INTRODUCTION TO

ARTIFICIAL INTELLIGENCE

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Hi, I am Ankit Deshmukh!

Hydrology & Water Resources Engineer

- Ph.D. (IIT Hyderabad) – Climate Vulnerability & Catchment Modeling
- Data Science | Python/R | Statistical Analysis
- Climate Risk Assessment & Adaptation Strategies
- Generative Art and Wood working

Ankit Deshmukh

Department of Civil Engineering

Odd Semester 2026, w.e.f: July 20, 2026

Day	08:00-09:00	09:00-09:55	10:00-10:55	10:55-11:10	11:10-12:05	12:10-13:05	13:10-14:05	14:10-15:05	15:10-16:05
Monday					S1 (24CV201T) E102, CE(3) - L				
Tuesday		D6 (24CV301P) C016, CE(5) - P			D4 (24CV301P) C016, CE(5) - P			Office Hours	
Wednesday						S2 (24CV201T) E103, CE(3) - L		S1 (24CV201T) E102, CE(3) - L	
Thursday								S2 (24CV201T) E103, CE(3) - L	
Friday					S2 (24CV201T) E103, CE(3) - L	S1 (24CV201T) E102, CE(3) - L			

Location Abbr.	Location Name	Subject Abbr.	Subject Name
C016	C, FM & Hydraulic Engg. Lab	24CV301P	Hydrology and Water Resources - lab
E102	E, Lecture Hall	24CV201T	Introduction to Artificial Intelligence
E103	E, Lecture Hall		

Office hours: Tue*14:00 to 16:00*

- ankit.deshmukh@sot.pdpu.ac.in
- D-Block Cubical C-7
- ankitdeshmukh.com/

Official Communication Policy

- Email is the only official mode of communication for this course.
- Calls and WhatsApp will not be considered official communication channels.
- Students are responsible for checking their university email regularly

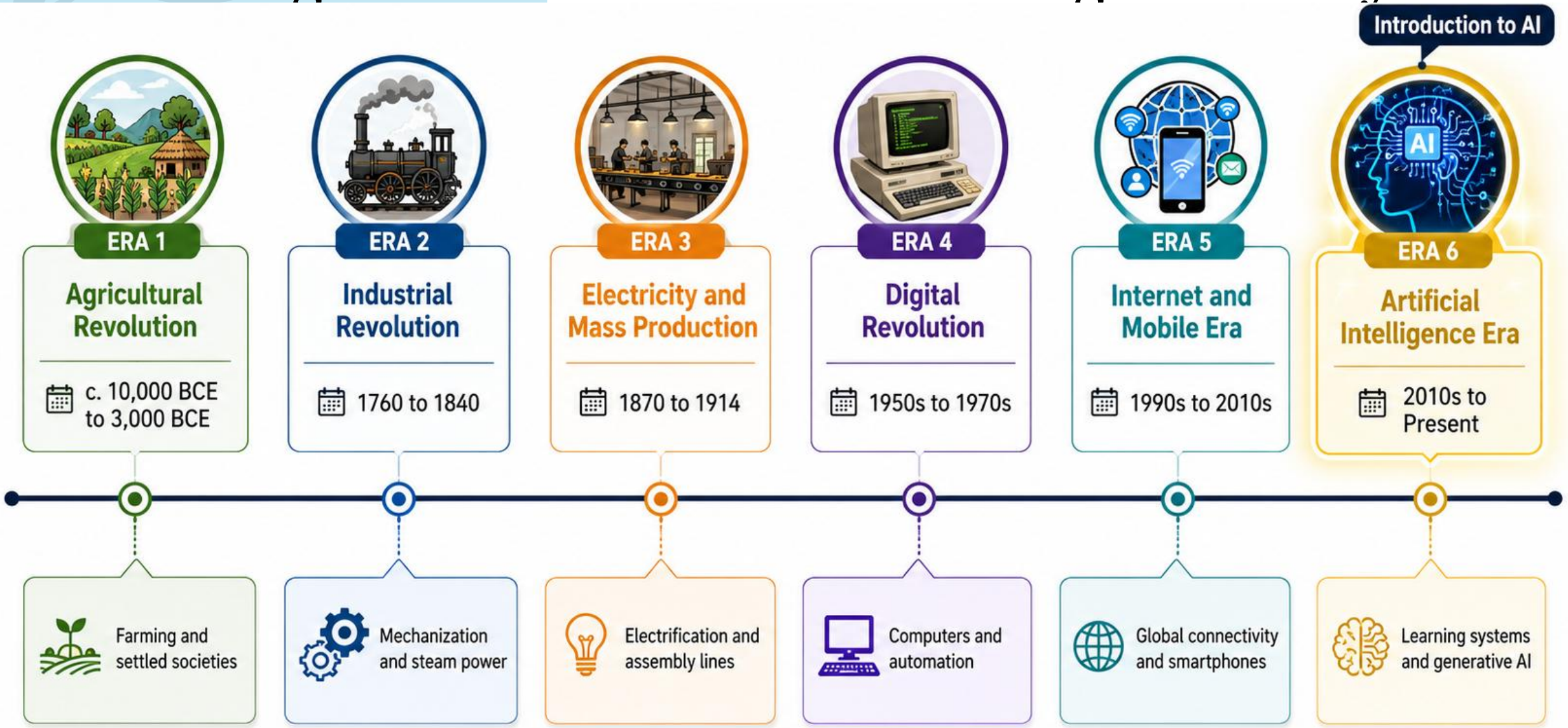
Email Communication Guidelines

- Use a clear subject line.
- Maintain a professional format.
- Write clearly and respectfully.
- Send emails only from your official university email account.

Classroom Rules

- **Be on time:** Students arriving **10 minutes** late will not receive attendance.
- **Silence your phone:** Keep mobile phones on silent mode.
- **Come prepared:** Bring your laptop or notebook to every class.
- **Stay engaged:** Take notes and actively participate in class.

