HONORS
offered by
Department of Information Technology

B.Tech – IT (Honors)

SNo.	Course Name	L-T-P	CR	Prerequisites	Offered to
POOL-1					
1	Practical Cryptography in Python	3-1-0	4	Python	IT
2	Practical Machine Learning with Python	3-1-0	4	Python	IT
3	Parallel Programming	3-1-0	4	Data structures Programming	IT
4	Enterprise Architecture Foundations	3-1-0	4	Software Engineering	IT
POOL-2					
1	Computer Forensics and Cyber Crime	3-1-0	4	Security	IT
2	Business Intelligence	3-1-0	4	Data Science	IT
3	Distributed and Cloud Computing: From Parallel Processing to IoT	3-1-0	4	Parallel Programming	IT
4	Software Design	3-1-0	4	Software Engineering	IT
POOL-3					
1	Cyber Laws and Ethics	3-1-0	4	Cyber Crime	IT
2	Reinforcement Learning	3-1-0	4	Machine Learning	IT
3	Cloud Networking	3-1-0	4	Cloud Computing Networks	IT
4	Software Quality Analysis	3-1-0	4	Scripting Languages	IT
POOL-4					
1	Blockchain Fundamentals	3-1-0	4	Security	IT
2	Computer Vision	3-1-0	4	Graphics Programming	IT
3	Cloud Security and Privacy	3-1-0	4	Cloud Computing Security	IT
4	Agile Software Development	3-1-0	4	Software Engineering	IT

Streams

1. Security & Forensics
2. Data Engineering
3. Distributed and Cloud Computing
4. Software Engineering

POOL-1

PRACTICAL CRYPTOGRAPHY USING PYTHON

Course Code – Category:
L T P E O
3 1 0 0 0

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisites: Python programming

Course Objective:

The course is intended to develop a greater intuition for the proper use of cryptography and the basics of writing cryptographic algorithms in Python, demystifies cryptographic internals, and demonstrates common ways cryptography is used incorrectly.

Course Outcomes:

After completion of this course, the students will be able to:
CO-1. Provide security of the data over the network.
CO-2. Implement various networking protocols.
CO-3. Protect any network from the threats in the world.
CO-4. Do research in the emerging areas of cryptography and network security

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	1	1	1	1		1	2	2
CO2	1	2	2	1		1	1	1	1			1	3	2
CO3	1	3	1	1	1			1	1	1		1	3	2
CO4	1	1	1	1	1	1	1	1	1	1		1	3	2

UNIT-I: 12 Periods

Cryptography: More Than Secrecy

Setting Up Your Python Environment, Caesar's Shifty Cipher, A Gentle Introduction to Cryptography, Uses of Cryptography, What Could Go Wrong?, YANAC: You Are Not A Cryptographer, "Jump Off This Cliff"—The Internet.

Hashing

Hash Liberally with hashlib, Making a Hash of Education, Digestible Hash, Pass Hashword,Hash Passwords, Cracking Weak Passwords.

Learning Outcomes: At the end of this unit, the students will be able to

- Understand where cryptography is used, why, and how it gets misused
- Know what secure hashing is used for and its basic properties

UNIT-II: 12 Periods

Symmetric Encryption: Two Sides, One Key –Let's Scramble!, What Is Encryption, Really?, AES: A Symmetric Block Cipher, ECB Is Not for Me, Wanted: Spontaneous Independence, Key and IV Management, Exploiting Malleability, Weak Keys, Bad Management, finalize().

Learning Outcomes: At the end of this unit, the students will be able to

- Get up to speed on algorithms and modes for block ciphers such as AES, and see how bad configurations break

UNIT-III: 12 Periods

Asymmetric Encryption: Public/Private Keys - A Tale of Two Keys, Getting Keyed Up, RSA Done Wrong: Part One, Stuffing the Outbox, What Makes Asymmetric Encryption Different?, Pass the Padding, The Proof Is in the Padding, Exploiting RSA Encryption with PKCS #1 v1.5 Padding, Additional Notes About RSA,

Learning Outcomes: At the end of this unit, the students will be able to

- Discover how RSA encryption can be broken if insecure padding is used

UNIT-IV: 12 Periods

Message Integrity, Signatures, and Certificates- An Overly Simplistic Message Authentication Code (MAC), MAC, HMAC, and CBC-MAC, Digital Signatures: Authentication and Integrity, Certificates: Proving Ownership of Public Keys, Certificates and Trust, Revocation and Private Key Protection, Replay Attacks, ummarize-Then-MAC

Learning Outcomes: At the end of this unit, the students will be able to

- Use message integrity and/or digital signatures to protect messages

UNIT-V: 12 Periods

Combining Asymmetric and Symmetric Algorithms– Exchange AES Keys with RSA, Asymmetric and Symmetric: Like Chocolate and Peanut Butter, Measuring RSA's Relative Performance, Diffie-Hellman and Key Agreement, Diffie-Hellman and Forward Secrecy, Challenge-Response Protocols,

More Symmetric Crypto: Authenticated Encryption and Kerberos-AES-GCM, AES-GCM Details and Nuances, An Introduction to Kerberos

Learning Outcomes: At the end of this unit, the students will be able to

- Utilize modern symmetric ciphers such as AES-GCM and CHACHA

Text Book:s

1. Practical Cryptography in Python, Learning Correct Cryptography by Example - Authors Seth James Nielson, Christopher K. Monson

Reference Books:

1. Practical Cryptography for Developers, Svetlin Nakov, https://cryptobook.nakov.com/ (This book is freely available.)

PRACTICAL MACHINE LEARNING WITH PYTHON

Course Code – Category:

L	T	P	E	O
3	1	0	0	0

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s):

- Python programming knowledge
- Basic knowledge of mathematics and statistics

Course Objectives

- Learn the purpose of Machine Learning and where it applies in the real world
- Explore several algorithms and see how they help us perform several machine learning tasks.

Course Outcomes

On completing this course student will be able to
CO-1: Illustrate basics of machine learning using Python
CO-2: Describe supervised and unsupervised algorithms and their practical uses
CO-3: Use a suitable programming language to work with data and apply machine learning tools to it.
CO-4: Design simple algorithms, code them with python and test with benchmark datasets.

