IV Year - I Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	PC	UGCS7T0323	Blockchain Technology	3	0	0	3	30	70	100
2	MC	UGMB7T0223	Human Resource Management	2	0	0	2	30	70	100
3	PE	UGCS7T0223 UGCS7T2023 UGCS7T2123 UGCS7T2223	**Professional Elective-IV** 1. Software Architecture & Design Patterns 2. Network Management Systems and Operations 3. Deep Learning 4. Malware Analysis & Reverse Engineering 5. MOOCs (12 week Swayam/NPTEL course recommended by the BoS)	3	0	0	3	30	70	100
4	PE	UGCS7T0423 UGCS7T2323 UGCS7T2423 UGCS7T2523	**Professional Elective-V** 1. Augmented Reality & Virtual Reality 2. Intrusion Detection and Prevention System 3. Metaverse 4. Cyber Laws and Security Policies 5. MOOCs (12 week Swayam/NPTEL course recommended by the BoS)	3	0	0	3	30	70	100
5	OE		Open Elective – III	3	0	0	3	30	70	100
6	OE		Open Elective – IV	3	0	0	3	30	70	100
7	SEC	UGCS7K2623	Ethical Hacking	0	1	2	2	30	70	100
8	AC	UGCS7A1323	Constitution of India	2	0	0	0	30	-	30
9	Internship	UGCS7I2723	Evaluation of Industry Internship	-	-	-	2	-	50	50
			Total	**19**	**1**	**2**	**21**	**240**	**540**	**780**
Honors/Minor Course (3 or 4.5 Credits)										

IV Year - II Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	Internship & Project	UGCS8J0123	Full Semester Internship & Project Work	0	0	24	12	60	140	200
			Total	**0**	**0**	**24**	**12**	**60**	**140**	**200**

L – Lectures, T – Tutorials, P – Practicals, C – Credits, IM – Internal Marks, EM – External Marks, TM – Total Marks
BS&H - Basic Science & Humanities, ES - Engineering Science, PC - Professional Core, PE - Professional Elective
SEC - Skill Enhancement Course, MC - Management Course, AC - Audit Course, OE - Open Elective

IV Year
I Semester

BLOCKCHAIN TECHNOLOGY
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives: The objectives of the course are to make student

- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- Able to know the security issues of blockchain technology.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain the fundamental concepts of blockchain, cryptocurrencies, and distributed ledger technologies.

CO2: Apply public and private blockchain mechanisms to implement decentralized applications.

CO3: Analyze consensus algorithms and smart contract functionalities in blockchain platforms.

CO4: Evaluate security, privacy, and scalability challenges in blockchain systems.

CO5: Design blockchain-based solutions for real-world applications across different domains.

Syllabus:

UNIT I: (10 Hours)

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future. Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT II: (10 Hours)

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT III: (10 Hours)

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, Ecommerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain. Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT IV: (10 Hours)

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain

UNIT V: (10 Hours)

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities. Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain. Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO3	3	3	3	3	3	–	–	–	–	–	–	3	3	3
CO4	3	3	–	3	–	–	–	3	–	–	–	3	3	3
CO5	3	3	3	3	3	–	–	–	–	–	–	3	3	3

Text Books:

1. "Blockchain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A, Meena Karthikeyan , Universities Press.

Reference Books :

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

HUMAN RESOURCE MANAGEMENT

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

Students must be aware of the basic principles of Human Resource Management because success in today's complex business environment depends on effective management of its human resources. This introductory course on Human Resource Management will familiarize the students with the basic concepts, roles, functional areas and activities of HR and help students understand organization's employees, their interest, motivation and satisfaction, and their belief of fair treatment- all of which actually impact the firm's current performance and sustainability in the long run.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain the concepts, functions, and significance of Human Resource Management in organizations.

CO2: Apply HR system design principles, HR accounting, auditing, and HR information systems in organizational environments.

CO3: Analyze recruitment, staffing, compensation, employee relations, and training functions in Human Resource Management.

CO4: Evaluate human resource planning, succession planning, and strategic HRM practices for organizational effectiveness.

CO5: Assess HR challenges, customer–employee interactions, and HR practices in service sector organizations.

Syllabus:

UNIT I: (10 Hours)

Human Resource Management: Concept and Challenges, HR Philosophy, Policies, Procedures and Practices.

UNIT II: (10 Hours)

Human Resource System Design: HR Profession, and HR Department, Line Management Responsibility in HRM, Measuring HR, Human resources accounting and audit; Human resource information system

UNIT III: **(10 Hours)**

Functional Areas of HRM: recruitment and staffing, benefits, compensation, employee relations, HR compliance, organizational design, training and development, human resource information systems (H.R.I.S.) and payroll.

UNIT IV: **(10 Hours)**

Human Resource Planning: Demand Forecasting, Action Plans– Retention, Training, Redeployment & Staffing, Succession Planning, Strategic Management of Human Resources: SHRM, relationship between HR strategy and overall corporate strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace

UNIT V: **(10 Hours)**

Human Resource Management in Service Sector- Special considerations for Service Sector including

- Managing the Customer – Employee Interaction
- Employee Empowerment and Customer Satisfaction
- Service Failure and Customer Recovery – the Role of Communication and Training
- Similarities and Differences in Nature of Work for the Frontline Workers and the Backend
- Support Services - Impact on HR Practices Stressing Mainly on Performance
- Flexible Working Practices – Implications for HR

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	3	–	3	3	3	–	3	–	–
CO2	3	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	–	3	3	3	3	3	–	–

Text Books:

1. Gary Dessler, Human Resource Management

SOFTWARE ARCHITECTURE & DESIGN PATTERNS
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

- Understand the basic concepts to identify state behaviour of real world objects
- Apply Object Oriented Analysis and Design concepts to solve complex problems
- Construct various UML models using the appropriate notation for specific problem context
- Design models to Show the importance of systems analysis and design in solving complex problems using case studies
- Study of Pattern Oriented approach for real world problems

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain object-oriented design principles, software architecture concepts, and design pattern fundamentals.

CO2: Apply UML modeling techniques for software analysis and design.

CO3: Analyze structural and behavioral design patterns for solving real-world software problems.

CO4: Design scalable and maintainable software architectures using suitable design patterns and architectural models.

CO5: Evaluate software systems based on architectural quality attributes, distributed architectures, and design efficiency.

Syllabus:

UNIT I: (10 Hours)

Introduction: design pattern, describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern What is object-oriented development? key concepts of object-oriented design other related concepts, benefits and drawbacks of the paradigm

UNIT II: (10 Hours)

Analysis a System: Overview of the analysis phase, stage 1 gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation,

discussions and further reading

UNIT III: (10 Hours)

Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy

UNIT IV: (10 Hours)

Interactive systems and the MVC architecture: Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions

UNIT V: (10 Hours)

Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	3	–	–	–	–	–	–	–	–	3	3	3
CO2	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	3	–	–	–	–	–	–	3	3	3

Text Books:

1. Object Oriented Analysis, Design and Implementation, Brahma Dathan, Sarnath Rammath , Universities Press, 2013
2. Design Patterns, Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, PEARSON Publication, 2013

Reference Books :

1. Frank Bachmann, Regine Meunier, Hans Rohnert "Pattern Oriented Software Architecture", Volume 1, 1996.
2. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998

NETWORK MANAGEMENT SYSTEMS AND OPERATIONS
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

To understand the principles of network management, different standards and protocols used in managing complex networks. To understand the Automation of network management operations and making use of readily available network management systems.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain network management concepts, standards, architectures, and management functions in communication networks.

CO2: Apply SNMP-based network management techniques and management information models for monitoring network resources.

CO3: Analyze RMON and Telecommunication Management Network (TMN) architectures for effective network management.

CO4: Evaluate network management tools, enterprise management solutions, and commercial network management systems.

CO5: Analyze web-based network management frameworks and interpret network management data for decision-making.

Syllabus:

UNIT I: (10 Hours)

DATA COMMUNICATION AND NETWORK MANAGEMENT OVERVIEW: Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

UNIT II: (10 Hours)

SNMPV1 NETWORK MANAGEMENT MANAGED NETWORK: Organization and Information Models MANAGED NETWORK: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model. SNMPV1 NETWORK MANAGEMENT: Communication and Functional Models The SNMP Communication Model, Functional model. SNMP MANAGEMENT: SNMPv2 Major Changes in SNMPv2, SNMPv2 System architecture,

SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

UNIT III: (10 Hours)

SNMP MANAGEMENT: RMON: What is Remote Monitoring? RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON TELECOMMUNICATIONS MANAGEMENT NETWORK: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation Issues.

UNIT IV: (10 Hours)

NETWORK MANAGEMENT TOOLS AND SYSTEMS: Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management, Enterprise Management Solutions.

UNIT V: (10 Hours)

WEB-BASED MANAGEMENT: NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, **WBEM:** Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network , Future Directions. Case Studies:

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO3	3	3	–	3	–	–	–	–	–	–	–	3	3	3
CO4	3	3	–	3	3	–	–	–	–	–	–	3	3	3
CO5	3	3	–	3	3	–	–	–	–	–	–	3	3	3

TEXT BOOKS:

1. Mani Subrahmanian, "Network Management Principles and Practice", 2nd Edition, Pearson Education, 2010.

Reference Books:

1. Morris, "Network management", 1st Edition, Pearson Education, 2008.
2. Mark Burges, "Principles of Network System Administration", 1st Edition, Wiley DreamTech, 2008.

Web References:

1. http://nptel.iitm.ac.in/courses/IIT-MADRAS/ Computer Network

DEEP LEARNING

(Professional Elective-IV)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short-term memory cells and convolution neural networks.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain the fundamentals of artificial neurons, perceptrons, and feedforward neural networks.

CO2: Analyze deep neural network architectures, training mechanisms, and representation learning techniques.

CO3: Apply optimization and regularization techniques for improving deep learning model performance.

CO4: Analyze recurrent neural networks, convolutional neural networks, and generative deep learning models.

CO5: Evaluate recent deep learning architectures and their applications in vision, natural language processing, and speech processing.

Syllabus:

UNIT I: (10 Hours)

Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

UNIT II: (10 Hours)

Feedforward Networks- Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders. Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

UNIT III: (10 Hours)

Better Training of Neural Networks- Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT IV: **(10 Hours)**

Recurrent Neural Networks- Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs. Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

UNIT V: **(10 Hours)**

Recent trends- Variational Auto encoders, Transformers, GPT Applications: Vision, NLP, Speech

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO3	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO4	3	3	–	3	3	–	–	–	–	–	–	3	3	3
CO5	3	3	–	3	3	–	–	–	–	–	–	3	3	3

TEXT BOOKS:

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

Reference Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas,1996
2. Pattern Recognition and Machine Learning, Christopher Bishop,2007
3. Deep Learning with Python, François Chollet, Manning Publications,2017

MALWARE ANALYSIS & REVERSE ENGINEERING
(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives: The objectives of the course are to

- To learn fundamentals of malware analysis which includes analysis of JIT compilers for malware detection in legitimate code.
- To explore the techniques for detecting, analyzing, reverse engineering and eradicating malware.
- Employ network and system-monitoring tools to examine how malware interacts with the file system, registry, network, and other processes in a Windows environment.
- Assess the threat associated with malicious documents.
- Build an isolated, controlled laboratory environment for analyzing the code and behaviour of malicious program.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain malware analysis methodologies, malware classifications, and reverse engineering fundamentals.

CO2: Apply malware analysis tools and forensic techniques to investigate malicious software and system artifacts.

CO3: Analyze malware behavior through debugging, code analysis, and reverse engineering techniques.

CO4: Utilize Python scripting and memory forensic tools for malware investigation and analysis.

CO5: Evaluate malware threats, network indicators, and analysis environments for effective malware detection and response.

Syllabus:

UNIT I: (10 Hours)

Fundamentals of Malware Analysis (MA), Reverse Engineering Malware (REM) Methodology, Brief Overview of Malware analysis lab setup and configuration, Introduction to key MA tools and techniques, Behavioural Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining Clam AV Signatures, Creating Custom Clam AV Databases.

UNIT II: **(10 Hours)**

Malware Forensics Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries, Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plu-gins, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.

UNIT III: **(10 Hours)**

Malware and Kernel Debugging Opening and Attaching to Processes, Configuration of JITDebugger for Shellcode Analysis, Controlling Program Execution, Setting and Catching Breakpoints, Debugging with Python Scripts and Py Commands, DLL Export Enumeration, Execution, and Debugging, Debugging a VMware Workstation Guest (on Windows), Debugging a Parallels Guest (on Mac OS X).

UNIT IV: **(10 Hours)**

Memory Forensics and Volatility Memory Dumping with MoonSols Windows Memory Toolkit, Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA.

UNIT V: **(10 Hours)**

Researching and Mapping Source Domains/IPs Using WHOIS to Research Domains, DNS Hostname Resolution, Querying Passive DNS, Checking DNS Records, Reverse IP Search New Course Form, Creating Static Maps, Creating Interactive Maps.

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO3	3	3	–	3	3	–	–	–	–	–	–	3	3	3
CO4	3	3	3	3	3	–	–	–	–	–	–	3	3	3
CO5	3	3	3	3	3	–	–	–	–	–	–	3	3	3

TEXT BOOKS:

1. Sikorski, M., &Honig, A. (2012). Practical malware analysis: the hands-on guide to dissecting malicious software. No starch press.
2. Eilam, E. (2005). Reversing, Secrets of Reverse Engineering Wiley Publishing.

3. Malin, C. H. (2013). Linux Malware Incident Response: A Practitioner's Guide to Forensic Collection and Examination of Volatile Data: An Excerpt from Malware Forensic Field Guide for Linux Systems. Elsevier.

REFERENCE BOOKS:

1. Shashidhar, N., & Cooper, P. (2016, April). Teaching malware analysis: The design philosophy of a model curriculum. In 2016 4th International Symposium on Digital Forensic and Security (ISDFS) (pp. 119-125). IEEE.

2. Singh, A. (Ed.). (2009). Identifying malicious code through reverse engineering (Vol. 44). Springer Science & Business Media.

AUGMENTED REALITY & VIRTUAL REALITY

(PROFESSIONAL ELECTIVE-IV)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives: The objectives of the course are to

- Provide a foundation to the fast-growing field of AR and make the students aware of the various Augmented Reality concepts.
- Give historical and modern overviews and perspectives on virtual reality.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain the fundamentals, concepts, components, and applications of Augmented Reality and Virtual Reality systems.

CO2: Analyze hardware devices, sensors, tracking mechanisms, and interaction techniques used in AR/VR environments.

CO3: Apply AR/VR development frameworks and tools for creating immersive virtual environments.

CO4: Design interactive AR/VR applications using appropriate rendering, visualization, and user interaction techniques.

CO5: Evaluate AR/VR systems and their applications in education, healthcare, entertainment, industry, and smart environments.

Syllabus:

UNIT I: (10 Hours)

Introduction to Augmented Reality: Augmented Reality, Defining augmented reality, history of augmented reality, Examples, Related fields Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

UNIT II: (10 Hours)

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking. Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

UNIT III: **(10 Hours)**

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations Light and Optics: Basic Behaviour of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

UNIT IV: **(10 Hours)**

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, Perception of Colour Visual Rendering: Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT V: **(10 Hours)**

Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Interaction: Motor Programs and Remapping, Locomotion, Social Interaction Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	–	3	3	–	–	–	–	–	–	3	3	3
CO3	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO4	3	3	3	3	3	–	–	–	–	–	–	3	3	3
CO5	3	3	–	3	3	–	–	–	–	–	–	3	3	3

TEXT BOOKS:

1. "Augmented Reality: Principles & Practice" by Schmalstieg, Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

REFERENCE BOOKS:

1. "AR Game Development", Allan Fowler, 1st Edition, Apress Publications, 2018, ISBN 978-1484236178
2. "Understanding Virtual Reality: Interface, Application and Design", William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer

Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. "Developing Virtual Reality Applications: Foundations of Effective Design", Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
4. "Designing for Mixed Reality", Kharis O'Connell, O'Reilly Media, Inc., 2016, ISBN:9781491962381
5. "Theory and applications of marker-based augmented reality", Sanni Siltanen, Julkaisija, Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. "Designing Virtual Systems: The Structured Approach", Gerard Jounghyun Kim,2005

INTRUSION DETECTION AND PREVENTION SYSTEM

(Professional Elective-V)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Pre requisites: Fundamental knowledge in Operating Systems, and Networks

Course Objectives:

1. Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
2. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
3. Analyze intrusion detection alerts and logs to distinguish attack types from false alarms

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain intrusion detection concepts, cyber threats, attack methodologies, and IDS architectures.

CO2: Apply intrusion prevention techniques and intrusion analysis methods to identify security incidents.

CO3: Utilize Snort IDS for network traffic monitoring, attack detection, and event analysis.

CO4: Analyze and configure Snort rules, plugins, preprocessors, and alert mechanisms for effective intrusion detection.

CO5: Evaluate IDS/IPS architectures and design suitable intrusion prevention strategies for securing network environments.

Syllabus:

UNIT I: (10 Hours)

History of Intrusion detection, Audit, Concept and definition , Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

UNIT II: (10 Hours)

Intrusion Prevention Systems, Network IDs protocol-based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis, techniques Responses requirement of responses, types of responses mapping responses to policy Vulnerability analysis, credential analysis non credential analysis

UNIT III: **(10 Hours)**

Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes.

UNIT IV: **(10 Hours)**

Working with Snort Rules, Rule Headers, Rule Options, The Snort Configuration File etc. Plugins, Preprocessors and Output Modules, Using Snort with MySQL.

UNIT V: **(10Hours)**

Using ACID and Snort Snarf with Snort, Agent development for intrusion detection, Architecture models of IDs and IPs.

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO3	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO4	3	3	–	3	3	–	–	–	–	–	–	3	3	3
CO5	3	3	3	3	3	–	–	3	–	–	–	3	3	3

TEXT BOOKS:

1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.

REFERENCE BOOKS:

1. Christopher Kruegel,FredrikValeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
2. Carl Endorf, Eugene Schultz and Jim Mellander" Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
3. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
4. T. Fahringer, R. Prodan, "A Text book on Grid Application Development and Computing Environment". 6th Edition, KhannaPublihsers, 2012.

METAVERSE
(Professional Elective-V)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

- To understand the fundamental concepts of the Metaverse, including its architecture, technologies, and applications.
- To explore Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) as core components of the Metaverse.
- To study blockchain, NFTs, and decentralized finance (DeFi) as economic foundations of the Metaverse.
- To analyze Metaverse-based social interactions, business models, and ethical considerations.
- To gain hands-on experience with tools and platforms used to develop Metaverse applications.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain the concepts, evolution, architecture, and enabling technologies of the Metaverse.

CO2: Analyze virtual worlds, digital identities, avatars, and immersive user experiences in Metaverse environments.

CO3: Apply blockchain, NFTs, cryptocurrencies, and decentralized technologies within Metaverse ecosystems.

CO4: Evaluate security, privacy, governance, and ethical challenges associated with Metaverse platforms.

CO5: Design and assess Metaverse-based applications for education, healthcare, commerce, entertainment, and smart cities.

Syllabus:

UNIT I: (10 Hours)

Introduction to Metaverse Definition and Evolution of the Metaverse, Key Components: VR, AR, MR, AI, and Blockchain, Applications of Metaverse: Gaming, Education, Healthcare, and Business. Challenges and Ethical Issues in the Metaverse

UNIT II: (10 Hours)

Virtual Reality (VR) and Augmented Reality (AR) Fundamentals of VR and AR Technologies, Hardware and Software Requirements Interaction Techniques and User

Experience, Metaverse Platforms: Oculus, Microsoft Mesh, Horizon Worlds, Hands-on: Creating a Simple VR/AR Environment

UNIT III: (10 Hours)

Blockchain and Decentralization in the Metaverse Introduction to Blockchain Technology, Cryptocurrencies, NFTs, and Smart Contracts, Decentralized Applications (DApps) and Web3, Security and Privacy Considerations Hands-on: Deploying an NFT on a Test Blockchain

UNIT IV: (10 Hours)

Metaverse Economy and Social Structures Digital Goods, Virtual Real Estate, and Digital Identity, Economic Models: Play to-Earn, DeFi, and Tokenomics, Social and Ethical Aspects: Digital Citizenship and Governance, Future Trends in Metaverse Economy

UNIT V: (10 Hours)

Tools and Development in the Metaverse Metaverse Development Platforms: Unity, Unreal Engine, and WebXR, AI and Cloud Computing in the Metaverse, 3D Asset Creation and Interoperability Standards, Hands-on: Building a Basic Metaverse Application

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	–	–	–	–	3	3	3
CO2	3	3	–	3	3	–	–	–	–	–	–	3	3	3
CO3	3	3	3	–	3	–	–	–	–	–	–	3	3	3
CO4	3	3	–	–	–	3	–	3	–	–	3	3	3	3
CO5	3	3	3	3	3	–	–	–	–	–	–	3	3	3

TEXT BOOKS:

1. Tony Parisi, Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, O'Reilly Media.
2. Matthew Ball, The Metaverse: And How It Will Revolutionize Everything, Liveright Publishing.

REFERENCE BOOKS:

1. Mark Van Rijmenam, Step into the Metaverse: How the Immersive Internet Will Unlock a Trillion-Dollar Social Economy, Wiley.
2. Josh O'Kane, The Metaverse Economy: How Web3, Blockchain, and AI Are Shaping the Future of Business.

CYBER LAWS AND SECURITY POLICIES

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

This course provides to know the cyber laws and different security policies and to know the different ethical responsibilities In the present world and student can able know how the cyber employ will be in the organization and to know the different organization and human adoption rights

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain computer security concepts, information security standards, legal requirements, and security governance frameworks.

CO2: Apply security planning, system administration, and security policy implementation techniques in organizational environments.

CO3: Analyze information security policies, procedures, standards, and compliance requirements for information protection.

CO4: Evaluate organizational information security practices, employee responsibilities, and risk management strategies.

CO5: Assess security governance frameworks, human factors, and organizational security culture for effective information assurance.

Syllabus:

UNIT I: (10 Hours)

Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity

UNIT II: (10 Hours)

Secure System Planning and administration, Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Redbook and Government network evaluations.

UNIT III: (10 Hours)

Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies -process management-planning and preparation-developing policies-asset classification policy-developing standards.

UNIT IV: **(10 Hours)**

Information security: fundamentals-Employee responsibilities- information classification- Information handling- Tools of information security- Information processing-secure program administration.

UNIT V: **(10 Hours)**

Organizational and Human Security: Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	3	–	3	–	–	–	3	3	3
CO2	3	3	3	–	–	3	–	3	–	–	–	3	3	3
CO3	3	3	–	–	–	3	–	3	–	–	–	3	3	3
CO4	3	3	–	–	–	3	–	3	–	–	3	3	3	3
CO5	3	3	–	–	–	3	–	3	–	–	3	3	3	3

TEXT BOOKS:

1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition, O' Reilly Media, 2006.
2. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", 2nd Edition Prentice Hall, 2004.
3. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.

REFERENCE BOOKS:

1. Thomas R Peltier, Justin Peltier and John blackley, "Information Security Fundamentals", 2ndEdition, Prentice Hall, 1996

2. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springer-verlag, 1997 3. James Graham, " Cyber Security Essentials" Averbach Publication T & F Group.

ETHICAL HACKING
(SKILL ENHANCEMENT COURSE)

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**0**	**1**	**2**	**2**

Course Objectives:

The main objective of this course is to render every database-based transaction safe, secure and simple. We aim to transform the internet security industry by infusing professionalism and a never before seen efficiency.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain ethical hacking concepts, penetration testing methodologies, cyber threats, and security assessment processes.

CO2: Apply reconnaissance, scanning, enumeration, and vulnerability assessment techniques to identify security weaknesses.

CO3: Analyze system, network, and web application vulnerabilities using ethical hacking tools and methodologies.

CO4: Perform controlled penetration testing and evaluate security risks using industry-standard frameworks and tools.

CO5: Recommend security controls, mitigation strategies, and ethical practices for strengthening organizational cybersecurity.

Syllabus:

UNIT I: (10 Hours)

Hacking Windows: BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies URL History, The Registry, Baby Sitter Programs.

UNIT II: (10 Hours)

Advanced Windows Hacking: Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.

UNIT III: (10 Hours)

Getting Past the Password: Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords,

UNIT IV: (10 Hours)

The Perl Manual: Perl: The Basics, Scalars, Interacting with User by getting Input, Chomp() and Chop(), Operators, Binary Arithmetic Operators, The Exponentiation Operator(**), The Unary Arithmetic Operators, Other General Operators, Conditional Statements, Assignment Operators. The?: Operator, Loops, The While Loop, The For Loop, Arrays, THE FOR EACH LOOP: Moving through an Array, Functions Associated with Arrays, Push() and Pop(), Unshift() and Shift(), Splice(), Default Variables, $_, @ARGV, Input Output, Opening Files for Reading, Another Special VariableS.

UNIT V: (10 Hours)

How does a Virus Work? What is a Virus?, Boot Sector Viruses (MBR or Master Boot Record), File or Program Viruses, Multipartite Viruses, Stealth Viruses, Polymorphic Viruses, Macro Viruses, Blocking Direct Disk Access, Recognizing Master Boot Record (MBR) Modifications, Identifying Unknown Device Drivers, How do I make my own Virus?, Macro Viruses, Using Assembly to Create your own Virus, How to Modify a Virus so Scan won"t Catch it, How to Create New Virus Strains, Simple Encryption Methods.

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	–	–	–	–	–	3	–	–	–	3	3	3
CO2	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	3
CO5	3	3	–	3	–	–	–	3	–	–	–	3	3	3

TEXT BOOKS:

1. Patrick Engbreston: "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy",1st Edition, Syngress publication,2011.

CONSTITUTION OF INDIA

Subject Code: UGCS7T0123	**L**	**T**	**P**	**C**
IV Year / I Semester	**2**	**0**	**0**	**0**

Course Objectives: The objectives of the course are to

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1: Explain the historical evolution, philosophy, and fundamental principles of the Constitution of India.

CO2: Describe Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy enshrined in the Constitution.

CO3: Analyze the structure, powers, and functions of the Legislature, Executive, and Judiciary in India.

CO4: Examine local self-government institutions and democratic decentralization mechanisms in India.

CO5: Evaluate the role of constitutional bodies, governance institutions, and constitutional values in promoting social justice and national development.

Syllabus:

UNIT I: (10 Hours)

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution- Preamble, Salient, Features

UNIT II: (10 Hours)

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III: (10 Hours)

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive- President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV: (10 Hours)

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT V: (10 Hours)

Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Mapping of COs to POs:

POs/ COs	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
CO1	3	–	–	–	–	3	–	3	3	–	–	3	–	–
CO2	3	–	–	–	–	3	–	3	3	–	–	3	–	–
CO3	3	3	–	–	–	3	–	3	3	–	–	3	–	–
CO4	3	3	–	–	–	3	–	3	3	–	–	3	–	–
CO5	3	3	–	–	–	3	–	3	3	–	–	3	–	–

TEXT BOOKS:

1. The Constitution of India, 1st Edition, (Bare Act), Government Publication, 1950 2. Framing of Indian Constitution, 1st Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar, 2015

REFERENCE BOOKS:

1. Indian Constitution Law, 7th Edition, M. P. Jain, Lexis Nexis, 2014 Rubrics for Project Work: