SCHEME FOR EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
FOURTH YEAR, INFORMATION TECHNOLOGY
SEMESTER VIII
EFFECTIVE FROM SESSION 2025-26 (NEP)

SL. NO.	SUBJECT CODE	SUBJECTS	PERIODS/ WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
PRACTICAL									
1	ITUHPV1	MAJOR PROJECT	0	0	16	200	200	400	8
TOTAL CREDITS									**8**
IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL									

SCHEME FOR EXAMINATION
B.TECH. (FOUR YEAR) DEGREE COURSE
FOURTH YEAR, INFORMATION TECHNOLOGY
SEMESTER VII
EFFECTIVE FROM SESSION 2025-26 (NEP)

NO.	SUBJECT CODE	SUBJECTS	PERIODS/ WEEK			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1	ITUGTT1	CYBER SECURITY	4	0	0	40	60	100	4
2	ITUGTT2	DEEP LEARNING	3	0	0	40	60	100	3
3	ITUGTKX	DEPARTMENT ELECTIVE - VII	3	0	0	40	60	100	3
4	ITUGTKX	DEPARTMENT ELECTIVE - VIII	3	0	0	40	60	100	3
5	ITUGTO1	MOOC COURSE - II	3	0	0	-	-	100	3
PRACTICAL									
1	ITUGLT1	CYBER SECURITY LAB	0	0	3	25	25	50	1.5
2	ITUGLT2	DEEP LEARNING LAB	0	0	3	25	25	50	1.5
3	ITUGPV1	MINOR PROJECT	0	0	8	50	50	100	4
TOTAL CREDITS									**23**
IA- INTERNAL ASSESSMENT, ESE-END SEMESTER EXAMINATION, L-LECTURE, T-TUTORIAL, P-PRACTICAL									

THEORY	
ITUGTT1	CYBER SECURITY
ITUGTT2	DEEP LEARNING
ITUGTKX	DEPARTMENT ELECTIVE - VII
ITUGTKX	DEPARTMENT ELECTIVE - VIII
ITUGTO1	MOOC COURSE – II
PRACTICAL	
ITUGLT1	CYBER SECURITY LAB
ITUGLT2	DEEP LEARNING LAB
ITUGPV1	MINOR PROJECT

DEPARTMENT ELECTIVE - VII

1	ITUGTK1	EDGE COMPUTING & INTELLIGENCE
2	ITUGTK2	GAME THEORY
3	ITUGTK3	GREEN COMPUTING

DEPARTMENT ELECTIVE - VIII

1.	ITUGTK4	ARTIFICIAL INTELLIGENCE OF THINGS
2.	ITUGTK5	REAL TIME SYSTEM
3.	ITUGTK6	COMPUTER VISION

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGTT1	**4**	**0**	**0**	**4 HOURS**	**40**	**60**	**4**

CYBER SECURITY

Course Objectives:

1. Identify the technical foundations of Cyber security.
2. Apply principles of cryptography for design of block ciphers.
3. Analyze the principles of public – Key Cryptosystemsand applications.
4. Explore the importance of Cyber Security and Secure financial transactions.
5. Explore the concepts of Firewall, and intrusion detection.

UNIT I

A Model for Network Security Services, Mechanisms, and Attacks, Viruses & Worms, The OSI Security Architecture, symmetric cipher model, substitution techniques Transposition techniques, Steganography.

UNIT II

Block ciphers and the data encryption standard , simplified DES , Block cipher principles , The data Encryption Standard , Differential and Linear Cryptanalysis, Block Cipher Design principles , The AES cipher , Triple DES , blowfish , RC5, Rc4 Stream Cipher

UNIT III

principles of public –Key Cryptosystems , public –Key cryptosystems , Requirements for public –Key Cryptosystems, The RSA Algorithm , Key management , key Distribution ,Hash Functions SHA, MD5. Diffie-Hellman Key Exchange Algorithm

UNIT IV

WEB & IP Security: Web Security Threats, SSL Architecture, SSL Record Protocol, Alert Protocol, Handshake Protocol, Transport Layer Security, Secure Electronic Transaction, IP Security

UNIT V

Intruders: Intrusion Techniques, Firewall Design principles, Block Chain Technology, BitCoin, Types of Firewalls.