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 1 0	PO 1 1	PO 1 2	PSO 1	PSO 2
CO1	1	1							1	1		2	2	2
CO2	3		1	2	2	2			1	1		2	2	2
CO3	2	2	2	2	3	2	1	1	3	3	2	3	3	2
CO 4	2	2	3	3	3	2	2	1	3	3	2	3	3	2

UNIT-I: Machine Learning Basics **10 Periods**

Introduction, Why Machine Learning, , Need for Machine Learning, Understanding Machine Learning, Types of Machine Learning, Main Challenges in Machine Learning, Real world applications of Machine Learning

Learning outcomes: At the end of the unit, the student will be able to

- Learn why we need machine learning and its fundamentals
- How best we can leverage Machine Learning to get the maximum from your data

UNIT-II: Python Machine Learning Ecosystem **10 Periods**

Introduction**,** Strengths**,** Installing Jupyter notebook, numpy, pandas, Scikit- Learn, Essential Libraries and Tools, Loading sample dataset, loading a CSV File, Loading an Excel File, First Application: Classifying iris species, training and Testing Data, Build the model (knn), making predictions, evaluating model, Pre-processing and Feature Extraction

Learning outcomes: At the end of the unit, the student will be able to

- Learn why python is apt language for Machine Learning
- Use python libraries to solve machine learning problems

UNIT-III: Data Wrangling **11 Periods**

DataCollection, Data Description, Understanding Data, Get Data, Imputing Missing Values, Handling Duplicates, Handling Categorical Data, Normalizing Values, Prepare Data for Machine Learning Algorithms, Data Visualization,.

Learning outcomes: At the end of the unit, the student will be able to

- Learn how raw data is converted to a form where it can be used in machine learning algorithms
- Implement Data wrangling techniques to get the data into a form where it can be utilized in Machine Learning Algorithms for analysis

UNIT-IV: Supervised Learning **(12 Periods)**

Introduction, Logistic Regression, K nearest Neighbours, Naive Bayes Classifier, Support Vector Machines, Random Forest

Learning outcomes: At the end of the unit, the student will be able to

- Identify the characteristics of data and implement techniques to solve problem
- Analyze the data and predict decisions using Supervised Learning algorithms

UNIT-V: Unsupervised Learning **(12 periods)**

Introduction, Supervised VS unsupervised, Types of unsupervised Learning, Challenges in Unsupervised Learning K Means Clustering, DBSCAN, Principal Component Analysis

Learning outcomes: At the end the unit, student will be able to

- Distinguish supervised and unsupervised learning
- Analyze the data and predict decisions using Unsupervised Learning algorithms

Textbooks:

- Practical Machine Learning with Python by Dipanjan Sarkar Raghav Bali Tushar Sharma
- Introduction to Machine Learning with Python by Andreas C. Müller, Sarah Guido

Reference Books:

1. Machine Learning with Python Cookbook by Chris Albon
2. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron

PARALLEL PROGRAMMING

Course Code – Category:
L T P E O
3 1 0 0 0

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s): Data Structures Programming

Course Objectives

1. To familiarize the issues in parallel computing.
2. To describe distributed memory programming using MPI.
3. To understand shared memory paradigm with Pthreads and with OpenMP.
4. To learn the GPU based parallel programming using OpenCL.

Course Outcomes

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

CO-1: Identify issues in parallel programming.

CO-2: Develop distributed memory programs using MPI framework.

CO-3: Design and develop shared memory parallel programs using Pthreads and using OpenMP.

CO-4: Implement Graphical Processing OpenCL programs.

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	1		2				2		3	2	2	2
CO2	2		3	2	2				2	1		2	3	2
CO3	3	2	3	2	2				2	2	3	2	3	2
CO4	3	2	2	2	2				2	1	3	2	3	2

UNIT-I: FUNDAMENTALS OF PARALLEL COMPUTING 10 Periods

Need for Parallel Computing – Parallel Computer Models – ILP, TLP and Data Parallelism – Parallel Programming Overview – Processes, Tasks and Threads – Parallel Programming Models – Shared Memory Programming – Message Passing Paradigm – Interaction and Communication – Interconnection Networks

Learning outcomes: At the end of this unit, the students will be able to

- Explain the different parallel computer models
- Illustrate parallel programming models.
- Describe the interaction and communication inter connection networks

UNIT-II: CHALLENGES OF PARALLEL PROGRAMMING 8 Periods

Identifying Potential Parallelism – Techniques for Parallelizing Programs – Issues – Cache Coherence issues – Memory Consistency Models – Maintaining Memory Consistency – Synchronization Issues – Performance Considerations.

Learning outcomes: At the end of this unit, the students will be able to

- Classify the techniques for parallelizing programs
- Identify the cache, coherence, and synchronization issues.
- Describe Memory consistency Models
- Identify the performance considerations

UNIT-III: 8 Periods

OpenMP Execution Model – Memory Model and Consistency – OpenMP Directives – Run Time Library Routines – Handling Data and Functional Parallelism – Performance Considerations.

Learning outcomes: At the end of this unit, the students will be able to

- Explain OpenMP Execution Model – Memory Model and Consistency
- Describe how to handle data functional Parallelism.
- Identify Run Time Library Routines.

UNIT-IV: 9 Periods

The MPI Programming Model – MPI Basics – Circuit Satisfiability – Global Operations – Asynchronous Communication – Collective Communication – Other MPI Features – Performance Issues – Combining OpenMP and MPI.

Learning outcomes: At the end of this unit, the students will be able to

- Understand the MPI Programming Model.
- Explain Performance issues with MPI programming.

UNIT-V: PROGRAMMING HETEROGENEOUS PROCESSORS 10 Periods

GPU Architecture – Basics of CUDA – CUDA Threads – CUDA Memories – Synchronization Handling – Performance Issues – Application Development. Introduction to OpenCL.

Learning outcomes: At the end of this unit, the students will be able to

- Explain GPU architecture.
- Describe the CUDA threads and CUDA memories
- Develop the application using OpenCL framework

TEXT BOOKS

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, 2011.
2. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.

