St. Thomas College of Engineering & Technology
Vellilode, Sivapuram PO. Mattanur. Kannur District, Kerala
Approved by AICTE New Delhi, Govt. Of Kerala and Affiliated to APJ Abdul Kalam Technological University

COURSE HANDOUT

(B. Tech - Semester 3)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COLLEGE VISION

To be an Institute of repute recognized for excellence in education, innovation, and social contribution.

COLLEGE MISSION

M1: Infrastructural Relevance - Develop, maintain and manage our campus for our stakeholders.
M2: Life-Long Learning - Encourage our stakeholders to participate in lifelong learning through industry and academic interactions.
M3: Social Connect - Organize socially relevant outreach programs for the benefit of humanity.

DEPARTMENT VISION

To produce professionally competent, ethically sound and socially responsible Electronics and Communication Engineers.

DEPARTMENT MISSION

M1: Provide excellent infrastructure and lab facilities for quality education.

M2: Promote industry-academic interactions to keep up with technological advancements.

M3: Develop interpersonal skills and social responsibility among students through project-based and team-based learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

Graduates of B. Tech ECE program after graduation will:

PEO1: Exemplify technical competence in designing, analyzing, testing and fabricating electronic circuits.

PEO2: Acquire leadership qualities, rapport, communication skills in the organization and adapt to changing professional and societal needs.

PEO3: Work effectively as individuals and as team members in multidisciplinary projects

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Define, design, implement, model, and test electronic circuits and systems that perform signal processing functions.

PSO2: Segregate and select appropriate technologies for implementation of a modern communication system.

CONTENTS

COURSE INFORMATION SHEETS OF SEMESTER 3 COURSES

F

GNEST305

INTRODUCTION TO AI AND DATA SCIENCE

COURSE INFORMATION SHEET

PROGRAMME: ECE (UG)	**DEGREE**: BTECH
COURSE: INTRODUCTION TO AI AND DS	**SEMESTER: 3** **L-T-P-CREDITS**: 3-1-0-4
COURSE CODE: **REGULATION**: GNEST305: 2024 SCHEME	**COURSE TYPE**: CORE
COURSE AREA/DOMAIN: COMPUTER SCIENCE/IT	**CONTACT HOURS**: 3
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME**: NIL

SYLLABUS

MODULE	DETAILS	HOURS
I	**Introduction to AI and Machine Learning**: Basics of Machine Learning - types of Machine Learning systems- challenges in ML- Supervised learning model example- regression models- Classification model example- Logistic regression-unsupervised model example- K-means clustering. Artificial Neural Network-Perceptron-Universal Approximation Theorem(statement only)-Multi-Layer Perceptron-Deep Neural Network-demonstration of regression and classification problems usingMLP.(Text-2)	11
II	**Mathematical Foundations of AI and Data Science**:Role of linear algebra in Data representation and analysis–Matrix decomposition-Singular Value Decomposition (SVD)- Spectral decomposition- Dimensionality reduction technique-Principal Component Analysis (PCA). (Text-1)	11
III	**Applied Probability and Statistics for AI and Data Science**: Basics of probability-random variables and statistical measures - rules in probability- Bayes theorem and its applications- statistical estimation-Maximum Likelihood	11

	Estimator (MLE) - statistical summaries- Correlation analysis- linear correlation(direct problems only)- regression analysis-linear regression (using least square method)(Textbook4)	
IV	**Basics of Data Science**: Benefits of data science-use of statistics and Machine Learning in Data Science- data science process - applications of Machine Learning in Data Science- modelling process- demonstration of ML applications in data science-Big Data and Data Science.(For visualization the software tools like Tableau, PowerBI, R or Python can be used. For Machine Learning implementation,Python,MATLAB or R can be used.)(Textbook-5)	11
Total hours		**44**

TEXT BOOKS/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Introduction to Linear Algebra : Gilbert Strang
T2	Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow : Aurélien Géron
R1	Datascience: concepts and practice : Kotu, Vijay,and Bala Deshpande
R2	Probability and Statistics for Data Science : Carlos Fernandez- Granda

COURSE PREREQUISITES: NIL

COURSE CODE	COURSE NAME	DESCRIPTION	SEMESTER

COURSE OBJECTIVES:

1	Demonstrate a solid understanding of advanced linear algebra concepts, machine learning algorithms and statistical analysis techniques relevant to engineering applications,principles and algorithms.
2	Apply theoretical concepts to solve practical engineering problems, analyze data to extract meaningful insights,and implement appropriate mathematical and computational techniques for AI and data science applications.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

COs / CO-PO/PSO MAPPING. /BLOOM'S TAXONOMY LEVEL	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
GNEST305.1	Apply the concept of machine learning algorithms including neural networks and supervised/unsupervised learning techniques for engineering applications.													
	3	**3**	**3**	**3**										
	APPLY													
GNEST305.2	Apply advanced mathematical concepts such as matrix operations, Singular values, and principal component analysis to analyze and solve engineering problems.													
	3	**3**	**3**	**3**										
	APPLY													
GNEST305.3	Analyze and interpret data using statistical methods including descriptive statistics correlation, and regression analysis to derive Meaningful insights and make informed decisions.													
	3	**3**	**3**	**3**									**1**	
	APPLY													
GNEST305.4	Integrate statistical approaches and machine learning techniques to ensure practically feasible solutions in engineering contexts.													
	3	**3**	**3**	**3**									**1**	
	APPLY													
MAPPING AVERAGE	**3**	**3**	**3**	**3**									**1**	

JUSTIFICATION FOR CO-PO/PSO MAPPING:

CO	PO/PSO	MAPPING LEVEL	JUSTIFICATION
GNEST305.1	PO1	**3**	Students apply mathematical foundations (e.g., linear algebra, probability) in understanding ML principles.
	PO2	**3**	Identifying where and how AI/ML is applicable to solve real-world problems is a core learning outcome.
	PO3	**3**	Students begin to understand how AI can be integrated into engineering systems for intelligent solutions.
	PO4	**3**	Students analyze ML examples and case studies that involve data-driven investigation.
GNEST305.2	PO1	**3**	Regression and classification models rely heavily on mathematical concepts such as linear algebra, calculus, and statistics. Students apply foundational knowledge to understand and implement these models.
	PO2	**3**	Supervised learning models are used to solve practical engineering and real-world problems, such as prediction and classification tasks. Students learn to choose appropriate models and evaluate their performance.
	PO3	**3**	By implementing regression and classification models, students design data-driven solutions, integrate them into broader systems, and optimize model performance.
	PO4	**3**	Students train, test, and validate supervised models using datasets, perform error analysis, and interpret results—key aspects of engineering investigation and data interpretation.
GNEST305.3	PO1	**3**	K-means clustering and other unsupervised learning techniques rely on mathematical concepts such as

			Euclidean distance, centroids, and optimization. Students apply this foundational knowledge to understand how clustering algorithms group data.
	PO2	**3**	Students learn to identify problems suitable for unsupervised approaches and use clustering to uncover patterns in unlabeled data, which is common in engineering and data science applications.
	PO3	**3**	Clustering algorithms are used to design solutions in fields like customer segmentation, fault detection, and image analysis. Students learn to implement and tune clustering methods to produce meaningful groups.
	PO4	**3**	Students explore datasets, perform clustering, analyze group characteristics, and validate cluster quality—skills essential for conducting meaningful data-driven investigations.
	PSO1	**1**	Applying sustainable principles while designing electronic circuits and signal processing systems encourages the use of energy-efficient and eco-friendly components, reducing power consumption and electronic waste. This aligns with PSO1's emphasis on modeling and testing responsible systems.
GNEST305.4	PO1	**3**	Understanding and implementing neural networks, including MLP, requires application of mathematical concepts like matrix operations, calculus (for backpropagation), and linear algebra. This CO ensures students apply these fundamentals in a practical AI context.
	PO2	**3**	Students use ANN models to formulate and solve real-world regression and classification problems, such as image or signal recognition, which are core

			applications in engineering and AI systems.
	PO3	**3**	Designing neural network models involves choosing appropriate architectures, activation functions, and optimization methods, enabling students to build AI components that address complex tasks.
	PO4	**3**	Students are trained to experiment with ANN models, analyze performance metrics (like accuracy and loss), tune hyperparameters, and interpret results, which develops their skills in data-driven investigation and validation.
	PSO1	**1**	Sustainable engineering principles guide students to choose energy-efficient components, low-power designs, and recyclable materials in signal processing systems, aligning with environmentally responsible engineering practices.

CORRELATION Levels: 3- Substantial (High) 2- Moderate (Medium) 1-Slight (Low)

GAPS IN THE SYLLABUS-TO MEET INDUSTRY/PROFESSION REQUIREMENTS

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Practical session on data visualization using software tools like Python not included	Workshop on Python	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10,PO11,PO 12,PSO1(1)

CONTENT BEYOND THE SYLLABUS/ADVANCED TOPICS/DESIGN

SL NO:	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POS /PSOS
1	Future trends and scope of Artificial Intelligence in Industry	Learning materials on Future trends and scopes in Artificial Intelligence	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10,PO11,PO 12,PSO1(1)

WEB SOURCE REFERENCES:

SL NO:	DESCRIPTION
1	

DELIVERY TECHNOLOGIES

CLASSROOM WITH BLACK BOARD/WHITE BOARD/SMART BOARD	✔	**ICT TOOLS**	
CLASSROOM WITH LCD PROJECTOR	✔	**ELECTRONIC CLASSROOM**	

INSTRUCTION METHODS

FACE TO FACE INSTRUCTION	Direct	✔	**FLIPPED CLASSROOM**	✔
	Project-based instruction		**BLENDED LEARNING**	✔
	Problem-based instruction		**ONLINE COURSES/MOOCs**	
	Technology enhanced learning		**OTHERS (IF ANY)**	
	Experiential learning			
	Participative learning			

CO ASSESSMENT TOOLS-DIRECT

ASSIGNMENTS	✔	**TUTORIALS**	✔	**SERIES EXAMINATIONS**	✔	**UNIVERSITY EXAM**	✔
LAB PRACTICES		**VIVA**		**INTERNAL LAB EXAM**		**REPORT/ DOCUMENT PREPARATION**	
PRESENTATION		**EVALUATION BY GUIDE**		**INTERIM EVALUATION**		**FINAL EVALUATION**	

CO ASSESSMENT TOOLS -INDIRECT

ASSESSMENT OF COURSE OUTCOMES (BY COURSE EXIT (END) SURVEY)	✔

ASSESSMENT ITEMS /CLASS SESSIONS/LAB/FIELD/TUTORIAL HOURS FOR EACH COURSE OUTCOMES

CO	ASSESSMENT ITEMS	CLASS SESSIONS	LAB/FIELD/TUTORIAL HOURS
GNEST305.1	S1,A1,T1	**14**	1
GNEST305.2	S2,A1,T2	**14**	1
GNEST305.3	S2,A2,T3	**14**	1
GNEST305.4	S3,A3,T4	**14**	1
		TOTAL HOURS OF INSTRUCTION	**60**

Prepared by **Approved by HOD**

Rinija G N