

Branch Name:	Bachelor of Science (Information Technology)
Program Code:	ET110
Semester/Year:	Semester - VII/ Fourth Year
Subject Title:	Deep Learning
Subject Code:	17-ITM401-4C
Pre-requisite:	Basic knowledge of python programming and statistics

Course Objective: The objective of this course is to provide students with fundamental knowledge of Deep Learning and artificial neural network architectures used in intelligent systems. The course focuses on training techniques for artificial neural networks, classification methods, and the design of neural network models for machine learning applications. It also aims to develop skills in designing, implementing, and deploying deep learning models for solving real-world data-driven problems.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03		02	04	50	25	-	25	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to Deep Neural Networks: History of Deep Neural Networks, Neural Networks Success Stories, McCulloch Pitts Neuron, Perceptron and Deep Neural Networks, Training Neural networks with Tensorflow, Common Tensorflow API's - KERAS, Estimator, Layers, Machine Learning vs Neural Networks. Deep Neural Networks: Basics of Deep Learning: features, weights, loss function, cost function, ANN: forward propagation; Backpropagation, Stochastic Gradient Descent, Batch gradient descent, mini batch gradient descent, Optimizers: Momentum, RMSProp, Adam, Deep Learning Experiments: Datasets, training-validation testing set, Network architecture search, Types of NN-CNN, RNN, Feedforward, Estimator, Layers, evaluation measures: accuracy, precision, recall, f-measure.	12	25
2	Convolutional Neural Networks (CNNs) Architectures: Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet , CNNs for Recognition, Verification, Detection, and Segmentation: CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN, YOLO, Semantic segmentation, Instance segmentation, Evaluation measure: IoU/Jacard Index, Dice score, Mean pixel accuracy, Segnet, Unet, Mask R-CNN.	12	25

3	Model Improvement: Overfitting vs underfitting, Bias vs Variance, hyper parameter tuning: random, coarse to fine; Regularization: L1, L2 regularization, Dropout, Early stopping, Data normalization, Augmentation; Convolutional Neural Networks: convolution, striding, padding, pooling, 1x1 convolution, famous CNN models; CNN Applications: Transfer Learning, Image classification, face detection. Generative Applications: Understanding Generative Adversarial Networks, Image Inpainting, Image Super Resolution, Colorization of Black and White Images, Human Face Generation, Music Generation.	10	20
4	Temporal data analysis: Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs Encoder Decoder Models.	5	15
5	Application of Deep Neural Network models: Multitask Deep Learning, Multiview Deep Learning, automatic image captioning, Deep learning software-H2O.ai, Dato GraphLab, Bengio, Caffe, TensorFlow, PowerAI.	4	15

List of Reference Books:

1. “Computer Vision Metrics: Survey, Taxonomy, and Analysis of Computer Vision, Visual Neuroscience, and Visual AI” by Andy Krig Scott, SPRINGER VERLAG, SINGAPOR.
2. “Modern Deep Learning and Advanced Computer Vision: A Perspective Approach” by Dr.P.S.Jagadeesh Kumar, Prof. Thomas Binford, Dr. J. Ruby, J. Lepika, Intel, Paperback.
3. “Deep Learning in Computer Vision: Principles and Applications” by Mahmoud Hassaballah, Ali Ismail Awad, CRC Press.
4. “Foundations of Machine Learning” by Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, MIT Press.
5. “Deep Learning” by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

List of Suggested titles of Experiments:

1. Implement simple vector addition in Tensor Flow.
2. Implement a regression model in Keras
3. Implement a perception in Tensorflow/Keras Environment,
4. Implement a Feed Forward Network in TensorFlow/Keras.
5. Implement an image classifier using CNN in TensorFlow/Keras
6. Improve the deep Learning model by fine Tuning hyper parameters.
7. Implement a Transfer Learning concept in image classification.
8. Using a pre trained model on Keras for transfer learning.
9. Perform Sentimental Analysis using RNN.
10. Implement an LSTM based Auto encoding InTensorflow/Keras
11. Image generation using GAN.
12. Train a deep Learning model to classify a given image using pre trained model,
13. Recommendation system from sales data using Deep Learning
14. Implement Object detection using CNN.
15. Implement any simple Reinforcement Algorithm for an NLP problem.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand and apply the gradient descent and its optimization in solving the problem using deep neural networks.	2 Understanding 4 Analyzing
CLO2	Analyze and compare different Convolutional Neural Network (CNN) architectures.	2 Understanding 5 Evaluating
CLO3	Analyze and compare different Recurrent Neural Network (RNN) architectures.	4 Analyzing 2 Understanding
CLO4	Apply, evaluate and compare various deep networks with their performance parameters.	2 Understanding 3 Applying
CLO5	Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems	3 Applying 4 Analyzing 5 Evaluating