REFERENCES

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", Second Edition, Pearson Education Limited, 2003.
2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
3. Ian Foster, "Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering", Addison Wesley Longman Publishing Co., USA, 1995.
4. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware/ Software approach", Morgan Kaufmann / Elsevier Publishers, 1999.
5. OpenMP Programmer's Manual. 6. MPI Programmer's Manual

Enterprise Architecture Foundation

Course Code – Category: **CREDITS 4**

L	T	P	E	O
3	1	0	0	0

Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s): None

Course Objectives

This course covers foundational aspects of both enterprise and architectural thinking, including the software to technology to solution architecture continuum, role of EA in business and IT alignment, architectural styles and techniques for capturing and documenting architectures. Techniques for analyzing and reasoning about architectures are practiced in assignments in class.

Course Outcomes

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

CO-1: Know theoretical foundations of modern overview, tools and uses of enterprise architecture

CO-2: Know main theoretical prerequisites of managing, deploying enterprise architecture

CO-3: Formulate documenting enterprise architecture.

CO-4: Use methods of interactive modelling of additional enterprise architecture tools.

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	2	1	1	1	1		2	3	2
CO2	3	3	1	1	2	2	1	1	1	1		2	3	2
CO3	3	3	1	1	2	2	1	1	1	1		2	3	2
CO4	3	3	2	1	2	2	1	1	1	1		2	3	2

UNIT-I: **10 Periods**

Introduction to EA: What is Enterprise Architecture,Context for Enterprise Architecture, Levels of Architecture,Types of Architecture, Scope of Architecture, Characteristics of Good Architecture, Lists Diagrams and Matrices.

Meet the Enterprise Architecture Tools: Activity Diagram, Auditing, Balanced Scorecard, Business Process Diagram, Calendar, Class Diagram, Component Diagram, Dashboard Diagram, Decision Tree Diagram, Deployment Diagram,Gap Analysis Matrix, Heat Map,

Learning outcomes: At the end of this unit, the students will be able to

- Understand the architecture continuum and the relation between software, applications, technology and solution architectures

UNIT-II: **10 Periods**

Meet the Enterprise Architecture Tools: Import and Export Spreadsheets, Organizational Chart Diagram, Patterns, Relationship Matrix, Requirement Diagram, Roadmap Diagram, Specification Manager, Strategy Map, Team Reviews, Team Reviews, Traceability Window, Value Chain.

Uses of Enterprise Architecture: Mergers and Acquisitions, Corporate Divestiture, Architecture Oversight, Business and Systems Improvement, Communication, Enterprise Transitions, Implementation Guide, Portfolio Management.

Learning outcomes: At the end of this unit, the students will be able to

- Understand architectural styles and patterns used in solution development and use these in projects
- Understand the concepts and components of business architecture.

UNIT-III: **10 Periods**

Architecture Program Setup: Management Structure, Architecture Process, Architecture Repository, Tool Setup, Architecture Principles.

Managing an Enterprise Architecture: Governance Process, Architecture Steering Committee, Architecture Review Board, Governance Register, Architectures: Strategic Plans, Mission and Vision, Drivers, Goals and Objectives, Capabilities, Business Processes, Conceptual Information Model, Logical Data Model, Schemas and Messages, Physical Data Model, Application Lists Diagrams and Matrices, Application Communication, Interface Lists, Capabilities and Applications, Business Processes and Applications, Application Platform Services, Infrastructure Facilities, Stakeholder Modeling, Requirements Modeling.

Learning outcomes: At the end of this unit, the students will be able to

- Use a diagramming tool to develop architectural viewpoints
- Understand and use quality attributes for analyzing and reasoning about architectures

UNIT-IV: **10 Periods**

Document and Enterprise Architecture Techniques: Architecture Description, Requirement Specification, Vision, Plan, Assessment, Architecture Governance, Requirements Management, Partitioning, Portfolio Management, Balanced Scorecard, Baselines and Versioning, Business Goals and Objectives Modeling, Capability Modeling, Data Modeling, Principles Management, Risk Analysis and Management, Technical Reference Model, Use Cases and Scenarios.

Learning outcomes: At the end of this unit, the students will be able to

- Understand the role of enterprise architecture and the path to building enterprise level architecture models.

UNIT-V: **10 Periods**

Additional Enterprise Architecture Tools: Auto Names and Counters, Baseline Tool, Boundary, Document Artifact, Element Discussions, Glossary, Image Manager, List View, Mind Mapping Diagram, Model Views, Package Browser, Project Browser, Requirements Checklist, Requirement Properties, Risk Taxonomy, Security, Stereotyping, Tagged Values, Visual Filters, Working Sets

Learning outcomes: At the end of this unit, the students will be able to

- Effectively participate in a team effort to build architecture for software intensive systems

TEXT BOOKS

1. Enterprise Architect User Guide SeriesEnterprise Architecture Author: Sparx Systems & Stephen Maguire Date: 30/06/2017 Version: 1.0
2. An Introduction to Holistic Enterprise Architecture: Fourth Edition 4th Edition, Kindle Edition

REFERENCES

1. Designing Enterprise Architecture Frameworks: Integrating Business Processes with IT Infrastructure by N Zarvić, R Wieringa. Apple Academic Press (19 April 2016), 360 p. URL: https://doi.org/10.1201/b16417
2. Neubauer M., Stary CH., S-BPM in the Production Industry. Stakeholder approach, Springer Open, 2017. URL: https://www.springer.com/gp/book/9783319484655

Note: This course is related to Employability/Skill development.

POOL-2

COMPUTER FORENSICS AND CYBER CRIME

Course Code – Category:
L T P E O
3 1 0 0 0

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s): None

Course Objective:

1. The course will focus on the types and extent of current cyber crimes
2. Overview of cybercrime and the digital law enforcement practices put in place to respond to them.
3. To correctly define and cite appropriate instances for the application of computer forensics Correctly collect and analyze computer forensic evidence
4. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics

Course Outcomes:

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

CO-1 Distinguish between the different types of cybercrimes, including how they are conducted, who/what they target, where/why they persist, and the role the Internet plays in changing traditional crimes.
CO-2 Identify the challenges faced nationally and internationally at combating cybercrime, and the steps being taken by organizations and law enforcement to address these challenges.
CO-3 Enumerate how to conduct a digital forensics investigation, including the concept of the chain of evidence.
CO-4 Conduct basic computer forensic analysis
CO-5 Perform recovery of digital evidence from various digital devices using a variety of software utilities.