Technological Revolutions That Changed Society

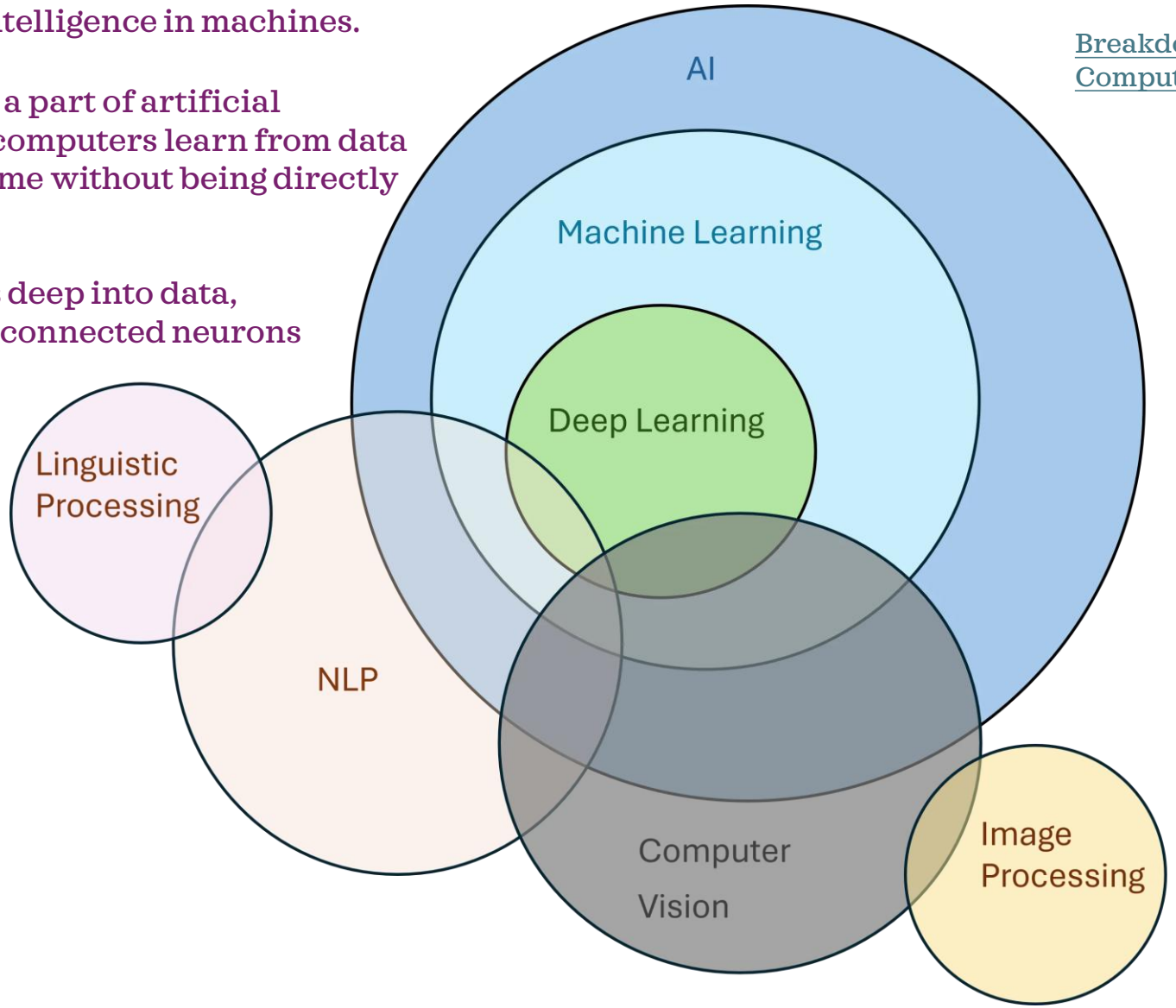


Venn Diagram showing relationship between AI, ML, DL, NLP, Computer vision

AI mimics human intelligence in machines.

Machine learning is a part of artificial intelligence where computers learn from data and improve over time without being directly told what to do.

Deep learning dives deep into data, mimicking the interconnected neurons of our brain



Breakdown: Simplify AI, ML, NLP, Deep Learning, Computer Vision | by Palak Jain | Medium

Application of AI in Civil Engineering

Structural Health Monitoring: AI models analyze sensor data to detect early damage.

Construction Scheduling: Machine learning optimizes timelines and adapts to delays.

Flood & Drought Forecasting: Hybrid AI–physics models improve water risk predictions.

Generative Design: AI explores thousands of design options for optimal efficiency.

Automated Quality Inspection: Computer-vision systems spot defects in concrete and welds.

BIM Enhancement: AI enriches Building Information Models with predictive cost and clash detection.

Traffic Flow Optimization: AI analyzes real-time data to adjust signals and reduce congestion.

Outcome based education

Program Outcomes (POs)

PO1: Engineering knowledge.

PO2: Problem Analysis.

PO3: Design/Development of solutions.

PO4: Conduct Investigation of Complex Problems.

PO5: Modern tool usage.

PO6: The Engineer and Society.

PO7: Environment and Sustainability.

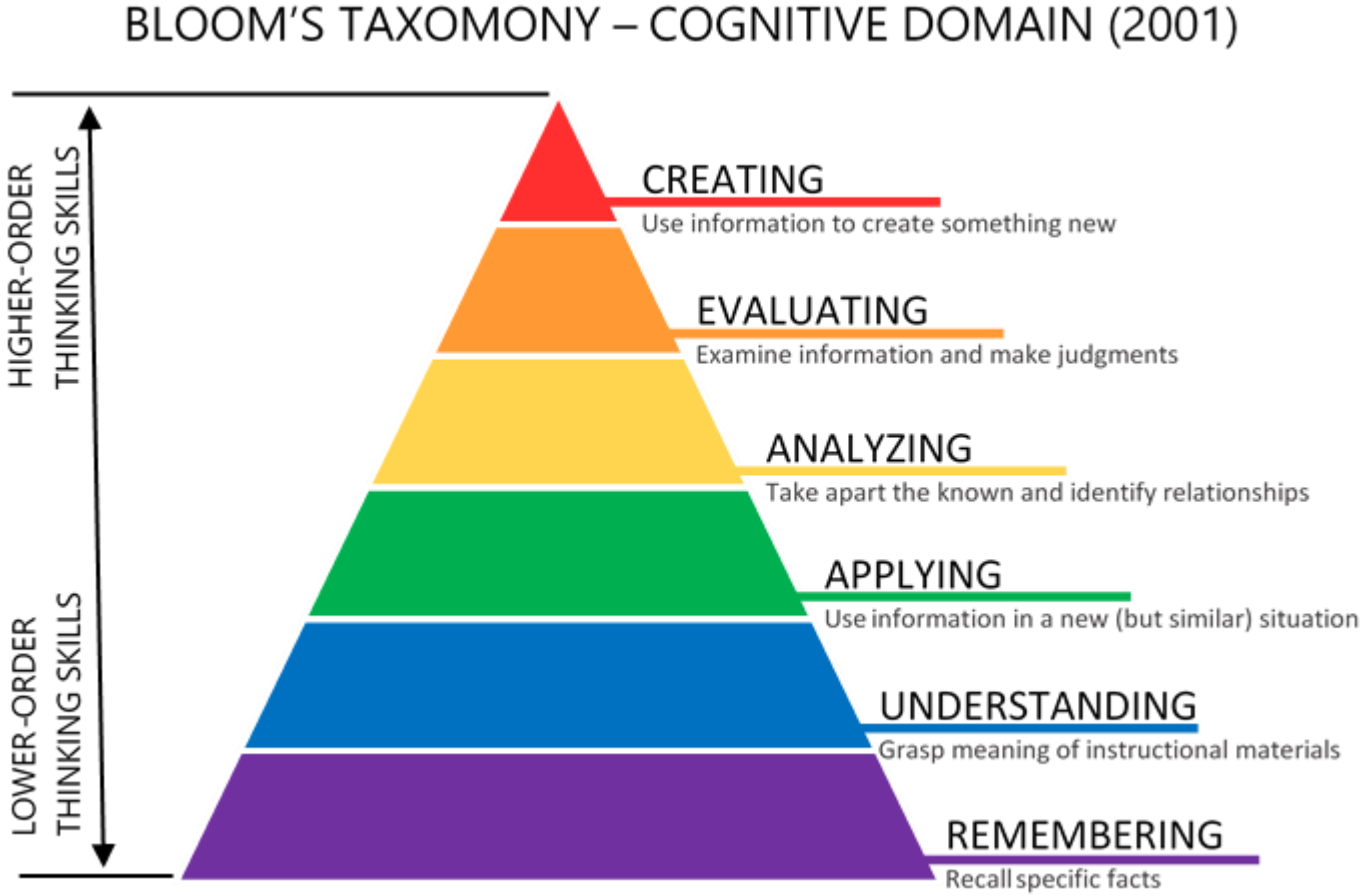
PO8: Ethics.

PO9: Individual and Team work.

PO10: Communication.

PO11: Project Management and Finance.

PO12: Life-long Learning.



educationaltechnology.net

Course Objectives and Structure

COURSE OBJECTIVES

- Understand key concepts and applications of Artificial Intelligence (AI).
- Master statistical analysis and data visualization with Python.
- Gain proficiency in implementing various machine learning algorithms.
- Develop practical skills in data preparation, model training, and evaluation.
- Apply regression and classification algorithms to solve real-world problems.

COURSE Structure

Pandit Deendayal Energy University | School of Technology										
24CV201T							Introduction to Artificial Intelligence			
Teaching Scheme							Examination Scheme			
L	T	P	C	Hrs./Week	Theory			Practical		Total
					MS	ES	IA	LW	LE/Viva	Marks
3	0	0	3	03	25	50	25	-	-	100

Course Syllabus

Unit 1: Foundations of AI in Civil Engineering (8 Hours.)

AI Fundamentals & Engineering Context, Introduction to AI (Definition, Scope of Machine Learning vs. Deep Learning), Data Science Lifecycle and Workflow, Narrow AI vs. Generative AI, Foundation Models and Large Language Models (LLMs), Core Learning Paradigms (Supervised, Unsupervised, Reinforcement Learning), Civil Engineering Applications (Pavement Deterioration Analysis, Concrete Strength Prediction, Traffic Flow Forecasting, Structural Health Monitoring, Bridge Inspection Automation, Construction Safety Systems), Water Resources Applications (Flood Forecasting, Rainfall Prediction, Drought Monitoring, Groundwater Modeling), Geospatial Foundations (Land Use Classification, Flood Mapping, Infrastructure Extraction), Ethical AI (Bias Mitigation, Explainable AI/XAI, Data Privacy in Public Works).

Unit 2: Statistics and Exploratory Data Analysis (14 Hours.)

Statistics and Exploratory Data Analysis (EDA), Engineering Data Types (Numerical, Categorical, Time-Series, Spatial data), Descriptive Statistics (Mean, Median, Mode, Variance, Standard Deviation, Quartiles), Probability Foundations for Risk Assessment, Visual Analytics with ggplot2 (Scatter Plots, Histograms, Density Plots, Boxplots, Violin Plots, Heatmaps, Correlation Matrices), Data Cleaning Procedures (Handling Missing Values, Removing Duplicates, Outlier Detection), Identifying Feature Relationships, Analysis of Environmental Datasets (e.g., Rainfall Variability).

Course Syllabus

Unit 3: Machine Learning Workflows and Evaluation (15 Hours.)

The Machine Learning Workflow, Comprehensive Data Preparation (Data Cleaning, Normalization, Scaling, Encoding Categories), Feature Engineering for Civil Data (Calculating Rainfall Intensity, Runoff Coefficients, NDVI Anomalies), Model Training and Validation, Evaluation Metrics for Regression (RMSE, MAE, R^2), Evaluation Metrics for Classification (Accuracy, Precision, Recall, F1 Score, ROC Curves), Statistical Challenges (Overfitting vs. Underfitting, Bias-Variance Tradeoff), Cross-Validation Techniques.

Unit 4: Advanced Modeling and Civil Engineering Applications (15 Hours.)

