label, an unclosed polygon, a polygon with an overshoot, a polygon with an under-shoot, and a sliver polygon. A diagram shows two overlapping polygons labeled 'P1' and 'P2' with a yellow sliver polygon between them. Another diagram shows a sliver polygon with '10 ha' and '1 ac' written next to it.



## Arc-Node topology

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### 15. Topology

- Set of rules that model the relationship

Connectivity

#### Arc-Node topology

	From	To
A	1	2
B	2	3
C	3	4
D	3	5
E	5	6
F	5	7
H	6	8
I	8	9
J	9	10

5:05 / 9:07 Master Course/Prin - 2

## Polygon-arc topology

Geographical Information System

### 15. Topology

Area definition

- Polygon-Arc Topology

A - 1, 6, 14  
B - 2, 14, 7, 15, 13

5:15 / 6:59 Master Course/Prin - 2

## Editing Attributes

Name	ID
1. Mettur	
2. Palayam	
3. Karaimala	
4. Puzos Station	
5. Puzos Dam	
6. Sengale	
10. Chunnai	
12. Mosque	

## Generalization problem

Geographical Information System

### 17. Generalization Problem

1:50000

Road

09:16

Dr. S. Jayakumar

## Raster Data Model

## QGIS elements

## 5. Course structure

### 5.c. In-class discussion

The in-class discussion will focus on how to approach environmental problems spatially and distinguish the factors responsible for the problems

### 5.d. In-class assignments & field assignment

Understanding various national and international environmental issues in urban and rural areas, preparedness for field study, data quality standards, various methods and procedures available

### 5.e. Reading and discussion of assigned papers for seminars

Understanding the environmental problem, debate the novel approach in the methodology, need for such studies, data and tools utilized.

### 5.f. Group project presentation

Ability to make presentation, effective communication, critical interpretation of data, response to audience

## 6. Course Assessment

Type of assessment	Percentage of Marks
In-class discussion	5
Assignment	5
Seminars	10
Group projects	10
Internal assessment test (MCQ types)	10
Final assessment	60
<b>Total</b>	<b>100</b>

## 7. References

1. Chang, KT, 2017, Introduction to Geographic Information Systems, McGraw Hill Education 4<sup>th</sup> Edition.
2. Robinson, AH, Morrison, JL, Muehrcke, PC, Kimerling, AJ, Guptill, SC, 2009, Elements of Cartography, 6<sup>th</sup> Edition, Wiley Publication.
3. Husain, M, 2014, Evolution of Geographical Thought, Rawat Publishing house.
4. Hands-On Geospatial Analysis with R and QGIS <https://www.packtpub.com/application-development/hands-geospatial-analysis-r-and-qgis> Author: Shammunul Islam Date: November 2018
5. QGIS Tutorials and Tips, downloadable from <https://www.qgistutorials.com/en/>