Mapping of Course Outcomes with POs and PSOs (TNR-12-B-U-C)

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	2	2			1			3				2	3	2
CO2	2	2			1			3				2	3	2
CO3	2	3	2	2		2		3	3			2	3	2
CO4	2	3	2	1	2	3		3	2			2	3	2
CO5	2	3	3	2	3	2		3				2	3	2

UNIT -1 **8 periods**

Understanding Cyber Crimes and Cyber Offences, Crime in context of Internet, Types of Crime in Internet, Crimes targeting Computers: Definition of Cyber Crime & Computer related Crimes; History, Development and Reasons for Growth of Cyber Crimes; Social Media and its Role in Cyber World, Fake News, Defamation, Online Advertising

Learning outcomes: At the end of this unit, the students will be able to

- Define and describe the nature and scope of cybercrime;
- Critically evaluate the impact of cybercrime on information professions.

UNIT –II **8 periods**

Prevention of Cyber Crimes & Frauds; Critical analysis & loop holes of The IT Act, 2000 in terms of cyber crimes; Cyber Crimes: Freedom of speech in cyber space & human right issues ; International position on Free Speech in Internet

Learning outcomes: At the end of this unit, the students will be able to

- Analyze the IT Act, 2000 in terms of cyber crime in order to prevent them.
- Understand once rights in the open internet.

UNIT – III **8 periods**

Introduction: Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Computer Forensics Systems – Vendor and Computer Forensics Services.

Learning outcomes: At the end of this unit, the students will be able to

- Distinguish various computer forensics technology, systems and services.

UNIT–IV **10 periods**

Computer forensics evidence and capture: Data Recovery – Evidence Collection and Data Seizure-Duplication and Preservation of Digital Evidence-Computer Image Verification and Authentication.

Learning outcomes: At the end of this unit, the students will be able to

- Understand the measures to be taken while dealing with evidence and seizure
- Protect and preserve an evidence requiring investigation

UNIT–V **10 periods**

Computer forensic analysis: Discover of Electronic Evidence Identification of Data – Reconstructing Past Events – Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies

Learning outcomes: At the end of this unit, the students will be able to

- Analyze an forensic evidence in finding an appropriate fact from the information regenerated
- Understand various tactics of crime in cyberspace and act accordingly.

TEXT BOOKS:

1. Prashant Mali: Cyber Law & Cyber Crimes Sumplified, Cyber Infonedia Publisher
2. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005.

REFERENCES:

1. Real Digital Forensics by Keith j.Jones, Richard Bejitlich,Curtis W.Rose ,Addison Wesley Pearson Education
2. Forensic Compiling,A Tractitioneris Guide by Tony Sammes and Brain Jenkinson,Springer International edition.
3. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., Latest Edition

BUSINESS INTELLIGENCE

Course Code – Category:
L T P E O
3 1 0 0 0

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s): Knowledge on Data Mining and Data Warehousing

Course Objectives

1. be exposed with the basic rudiments of business intelligence system
2. understand the modelling aspects behind Business Intelligence
3. understand of the business intelligence life cycle and the techniques used in it
4. be exposed with different BI tools and techniques

Course Outcomes

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

CO-1: understand the concepts of Business Intelligence, technologies and organizations for developing solutions to organizations.
CO-2: knowledge about different types of capabilities for the presentation of information.
CO-3: apply data mining models to business analytics problems to identify the impact of BI on corporate business performance.
CO-4: demonstrate the design of Data warehouses and enterprise architecture for data mining applications.
CO-5: describe the characteristics and steps of good business intelligence solutions for decision making system

Mapping of Course Outcomes with POs and PSOs

COs/POs -PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P01 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2	2	3	1	2	1	1	1	2	1		1	3	2
CO2	2	2	3	3	2	2	1	1	2	1		1	3	2
CO3	1	3	2	2	3	2	1	1	2	1		1	3	2
CO4	3	3	3	3	3	2	2	1	2	1		2	3	2
CO5	2	3	3	2	2	1	1	1	2	1		1	3	2

UNIT-I Business Intelligence and Its Impacts 10 Periods

Introduction, data, information, and knowledge, what is business intelligence?, driving factors , business intelligence and related technologies, contemporary organizations, obstacles to business intelligence.

Learning outcomes: At the end of this unit, the students will be able to

- understand the fundamentals of business intelligence
- understand of the business intelligence life cycle and the techniques used in it

UNIT-II BI Capabilities **12 Periods**

Introduction, four synergistic capabilities, organizational memory, information integration, insight creation: Factors for Insight Creation Capability and Technologies, presentation.

Learning outcomes: At the end of this unit, the students will be able to

- Summarized the main capabilities of BI solutions
- Identify the technologies facilitating each capability

UNIT-III Technologies Enabling Organizational Memory and Information Integration

12Periods

Introduction enterprise resource planning systems, data warehouse, designing the enterprise architecture, knowledge repositories.

Introduction, integration of data sources in a business intelligence application, text mining, environmental scanning, web mining, application of web mining in customer relationship management.

Learning outcomes: At the end of this unit, the students will be able to

- Analyze the different Data mining applications
- Apply Different mining tools for Business Intelligence

UNIT-IV Technologies Enabling Insights and Presentation **12 Periods**

Technologies to create insights: using data mining to create new explicit knowledge, the business analytics process, the data mining models(what happened, what will happen, what happened), effective implementation of business analytics.

Presentation: online analytical processing, visual analytics, performance dashboards, balanced scorecards, it governance, impact of business intelligence on corporate performance.

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Learning outcomes: At the end of this unit, the students will be able to

- Apply different Business Technologies in today's dynamic business environment
- Apply various modelling techniques for data visualization.

UNIT-V Business Intelligence Tools **10 Periods**

What are business intelligence tools? Tools Supporting Organizational Memory Capability, Tools Integration Capability, Insight Creation Capability, and Presentation Capability, customization versus standardization of BI tools, leading business intelligence vendors.

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Learning outcomes: At the end of this unit, the students will be able to

- Know the various BI tools
- Identify the standardization of BI tools.

TEXT BOOKS

1. Rajiv Sabherwal, Irma Becerra-Fernandez, "Business Intelligence Practices, Technologies, and Management", John Wiley & Sons, Inc.
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.

REFERENCES

1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence", second edition, a john Wiley & sons, inc. Publication.
2. Efraim Turban, Ramesh Sharda, Dursun Delen "Decision Support Systems and Intelligent Systems", , 9th Edition, Pearson 2011.
3. Galit Shmueli, Nitin R. Patel and Peter C. Bruce "Data Mining for Business: Intelligence Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", , Wiley, 2007.

Distributed and Cloud Computing: From Parallel Processing to IoT

Course Code – Category:
L T P E O
3 1 0 0 0

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s): Distributed systems, Networking, Virtualization, Database

Course Objectives

1. To introduce distributed system and cloud models
2. Examine distributed computational model and understand the need for cloud computing.
3. Applications ofGrid Computing Systems and Resource Management
4. Examine the Peer-to-Peer Computing functions, security management and Internet of Things

Course Outcomes

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

CO-1: Examinethe prototypes in distributed systems, cloud servicesand Service-Oriented Architectures for Distributed Computing.

CO-2: Determine the need of virtualization in a cloud environment and compute cloud storage using virtualization.

CO-3: Evaluate the models used in Grid computing and cloud environments for real time applications.

CO-4: Apply critical operations involved in Peer-to-Peer computing and Internet of Things towards research and innovation.

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1	1	1	1		1	2	3	2
CO2	2	3	2	1		1	1	1	1	1	1	2	3	2
CO3	3	2	1	1		1	1	1	1	1	1	2	3	2
CO4	2	2	2	3		1	1	1	1	1	1	2	3	2

UNIT – I Distributed System Models, Enabling Technologies and Computer Clusters for Scalable Parallel Computing **10 Periods**

Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds. Clustering for Massive Parallelism, Computer Clusters and MPP Architectures, Design Principles of Computer Clusters.

Learning outcomes: At the end of this unit, the students will be able to

- Identify the models and technologies for distributed and cloud computing.
- Analyse the Software Environments for Distributed Systems and Clouds.
- Apply computer clusters for scalable parallel computing.

UNIT – II Virtual Machines, Visualization of Clusters and Data Centers, Cloud Platform Architecture over Virtualized Data Centers 12 Periods

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Cloud Computing and Service Models, Data-Center Design and Interconnection Networks,Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS, and Azure, Inter-cloud Resource Management, Cloud Security and Trust Management.

Learning outcomes: At the end of this unit, the students will be able to

- Examine the models used for Visualization of Clusters and Data Centres.
- Know the Cloud Platform Architecture over Virtualized Data Centres.

UNIT – III Service-Oriented Architectures for Distributed Computing 8 Periods

Services and Service-Oriented Architecture, Message-Oriented Middleware, Portals and Science Gateways, Discovery, Registries, Metadata, and Databases, Workflow in Service-Oriented Architectures.

Learning outcomes: At the end of this unit, the students will be able to

- Apply Service-Oriented Architectures for Distributed Computing.
- Discover Registries, Metadata, and Databases for distributed applications.

UNIT – IV Cloud Programming and Software Environments, Grid Computing Systems 12 Periods

Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft AZURE, Grid Architecture and Service Modelling,Software and Middleware for Grid Computing, Grid Application Trends and Security Measures.

Learning outcomes: At the end of this unit, the students will be able to

- Know the Cloud Programming and Software Environments for various clouds like Amazon AWS and Microsoft Azure.
- Analyse the methods of Grid Computing for real time applications.

UNIT – V Peer-to-Peer Computing, Overlay Networks, Ubiquitous Clouds and the Internet of Things 13 Periods

Peer-to-Peer Computing Systems, P2P Overlay Networks and Properties, Routing, Proximity, and Fault Tolerance, Trust, Reputation, and Security Management, P2P File Sharing and

Copyright Protection. Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things,

Learning outcomes: At the end of this unit, the students will be able to

- Apply Peer-to-Peer Computing models for real time applications.
- Apply the concepts of Ubiquitous Clouds andInternet of Things for Innovative Applications.

TEXT BOOKS:

1. Distributed and Cloud Computing from parallel processing to the internet of things, Kai Hwang. Geoffrey C. Fox, Jack J. Dongarra, Elsevier, 2012.

REFERENCES:

1. Cloud Computing: principles and paradigms (Wiley Series on Parallel and Distributed Computing), Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley Publishing (c) 2011.
2. Distributed Computing: Principles, Algorithms, and Systems, Ajay D. Kshemkalyani and Mukesh Singhal, Cambridge, 2008
3. https://www.brainkart.com/subject/Cloud-Computing_389/

POOL-3

CYBER LAWS AND ETHICS

(Honors)

Course Code :
L T P E O
3 1 0 1 2

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Pre- Requsities: Human Values and Professional Ethics (HVPE)

Course Objectives:
A successful student will fulfill the following course objectives:

1. Identify and manage ethical issues related to the use and advancement of Information and Communication Technology (ICT).
2. Discuss the social impacts of computers in information technology.
3. Students will be given a broad overview of relevant topics to include free speech, privacy, security and the law.
4. Understand the ethical issues associated with confidentiality and privacy as they relate to information technology.

Course Outcomes:
At the end of the course student should be able to:

CO 1: Familiarize the concept and perspectives of cyber ethics.
CO 2: Critically analyze ethical issues related to ICT associated with confidentiality and privacy as they relate to information technology.
CO 3: Acquire the knowledge on different kinds of cyber-crimes and familiarize the intellectual property disputes in cyberspace regulating commerce.
CO 4: Understand the impact of cyber ethics on online communities, virtual reality and artificial intelligence.

Mapping of course outcomes with program outcomes:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1		1		2	1	3	1	2	1	2	2	2
CO2	1	2	1	2		2	2	3	1	2	1	3	2	2
CO3	2	2	1	1		1	1	3	1	1		2	2	2
CO4	2	2		2		1	1	3	1	1		2	2	2

SYLLABUS

Unit-1:

Introduction to Cyber ethics: Concepts, Perspectives, and Methodological Frameworks: Defining Key Terms: Cyber ethics and Cyber Technology, The Cyber ethics Evolution: Four Developmental Phases in Cyber Technology, Are Cyber ethics Issues Unique Ethical Issues?, Cyber ethics as a Branch of Applied Ethics: Three Distinct Perspectives, A Comprehensive Cyber ethics Methodology, A "Disclosive" Method for Cyber ethics, A Comprehensive Strategy for Approaching Cyber ethics Issues.