Machine Learning Algorithms & Geospatial Engineering, Regression Models (Linear Regression for Structural Design, Logistic Regression for Failure Prediction), Tree-Based Models (Decision Trees, Random Forests for Flood Susceptibility and Crop Yield), Proximity and Probability Models (K-Nearest Neighbors, Naive Bayes), Clustering Techniques (K-Means and Hierarchical Clustering for Regional Analysis), Geospatial Data Structures (Raster vs. Vector data, Satellite Image Processing), Remote Sensing Integration (GIS + AI Fusion), Advanced Mapping Applications (Urban Heat Island analysis, Landslide Mapping, River Change Detection).

Evaluation for this semester

Component	IA	Mid	Final
Written Exam	0	25	$\left(\frac{100}{2}\right)$
Quiz	4 + 5	-	-
Assignments	16	-	-
SUM	25	25	50
End Semester Exams (3-hr): *26 Nov 2026*			

- Mid sem exam: 6 questions (4*5) + (2*2.5) : 25
- IA: 3 quiz 3 marks each and 4 assignment 4 marks each : 25
- End sem exam: 10 questions (10*10) : 50

- if(END ≥ 35 && TOTAL ≥ 40){ "Pass" } else { "Fail" }

Reference books

- Russell & Norvig – *Artificial Intelligence: A Modern Approach* (Concepts)
- James et al. – *Introduction to Statistical Learning* (Machine Learning)
- Wickham et al. – *R for Data Science* (Practical R Programming) R for Data Science (2e)

Academic Calendar and Links

IoAI Theory Handouts:

See your attendance and Marks:

[Sample Link]

Class Representative(s)

S1:

S2:

PANDIT DEENDAYAL ENERGY UNIVERSITY
Academic Calendar: 2026-27
Faculty of Engineering and Technology (FoET)
Faculty of Liberal Studies (FoLS)
School of Law (SoL)

Odd Semester: UG Sem.1/3/5/7 & PG Sem. 1/3 (FoET) & UG Sem. 1/3/5/7 & PG Sem. 1/3 (FoLS), UG Sem. 1/3 (SoL)	
Particulars	**Date**
Semester registration for all programs for FoET, FoLS, SoL	13th July 2026
Department Orientation & Commencement of classes for all programs for FoET, FoLS and SoL	20th July 2026
Evaluation of Rural Internship/CSSI, Industry Orientation, and Industrial Internship	3rd – 7th August, 2026
Attendance Review – I	14th August, 2026
Independence Day Celebration	15th August, 2026
Internal Assesment-1 (Quiz, Test, Assignment etc.)**	17th – 21st August, 2026
Student mentoring week – I	17th – 21st August, 2026
Parent Teacher Meeting	22nd August, 2026
Eminent Lecture Series – Expert Lecture I	August, 2026
Attendance Review – II	11th September, 2026
Mid Semester Examination (MSE) / Project Phase I Review for PG	21st September, 2026
Eminent Lecture Series – Expert Lecture II	September, 2026
Last date of showing evaluated answer books and submission of MSE Marks	1st October, 2026
Comprehensive Project (CP)/Major Project (MP) Allocation for even term	October, 2026
Board of Studies (BoS) Meeting and Faculty Board Meeting	September, 2026
Declaration of Mid Semester Exam Result	9th October, 2026
Rangtaal (Navratri Celebration)	16th October, 2026
Tesseract - The Science & Technical Fest	30th October-1st November, 2026
Attendance Review - III	16th October, 2026
Internal Assesment-2 (Quiz, Test, Assignment etc.)**	19th – 23rd October, 2026
Rural Internship for FoLS – SARI Phase I	23rd October, 2026
Student mentoring week – II	26th – 30th October, 2026
360 Degree Feedback	26th – 30th October, 2026
Attendance Review IV and Declaration of Provisional Detention List	30th October, 2026
Classes End	6th November, 2026
Declaration of Detention List and Hall Ticket Generation	6th November, 2026
Diwali Break	9th -13th November, 2026
Practical Examinations and Viva Voce	16th -20th November, 2026
End Semester Examination (Regular + Backlog Examinations)	26th November, 2026
Dissertation presentation for UG/PG programs	7th – 11th December, 2026
Ph.D. Progress Review	November – December, 2026
NGO Internship for SoL Begins	10th December, 2026
Last date of showing evaluated answer books and submission of end semester examination marks	18th December, 2026
Alumni Day (School Level)	19th December, 2026
Rural Internship for FoLS – SARI Phase II	December 2026
Declaration of End Semester Examination Result	24th December, 2026
Winter Break	28th December, 2026 – 1st January, 2027