SCHEME OF INSTRUCTION

Common to B.E (CSE(AI&ML), CSE(AI), AI&ML)

SEMESTER - VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC701AI	Information Security	3	-	-	3	30	70	3	3
2	PC702 AI	Big Data Analytics	3	1	-	3	30	70	3	4
3	PC703 AI	Generative AI	3	1	-	3	30	70	3	4
4	PE	Professional Elective-IV	3	-	-	3	30	70	3	3
5	OE-II	Open Elective-II	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
5	PC 751 AI	Information Security Lab	-	-	2	2	25	50	2	1
6	PC 752 AI	Big Data Analytics Lab	-	-	2	2	25	50	2	1
7	PW 753 AI	Project Work-I	-	-	6	6	50	-	-	3
8	SI651AI	Summer Internship	-	-	-	-	50	50	-	1
			15	**2**	**10**	**25**	**300**	**500**	**-**	**23**

Professional Electives -IV	
Course code	**Course Title**
PE741AI	Information Retrieval Systems
PE742AI	Intellectual Property Rights
PE743AI	Multimedia Technologies
PE744AI	Software Process & Project Management
PE745AI	Predictive Analytics

PC 701 AI	INFORMATION SECURITY					
Prerequisites	**Computer Networks**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. To understand the fundamentals of information security, threats, attacks, and secure software development.
2. To learn legal, ethical, and risk management aspects of information security.
3. To understand security planning, policies, standards, and network security mechanisms.
4. To gain knowledge of intrusion detection, access control, cryptography, and secure communications.
5. To apply information security implementation, certification, and maintenance practices in organizations.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the basic concepts of information security, security models, threats, attacks, and secure software development.

CO2: Identify legal, ethical, and professional issues in information security and apply risk management techniques to address security risks.

CO3: Develop security policies, standards, continuity plans, and implement network security solutions such as firewalls and VPNs.

CO4: Apply intrusion detection, access control, cryptographic techniques, and secure communication protocols to protect information systems.

CO5: Implement and maintain information security programs using security management, certification, accreditation, and maintenance practices.

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk

Management Discussion Points.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non-Technical Aspects of implementation, Security Certification and Accreditation.

Information Security Maintenance: Security management models, Maintenance model

Text Books:

1. Michael E Whitman and Herbert J Mattord, *Principles of Information Security*, Cengage Learning, 6 th Edition 2018
2. Atul khate, Cryptography and Network Security" 4 th edition , Tata Mc Graw Hill , 2019

References:

1. Nina Godbole, "Information Systems Security: Security Management, Metrics, Frameworks and Best Practices" Second Edition, WILEY 2017
2. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi
3. V.K. Pachghare, "Cryptography and Information Security", PHI Learning

PC 702 AI	BIG DATA ANALYTICS					
Prerequisites	**Database Management Systems**		**L**	**T**	**P**	**C**
			3	**1**	**0**	**1**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To understand the fundamentals of Big Data and Hadoop.
2. To understand Apache Hadoop, HDFS concepts and HDFS interfaces for managing Big Data.
3. To understand Map Reduce Jobs,YARN and Spark for Big Data Processing.
4. To explore Hadoop Ecosystem tools such as Pig, Hive and HBase.
5. To learn basic Machine Learning concepts and NoSQL databases for Big Data applications.

Course Outcomes

On completion of this course, students will be able to:

CO1: Explain the concepts of Big Data and Hadoop.

CO2: Use HDFS and Hadoop tools for storing and managing large datasets.

CO3: Apply MapReduce, YARN, and Spark concepts to process and analyze Big Data in distributed environments.

CO4: Apply Pig, Hive, and HBase for Big Data analysis and management.

CO5:Understand Machine Learning concepts and NoSQL databases used in Big Data applications.

UNIT – I

Introduction to Big Data and Hadoop: Types of Digital Data, Introduction to Big Data, Architecture and Applications, Characteristics of Big Data - 5 V's, Big Data Analytics and types, History and Evolution of Hadoop, Apache Hadoop, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategies - Introduction to Info Sphere, Big Insights.

UNIT – II

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Reading data from Hadoop URL, Writing data, Data flow in HDFS, Data Ingestion with Flume and Scoop and Hadoop archives.

Hadoop I/O: Compression, Serialization, Avro and File-Based Data Structures.

UNIT – III

Map Reduce: Concepts of Map Reduce, Anatomy of a Map Reduce Job Run, Hadoop Storage & Processing Daemons, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features. YARN Architecture, Workflow, Features and Limitations.

Spark: Architecture of Spark, Spark vs Map Reduce, Advantages and Applications.

UNIT – IV

Hadoop Ecosystem Tools: Pig, Hive, HBase

Pig: Introduction to PIG, Architecture, Execution Modes of Pig, Comparison of Pig with Database Grunt,

Pig Latin, User-Defined Functions, Types of UDF's, Data Processing Operators, Datatypes in Pig, Advantages and Limitations of Pig.

Hive: Architecture, Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

HBase: HBasics, Concepts, Clients, Example, HBase Versus RDBMS.

UNIT – V

Machine Learning and Big Data: Introduction to Machine Learning, Types - Supervised Learning, Unsupervised Learning, Role of Big Data in Machine Learning, Collaborative Filtering.

NoSQL : Introduction to NoSQL, Types, NoSQL vs RDBMS, Characteristics and Applications.

Textbooks:

1. Hadoop: The Definitive Guide – Tom White, O'Reilly Media, 2015.
2. Big Data Analytics – Seema Acharya and Subhasini Chellappan, Wiley India, 2015.
3. Big Data Analytics – Vikram Pudi and P. Radha Krishna, Oxford University Press, 2016.

Suggested Readings:

1. Machine Learning and Big Data: Concepts, Algorithms, Tools and Applications – Uma N. Dulhare, Khaleel Ahmad, and Khairol Arnali Bin Ahmad, Scrivener Publishing, Wiley, 2020.
2. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence – Pramod J. Sadalage and Martin Fowler, Addison-Wesley, 2013.
3. Intelligent Data Analytics – Michael Berthold and David J. Hand, Springer, 2007.
4. Big Data and Business Analytics – Jay Liebowitz, Auerbach Publications, CRC Press, 2013.

Online references:

https://www.geeksforgeeks.org/big-data/what-is-big-data-analytics/

https://www.coursera.org/in/articles/big-data-analytics

https://youtube.com/playlist?list=PLxCzCOWd7aiHUUi6ZlansKbDw_cXut0El&si=PH-bVZ1__t_WC5iq

PC 703 AI	GENERATIVE AI					
Prerequisites	**Machine Learning** **Artificial Intelligence**		**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To introduce the concepts, architectures, and workflows of Generative AI systems.
2. To study and implement models such as GANs, VAEs, and Transformers.
3. To explore text, image, and music generation applications using deep learning frameworks.
4. To examine ethical and societal implications of Generative AI technologies.
5. To equip students with practical skills in GenAI tools and model deployment.

Course Outcomes (COs)

On completion of this course, students will be able to:

CO1: Explain the principles and evolution of Generative AI models.

CO2: Implement core architectures like GANs, VAEs, and Transformers.

CO3: Analyze and compare the performance of generative models for text, image, and music generation.

CO4: Apply Generative AI techniques for real-world interdisciplinary applications.

CO5: Evaluate ethical issues such as data bias, deepfakes, and responsible AI deployment.

UNIT – I:

Foundations of Generative AI:Evolution of AI and Deep Learning, Neural Network fundamentals: Perceptrons, Backpropagation, Generative AI overview, Applications: Art, Text, Music, Healthcare.

UNIT – II:

Generative Models , Variational Autoencoders (VAE), Generative Adversarial Networks (GANs), Case study: Image synthesis using GANs.

UNIT – III:

Transformers and Language Models,Attention Mechanism, Transformer architecture, Large Language Models (GPT, BERT, T5), Text generation and summarization.

UNIT – IV:

Tools and Techniques : TensorFlow, RoboFlow and PyTorch, Data preprocessing, Training strategies, Model Tunning(LoRA),Model evaluation metrics (FID, BLEU, ROUGE, Perplexity),RAG(Retrieval Augmented Generation) methods.

UNIT – V:

Applications and Ethics :Generative AI in business, finance, and education; Music and video generation; Ethical issues; Responsible AI frameworks, Enterprise memory and Context windows of LLMs,Model Quantisation..

Textbooks:

1. *Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play* — David Foster (O'Reilly, 2nd Ed., 2023)
2. *Generative AI with Python and TensorFlow 2* — Joseph Babcock & Raghav Bali (Packt, 2021)

Reference books:

1. *Deep Learning* — Ian Goodfellow, Yoshua Bengio & Aaron Courville (MIT Press, 2016)
2. *Generative AI in Practice* — Bernard Marr (Wiley, 2024)
3. *Natural Language Processing with Transformers* — Lewis Tunstall, Leandro von Werra & Thomas Wolf (O'Reilly, 2022)
4. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* — Aurélien Géron (O'Reilly, 3rd Ed., 2022)

PE 741AI	INFORMATION RETRIEVAL SYSTEM					
Prerequisites	**Computer Networks and Web Technologies**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1: Understand the fundamentals of Information Retrieval systems and Boolean retrieval techniques.

2: Learn indexing, compression, and vector space models for efficient information retrieval.

3: Understand evaluation methods, relevance feedback, probabilistic, and language models for information retrieval.

4: Apply text classification and clustering techniques for organizing textual data.

5: Understand latent semantic indexing, web crawling, and link analysis in web search systems.

Course Outcomes
After completing this course, the student will be able to:

CO1: Explain Information Retrieval concepts and implement indexing and Boolean retrieval techniques.

CO2: Apply indexing, compression, and vector space models for efficient document retrieval.

CO3: Evaluate retrieval performance using relevance feedback, probabilistic, and language models.

CO4: Apply text classification and clustering algorithms for document organization.

CO5: Analyze latent semantic indexing, web crawling, and link analysis techniques for web search.

UNIT – I
Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.
Boolean Retrieval: An example information, building an inverted index, processing Boolean queries, the extended Boolean model versus ranked retrieval.
The term vocabulary and postings list: Document delineation and character sequence decoding, determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings, and Phrase queries.
Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, spelling correction

UNIT – II
Index construction: Hardware basics, blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.
Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.
Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, the vector space model for scoring, and Variant tf-idf functions.

UNIT – III
Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.
Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

Probabilistic information retrieval: Basic probability theory, The Probability Ranking Principle, The Binary Independence Model.
Language models for information retrieval: Language models, The query likelihood model.

UNIT – IV
Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection.
Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k-nearest neighbor, Linear versus nonlinear classifiers.
Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, **k-means.**
Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT – V
Matrix decompositions and Latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.
Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates, and shingling.
Web crawling and Indexes: Overview, Crawling, Distributing indexes, Connectivity servers. **Link analysis:** The Web as a graph, Page Rank, Hubs and Authorities.

Suggested Reading:
1 Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England, 2008.
2 David A. Grossman, Ophir Frieder, Information Retrieval–Algorithms and Heuristics, Springer, 2nd Edition (Distributed by Universities Press), 2004.
3 Gerald J Kowalski, Mark T Maybury. Information Storage and Retrieval Systems, Springer, 2000.
4 Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kaufmann Publishers, 2002.

PE 742AI	INTELLECTUAL PROPERTY RIGHTS					
Prerequisites	**Professional Ethics**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. To introduce the fundamentals and significance of Intellectual Property Rights (IPR).
2. To provide knowledge of trademarks, copyrights, patents, and trade secrets.
3. To familiarize students with national and international IPR laws, treaties, and agreements.
4. To understand the protection, registration, and management of intellectual property assets.
5. To develop awareness of emerging trends and global developments in Intellectual Property Rights.

Course Outcomes

1. Classify the intellectual property rights to provide the legal rights, patents, trademarks, copyrights and trade secrets.
2. Identify the world trade organization agreements for trade related intellectual properties rights and investments.
3. Infer the geographical Indications of international development of law for policy and legal issues.
4. Interpret the purpose in category of marks for the international trademark registration.
5. Utilize the new international developments for trademarks law, copyright law and patent law.

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international Organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, Selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights

and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

Textbooks:

1. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets — Deborah E. Bouchoux (Cengage Learning, 5th Ed.)

2. Intellectual Property Rights: Unleashing the Knowledge Economy — Prabuddha Ganguli (Tata McGraw-Hill, 2001)

Suggested Readings:

1. *Intellectual Property Law* — Lionel Bently & Brad Sherman (Oxford University Press, 5th Ed., 2022)
2. *Law Relating to Intellectual Property* — B.L. Wadehra (Universal Law Publishing, 5th Ed., 2012)
3. *Intellectual Property Rights in the WTO and Developing Countries* — C.M. Correa (Kluwer Law International, 2000)
4. *Patent It Yourself* — David Pressman & David E. Blau (Nolo Press, 17th Ed., 2022)

PE 743AI	MULTI MEDIA TECHNOLOGIES					
Prerequisites	**Computer Graphics Fundamentals**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To introduce the fundamentals of multimedia technologies and multimedia system components.
2. To provide knowledge of multimedia data representation, compression, and communication techniques.
3. To familiarize students with multimedia system architecture, databases, and information retrieval.
4. To understand multimedia authoring, interactive applications, and virtual reality technologies.
5. To develop the ability to design and implement multimedia applications for real-world scenarios.

Course Outcomes:

By the end of this course, the students will be able to

1. Demonstrate knowledge and understanding of the concepts, principles and theories of Multimedia Applications and Virtual environments.
2. Analyze and solve problems related to their expertise in Multimedia Applications and Virtual Environments.
3. Extend their basic knowledge to encompass new principles and practice
4. Demonstrate their computing, technical and theoretical skills by developing a substantial Multimedia application.
5. Plan, conduct and report on the development of a Multimedia Application

UNIT-I

Introduction to Multimedia: Concept of Non- Temporal and Temporal Media. Basic Characteristics of Non-Temporal Media; Images, Graphics, Text.

Basic Characteristics of Temporal Media: Video, Audio, and Animation. Hypertext and Hypermedia. Presentations: Synchronization, Events, Scripts and Interactivity, Introduction to Authoring Systems.

UNIT-II

Compression Techniques: Basic concepts of Compression.

Still Image Compression: JPEG Compression. Features of JPEG2000.

Video Compression: MPEG- 1&2 Compression Schemes, MPEG-4 Natural Video Compression.

Audio Compression: Introduction to speech and Audio Compression, MP3 Compression Scheme. Compression. Of synthetic. Graphical objects.

UNIT-III

Multimedia Systems Architecture: General Purpose Architecture for Multimedia Support: Introduction to Multimedia PC/Workstation Architecture, Characteristics of MMX instruction set,

I/O systems: Overview of USB port and IEEE 1394 interface, Operating System Support for Multimedia.

UNIT-4

Multimedia Information Management: Multimedia Database Design,

Content Based Information Retrieval: Image Retrieval, Video Retrieval, Overview of MPEG-7, Design of video-on-Demand Systems.

UNIT-5

Introduction to Virtual Reality and Virtual Reality Systems: Related Technologies, Tele-operation and Augmented Reality Systems Interface to the Virtual World-Input; Head and hand trackers, data globes, hap tic input devices. Interface to the Virtual World- Output, Stereo display, head- mounted display, auto-stereoscopic displays, holographic displays, hap tic and force feedback.

Textbooks:

1. *Multimedia Computing, Communications and Applications* — Ralf Steinmetz & Klara Nahrstedt (Pearson Education / Prentice Hall, 1995)
2. *Multimedia System Design* — Prabhat K. Andleigh & Kiran Thakrar (PHI Learning, 2nd Ed.)

Suggested Readings:

1. *Virtual Reality Systems* — John Vince (Pearson Education / Addison-Wesley, 1995)
2. *Multimedia Technology and Applications* — David Hillman (Galgotia Publications, 1998)
3. *Multimedia: Making It Work* — Tay Vaughan (McGraw-Hill / Osborne, 9th Ed., 2014)
4. *Introduction to Data Compression* — Khalid Sayood (Morgan Kaufmann, 5th Ed., 2017)

PE 744 AI	SOFTWARE PROCESS & PROJECT MANAGEMENT					
Prerequisites	**Software Engineering**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

The course will help to

1. Acquired Knowledge on phases in the life cycle of software development.
2. Acquired knowledge on project organization, project control and process instrumentation.
3. Acquired knowledge on software process management.
4. Develop managerial skills for software project development.
5. Understand software economics.

Course Outcomes:

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

CO1: Explain software process maturity models, software economics, and software life-cycle phases.

CO2: Understand project organization, process automation, and project control techniques.

CO3: Analyze software workflows, milestones, artifacts, and project metrics.

CO4: Apply project planning, estimation, scheduling, and risk management techniques.

CO5: Design and manage software projects using modern software project management practices.

UNIT - I

Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM,PSP, TSP).

UNIT – II

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

UNIT – III

Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments. Process Planning Work

breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT -IV

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT -V

CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles,Next-Generation software Economics, Modern Process Transitions.

Text Books:

1. Managing the Software Process, Watts S. Humphrey, Pearson Education
2. Software Project Management, Walker Royce, Pearson Education

Reference Books:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
2. Process Improvement essentials, James R. Persse, O'Reilly, 2006
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
4. Applied Software Project Management, Andrew Stellman& Jennifer Greene, O'Reilly, 2006

PE 745 AI	**PREDICTIVE ANALYTICS**					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. To introduce the fundamentals of predictive analytics and the data mining process.
2. To provide knowledge of data preparation, visualization, and preprocessing techniques.
3. To familiarize students with predictive modeling algorithms and data mining techniques.
4. To understand model evaluation, validation, and deployment strategies.
5. To develop the ability to build and apply predictive analytics models for data-driven decision making.

Course Outcomes:

CO1: Explain data mining concepts, KDD/CRISP-DM processes, applications, and challenges of data mining.

CO2: Apply data understanding, visualization, preprocessing, and data preparation techniques for mining tasks.

CO3: Develop predictive and descriptive models using various data mining techniques and algorithms.

CO4: Evaluate, compare, and validate data mining models using appropriate performance assessment methods.

CO5: Deploy, monitor, and update data mining models for real-world decision-making applications.

UNIT-I

Introduction to Data Mining Introduction, what is Data Mining? Concepts of Datamining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM,Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

UNIT-II

Data Understanding and Preparation Introduction, Reading data from various sources,Data visualization, Distributions and summary statistics, Relationships among variables,Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation,Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching,Partitioning data, Missing Values.

UNIT-III

Model development & techniques Data Partitioning, Model selection, Model

Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

UNIT-IV

Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Meta Level Modeling

UNIT-V

Deploying Model, Assessing Model Performance, Updating a Model.

Text Book:

1. Shmueli, G., Bruce, P. C., Gedeck, P., & Patel, N. R., *Data Mining for Business Analytics: Concepts, Techniques, and Applications in Python*, 4th Edition, Wiley, 2023.
2. Larose, D. T., & Larose, C. D., *Discovering Knowledge in Data: An Introduction to Data Mining*, 3rd Edition, Wiley, 2019.

Reference Books

1. Han, J., Kamber, M., & Pei, J., *Data Mining: Concepts and Techniques*, 4th Edition, Morgan Kaufmann, 2022.
2. Witten, I. H., Frank, E., Hall, M. A., & Pal, C. J., *Data Mining: Practical Machine Learning Tools and Techniques*, 4th Edition, Morgan Kaufmann, 2016.
3. Kotu, V., & Deshpande, B., *Predictive Analytics and Data Mining: Concepts and Practice with RapidMiner*, 2nd Edition, Morgan Kaufmann, 2019.
4. James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J., *An Introduction to Statistical Learning with Applications in Python*, 2nd Edition, Springer, 2023.

PE 751 AI	INFORMATION SECURITY LAB					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**2**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives

1. Learn classical cryptographic techniques.
2. Implement modern cryptographic algorithms.
3. Understand digital signatures and authentication.
4. Use open-source information security tools.
5. Analyze network security and defense mechanisms.

Course Outcomes

CO1: Implement classical cryptographic techniques.

CO2: Develop modern cryptographic algorithms.

CO3: Apply digital signature and authentication techniques.

CO4: Use open-source security tools for secure communication and analysis.

CO5: Analyze network security threats and implement defense mechanisms.

LIST OF EXPERIMENTS:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts
    a) Caesar Cipher
    b) Playfair Cipher
    c) Hill Cipher
    d) Vigenere Cipher
    e) Rail fence – row & Column Transformation
2. Implement the following algorithms
    a) DES
    b) RSA Algorithm
    c) Diffiee-Hellman
    d) MD5
    e) SHA-1
3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission andfor creating digital signatures (GnuPG)
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options

PC 752 AI	BIG DATA ANALYTICS LAB					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**2**	**2**
Evaluation	**CIE**	**25 Marks**	**SEE**		**50 Marks**	

Course Objectives

1. To provide practical knowledge of Hadoop Distributed File System (HDFS) and Hadoop ecosystem tools.
2. To develop skills in implementing MapReduce applications for big data processing.
3. To enable students to perform data manipulation and analysis using Apache Pig.
4. To introduce PIG Latin and HiveQL to process Big Data
5. To develop the ability to create and use User Defined Functions (UDFs) in Pig and Hive, Apache Spark.

Course Outcomes

CO1 : Understand Hadoop working environment.

CO2 : Develop and execute MapReduce programs for processing and analyzing large datasets.

CO3 : Write scripts using PIG to solve real world problems.

CO4 : Design and execute HiveQL queries for data storage, retrieval, sorting, grouping, and aggregation.

CO5 : Apply Hadoop ecosystem tools such as HDFS, Pig, Hive and Apache Spark to process Big Data.

List of Programs

1. Understanding and using basic HDFS commands.
2. Word count application using Mapper Reducer on single node cluster.
3. Working with files in Hadoop file system: Reading, Writing and Copying.
4. Write a Pig program to load a dataset and display its contents.
5. Write a Pig program to demonstrate the use of FOREACH and GENERATE operators.
6. Writing User Defined Functions / Eval functions for filtering unwanted data in Pig.
7. Retrieving user login credentials from /etc/passwd using Pig Latin.
8. Working with HiveQL: Create and Load Data into a Hive Table.
9. Demonstrate ORDER BY, SORT BY, GROUP BY, HAVING and Aggregate functions.
10. Writing User Defined Functions in Hive.
11. Write a Apache Spark program to create and display a DataFrame.
12. Write a Java Spark Program to filter records from a DataFrame based on a condition.

PW 753 AI	PROJECT WORK					
Prerequisites	**Software Engineering and Programming Skills**		**L**	**T**	**P**	**C**
			0	**0**	**6**	**3**
Evaluation	**CIE**	**50 Marks**	**SEE**		**-**	

Course Objectives:

1. To enhance practical and professional skills
2. To familiarize tools and techniques of systematic literature survey and documentation
3. To expose the students to industry practices and team work.
4. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following: Collection of project topics/descriptions from faculty members (Problems can also be invited from the industries)

- Grouping of students (max 3 in a group)
- Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills

Obtained in different courses, new technologies and current industry practices .This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide. Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes' presentation followed by 10 minutes' discussion.

3. Submit a technical write-up on the talk.

Atleast two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity)charts

SI 651 AI	SUMMER INTERNSHIP					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**0**	**1**
Evaluation	**CIE**	**50 Marks**	**SEE**		**50 Marks**	

Course Objectives

1. To give an experience to the students in solving real life practical problems with all its constraints.
2. To give an opportunity to integrate different aspects of learning with reference to real life problems.
3. To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes

After completing this course, the student will be able to

1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a pre-specified target, with limited scope, rather than taking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to pre-specified criteria.
4. Able to implement the selected solution and document the same

Summer Internship is introduced as part of the curriculum for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25Marks) followed by presentation before the committee constituted by the department (25Marks).One faculty member will coordinate the overall activity of Summer Internship.

Note:*Students have to undergo summer internship of 4 weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.

OE701AI	INTRODUCTION TO DEEP LEARNING					
Prerequisites	**Machine Learning and Artificial Intelligence**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. Understand the concept of neural networks, convolutional neural networks, and recurrent neural networks.
2. Implement deep learning algorithms, and learn how to train deep networks.
3. Gain in-depth knowledge of Tensor Flow along with its functions, operations, and the execution pipeline.
4. Understanding the major Architectures of Neural Networks and getting into the Convolutional neural Networks.
5. Understand the applications of implementing deep learning such as image processing, natural language processing, speech recognition, deep face - facial recognition system, etc.

Course Outcomes:

1. To understand the fundamentals of deep learning.
2. To be able to understand deep learning algorithms and design neural network.
3. To be able to train and implement a neural network.
4. To be able to have knowledge about convolutional neural networks.
5. To be able to apply neural networks in various fields.

UNIT – I

Artificial intelligence, Machine learning, and Deep learning - Artificial intelligence - Machine learning – Learning representations from data - The “deep” in deep learning - Understanding how deep learning works, in three figures -What deep learning has achieved so far- The promise of AI

UNIT – II

Getting started with neural networks - Anatomy of a neural network - Layers: the building blocks of deep learning - Models: networks of layers - Loss functions and optimizers: keys to configuring the learning process

The Neural Network-Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptron’s as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh

UNIT – III

Implementing Neural Networks in Tensor Flow - What is Tensor Flow? - How Does Tensor Flow Compare to Alternatives?- Installing Tensor Flow - Creating and ManipulatingTensor Flow Variables – Tensor Flow Operations - Placeholder Tensors - Sessions in Tensor Flow - Navigating Variable Scopes and Sharing Variables - Managing Models over the CPU and GPU

UNIT – IV

Introduction to Major Architectures of Deep Networks–Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks

UNIT –V

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

Text Books

1. Chollet, F., Deep Learning with Python, 2nd Edition, Manning Publications, 2021.
2. Buduma, N., & Locascio, N., Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, O'Reilly Media, 2017.

Reference Books

1. Goodfellow, I., Bengio, Y., & Courville, A., Deep Learning, MIT Press, 2016.
2. Patterson, J., & Gibson, A., Deep Learning: A Practitioner's Approach, O'Reilly Media, 2017.
3. Geron, A., Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, 2022.
4. Aggarwal, C. C., Neural Networks and Deep Learning: A Textbook, Springer, 2018.

SCHEME OF INSTRUCTION

Common to B.E (CSE(AI&ML), CSE(AI), AI&ML)

SEMESTER - VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	OE-III	Open Elective-III	3	-	-	3	30	70	3	3
2	PE	Professional Elective-V	3	-	-	3	30	70	3	3
3	PW861AI	Project Work-II	-	-	16	16	50	100	3	8
			6	**-**	**16**	**22**	**110**	**240**	**9**	**14**

Professional Elective -V	
Course code	**Course Title**
PE851AI	Block Chain Technologies
PE852AI	Robotics
PE853AI	Secure Software Engineering
PE854AI	Distributed Systems
PE855AI	Data Engineering

PE 851 AI	BLOCK CHAIN TECHNOLOGIES					
Prerequisites	**Information security and Cryptography**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To introduce the fundamentals of blockchain technology and distributed ledger systems.
2. To provide knowledge of blockchain architecture, cryptography, and consensus mechanisms.
3. To familiarize students with cryptocurrencies, smart contracts, and decentralized applications.
4. To understand blockchain security, regulations, and real-world applications.
5. To develop the ability to design, implement, and evaluate blockchain-based solutions.

Course Outcomes:

1. Understand the distributed databases
2. Explain about the blockchain technology
3. Explain Nakamoto consensus.
4. Learn about the cryptocurrency
5. Design, build, and deploy a distributed application.

UNIT-I

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. **Cryptography: Hash function, Digital Signature** - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

UNIT-II

Blockchain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

UNIT-III

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Bum, Difficulty Level, Sybil Attack, Energy utilization and alternate.

UNIT-IV

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, Vulnerability, Attacks, Side chain, Name coin

UNIT-V

Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Applications: Internet of Things, Medical record Management System, Domain Name Service, Future of Clock Chain

Case study: Naive Blockchain construction, Memory Hard algorithm - Hash cash implementation, Direct Acyclic Graph, Play with Go-Ethereum, Smart Contract Construction, Toy application using Block chain, Mining puzzles

Text Books

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
2. Bashir, I., Mastering Blockchain, 4th Edition, Packt Publishing, 2023.

Reference Books

1. Antonopoulos, A. M., Mastering Bitcoin: Programming the Open Blockchain, 2nd Edition, O'Reilly Media, 2017.
2. Antonopoulos, A. M., & Wood, G., Mastering Ethereum: Building Smart Contracts and DApps, O'Reilly Media, 2018.
3. Drescher, D., Blockchain Basics: A Non-Technical Introduction in 25 Steps, Apress, 2017.
4. Wattenhofer, R., The Science of the Blockchain, CreateSpace, 2016.

PE 852 AI	ROBOTICS					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. The objective of the course is to enable students to
2. Understand robot configuration, structures, basic components, workspace and generations of robots.
3. Get acquainted with performing spatial transformations and solve kinematics of the robot.
4. Get knowledge and analysis skills associated with trajectory planning.
5. Learn about various sensors, actuators, robot programming.

Course Outcomes

By the end of this course, the students will be able to

1. Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators.
2. Apply spatial transformation to obtain forward and inverse kinematics.
3. Solve robot dynamics problems, generate joint trajectory for path planning.
4. Describe the working principle of various sensors and program different operations.
5. Appreciate applications of robots in industry.

UNIT-1

Fundamentals of robot

Robot - Definition - Robot Anatomy - Co-ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load-Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT- 2

Robot drives systems and end effectors

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT-3

Sensors and machine vision

Requirements of a sensor, Principles and Applications of the following types of sensors-Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and

Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT- 4

Robot Kinematics and Robot Programming:

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

Unit 5

Implementation and robot economics

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Text Books

1. Craig, J. J., *Introduction to Robotics: Mechanics and Control*, 4th Edition, Pearson Education, 2018.
2. Groover, M. P., *Industrial Robotics: Technology, Programming, and Applications*, 2nd Edition, McGraw-Hill Education, 2020.
3. *Reference Books*
4. Klafter, R. D., Chmielewski, T. A., & Negin, M., *Robotic Engineering: An Integrated Approach*, 2nd Edition, Prentice Hall, 2003.
5. Fu, K. S., Gonzalez, R. C., & Lee, C. S. G., *Robotics: Control, Sensing, Vision, and Intelligence*, McGraw-Hill, 1987.
6. Niku, S. B., *Introduction to Robotics: Analysis, Control, Applications*, 3rd Edition, Wiley, 2020.
7. Deb, S. R., *Robotics Technology and Flexible Automation*, 3rd Edition, McGraw-Hill Education, 2017.

PE 853 AI	SECURE SOFTWARE ENGINEERING					
Prerequisites	**Information Security**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To introduce the fundamentals of secure software engineering and software security principles.
2. To provide knowledge of secure requirements engineering, architecture, and design practices.
3. To familiarize students with secure coding, testing, and software assurance techniques.
4. To understand software security challenges, vulnerabilities, and risk management throughout the SDLC.
5. To develop the ability to build, evaluate, and manage secure software systems using industry best practices.

Course Outcomes

CO1: Explain the fundamental concepts of software security, including software assurance, software threats, vulnerabilities, and secure software development challenges.

CO2: Apply secure requirements engineering principles using models such as SQUARE to elicit, analyze, and prioritize security requirements in software systems.

CO3: Analyze secure software architecture and design principles, including architectural risk analysis, security guidelines, and attack patterns to build secure systems.

CO4: Apply secure coding practices and testing techniques to identify vulnerabilities, perform code analysis, and ensure security throughout the software development lifecycle.

CO5: Evaluate governance models and security frameworks to manage secure software development, including maturity models, project management practices, and enterprise-level security strategies.

UNIT – I

Security a software Issue: Introduction, The Problem, Software Assurance and Software Security, Threats to software security, Sources of software insecurity, Benefits of detecting software security defects early, managing secure software development

What Makes Software Secure: Defining Properties of secure software, Influencing the security properties of software, Asserting and specifying desired security properties

UNIT – II

Requirements Engineering for secure software: Introduction, The SQUARE process Model, Requirements elicitation and prioritization.

UNIT – III

Secure Software Architecture and Design: Introduction, Software Security Practices for

Architecture and Design: Architectural risk analysis, Software Security Knowledge for Architecture and Design: Security Principles, Security Guidelines, and Attack Patterns.

Secure Coding and Testing: Introduction, Code analysis, Coding Practices, Software Security Testing, Security Testing considerations throughout the SDLC.

UNIT – IV

Security and Complexity:

System Assembly Challenges: Introduction, Security Failures, Functional and Attacker Perspectives for Security Analysis, System Complexity Drivers and Security, Deep Technical Problem Complexity.

UNIT – V

Governance and Managing for More Secure Software:

Governance and security, Adopting an Enterprise Software Security Framework, How much security is enough?, Security and project management, Maturity of Practice.

Text Books

1. Allen, J. H., Barnum, S. J., Ellison, R. J., McGraw, G., & Mead, N. R., *Software Security Engineering: A Guide for Project Managers*, Addison-Wesley Professional, 2008.
2. McGraw, G., *Software Security: Building Security In*, Addison-Wesley Professional, 2006.

Reference Books

1. Anderson, R. J., *Security Engineering: A Guide to Building Dependable Distributed Systems*, 3rd Edition, Wiley, 2020.
2. Howard, M., & LeBlanc, D., *Writing Secure Code*, 2nd Edition, Microsoft Press, 2003.
3. Graff, M., & van Wyk, K. R., *Secure Coding: Principles and Practices*, O'Reilly Media, 2003.
4. Grembi, J., *Developing Secure Software*, Cengage Learning, 2008.

PE 854 AI	DISTRIBUTED SYSTEMS					
Prerequisites	**Computer Networks and Operating Systems**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives

1. To acquire an understanding of the issues in distributed systems.
2. To learn about Naming and synchronization with different algorithms.
3. To study architectures and working of Distributed file systems, Distributed web-based system
4. To expose the students to distributed transaction management, security issues and replication.
5. To introduce Emerging trends in distributed computing

Course Outcomes

1. List the principles of distributed systems and describe the problems and challenges associated with these principles
2. Know about interposed communication and remote communication.
3. Know Distributed Computing techniques, Synchronous and Processes.
4. Know Distributed File Systems Apply Distributed web-based system. Understand the importance of security in distributed systems
5. Know distributed service oriented architecture.

UNIT-I

Introduction: Characteristics & Properties of Distributed Systems – Taxonomy - Types of Distributed Systems Design goals–Transparency Issues**.**

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware,and Self-Management in Distributed Systems.

Processes: Threads, Virtualization, Software Agents, Clients, Servers, and Code Migration. **Communication:** Inter process communication Mechanisms, Remote Procedure Call, Remote Method Invocation, Message-Oriented Communication, Stream- OrientedCommunication, and Multicast Communication.

UNIT-II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming and Attribute-Based Naming.

Synchronization: Clock Synchronization, Logical Clocks, Mutual Exclusion, GlobalPositioning of Nodes, and Election Algorithms**.**

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols**.**

UNIT-III

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client- Server Communication, Reliable Group Communication, Distributed Commit, and Recovery. Distributed **Object-Based Systems:** CORBA, DCOM, GLOBE -Architecture, Processes, Communication, Naming, Synchronization, ConsistencyandReplication, FaultTolerance, aNd Security.

UNIT-IV

Distributed File Systems: File system, DFS-definition, Characteristics, Goals, SUNNFS-NFS Architecture, NFS Implementation, Protocols, The CODA file system-Design Overview, An Example, Design Rational, Implementation, The GOOGLE file system-Definition, Architectures, GFSArchitecture Distributed Web-Based Systems: Traditional Web-Based Systems, Web Services Fundamentals, The Apache Web Server, Web Server Clusters, Communication, HTTP Fundamentals, Simple Object Access Protocol SOAP, Web Proxy Caching, Replication for Web Hosting Systems-CDN'S, Service-Oriented Architectures, REST and Web Services

UNIT-V

Distributed Coordination-Based Systems-Architecture, Naming and Security

Emerging Trends in Distributed Systems - Emerging Trends Introduction, Grid Computing, Cloud Computing and its roots in distributed systems mechanisms and self-management of distributed systems, Virtualization, Service Oriented Architecture, The Future of Emerging Trends.

Map-Reduce: Example, Scaling, Programming Model, Apache Hadoop, Amazon Elastic MapReduce, Mapreduce.net, Pig and Hive.

Text Books

1. Tanenbaum, A. S., & Van Steen, M., *Distributed Systems: Principles and Paradigms*, 3rd Edition, Pearson Education, 2017.
2. Coulouris, G., Dollimore, J., Kindberg, T., & Blair, G., *Distributed Systems: Concepts and Design*, 5th Edition, Pearson Education, 2012.Reference Books
3. Mahajan, S., & Shah, S., *Distributed Computing*, Oxford University Press, 2010.
4. Sinha, P. K., *Distributed Operating Systems: Concepts and Design*, PHI Learning.
5. Buyya, R., Broberg, J., & Goscinski, A., *Cloud Computing: Principles and Paradigms*, Wiley, 2013.
6. Hill, R., Hirsch, L., Lake, P., & Moshiri, S., *Guide to Cloud Computing: Principles and Practice*, Springer, 2013.

PE 855 AI	DATA ENGINEERING					
Prerequisites	**Database Management Systems and Data Warehousing Concepts**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. To introduce the fundamentals of data engineering and modern data processing systems.
2. To provide knowledge of data acquisition, data modeling, and ETL processes.
3. To familiarize students with data engineering frameworks and big data tools.
4. To understand APIs and their role in data integration and analytics applications.
5. To develop the ability to build scalable data engineering solutions for data-driven applications.

Course Outcomes:

At the end of this course the student will be able to

CO1 Acquire Knowledge on principles of data engineering

CO2 Study the data engineering design process to acquire data and develop data modeling methods for their evaluation

CO3 Explain data engineering frameworks and Big data tools

CO4 Understand the Categories of API

CO5 Learn and Understand data science projects using API

UNIT - I

Introduction

Data Scientist vs Data Engineer vs Data Analyst – Definition of Data Engineering? – Explaining the Data Pipeline, Data Warehouse and Data Engineer Role – Explaining Data Engineering and Data Warehouse- Building Data Warehouse: Understanding the Data Pipeline – Beyond Data Warehousing: Big Data Engineering – The Role of Data Engineer –The Hierarchy of Analytics – Building Data Foundations & Warehouses – ETL: Extract, Transform, and Load – Choosing ETL Frameworks – Two Paradigms: SQL vs. JVM – Centric ETL.

UNIT - II

Data Acquisition and Data Modelling

Data Acquisition – Data Gathering and Preparation – Data Cleaning – Storage – Data Modeling, Normalization and Star Schema – Data Partitioning by Datestamp– Backfilling Historical Data – Defining the Directed Acyclic Graph (DAG) – Operators: Sensors, Operators and Transfers – ETL Best Practices to follow.

UNIT - III

Data Engineering Frameworks and Big Data Tools

A Common Scenario – From Pipelines To Frameworks – Design Patterns For Data Engineering Frameworks – Incremental Computation Framework – Backfill Framework – Global Metrics Framework – Experimentation Reporting Framework – Data Warehousing / Big Data Tools – Hadoop and MapReduce– Hive and PIG– Apache Spark

UNIT - IV

Categories of API

Overview – Categories of API – Difference between an API and a Library – Walk through an example – 5 APIs – Facebook API – Google Map API – Twitter API – IBM Watson API –Quandl PI

UNIT - V

Data science projects using API

Data science projects using API – Social Media Sentiment Analysis – Introduction to Sentiment Analysis – Sentiment Analysis Use Cases – Sentiment Classification – Challenges of Sentiment Analysis– Opinion Mining – Applications – Challenges – Stock Prediction

Text Books

1. Reis, J., & Housley, M., Fundamentals of Data Engineering: Plan and Build Robust Data Systems, O'Reilly Media, 2022.
2. Bajraktari, M., Data Engineering with Python, Packt Publishing, 2021.

Reference Books

1. La Bella, L., Becoming a Data Engineer, Rosen Publishing Group, 2017.
2. Kleppmann, M., Designing Data-Intensive Applications, O'Reilly Media, 2017.
3. White, T., Hadoop: The Definitive Guide, O'Reilly Media, 2015.
4. Karau, H., Warren, R., et al., Learning Spark, O'Reilly Media, 2020.

PW 861 AI	PROJECT WORK - II					
Prerequisites	**Programming skills and Software Engineering**		**L**	**T**	**P**	**C**
			0	**0**	**16**	**8**
Evaluation	**CIE**	**50 Marks**	**SEE**		**100 Marks**	

Course Objectives

1. To enhance practical and professional skills
2. To familiarize tools and techniques of systematic Literature survey and documentation
3. To expose the students to industry practices and team work.
4. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes

By the end of this course, the students will be able to

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skills

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project Work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee composed of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.

OE 801 AI	HUMAN COMPUTER INTERACTION					
Prerequisites			**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**30 Marks**	**SEE**		**70 Marks**	

Course Objectives:

1. To introduce interaction frameworks and styles
2. To learn about interaction design process, design standards and principles
3. To introduce the concept of usability and usability testing
4. To familiarize interface components and technical issues of concern.
5. To design systems that make them accessible, usable, efficient, and safe for anyone and everyone

Course Outcomes:

Student will be able to:

1. Ability to specify, design and implement a prototype that involves significant human computer interaction.
2. Describe typical human–computer interaction (HCI) models and styles, as well as various historic HCI paradigms.
3. Understand that the interfaces' design emerges iteratively, through repeated design–evaluation–redesign cycles involving users.
4. Outline how to characterize the user experience in terms of usability, user experience goals, and design principles.
5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.

UNIT- I

Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms

Interaction Frameworks and Styles: Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles.

UNIT- II

Interaction Design **Process:** Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models

Discovery: Discovery Phase Framework, Collection, Interpretation, Documentation

Design: Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface

UNIT- III

Design Principles: Principles of Interaction Design, Comprehensibility, Learn ability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity, Proportion,Screen Complexity, Resolution/Closure, and Usability Goals

Interaction Design Models: Model Human Processor, Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models

Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data

UNIT- IV

Interface Components: The WIMP Interface, Other Components

Icons: Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons. **Color:** The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color

UNIT- V

Text: Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues **Concerning Text Speech and Hearing:** The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound Touch and Movement: The Human Perceptual System, Using Hap-tics in Interaction Design, Technical Issues Concerning Hap-tics

Text Books

1. Preece, J., Rogers, Y., & Sharp, H., *Interaction Design: Beyond Human-Computer Interaction*, 5th Edition, Wiley, 2019.
2. Shneiderman, B., et al., *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 6th Edition, Pearson, 2016.

Reference Books

1. Heim, S., *The Resonant Interface: HCI Foundations for Interaction Design*, Addison-Wesley, 2007.
2. Dix, A., Finlay, J., Abowd, G., & Beale, R., *Human-Computer Interaction*, 3rd Edition, Pearson, 2004.
3. Norman, D. A., *The Design of Everyday Things*, Revised Edition, Basic Books, 2013.
4. Shneiderman, B., & Plaisant, C., *Designing the User Interface*, 5th Edition, Addison-Wesley, 2009.

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B.E CSE(AIML)

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