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CLO1	H	M		L		M	L		L	L	M	L	L	L		M
CLO2	H	H	H	M	M		M		M	L		M	H	H	M	H
CLO3	H	H	H	M	M	L	H	M	M	L	M	M	H	H	M	M
CLO4	H	M	M	M	L		L	H	M	L		L	M	H	L	M
CLO5	H	M		L		M	M		L	L	M	L	H	L	M	H

H: High, M: Medium, L: Low

Branch Name:	Bachelor of Science (Information Technology)
Program Code:	ET110
Semester/Year:	Semester - VII/ Fourth Year
Subject Title:	Advanced Big Data Analytics
Subject Code:	17-ITM402-4C
Pre-requisite:	Working knowledge of programming language and database concepts

Course Objective:

- Fundamental for Big Data Analytics this course concentrates on delivering the necessary concepts and features
- Big data analytics helps organizations harness their data and use it to identify new opportunities.
- That, in turn, leads to smarter business moves, more efficient operations, higher profits and happier customers. Businesses that use big data with advanced analytics gain value in many ways, such as: Reducing cost.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03		02	04	50	25	-	25	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction To Big Data Big Data: Introduction to Big Data, Big Data characteristics, Types of Big Data, Traditional vs. Big Data approach Hadoop: What is Hadoop? Core Hadoop Components, Hadoop Ecosystem (Hbase, Hive, Hcatalog, Pig, Sqoop, Oozie, Mahout, ZooKeeper), Physical Architecture, Hadoop limitations. NoSQL: What is NoSQL? NoSQL business drivers, NoSQL case studies (Amazon Dynamo DB, Google's Big Table, MongoDB, Neo4j), NoSQL data architecture patterns (Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores), Variations of NoSQL architectural patterns; Using NoSQL to manage big data Map Reduce: MapReduce and New Software stack (Distributed File Systems, Physical Organization of Compute Nodes), The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures	10	25

2	Processing stream data SCALA: What is Scala? Basic Operations, variable types, control structure, foreach loop, functions, procedures, array, higher order functions, Class in Scala, getters and setters, constructor, singletons, traits SPARK: Spark Components & its Architecture, Spark Deployment Modes, Spark Resilient Distributed Dataset (RDDs), RDD operations, transformations and actions, data loading and saving, Key-Value Pair RDDs, RDD Persistence, SPARK SQL, dataframes and datasets, JSON and Parquet file formats	12	25
3	Data Stream Mining: The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream, Filtering Streams (The Bloom Filter), Counting Distinct Elements in a Stream, Counting Ones in a Window, Decaying Windows.	8	15
4	Link Analysis: PageRank, Efficient Computation of Page Rank (PageRank implementation using MapReduce, Use of Combiners to Consolidate the Result Vector), Topic sensitive Page Rank, link Spam, Hubs and Authorities.	4	10
5	Data Visualization tools and techniques Tableau: Data type, file type, tool type, show me menu, Type of data source supported by, how to connect different data sources, edit metadata, filter fields, filter data source, type of charts, filter data, data joining, data blending, extract data, adding filter data, apply filter on chart and data, number functions, string functions. Power BI: Components of Power BI, designing tables and reports, preparing dashboards	10	25

List of Reference Books:

1. Radha Shankarmani, M Vijayalakshmi, Big Data Analytics, 2nd Edition, Wiley
2. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.
3. Seema Acharya, Subhashini Chhellaippan, BIG Data and Analytics , , Willey
4. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
5. VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packet Publishing 2013
6. Big Data Black Book, DreamTech
6. Introducing Microsoft Power BI, Alberto Ferrari and Marco Russo
7. Tableau For Dummies by Molly Monsey and Paul Sochan
8. Scala in depth by Joshua D. Suereth

Web Resources:

1. <http://www.bigdatauniversity.com>
2. <http://www.mongodb.com>
3. <http://hadoop.apache.org>