List of Books:

1. Cryptography and Network Security, Principles and Practice Third edition , William Stallings .
2. Atul Kahate, " Cryptography and Network Security," TMH
3. Introduction to network security, Krawetz, Cengage

Course Outcomes :

1. Understand the fundamental network security mechanism and threats.
2. Understand the concept of Block cipher and cryptanalyis .
3. Learn the Concept of Public key cryptography systems.
4. Understand the concept of Web security and secure electronic transaction.
5. Understand the Firewall design principles and Block-chain technology .

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGTT2	3	0	0	3 HOURS	40	60	3

DEEP LEARNING

Course Objectives:

1. To introduce the foundations of Artificial Neural Networks
2. To acquire the knowledge on Deep Learning Concepts
3. To learn various types of Artificial Neural Networks
4. To gain knowledge to apply optimization strategies
5. To acquire knowledge about different Applications of Deep Learning

UNIT - I

Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms, Historical Notes

UNIT - II

Regularization for Deep Learning:

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi- Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier.

UNIT - III

Optimization for Training Deep Models, How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta- Algorithms

UNIT - IV

Convolutional Networks:

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuro-scientific Basis for Convolutional Networks, Convolutional Networks and the History of DeepLearning

UNIT - V

Applications:

Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications

Text Book:

1. Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning series), MIT Press.

Reference Books:

1. Li Deng and Dong Yu, Deep Learning Methods and Applications, Foundations andTrends® in Signal Processing Volume 7 Issues 3-4, ISSN:1932-8346.
2. Dr. N.D. Lewis, Deep Learning Made Easy with R A Gentle Introduction for Data Science. Create Space Independent Publishing Platform (January 10,2016).
3. François Chollet, JJ Allaire, MEAP Edition Manning Early Access Program Deep Learning with R Version 1, Copyright 2017 ManningPublications.

Course Outcomes:

1. Ability to understand the concepts of Neural Networks
2. Ability to select the Learning Networks in modeling real world systems
3. Ability to use an efficient algorithm for Deep Models
4. Ability to apply optimization strategies for large scale applications
5. Ability to apply and frame deep learning applications

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGTK1	3	0	0	3 HOURS	40	60	3

EDGE COMPUTING & INTELLIGENCE

Course Objectives:

1. To introduce students to the fundamental principles, architecture, and applications of edge and fog computing.
2. To enable students to understand the enabling technologies for edge intelligence, including hardware, software frameworks, and AI/ML at the edge.
3. To explore security, privacy, and data management issues relevant to distributed edge systems.
4. To explore real-world case studies in implementing edge and fog computing applications.
5. To develop skills to design, analyze, and evaluate intelligent edge computing solutions for contemporary industry use cases.

UNIT I: Introduction

evolution of Edge, Fog, and Cloud computing, Comparative analysis, Edge computing architecture and components, Applications , Emerging trends and future directions

UNIT II: Enabling Technologies

IoT and its role in edge computing, Cloud-edge continuum and orchestration, Hardware platforms for edge intelligence (Raspberry Pi, NVIDIA Jetson, Intel Movidius), edge AI: TinyML, Federated learning. Software frameworks: TensorFlow Lite, EdgeX Foundry, AWS Greengrass, Flower AI.

UNIT III: Architectures and Protocols

Communication protocols (MQTT, CoAP, DDS), Edge networking (5G/6G, LPWAN, SDN, NFV), Microservices and containerization at the edge (Docker, Kubernetes), Data processing and analytics at the edge, Middleware and resource management. Computation Offloading. Edge Caching

UNIT IV: Edge Intelligence and Security

Federated learning: algorithms, architecture, frameworks. Privacy techniques: Differential privacy, secure aggregation, Transfer learning, Federated transfer learning, Edge training vs inference; Edge-cloud hybrid training, Communication constraints, energy-efficiency in learning, Security issues and challenges, Blockchain Integration, security services at the edge.

UNIT V: Real-World Applications and Emerging Trends

Case studies: Smart cities, healthcare, autonomous vehicles, industrial IoT, UAVs. Design methodology for intelligent edge applications, Tools and platforms for prototyping edge intelligence solutions, Emerging trends.

TEXT BOOKS / REFERENCE BOOKS

1. Y. Zhang, Mobile Edge Computin, Simula: Springer, 2021.
2. R. Buyya and S. N. Srirama, Fog and Edge Computing: Principles and Paradigms. Wiley, 2019.
3. D. Situnayake and Jenny Plunkett, AI at the Edge: Solving Real-World Problems with Embedded Machine Learning. O'Reilly Media, 2022.

Course Outcomes :

At the end of the course, students will be able to:

1. Describe the concepts, architectures, and benefits of edge computing systems and Intelligence.
2. Apply enabling technologies to design edge computing solutions.
3. Evaluate security and privacy challenges in edge computing and recommend mitigation techniques.
4. Analyze and critique real-world case studies and applications of edge intelligence.
5. Design and develop prototype solutions using edge computing frameworks and platforms.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGTK2	3	0	0	3 HOURS	40	60	3

GAME THEORY

Course objectives

1.To introduce Game theory in application and improving analytical and decision-making skills.
2.To learn about Game theory and different types of game
3.To learn the strategic way of thinking about behavior of repeated games.
4.To learn their strategies and decisions in an economy, business and life.
5.To learn bargaining Mechanism

Unit 1

Introduction to game theory, routing games and mechanism design, Strategies, cost and payoffs; prisoner's dilemma, nash equilibrium, Strategic games; Best response; dominant Strategies; pure Strategy v/s mixed Strategy.

Unit 2

Repeated games; Bayesian games Routing games; Selfish routing; Quantifying inefficiency of equilibria; Price of Anarchy

Unit 3

Social optimum; price of stability; Scheduling games.
Population games; Evolutionary game theory;

Unit 4

Evolutionary stable Strategy; Replicator dynamics. Non cooperative games , cooperative game theory

Unit 5

Nash bargaining Mechanism design,Algorithmic mechanism design, distributed algorithmic mechanism design

BOOK:

1.Game Theory,by D. Fudenberg and j.Tirole, MIT press 1991.
2.Algorithmic Game Theory, edited by N.nisan, T. Roughgarden, E. Tardos, and v.v. vazirani,Cambridge University press 2007**.**

Other References:

1.Auction Thoery, by v. Krishna, academic press,2002.
2.A course in Game theory, by M.J . Osborne,A.Rubinstein,MIT press,1994.
3.Dynamic Non cooperative Game Theory, byT Basar and G.J. Olsder,1999
4. Evolutionary Game Theory, Jorgen W.Weibull,The MIT presss 1997.

Course Outcomes

On successful completion of this course, students will be able to:
1. Identify strategic situations and represent them as games
2. Solve simple games using various techniques
3. Analyze economic situations using game theoretic techniques
4. Recommend and prescribe which strategies to implement
5. understand the concept of bargaining Mechanism

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGTK3	**3**	**0**	**0**	**3 HOURS**	**40**	**60**	**3**

GREEN COMPUTING

Course Objectives:

1. **To introduce the fundamentals of Green IT** and its impact on business, IT systems, and the environment.
2. **To explore strategies and models** for designing and implementing environmentally responsible computing practices.
3. **To understand the application of virtualization, green data centers, and grid frameworks** in reducing environmental impact.
4. **To examine the legal, cultural, and technical aspects** of green compliance, including protocols, standards, and audits.
5. **To analyze real-world case studies** and assess the practical application of Green IT strategies across various sectors.

UNIT I

FUNDAMENTALS: Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT II

GREEN ASSETS AND MODELING: Green Assets: Buildings, Data Centres, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models

UNIT III

GRID FRAMEWORK: Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data centre – Green Grid framework.

UNIT IV

GREEN COMPLIANCE: Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future

UNIT V

CASE STUDIES: The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector

List of Books:

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014

2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies, August 2012.

REFERENCES

1. Alin Gales, Michael Schaefer, Mike Ebbers, ―GreenData Centre: steps for the Journey, Shroff/IBM rebook, 2011.
2. John Lamb, ―The Greening of IT, Pearson Education, 2009
3. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008
4. Carl speshocky, ―Empowering Green Initiatives with IT, John Wiley & Sons, 2010
5. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency, CRC Press

Course Outcomes :

1. Understand and explain the relationship between IT, business, and environmental sustainability.
2. **Design and model green assets and processes** such as data centers, networks, and supply chains for environmental efficiency.
3. **Implement virtualization and green computing techniques** for optimizing IT infrastructure and reducing carbon footprint.
4. **Apply green compliance standards and assess carbon management technologies** in organizational settings.
5. **Evaluate and apply Green IT strategies in practical scenarios**, including homes, hospitals, industries, and telecom sectors through case studies.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	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
CO 1	3	3	3	3	3								3	3	3
CO 2	3	3	3	3	3								3	3	3
CO 3	3	3	3	3	3								3	3	3
CO 4	3	3	3	3	3								3	3	3
CO 5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION/ WEEK	IA	ESE	CREDITS
ITUGTK4	3	0	0	3 hours	40	60	3