Learning outcomes: At the end of the unit the students are able to

1) Understand the importance of cyber ethics and how it was evolved.
2) Understand the concept and perspective of cyber ethics

Unit-2:

Privacy and Cyberspace: Privacy in the Digital Age: Who Is Affected and Why Should We Worry?, What Is Personal Privacy?, Why Is Privacy Important?, Gathering Personal Data: Surveillance, Recording, and Tracking Techniques, Analyzing Personal Data: Big Data, Data Mining, and Web Mining, Protecting Personal Privacy in Public Space, Privacy Legislation and Industry Self-Regulation, A Right to "Be Forgotten" (or to "Erasure") in the Digital Age.

Learning outcomes: At the end of the unit the students are able to

1) Understand the ethical issues associated with confidentiality and privacy as they relate to information technology.

Unit-3:

Security in Cyberspace: Security in the Context of Cyber technology, Three Categories of Cyber security, Cloud Computing and Security, Hacking and "The Hacker Ethic", Cyber terrorism, Information Warfare (IW).

Cybercrime and Cyber-Related Crimes: Cybercrimes and Cyber criminals, Hacking, Cracking, and Counter Hacking, Defining Cybercrime, Three Categories of Cybercrime: Piracy, Trespass, and Vandalism in Cyberspace, Cyber-Related Crimes, Technologies and Tools for Combating Cybercrime, Programs and Techniques Designed to Combat Cybercrime in the United States, National and International Laws to Combat Cybercrime, Cybercrime and the Free Press: The Wikileaks Controversy.

Learning outcomes: At the end of the unit the students are able to

1) Acquire the knowledge on cyber related crimes and technologies.

Unit-4:

Intellectual Property Disputes in Cyberspace: What Is Intellectual Property?, Copyright Law and Digital Media, Patents, Trademarks, and Trade Secrets, Jurisdictional Issues Involving Intellectual Property Laws, Philosophical Foundations for Intellectual Property Rights.

Regulating Commerce and Speech in Cyberspace: Introduction and Background Issues: Some Key Questions and Critical Distinctions Affecting Internet Regulation, Digital Rights Management (Drm), E-Mail Spam, Free Speech vs. Censorship and Content Control in Cyberspace, Pornography in Cyberspace.

Learning outcomes: At the end of the unit the students are able to

1) Familiarize yourself with laws, digital media, patents, trademarks, trade secrets related to computer ethics and individual conduct in cyberspace.

2) Explain Digital Rights Management and E- Mail spam.

Unit-5:

The Digital Divide, Democracy, and Work: The Digital Divide, Cyber Technology and the Disabled, Cyber Technology and Race, Cyber Technology and Gender, Cyber technology, Democracy, and Democratic Ideals, the Transformation and the Quality of Work.

Online Communities, Virtual Reality, and Artificial Intelligence: Online Communities and Social Networking Services, Virtual Environments and Virtual Reality, Artificial Intelligence (AI), Extending Moral Consideration to AI Entities.

Learning outcomes: At the end of the unit the students are able to

1) Understand the impact of cyber ethics on online communities, virtual reality and artificial intelligence.

Textbook:

Tavani, H.T. (2010). Ethics and technology: Controversies, questions and strategies in ethical computing (3rd ed.) Massachusetts, John Wiley & Sons Inc. ISBN: 978-0-470-50950-0

References:

1) Blackley, J. A., Peltier, J., & Peltier, T. (2003) *Information Security Fundamentals, 1st ed.* Boca Raton, FL. Auerbach Publications. ISBN: 0849319579/9780849319570
2) American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th edition). Washington, DC: Author. ISBN: 1-4338-0561-8

REINFORCEMENT LEARNING

(Honors)

Course Code : **CREDITS 4**

L T P E O Sessional Marks: 40

3 1 0 1 2 End Exam Marks: 60

End Exam: 3 Hours

Prerequisite(s): Python, Machine Learning

Course Objectives

1. To decide the sequence of actions to perform in an uncertain environment in order to achieve some goals that may not necessarily seem beneficial in near future but are optimal for getting better long term reward.

Course Outcomes

After completion of the course, the students will be to:

CO 1: Structure a reinforcement learning problem

CO 2: Apply basic RL algorithms for simple sequential decision making problems in uncertain conditions

CO 3: Evaluate the performance of the solution

CO 4: Interpret state-of-the-art RL research and communicate their results

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	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	1	1	1	1	1						1	3	2
CO2	1	3	3	1	2	1						1	3	2
CO3	1	3	3	1	2							1	3	2
CO4	2	3	3	2	2	1						1	3	2

Unit-1 **8 Periods**

Introduction

Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning.

Probability Primer:

Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation, Concepts of joint and multiple random variables, joint, conditional and marginal distributions, Correlation and independence.

Unit-2

Markov Decision Process **8 Periods**

Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process

(MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

Unit-3

Prediction and Control by Dynamic Programming **8 Periods**

Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

Unit-4

Monte Carlo Methods for Model Free Prediction and Control **8 Periods**

Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling

Unit-5

TD Methods **8 Periods**

Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants

Text Books

1. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto, 2nd Edition.
2. Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Alberto Leon-Garcia.

References

1. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy.
2. Machine Learning, Tom M.Mitchell, MGH, 1997.
3. Introduction to machine Learning, 2nd ed, Ethem Alpaydin, PHI

Online Resources

1. http://cse.iitkgp.ac.in/~adas/courses/rl_aut2021/rl_aut2021.php
2. https://nptel.ac.in/courses/106106143

Note: This course is related to Employability/Skill development.

CLOUD NETWORKING

(Honors)

Course Code :
L T P E O
3 1 0 1 2

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

COURSE OBJECTIVES:

1. Gain fluency in end-to-end transport algorithms that provide higher-level reliability and performance capabilities, based on simpler lower-layer functions.
2. Determine which lower-layer network protocols and components are appropriate for a wide variety of given application requirements.
3. Describe common attacks and apply appropriate defenses at multiple layers of the Internet architecture.
4. Gain practical experience with network programming by using and implementing realistic network infrastructure protocols and software, including routing protocols and TCP.
5. Understand the network stack of a cloud network – network virtualization, physical interconnection of servers, routing, congestion control, and application-level techniques.
6. Engineer networked applications for higher performance and reliability.

COURSE OUTCOMES:

By the end of the course, you will be able to:

CO 1: Understand the layered architecture of the Internet and the components of the fast-path data plane of multi-hop and multi-domain networks.

CO 2: Understand Switch Fabric Technology, Congestion Management, Traffic management.

CO 3: Understand the network stack of a cloud network.

CO 4: Analyse a (small) cloud network and evaluate its performance

Course Articulation Matrix (CO-PO Mapping)

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2				2				2	3	2
CO2	2	3	3	2				2				2	3	2
CO3	2	3	3	2				2				2	3	2
CO4	2	2	3	2				2				2	3	2

SYLLABUS

Unit-1: **10h**

Introduction to cloud networking: Networking Basics, Cloud Data Center, Characteristics of Cloud Networking, The Data Center Evolution, Computer Networks, Ethernet, Movement to the Cloud.

Unit-2: **12h**

Switch Fabric Technology: Switch Fabric Architecture, Shared bus architecture, Shared memory architecture, Crossbar switch, Switch Fabric Topologies, Congestion Management, Flow Control, Traffic Management.

Unit-3: **10h**

Networking Topologies: Traditional Multitiered Enterprise Network, Data Center Network Switch Type, Flat Data Center Networks, Rack Scale Architectures, Ethernet Data Rate Standards, Virtual Local Area Networks, Improving Network Bandwidth

Unit-4: **10h**

Server Virtualization and Networking: VM Overview, Virtual Switching, PCI Express, VM Migration, Multi-tenant Environments, Traditional Network Tunneling Protocols, VXLAN, NVGRE.

Unit-5: **12h**

Software-Defined Networking: Data Center Software Background, OpenStack, OpenFlow, Network Function Virtualization, SDN Deployment.

Textbook:

1. Cloud Networking Understanding Cloud-based Data Center Networks by Gary Lee "Computer Networks: A Systems Approach,", by Larry L. Peterson and Bruce S. Davie (5th ed., 2011).

POOL-4

BLOCKCHAIN FUNDAMENTALS

(HONOURS)

COURSE CODE:
L T P E O
3 1 0 0 0

CREDITS: 4
Sessional Marks: 40
External Marks: 60
End Exam: 3 Hrs

Prerequisites:
- Knowledge of Data structures.
- Cryptography and Network Security

Course Objectives:
- Understand how blockchain systems (mainly Bitcoin and Ethereum) work.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from blockchain technology into their own projects.

Course Outcomes:
Upon completion of this course, the students will be able to
1. Explain the basic concepts and technology used for blockchain
2. Describe the primitives of the distributed computing and cryptography related to blockchain.
3. Illustrate the concepts of Bitcoin and their usage
4. Analyze the working of Ethereum and Smart Contracts.

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	-	-	-	-	-	1	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	1	-	-	2	1
CO3	2	3	2	-	-	-	-	-	-	2	-	-	2	-
CO4	3	3	2	2	-	-	-	-	-	2	-	2	2	2
1: Weakly related, 2: Moderately related and 3: Strongly related														

UNIT – I **9 Periods**

Introduction of Blockchain: Back-story of Blockchain, What is Block chain, Centralized Vs Decentralized Systems, Layers of Blockchain, Why Blockchain is Important? Blockchain uses and use cases, Public Vs Private Blockchains.

Learning Outcomes: At the end of this unit, Students are able to
1. Explain the need of Blockchain
2. Describe the benefits of Blockchain

UNIT II: **12 Periods**

How Blockchain Works: Laying the Blockchain foundation, Cryptography, Symmetric Key Cryptography basics, Asymmetric Key Cryptography basics,SHA-256,Game Theory: Nash Equilibrium, Prisoner's Dilemma, Byzantine Generals Problem, Blockchain data structure, Merkle Trees, Properties of Blockchain Solutions, Distributed Consensus Mechanisms, Blockchain Applications, and Scaling Blockchain.

Learning Outcomes: At the end of this unit, Students are able to

1. Describe the Blockchain working.
2. Explain the different Cryptographic Concepts used in Blockchain

UNIT-III: **9 Periods**

How Bitcoin Works: The History of Money, Dawn of Bitcoin, What Is Bitcoin?, Working with Bitcoins, The Bitcoin Blockchain, Block Structure, The Genesis Block, The Bitcoin Network, Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining.

Learning Outcomes: At the end of this unit, Students are able to

1. Illustrate the concept of Bitcoin
2. Explain different primitive concepts related to Bitcoin

UNIT-IV: **8 Periods**

Block Propagation, Bitcoin Scripts, Full Nodes Vs SPVs, Bitcoin Wallets, How Ethereum Works: From Bitcoin to Ethereum: Ethereum as a Next-Gen Blockchain, Design Philosophy of Ethereum.

Learning Outcomes: At the end of this unit, Students are able to

1. Illustrate the concept of Block Propagation problem
2. Explain basic concepts related to Ethereum

UNIT-V: **12 Periods**

Enter the Ethereum Blockchain: Ethereum Blockchain, Ethereum Accounts, Trie Usage, Merkle Patricia Tree, RLP Encoding, Ethereum Transaction and Message Structure, Ethereum State Transaction Function, Gas and Transaction Cost. Ethereum Smart Contracts, Ethereum Virtual Machine, Ethereum Ecosystem.

Learning Outcomes: At the end of this unit, Students are able to

1. Describe How Ethereum works
2. Analyze how Smart Contracts are used in Ethereum

Text Books:

1.Bikramaditya Singhal, Gautam Dhameja and Priyansu Sekhar Panda, "Beginning Blockchain:A Beginner's Guide to Building Blockchain Solutions" 2018, Apress

2. Antonopoulos and G. Wood, "Mastering Ethereum" 1st Edition,2018, O'Reilly Publications

Reference Books:

1. Antonopoulos, "Mastering Bitcoin" 1st Edition, 2014, O'Reilly Publications

Web Resources:

1. https://solidity-by-example.org/

2.https://www.coursera.org/learn/blockchain-basics

3. https://cs251.stanford.edu/syllabus.html

COMPUTER VISION
Honors

COURSE CODE
L P T E O
3 0 1 0 2

CREDITS 4
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s): Knowledge in Computer Graphics, Image Processing.

Course Objectives:

1. Understand primitive algorithms for drawing line, circle and ellipse.
2. Introduction to computer vision and history.
3. Identify different image formations and Image processing.
4. Describe error detection and segmentations.
5. Analyse various forms of motions.

Course Outcomes:

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

CO1: Understand the fundamentals of computer vision and image processing.

CO2: Analyse various feature detection and segmentation techniques.

CO3: Demonstrate 2D and 3D feature-based alignment

CO4: Apply Motion related techniques.

Mapping of Course Outcomes with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				2							1	2	1
CO2		1	2									2	1	2
CO3	1				2							1	1	2
CO4					3							2	1	1

UNIT 1 **12 Periods**

Introduction Line Circle and Ellipse Drawing Algorithms – Attributes, Introduction to computer vision, A brief history, Notation. **Image formation:** Geometric primitives and transformations, Photometric image formation, The digital camera.

Learning Outcomes: At the end of this unit students will be able to

1. Draw the Line Circle and ellipse with the help of algorithms.
2. Explain in detail about computer vision and its history.
3. Illustrate image formation.

UNIT 2 **8 Periods**

Image processing: Point operators, Linear filtering, More neighbourhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations, Global optimization.

Learning Outcomes: At the end of this unit students will be able to

1. Review the fundamental concepts of image processing.
2. Demonstration of Fourier and geometric transformation.

UNIT 3 **8 Periods**

Feature detection and matching: Points and patches, Edges, Lines

Segmentation: Active contours, Split and merge, mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.

Learning Outcomes: At the end of this unit students will be able to

1. Explain the process of feature detection and segmentation.

UNIT 4 **12 periods**

Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration.

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, Constrained structure and motion.

Learning Outcomes: At the end of this unit students will be able to

1. Define image alignment and discuss various methods of alignment.
2. Discuss two frame structure from motion.

UNIT 5 **10 Periods**

Dense motion estimation: Translational alignment, Parametric motion, Spline-based motion, Optical flow, Layered motion.

Image stitching: Motion models, Global alignment, Compositing.

Learning Outcomes: At the end of this unit students will be able to

1. Explain about various motion estimation.
2. How to choose compositing surface.

TEXT BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010.
2. Donald Hearnand M. Pauline Baker, “Computer Graphics C Version”, Pearson Education, 2003.

REFERENCES :

1. E. R. Davies, ―Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.
2. R. Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer 2011. 6. Simon J. D. Prince, ―Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.
3. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.

CLOUD SECURITY & PRIVACY
Honors

COURSE CODE
L P T E O
3 0 1 0 2

CREDITS 3
Sessional Marks: 40
End Exam Marks: 60
End Exam: 3 Hours

Prerequisite(s):Cloud Computing, Basics of Security and Privacy

Course Objectives

1. Analyze the components of cloud computing showing how security and privacy can be achieved.
2. Appraise compliance issues that arise in the infrastructure and data of cloud services.
3. Appraise risks, legal and regulatory implications where data is stored

Course Outcomes

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

CO-1: Identify the models required for governance in the cloud.
CO-2: Implement effective Infrastructure and Data Security solutions and their governance
CO-3: Assess security management, and authentication issues with IAM
CO-4: Describe protection measures in virtualized cloud environments.

Mapping of Course Outcomes with POs and PSOs

COs/POs-PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12	PSO1	PSO2
CO1	2	2	3	1	3	1	1	1	2	1	1	1	3	2
CO2	2	3	3	3	3	2	1	1	2	1	1	1	3	2
CO3	1	3	3	3	3	2	1	1	2	1	1	1	3	2
CO4	3	3	3	3	3	2	2	1	2	1	1	2	3	2

UNIT-I **10 Hours**

WHAT IS CLOUD COMPUTING: Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.

Learning outcomes: At the end of this unit, the students will be able to

- Understand cloud computing.
- Describe cloud service models.

UNIT- II **10 Hours**

INFRASTRUCTURE SECURITY: Infrastructure Security-The Network Level, Infrastructure Security-The Host Level, Infrastructure Security-The Application Level. DATA SECURITY AND STORAGE: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security

Case Study AWS VPC Network Security, AWS VPC Architecture, VPC Endpoints, Egress traffic

Learning outcomes: At the end of this unit, the students will be able to

- Define Security.
- Understand aspects of data and storage security.

UNIT- III **10 Hours**

IDENTITY AND ACCESS MANAGEMENT: Trust Boundaries and IAM, Why IAM? IAM Challenges, IAM Definitions, IAM Architecture, and Practice, Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

AWS: Introduction to Temporary IAM credentials, Introduction to IAM Database Authentication, IAM Permission Boundaries.

Learning outcomes: At the end of this unit, the students will be able to

- Define IAM.
- Understand Standards and protocols for various cloud services.
- Apply database authentication on IAM

UNIT-IV **10 Hours**

SECURITY MANAGEMENT IN THE CLOUD: Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.

AWS: Introduction to S3 data protection, DynamoDB data protection, Security Hub

Learning outcomes: At the end of this unit, the students will be able to

- Define Security Management.
- Understand Access Control, Vulnerability, and Configuration Management.
- Apply for data protection on S3, DynamoDB

UNIT V **10 Hours**

PRIVACY: What Is Privacy? What Is the Data Life Cycle? What Are the Key Privacy Concerns in the Cloud? Who Is Responsible for Protecting Privacy? Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

Privacy Features of AWS: EC2, EBS, S3, RDS

Learning outcomes: At the end of this unit, the students will be able to

- Define Privacy.
- UnderstandLegal and Regulatory Implications.
- Apply privacy features of AWS services

TEXT BOOKS

1. Cloud Security and Privacy-An enterprise perspective on Risks and compliance, O'REILLY, Tim Mather, Subra Kumaraswamy, Shahed Latif- 2009., ISBN-978-0-596-80276-9.

REFERENCES

1. Security, Privacy, and Digital Forensics in the Cloud-Lei Chen (Editor), Hassan Takabi (Editor), Nhien-An Le-Khac (Editor),ISBN: 978-1-119-05328-