List of Suggested titles of Experiments:

1. MongoDB CRUD Operations
2. MongoDB Aggregation Framework
3. Tableau: Preparing Dashboards and Stories
4. Spark: Multiple practicals on Scala and Spark and SPARK SQL (dealing with different types of data like mysql, csv, json, parquet, etc)

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	To understand the basic idea of artificial intelligence and its application areas.	1 Remembering 2. Understanding
CLO2	Understand several key big data technologies used for storage, analysis and manipulation of data.	2 Understanding 3 Applying
CLO3	Recognize the key concepts of MongoDB, Scala and Spark	2 Understanding 3 Applying
CLO4	Solve business intelligence related queries using Data Visualization tool like tableau, PowerBI	2 Understanding 3 Applying 5 Evaluate
CLO5	Apply Advance concepts related to big data in projects/real life scenarios	2. Understanding 3 Applying 5 Evaluate

Mapping of CLOs with POs & PSOs

Course	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PS O1	PS O2	PS O3	PS O4
CLO1	M	0	0	0	L	0	0	0	0	0	0	0	L	H	M	M
CLO2	H	M	0	M	H	0	M	0	M	0	M	0	H	L	M	H
CLO3	0	0	0	0	H	0	0	0	M	0	M	0	M	L	H	M
CLO4	L	0	0	0	H	M	0	0	M	0	H	0	H	M	L	M
CLO5	M	L	0	M	L	0	L	0	0	0	0	0	H	L	M	H

H: High, M: Medium, L: Low

Branch Name:	Bachelor of Science (Information Technology)
Program Code:	ET110
Semester/Year:	Semester - VII/ Fourth Year
Course Title:	Research Methodology
Course Code:	17-ITM403-4C
Pre-requisite Course:	-

Course Objectives:

1. To understand the need and relevance of research in the field of management.
2. To provide an insight on research as a tool for problem-solving and decision-making.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	0	2	4	50	25	-	25	100

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction to Research Methodology : Nature of research and its role in decision making; Steps in the research process; Types of research: qualitative research vs. quantitative research, exploratory vs conclusive; defining the research problem, research objectives and research hypothesis.	9	20%
2	Research Design, Sampling and Literature Review: Meaning and classification of research design: exploratory, descriptive, causal; Techniques of sampling: Probability vs Non probability; determination of sample size; Primary data collection: survey vs. observation, interviews; Secondary data research: advantages and limitations; Role of literature review in research, fundamentals of SLR and Meta Analysis.	12	30%
3	Scaling Techniques and Questionnaire Designing: Primary scales of Measurement – nominal, ordinal, interval and ratio. Scaling techniques – comparative vs non-comparative, balanced vs unbalanced; itemized rating scale: Likert Scale. Designing a Questionnaire; Descriptive Statistics – Measures of Central Tendency: & Dispersion, Correlations and linear regression, Chi-Square test, t-test, z-test, f-test. Presentation of Data: Tabular, Graphic, Bar Diagram and Pie Chart, etc. Statistical Packages – MS Excel, SPSS, and Web-based Statistical Analysis Tools, etc.	18	35%
4	Report Writing and Ethics in Research: Preparing a Research proposal; Essentials of Report writing: Types and Structure, Citation and Acknowledgement, Impact factor, Cite score; Ethics in Research: Researcher's Ethical Code, Plagiarism. IPR – Types and relevance in Research Methodology.	6	15%

Text Books:

1. Kothari & Garg (2019). Research Methodology methods and techniques (4th Edition), New Age International Publishers.
2. Chawla & Sondhi (2018). Research Methodology Concepts and Cases (2nd Edition), Vikas Publication.
3. Jesson, Matheson & Lacey (2011). Doing Your Literature Review Traditional and Systematic Techniques, Sage publication.

Reference Books:

1. Oliver, P. (2010). The student's guide to research ethics (2nd Edition). McGraw-Hill Education (UK).

LIST OF EXPERIMENTS / PRACTICALS

1. Identify and formulate a research problem with objectives and hypothesis.
2. Prepare a comparative study of qualitative and quantitative research methods.
3. Design different types of research designs for sample case studies.
4. Prepare a sampling plan using probability and non-probability sampling methods.
5. Conduct literature review using Google Scholar, ResearchGate, IEEE, etc.
6. Design a questionnaire using Likert Scale and rating scales.
7. Create datasets and perform measures of central tendency using MS Excel/SPSS.
8. Perform correlation and linear regression analysis on sample data.
9. Perform hypothesis testing using t-test, z-test, chi-square test and F-test.
10. Represent data using tables, bar charts and pie charts in Excel/SPSS.
11. Use web-based statistical tools/SPSS for data interpretation.
12. Prepare a research proposal and final research report.
13. Check plagiarism and apply citation/referencing standards (APA/IEEE).
14. Case study on research ethics and Intellectual Property Rights (IPR).

Course Learning Outcomes (CLO):

COs	Statements	Bloom's Level
CO1	Understand the nature, scope and importance of research methodology and identify research problems, objectives and hypotheses.	2 Understanding 3 Applying
CO2	Analyze and apply different research designs, sampling techniques and data collection methods for research studies.	3 Applying 4 Analyzing
CO3	Design questionnaires and apply appropriate scaling techniques and statistical tools for quantitative and qualitative data analysis.	3 Applying 4 Analyzing
CO4	Interpret and present research data using descriptive statistics, graphical methods and statistical software tools such as MS Excel and SPSS.	3 Applying 4 Analyzing
CO5	Prepare research proposals and reports while following ethical practices, citation standards, plagiarism guidelines and IPR concepts.	3 Applying 5 Evaluating

Mapping of CLO with PO and PSO

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H	M								L			H			
CLO2	H	H	M	M									H	M		
CLO3	M	H	H	H	M								M	H	M	
CLO4	M	H	M	H	H				M				M	H	M	
CLO5		M	M		M	H	H	H	M	H	M	L		M	H	H

H:High, M:Medium, L:Low

Branch Name:	Bachelor of Science (Information Technology)
Program Code:	ET110
Semester/Year:	Semester - VII/ 4th Year
Subject Title:	Security in Cyber Physical Environment
Subject Code:	17-ITE401-4C
Pre-requisite:	Fundamentals of Cybersecurity

Course Objective:

This course aims to provide students with an in-depth understanding of the security challenges and solutions in cyber-physical systems (CPS).

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03		02	04	50	25	-	25	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to Cyber-Physical System: Components of CPS: Sensors, Actuators, Communication, and Control Systems Applications of CPS (Smart Grids, Healthcare, Autonomous Systems, Industrial Control Systems), Security and Privacy Issues in CPS	5	15
2	Security Fundamentals: Basic Security Concepts: Confidentiality, Integrity, Availability, Authentication Security Threats and Attacks in CPS: Denial of Service (DoS), Spoofing, Physical Attacks, Cryptographic Basics: Symmetric and Asymmetric Encryption, Hashing, Digital Signatures	7	25
3	Threats and Vulnerabilities in CPS: CPS Vulnerabilities: Physical Security, Network Security, System Security Common Attacks on CPS: Replay Attacks, Eavesdropping, Man-in-the-Middle (MITM), Side-channel Attacks Risk Management and Security Frameworks in CPS Vulnerabilities in Communication Protocols used in CPS (MQTT, CoAP, etc.) Case Study: Security Breaches in Real-world CPS Applications (e.g., Stuxnet)	8	25
4	Secure Communication in CPS: Protocols for Secure Communication in CPS, Lightweight Cryptographic Techniques for CPS (Elliptic Curve Cryptography, SHA-256), Key Management in CPS Networks, Secure Routing Protocols for CPS and IoT, Secure Data Aggregation and Trust Models in CPS	8	20

5	Privacy Protection in CPS: Privacy Issues in CPS, Privacy-Preserving Data Collection and Analysis Techniques, Differential Privacy in CPS: Authentication and Authorization Techniques for CPS	7	15
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List of Reference Books:

1. "Cyber-Physical Systems: Security and Privacy" by Fei Hu
2. "Security of Cyber-Physical Systems" by William M. P. and Sudhir S.
3. "Introduction to Cyber-Physical Systems Security" by S. S. Yau, A. Shami, L. Zeng
4. "Cybersecurity for Smart Cities: Protecting the Cyber-Physical Systems" by R. A. Sheikh

List of Suggested titles of Experiments:

- a. Implement symmetric and asymmetric encryption algorithms.
- b. Set up secure communication using SSL/TLS for CPS devices.
- c. Implement role-based access control (RBAC) for a CPS-based application.
- d. Simulate the impact of a DoS attack on a smart grid system.
- e. Develop secure communication protocols for IoT devices in a CPS network.
- f. Implement differential privacy methods for sensor data collection.
- g. Use tools to conduct a risk assessment of a CPS application.
- h. Model the security measures for a smart city with IoT devices.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the components of Cyber-Physical Systems (CPS), their applications, and the associated security and privacy challenges.	1 Remembering 2. Understanding
CLO2	Analyze the fundamental concepts of security, including confidentiality, integrity, availability, and authentication, and their application in CPS environments.	2. Understanding 4. Analyzing
CLO3	Identify threats, vulnerabilities, and common attacks in CPS, such as DoS, spoofing, MITM, and side-channel attacks, and evaluate their potential impacts.	3. Applying 5. Evaluating
CLO4	Develop secure communication strategies for CPS, including the use of lightweight cryptographic techniques, key management, and secure routing protocols.	3. Applying 6. Creating
CLO5	Investigate real-world CPS security breaches (e.g., Stuxnet) to understand vulnerabilities in communication protocols and design mitigation strategies.	4. Analyzing 5. Evaluating

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CLO1	M	H	L	H	M	H	M						H	L	H	H
CLO2	H	M	M	H	H	M	H						L	M	M	M
CLO3	M	H	M	L	M	M	M						M	H	L	H
CLO4	M	H	M	L	L	H	L						H	M	L	L
CLO5	M	M	M	H	H	L	M						H	H	M	M

H: High, M: Medium, L: Low

Branch Name:	Bachelor of Science (Information Technology)
Program Code:	ET110
Semester/Year:	Semester - VII/ 4 th Year
Subject Title:	Computer Vision
Subject Code:	17-ITE402-4C
Pre-requisite:	Basic of mathematics: calculus, linear algebra and probability. Ability to program in C/C++/MATLAB and algorithms, Some background knowledge of image

Course Objective:

- To provide fundamental understanding of image processing and computer vision concepts.
- To develop analytical skills for shape, texture, and feature analysis in digital images.
- To introduce 3D vision and motion estimation techniques for scene understanding.
- To enable students to design and implement practical applications using modern computer vision tools and algorithms.
- To enhance students' ability to apply deep learning and machine learning models in solving real-world vision problems.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03		02	04	50	25	-	25	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	IMAGE PROCESSING FOUNDATIONS Review of image processing techniques, classical filtering operations, thresholding techniques, edge detection techniques, corner and interest point detection, mathematical morphology, texture	6	15
2	SHAPES AND REGIONS Binary shape analysis, connectedness, object labeling and counting, size filtering, distance functions, skeletons and thinning, deformable shape analysis, boundary tracking procedures, active contours, shape models and shape recognition, centroidal profiles, handling occlusion, boundary length measures, boundary descriptors, chain codes, Fourier descriptors, region descriptors, moments.	10	25
3	Feature Detection and Matching: Edge Detection, Interest Points and Corners, Local Image Features, Feature Matching, Model Fitting and RANSAC	8	20
4	3D VISION AND MOTION Methods for 3D vision, projection schemes, shape from shading, photometric stereo, shape from texture, shape from focus, active range finding, surface representations, point-based representation, volumetric representations, 3D object recognition, 3D reconstruction, introduction to motion, triangulation,	10	20

	bundle adjustment, translational alignment, parametric motion, spline-based motion, optical flow, layered motion		
5	APPLICATIONS Photo album: Face detection, Face recognition, Eigen faces, Active appearance and 3D shape models of faces Vehicle vision system: locating roadway, road markings, identifying road signs, locating pedestrians	8	20

List of Reference Books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Computer Vision: A Modern Approach by Forsyth and Ponce.
3. Probabilistic Graphical Models by Koller and Friedman.
4. Dictionary of Computer Vision and Image Processing, by Fisher et al.
5. Deep Learning, by Goodfellow, Bengio, and Courville.
6. Machine Learning: A Probabilistic Perspective by Murphy.

List of Suggested titles of Experiments:

1. Study and implementation of basic image processing operations (filtering, smoothing, thresholding).
2. Edge detection using Sobel, Prewitt, and Canny operators.
3. Corner and interest point detection using Harris and Shi-Tomasi algorithms.
4. Binary shape analysis and region labeling.
5. Boundary tracking and contour detection using chain codes.
6. Shape representation using Fourier and region descriptors.
7. Implementation of Hough Transform for line, circle, and ellipse detection.
8. Feature extraction and matching using SIFT/ORB descriptors.
9. 3D reconstruction from stereo images.
10. Motion estimation using optical flow techniques.
11. Object detection and classification using pre-trained CNN models.
12. Face detection and recognition using Eigenfaces or Deep Learning models.
13. Implementation of vehicle or pedestrian detection in a video stream.
14. Mini Project: Develop a small application using OpenCV/Python for a real-world problem (e.g., attendance system, lane detection, etc.).

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	List fundamental image processing techniques required for computer vision.	1 Remembering 2. Understanding
CLO2	Outline shape analysis and Implement boundary tracking techniques.	2 Understanding 4 Analyze
CLO3	Apply Hough Transform for line, circle, and ellipse detections.	3 Applying
CLO4	Apply 3D vision techniques and Implement motion related techniques.	3 Applying
CLO5	Develop applications using computer vision techniques.	2. Understanding 3 Applying

Mapping of CLOs with POs & PSOs

Course	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CLO1	H	M	H	L	L	M	–	–	L	–	–	–	H	L	–	–
CLO2	L	M	H	L	L	–	–	–	L	L	–	–	M	L	–	–
CLO3	M	H	M	L	M	H	–	M	L	–	–	–	M	L	–	–
CLO4	M	M	L	L	M	H	–	M	L	–	–	–	M	L	–	–
CLO5	M	L	L	L	M	H	–	M	L	–	–	–	H	L	–	–

H: High, M: Medium, L: Low

Branch Name:	Bachelor of Science (Information Technology)
Program Code:	ET110
Semester/Year:	Semester - VII/ 4 th Year
Subject Title:	Embedded System Design
Subject Code:	17-ITE403-4C
Pre-requisite:	Students should have Basic knowledge of Computer hardware and C language, basic knowledge of assembly language and digital electronics with ability of Programming.

Course Objective:

To introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system, optical amplifiers, fiber network elements, basic optical components, and techniques of fiber optic measurement.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	-	02	04	50	25	-	25	100

Subject Contents				
Sr. No	Topic	Total Hours	Weight (%)	
1	Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.	6	20	
2	Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.	8	20	
3	Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.	7	20	
4	RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multi processing and Multi tasking, Task Scheduling.	8	20	
5	TASK COMMUNICATION: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.	8	20	

List of Reference Books:

1. Embedded Systems - Raj Kamal, TMH
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013.
4. An Embedded Software Primer - David E. Simon, Pearson Education.

List of Suggested titles of Experiments:

1. Introduction to MSP430 Kit and Programming Environment with program to workwith ports
2. Configure timer block with capture/compare channel 0 & 1 to generate 4.096 KHz & 1.024KHz signal.
3. Configure watchdog timer in watchdog & interval mode.
4. Test various Power Down modes in MSP430.
5. Read Temperature of MSP430 with the help of ADC.
6. Use Timer to trigger ADC for reading analog signal in most efficient manner to reduce power consumption.
7. Configure DAC to generate positive ramp signal.
8. Use Comparator to compare the signal threshold level.
9. Implement Hardware Multiplier to multiply two arrays to perform MAC operation.
10. Implement DMA controller for basic convolution algorithm.
11. Use I2C protocol for communication between more than two MSP430 connected on I2C bus.
12. Use SPI protocol for communication between two MSP430.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the properties of microprocessor, memory, peripheral components and buses in an embedded system.	1 Remembering 2. Understanding
CLO2	Design of an embedded system using an ARM processor.	2 Understanding 4 Analyze
CLO3	Understand concepts of architecture and code for embedded systems.	3 Applying
CLO4	Understand the basic properties of a real-time operating system	3 Applying
CLO5	role of the compiler in the embedded system design process	2. Understanding 3 Applying

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PS O1	PS O2	PS O3	PS O4
CLO1	H	M	H	L	L	M			L				H	L		
CLO2		L	M	H	L	L					L	L	M	L		
CLO3	M	H	M	L	M	H		M		L			M	L		
CLO4	M	M	L	L	M	H		M	L				M	L		
CLO5	M	L	L	L	M	H		M		L			H	L		

H: High, M: Medium, L: Low