ARTIFICIAL INTELLIGENCE OF THINGS (AIoT)

COURSE OBJECTIVES:

- Introduce students to the fundamental concepts and architecture of AIoT systems.
- Enable understanding of how artificial intelligence techniques can be applied to real-time IoT data for intelligent decision-making.
- Familiarize students with edge AI deployment techniques and the integration of machine learning models in embedded IoT environments.
- Explore communication protocols, energy efficiency, and security challenges in AIoT systems.
- Encourage practical implementation through a project-based approach to solve real-world problems using AIoT.

UNIT I

Introduction to AIoT and IoT Fundamentals: AIoT definition, Evolution, and Scope, AIoT Architecture, Communication Protocols: MQTT, CoAP, HTTP, Bluetooth, ZigBee, Cloud and Edge Platforms for IoT (AWS, Azure, Google IoT Core)

UNIT II

Artificial Intelligence for IoT: Introduction to Machine Learning: Supervised, Unsupervised, Reinforcement Learning, AI Lifecycle: Data Collection, Training, Inference of IoT devices

UNIT III

Edge AI and System Integration: Energy-efficient AI for IoT devices, Integration of AI Models into IoT Hardware

UNIT IV

Networking, Communication, and Security in AIoT: IoT Networking Protocols: LPWAN, LoRa, NB-IoT, Real-time Constraints: Delay, Jitter, Congestion

UNIT V

AIoT Applications: Smart Cities: Traffic Control, Waste Management, Smart Health: Remote Monitoring, Diagnosis, Wearables, Industrial AIoT: Predictive Maintenance, Automation, Smart Agriculture and Environmental Monitoring

Reference Books:

1. Internet of Things by Rajkumar Buyya
2. Artificial Intelligence: A Modern Approach by Russell & Norvig
3. Deep Learning for IoT Applications by Amartya Mukherjee
4. Online Platforms: Edge Impulse, TensorFlow Lite, AWS IoT EduKit

COURSE OUTCOMES:

Students will try to learn:

- Explain the architecture and components of an AIoT system, including sensors, data

pipelines, and AI models.

- Apply machine learning and deep learning algorithms to analyze and interpret IoT sensor data.
- Design and deploy lightweight AI models on edge devices using platforms like TensorFlow Lite or Edge Impulse.
- Evaluate and address networking, security, and power-efficiency considerations in AIoT deployments.
- Develop and demonstrate a working AIoT application addressing a real-world industrial or societal need.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION/ WEEK	IA	ESE	CREDITS
ITUGTK5	3	0	0	3 hours	40	60	3

REAL TIME SYSTEM

COURSE OBJECTIVES:

- To apply the terminology, and list applications, of real time systems.
- Be able to explain the purpose and structure of a real time operating system.
- To illustration of key OS analysis and optimization
- To understand purpose, structure and functions of operating systems
- General understanding of structure of modern computers.

Unit-I

Basic Real- Time Concepts, Computer Hardware, Language Issues: Basic component Architecture, terminology, Real Time Design Issues, CPU, Memories, Input- Output, Other Devices Language Features, Survey of Commonly Used Programming Languages, Code Generation

Unit-II

Software life cycle, Real Time Specification and Design Techniques, Real Time Kernels: Phases of software life cycle, Non-temporal Transition in the software life cycle, Spiral model, Natural languages, Mathematical Specification, Flow Charts, Structure Charts, Pseudocode and programmable Design Languages, Finite state Automata, Data Flow Diagrams, Petrinets, Statecharts, Polled Loop Systems, phase/State Driven Code, Coroutines, Interrupt Driven System, Foreground/Background Systems Full Featured Real Time OS

Unit-III

Intertask Communication and Synchronization, Real Time memory Management, System Performance Analysis and Optimization: Buffering Data, Mail boxes Critical Region, Semaphores, Event Flags and Signals, Deadlock, Process Stack Management, Dynamic Allocation, Static Schemes, Response Time Calculation, Interuupt Latency, Time Loading and its Measurement, Scheduling NP Complete, Relocating Response Times And time Loading, Analysis of Memory Requirements, Reducing Memory Loading, I/O Performance.

Unit-IV

Queuing Models, Reliability, Testing, And Fault Tolerance, Multiprocessing Systems: Basic Buffer size Calculation, Classical Queuing Theory, Little's Law, Faults, Failures ,bugs AND effects. Reliability, Testing, Fault Tolerence, Classification of Architectures, Distributed Systems, Non Von Neumann Architectures.

Unit-V

Hardware/ Software Integration, Real Time Applications: Goals of Real Time System Integration, Tools, Methodology, The Software Hesisenberg Uncertainity Principle, Real Time Systems As Complex System, First Real Time Application Real Time Databases, Real time Image Processing Real Time UNIX, building Real Time Applications with Real Time Programming Languages.

Text Books :

1. Real Time System, Jane W.S.Liu 2. Real Time Systems Design and Analysis by Phillip A. Laplante,PHI

Reference Books:

1 Hard Real Time Computing Systems Predictable Scheduling Algorithms and applications by Giorgio C. Buttazzo
2 Real Time Design Patterns: Robust Scalable Architecture for Real Time System by BrucePowel Douglass.
3. Real Time System: Scheduling, Analysis and Verification by Albert M.K. Change.

COURSE OUTCOMES:

Students will try to learn:

- Describe the general architecture of computers and operating system.
- Understand and analyze theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files.
- Describe the foundation for programming languages developed for real time programming.
- Use real time system programming languages and real time operating systems for real time applications.
- Analyze real time systems with regard to keeping time and resource restrictions.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGTK6	3	0	0	3 HOURS	40	60	3

COMPUTER VISION

COURSE OBJECTIVES:

1. To learn and understand the fundamentals of Computer Vision techniques.
2. To provide basic understanding of applications of Computer Vision techniques.
3. To understand the image formation process.
4. To understand the basic techniques and issues in2-D and 3-D computer vision
5. To apply Computer Vision techniques to solve real world applications.

Unit-1

Recognition Methodology: Conditioning, Labeling, Grouping,Extracting, Matching. Morphological Image Processing: Introduction, Dilation, Erosion,Opening, Closing,Hit-or-Miss transformation, Morphologicalalgorithm operations on binary images, Morphological algorithm Operations on gray-scale images, Thinning, Thickining , Regiongrowing, region shrinking.

Unit-2

Image Representation and Description: Representation schemes,Boundary descriptors, Region descriptors Binary Machine Vision: Thresholding, Segmentation, Connectedcomponent labeling, Hierarchal segmentation, Spatial clustering,Split & merge, Rule-based Segmentation, Motion-based segmentation.

Unit-3

Area Extraction: Concepts, Data-structures, Edge, Line-Linking,Hough transform, Line fitting, Curve fitting (Least-square fitting). Region Analysis: Region properties, External points, Spatialmoments, Mixed spatial gray-level moments, Boundary analysis:Signature properties, Shape numbers.

Unit-4

Facet Model Recognition: Labeling lines, Understanding linedrawings,Classification of shapes by labeling of edges, Recognition ofshapes, Consisting labeling problem, Back-tracking AlgorithmPerspective Projective geometry, Inverse perspective Projection, Photogrammetry - from 2D to 3D, Image matching:Intensity matching of ID signals, Matching of 2D image,Hierarchical image matching.

Unit-5

Object Models And Matching: 2D representation, Global vs. Localfeatures General Frame Works For Matching: Distance relational approach,Orderedstructural matching, View class matching, Models database organization.

BOOKS

Text Books:

1.RobertHaralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison- Wesley, 1993.

2. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach"

References:

1. Milan Sonka,VaclavHlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" Thomson Learning

COURSE OUTCOMES:

Students will try to learn:

1. Design and implement algorithms to perform image processing and feature extraction.
2. Design and implement algorithms for image segmentation.
3. Design and implement algorithms for representation of shape.
4. Design and demonstrate the 2D and 3D objects using
5. Design and build a real computer vision-based system.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGLT1	0	0	3	3 HOURS	25	25	1.5

CYBER SECURITY LAB

Course Objectives:

This course is designed to enable the students to:

1. To understand the working principle of various communication protocols.
2. Understand basic network models and Different transmission media used for data communication.
3. Understand the data link design issues and various data link protocols used for data transmission.
4. Comprehend different routing algorithms used for data transmission from source to destination in a network layer.
5. Know how internet addresses are configured and how internet protocols are used in connecting internet.

S.No.	Experiments
1	**Write a program to** implement a substitution cipher (Caesar Cipher) and transposition cipher.
2	**Write a program to** perform encryption and decryption using the DES algorithm.
3	**Write a program to** implement AES encryption for secure data communication.
4	**Write a program to** implement RSA algorithm for secure key exchange and message encryption.
5	**Write a program to** implement Diffie-Hellman key exchange protocol.
6	**Write a program to** generate and verify digital signatures using hash functions (e.g., SHA-256)
7	**Write a program to** simulate SSL/TLS handshake using socket programming or available tools.
8	**Write a program to** simulate basic intrusion detection based on log file analysis.
9	**Write a program to** configure a firewall using open-source tools (e.g., UFW/iptables) and demonstrate basic rules.
10	**Write a program to** simulate a basic blockchain with chained blocks and proof of work.

TEXT BOOKS

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, 3rd Edition, Pearson.
2. Atul Kahate, *Cryptography and Network Security*, Tata McGraw Hill.
3. C. Krawetz, *Introduction to Network Security*, Cengage Learning.

REFERENCE BOOKS

1. Behrouz A. Forouzan, *Cryptography and Network Security*, McGraw-Hill.
2. Charles P. Pfleeger and Shari Lawrence Pfleeger, *Security in Computing*, Pearson.
3. Bruce Schneier, *Applied Cryptography*, Wiley.
4. Kaufman, Perlman & Speciner, *Network Security: Private Communication in a Public World*, Pearson.

Course Outcomes:

At the end of this course the student can answer how to:

1. Implement classical and modern cryptographic techniques using programming languages.
2. Demonstrate the working of secure communication protocols and hashing.
3. Use key management and public key infrastructure in real-world scenarios.
4. Apply security principles using firewall and intrusion detection tools.
5. Simulate blockchain architecture and analyze its security mechanisms.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SUB CODE	L	T	P	DURATION	IA	ESE	CREDITS
ITUGLT2	0	0	3	3 HOURS	25	25	1.5

DEEP LEARNING LAB

Course Objectives:

This course is designed to enable the students to:

1. To introduce students to the practical implementation of deep learning models using Python and popular frameworks like TensorFlow or PyTorch.
2. To help students understand the structure and training of neural networks including CNNs, RNNs, and transformers.
3. To develop the ability to apply deep learning models for image, text, and sequence data tasks.
4. To expose students to advanced topics such as transfer learning, generative models, and object detection.
5. To empower students to design their own deep learning-based applications for real-world problems.

S.No.	Experiments
1	Write a program to implement a single-layer perceptron for binary classification.
2	Write a program to build and train a multi-layer neural network for digit classification using the MNIST dataset.
3	Write a program to build a Convolutional Neural Network (CNN) for image classification using the CIFAR-10 dataset.
4	Write a program to apply transfer learning using a pre-trained model (e.g., VGG16 or ResNet) for classifying a custom image dataset.
5	Write a program to implement an RNN or LSTM for text generation or sentiment analysis.
6	Write a program to build and train an autoencoder for image reconstruction.
7	Write a program to implement a simple Generative Adversarial Network (GAN) to generate images from noise.
8	Write a program to detect objects in images using a pre-trained object detection model like YOLO or SSD.
9	Write a program to classify text using a transformer model (e.g., BERT from Hugging Face Transformers).
10	Write a program to design and implement a mini deep learning application (e.g., medical image analysis, chatbot, fake image detection, etc.).

REFERENCE BOOKS

1. Goodfellow, I., Bengio, Y., Courville, A. Deep learning (Vol. 1). Cambridge: MIT press.
2. Martin T hagan etc, Neural network design (2nd edition), 2014
3. Taqiq Rashid, Make your own Neural Network, 2016
4. Tom Mitchell, Machine Learning, McGraw-Hill, 1997

Course Outcomes:

At the end of this course the student can answer how to:

1. Understand and apply different deep learning architectures in practical scenarios.
2. Use popular libraries like TensorFlow and PyTorch for training and evaluating models.
3. Analyze the performance of deep learning models on different data types (images, text, sequences).

4. Implement advanced techniques like transfer learning, autoencoders, GANs, and transformers.
5. Design and develop a small-scale deep learning-based application to address a real-world problem.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	3	3								3	3	3
CO3	3	3	3	3	3								3	3	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	2								3	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly