SCHEME OF INSTRUCTION & EXAMINATION
AICTE Model Curriculum

B.E.VII – Semester CSE (Artificial Intelligence &Machine Learning)

Proposed for the Academic Year 2023-2024

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC701CSM	Information Security	3	-	-	3	30	70	3	3
2	PC702CSM	Big Data Analytics	3		-	3	30	70	3	3
3	PE-III	Professional Elective-III	3	-	-	3	30	70	3	3
4	PE-IV	Professional Elective-IV	3	-	-	3	30	70	3	3
5	OE-II	Open Elective-II	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
6	PC751CSM	Information Security Lab	-	-	2	2	25	50	2	1
7	PC752CSM	Big Data Analytics Lab	-	-	2	2	25	50	2	1
8	PW753CSM	Project Work-I	-	-	6	6	50	-	-	3
9	SI754CSM	Summer Internship	-	-	-	-	50	50	-	2
			15	**0**	**10**	**25**	**300**	**450**	**-**	**22**

Professional Electives -III	
Course Code	**Course Title**
PE731CSM	Advanced Operating Systems
PE732CSM	Multimedia Technologies
PE733CSM	Software Process & Project Management
PE734CSM	Predictive Analytics

Professional Electives -IV	
Course Code	**Course Title**
PE741CSM	Data Visualization
PE742CSM	Information Retrieval Systems
PE743CSM	Intellectual Property Rights
PE744CSM	Cloud Computing

Open Elective -II	
Course Code	**Course Title**
OE701AL	Introduction to Deep Learning

Information Security

PC 701 CSM

Instruction:	3L per week
Duration of SEE:	3 hours
CIE:	30 marks
SEE:	70 marks

Credits: 3

Course Objectives:

Students will try:

1. To learn legal and technical issues in building secure information systems
2. To provide an understanding of network security
3. To expose the students to security standards and practices

Course Outcomes:

After completing this course the student will able to:

1. Describe the steps in Security Systems development life cycle (SecSDLC)
2. Understand the legal and ethical issues, common threats and attack to information systems
3. Identify security needs using risk management and choose the appropriate risk control strategy based on business needs
4. Use the basic knowledge of security frameworks in preparing security blue print for the organization
5. Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools
6. Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols
7. Understand the technical and non-technical aspects of security project implementation and Accreditation

UNIT-1 -

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 2

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 3

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 4

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 5

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, Cruptographu 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

Big Data Analytics

PC 702 CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks

Credits :3

Course Objectives:

Students will try:

- Understand big data for business intelligence.
- Identify business case studies for big data analytics.
- Defend big data Without SQL.
- Discuss the process of data analytics using Hadoop and related tools.

Course Outcomes:

After completing this course the student will able to:

1. Demonstrate big data and use cases from selected business domains.
2. Apply the knowledge of NoSQL big data management and experiment with Install, configure, and run Hadoop and HDFS.
3. Analyze map-reduce analytics using Hadoop.
4. Adapt Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics.

UNIT-1

Understanding Big Data: Characteristics of Data, Introduction to Big Data and its importance, Challenges posed by Big Data, Big data analytics and its classification, Big data applications: big data and healthcare – big data in banking – advertising and big data, big data technologies

Unit 2

Hadoop Distributed File System: Hadoop Ecosystem, Hadoop Architecture, HDFS Concepts, Blocks, Name nodes and Data nodes, Hadoop File Systems, The Java Interface, Reading Data from a Hadoop URL, Writing Data, Querying the File System, Deleting Data.

Unit 3

NOSQL Data Management: Introduction to NOSQL – aggregate data models, aggregates key value and document data models, relationships – graph databases, schema less databases, Sharding - map reduce – partitioning and combining – composing map-reduce calculations.

Unit 4

Map Reduce and Yarn: Hadoop Map Reduce paradigm, Map and Reduce tasks, Job and Task trackers, Mapper, Reducer, Map Reduce workflows, classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – Map Reduce types – input formats – output formats

Unit 5

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators. Hive: The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data.

Suggested Reading:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012, ISBN -13: 978-1449311520, ISBN-10: 1449311520
2. Pramod Sadalage, Martin Fowler, "NoSQL Distilled - A brief guide to the emerging world of polyglot", Addison Wesley 2013
3. Eric Sammer, "Hadoop Operations", O'Reilly, 2012, ISBN -13 978-1449327057, ISBN-10: 1449327052
4. VigneshPrajapati, Big data analytics with R and Hadoop, 2013, ISBN -13: 978-1782163282
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012, ISBN -13: 978-1449319335

Advanced Operating Systems

PE731 CSM

Instruction:	3L per week
Duration of SEE:	3 hours
CIE:	30 marks
SEE:	70 marks

Credits: 3

Course Objectives

- To get a comprehensive knowledge of the architecture of distributed systems.
- To understand the deadlock and shared memory issues and their solutions in distributed environments.
- To get a knowledge of resource Management and Distributed Scheduling
- To know the security issues and protection mechanisms for distributed environments.
- To get a knowledge of multiprocessor operating system and database operating systems.

Course Outcomes

After completing this course, the student will be able to

1. Understand the design approaches of advanced operating systems
2. Analyse the design issues of distributed operating systems.
3. Evaluate design issues of multi-processor operating systems.
4. Identify the requirements Distributed Shared Memory.
5. Formulate the solutions to schedule the real time applications.

Unit - I:

Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems.

Theoretical Foundations: Introduction, limitations of a distributed system, Lamport's logical clocks, vector clocks, causal ordering of messages, Global state reordering algorithm, Cuts of a distributed computation, termination detection.

Unit - II:

Distributed mutual exclusion: Lamport's algorithm, Ricart-Agrawala Algorithm, Maekawa algorithm, Suzuki-Kasami algorithm, Raymond's tree based algorithm.

Distributed Deadlock Detection -Introduction, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

UNIT – III:

Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.

Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues

UNIT- IV:

Multiprocessor operating systems - Basic multiprocessor system architectures – inter connection networks for multiprocessor systems – caching – hypercube architecture.

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration

Unit –V:

Protection and security -Preliminaries, the access matrix model and its implementations.-safety in matrix model- advanced models of protection.

Data security – cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography – multiple encryption – authentication in distributed systems.

Suggested Readings:

1. Mukesh Singhal, Niranjan G. Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw-Hill Edition 2001
2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems Pearson Prentice Hall, Edition – 2, 2007
3. Kskhemkalyani, A and Singhal, M. Distributed computing: Principles, Algorithms, and systems. Cambridge University Press.

Multimedia Technologies

PE732CSM

Instruction:	3L per week
Duration of SEE:	3 hours
CIE:	30 marks
SEE:	70 marks

Credits: 3

Course Objectives

1. To give each student a firm grounding in the fundamentals of the underpinning technologies in graphics, distributed systems and multimedia.
2. To teach students about the principled design of effective media for entertainment, communication, training and education.
3. To provide each student with experience in the generation of animations, virtual environments and multimedia applications, allowing the expression of creativity.
4. To provide each student with a portfolio of their own completed work at the end of the programme.

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-IV

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-V

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.

Suggested Readings:

1. Andleigh and Thakarar, Multimedia System Design,PHI
2. David Hillman, Multimedia Technology & Application, Galgotia Publications.
3. Steinmetz, Multimedia Computing Communication and Application, Pearson Education.
4. John Vince, Virtual Reality Systems, Pearson Education

SOFTWARE PROCESS & PROJECT MANAGEMENT

PE733CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks
Credits :3	

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 learning the concepts of this course , the student is able to

1. Gain knowledge of software economics, phases in the lifecycle of software development.
2. Understand project organization, project control and process instrumentation.
3. Analyze the major and minor milestones, artifacts and metrics from management and technical perspective
4. Design software product using conventional and modern principles of software project management.

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

Predictive Analytics

PE 734 CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks
Credits :3	

Course Objectives: The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.

Course Outcomes

1. Understand prediction-related principles, theories and approaches.

2. Learn model assessment and validation.

3. Understand the basics of predictive techniques and statistical approaches.

4. Analyze supervised and unsupervised algorithms.

UNIT - I

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

UNIT - II

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error.

UNIT - III

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting,

Examples (Spam data, California housing, New Zealand fish, Demographic data).

UNIT - IV

Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification,

Reproducing Kernels, SVM for regression, K-nearest – Neighbour classifiers (Image Scene Classification).

UNIT - V

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis**.**

TEXT BOOK:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.

REFERENCE BOOKS:

1. C.M.Bishop –Pattern Recognition and Machine Learning, Springer, 2006.

2. L. Wasserman-All of statistics.

3. Gareth James. Daniela Witten. Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R.

Data Visualization

PE741 CSM

Instruction :	**3L per week**
Duration of SEE :	**3 hours**
CIE :	**30 marks**
SEE :	**70 marks**
Credits :3	

Course Objectives:

The objectives of the course are:

1. To learn different statistical methods for Data visualization.
2. To learn basics of R and Python.
3. To learn usage of Watson studio.
4. To learn about packages Numpy, pandas and matplotlib.
5. To learn functionalities and usages of Seaborn.

Course Outcomes:

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

1. Apply statistical methods for Data visualization.
2. Gain knowledge on R and Python
3. Understand usage of various packages in R and Python.
4. Demonstrate knowledge of Watson studio.
5. Apply data visualization tools on various data sets.

UNIT I

Introduction to Statistics**:** Introduction to Statistics, Difference between inferential statistics and descriptive statistics, Inferential Statistics- Drawing Inferences from Data, Random Variables, NormalProbability Distribution, Sampling, Sample Statistics and Sampling Distributions. R overview and Installation- Overview and About R, R and R Studio Installation, Descriptive Data analysis using R, Description of basic functions used to describe data in R.

UNIT II

Data manipulation with R: Data manipulation packages, Data visualization with R. Data visualization in Watson Studio: Adding data to data refinery, Visualization of Data on Watson Studio.

UNIT III

Python: Introduction to Python, How to Install, Introduction to Jupyter Notebook, Python scripting basics, Numpy and Pandas.

UNIT IV

Data Visualization Tools in Python- Introduction to Matplotlib, Basic plots using matplotlib, Specialized Visualization Tools using Matplotlib, Advanced Visualization Tools using Matplotlib Waffle Charts, Word Clouds.

UNIT V

Introduction to Seaborn: Seaborn functionalities and usage, Spatial Visualizations and Analysis in Python with Folium, Case Study.

Suggested Reading*:*

1. Core Python Programming - Second Edition, R. Nageswara Rao, Dream tech Press.
2. R Graphics Essentials for Great Data Visualization by Alboukadel Kassambara

INFORMATION RETRIEVAL SYSTEM

PE742 CSM

Instruction :	**3L per week**
Duration of SEE :	**3 hours**
CIE :	**30 marks**
SEE :	**70 marks**

Credits :3

Course Objectives:

1. To Demonstrate genesis and diversity of information retrieval situations for text and hyper media.
2. To Analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia
3. To Demonstrate Information visualization technologies like Cognition and perception in the Internetor Web search engine.

Course Outcomes:

Student will be able to:

1. Describe models like vector-space, probabilistic and language models to identify the similarity of query and document
2. Implement clustering algorithms like hierarchical agglomerative clustering and k-means algorithm.
3. Understand natural language systems to build semantic networks for text.
4. Understand the measures to evaluate the performance of cross language information

UNIT – I: Introduction: Retrieval strategies: vector space model, Probabilistic retrieval strategies: Simple term weights, Non-binary independence model, Language models.

UNIT – II: Retrieval Utilities: Relevance feedback, clustering, N-grams, Regression analysis, Thesauri.

UNIT – III: Retrieval utilities: Semantic networks, parsing Cross –Language: Information Retrieval: Introduction, Crossing the Language barrier.

UNIT – IV: Efficiency: Inverted Index, Query processing, Signature files, Duplicate document detection.

UNIT – V: Integrating structured data and text. A historical progression, Information retrieval as relational application, Semi Structured search using a relational schema. Distributed Information Retrieval: A theoretical Model of Distributed retrieval, web search

Text books:

- David A. Grossman, OphirFrieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition(Distributed by Universal Press), 2004

Reference books:

1. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theoryand Implementation, Springer, 2004.
2. SoumenChakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
3. Christopher D Manning, PrabhakarRaghavan, HinrichSchutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009.

Intellectual Property Rights

PE 743 CSM

Instruction:	3L per week
Duration of SEE:	3 hours
CIE:	30 marks
SEE:	70 marks

Credits: 3

Course Objectives:

1. The knowledge on world trade organization, trade agreements and investments.
2. The importance of intellectual property rights to develop trade mark law, copy right law and patent law.
3. The new developments in the law of intellectual property rights in order to bring progressive changes towards a free market society and international trade practices under the trade related Intellectual Property Rights Agreement (TRIPS).

Course Outcomes

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

1. Classify the intellectual property rights to provide the legal rights, patents, trademarks, copyrights and trade secrets.
2. Relate the World Intellectual Property organization to protect intellectual property rules and policies.
3. Identify the world trade organization agreements for trade related intellectual properties rights and investments.
4. Outline the importance of intellectual property in organizations of different industrial sectors for the purpose of product and technology development.
5. Infer the geographical Indications of international development of law for policy and legal issues.
6. Interpret the purpose in category of marks for the international trademark registration.
7. Extend the fundamentals of copyright law and originality of material for the rights of reproduction.
8. Demonstrate the international copyright law with respect to ownership for the registration of copyright.
9. Summarize the trade secrets determination, misappropriation and protection for submission and litigation.
10. 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.

Suggested Readings:

1. Deborah. E. Bouchoux, Intellectual property right, Cengage learning.
2. Prabuddha ganguli, Intellectual property right – Unleashing the knowledge economy Tata McGraw Hill Publishing company ltd

CLOUD COMPUTING

PE744 CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks

Credits :3

Course Objectives:

1. To understand the concept of cloud computing
2. To understand the various issues in cloud computing.
3. To familiarize themselves with the lead players in cloud.
4. To appreciate the emergence of the cloud as the next generation computing paradigm.

Course Outcomes

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

1. Define Cloud Computing and related concepts and describe the characteristics, advantages, risks and challenges associated with cloud computing.
2. Explore virtualization technique
3. Explore characterize various cloud service models, cloud deployment models
4. Illustrate the use of various cloud services available online

UNIT - I

Introduction - Historical Development -System Models for Distributed and Cloud Computing; Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics

Cloud Deployment Models: Public, Private, Community, Hybrid Clouds, Challenges and Risks, Cloud Delivery Models: IaaS, PaaS, SaaS.

UNIT - II:

Virtual Machines & Cloud Computing Mechanism: Levels of Virtualization, Virtualization Structures//Tools, and Mechanisms,

Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization Desktop virtualization Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, **Cloud Infrastructure Mechanism:** Cloud Storage, Cloud Usage Monitor .

UNIT – III:

State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System,

UNIT- IV:

Cloud Security and Trust Management, Data Security in the Cloud: An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, Crypt DB: Onion Encryption layers DET, RND, OPE, JOIN, SEARCH, HOM, and Homomorphic Encryption.

UNIT –V:

Case Studies: Google App Engine (GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services (AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack, Migrating into a Cloud Introduction, Challenges

while migrating to Cloud, Broad approaches to migrating into the cloud why migrate -deciding on cloud migration, the Seven-step model of migration into a cloud, Migration Risks and Mitigation

Suggested Reading:

1. Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Cloud computing a practical approach - TATA McGraw- Hill , New Delhi – 2010
2. Thomas Erl, ZaighamMahood, Ricardo Puttini, ―Cloud Computing, Concept, Technology and Architecture‖, Prentice Hall, 2013.
3. K. Chandrasekhran, Essentials of cloud Computing: CRC press, 2014
4. John W. Rittinghouse, James F. Ransome, "Cloud Computing: Implementation, Management, and Security ". CRC Press 2009
5. Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Cloud computing a practical approach - TATA McGraw- Hill , New Delhi – 2010
6. Raluca Ada Popa, Catherine M.S. Redfield, NickolaiZeldovich, and Hari Balakrishnan, “CryptDB: Protecting Confidentiality with encrypted Query Processing”, 23rd ACM Symposium on Operating Systems Principles (SOSP 2011), Cascais, Portugal October 2011.
7. Craig Gentry, A Fully Homomorhic Encryption Scheme, September 2009.
8. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.
9. Rajkumar Buyya, James Broberg, Andrzej Goscinski,Cloud Computing (Principles and Paradigms), Edited by John Wiley & Sons, Inc. 2011

Information Security Lab

PC 751 CSM

Instruction:	2 per week
Duration of SEE:	2 hours
CIE:	25 marks
SEE:	50 marks

Credits: 1

Course Objectives:

Students will try:

1. Learn to implement the algorithms DES, RSA,MD5,SHA-1
2. Learn to use network security tools like GnuPG, KF sensor, Net Strumbler

Course Outcomes:

Student will able to:

1. Implement the cipher techniques
2. Develop the various security algorithms
3. Use different open source tools for network security and analysis

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
1. Implement the following algorithms
    a) DES
    b) RSA Algorithm
    c) Diffiee-Hellman
    d) MD5
    e) SHA-1
2. Implement the Signature Scheme - Digital Signature Standard
3. Demonstrate how to provide secure data storage, secure data transmission and forcreating digital signatures (GnuPG)
4. Setup a honey pot and monitor the honeypot on network (KF Sensor)
5. Installation of rootkits and study about the variety of options

Big Data Analytics Lab

PC 752 CSM

Instruction :	**2 per week**
Duration of SEE :	**2 hours**
CIE :	**25 marks**
SEE :	**50 marks**

Credits :1

Course Objectives:

Students will try:

1. To provide the knowledge to setup a Hadoop Cluster
2. To impart knowledge to develop programs using MapReduce Technique
3. To learn file handling in HDFS
4. To introduce Pig, PigLatin and HiveQL to process big data
5. To learn machine learning operations using Mahout Hadoop
6. To introduce NoSQL databases

Course Outcomes:

Student will able to:

1. Understand Hadoop working environment
2. Work with big data applications in multi node clusters
3. Write scripts using Pig to solve real world problems
4. Write queries using Hive to analyse the datasets
5. Apply big data and echo system techniques for real world

List of Experiments to be performed

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. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
5. Retrieving user login credentials from /etc/passwd using Pig Latin
6. Working with HiveQL.
7. Writing User Defined Functions in Hive

Suggested reading:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, April 2015.
2. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.

PROJECT WORK 1

PW 753 CSM

Instruction : **6 per week**

Duration of SEE : **6 hours**

CIE : **50 marks**

Credits :3

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.

At least 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
- Presentation- oral and written.

Summer Internship

SI754 CSM

Duration of SEE : 2 hours
CIE : 50 marks
Credits :2

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.*

INTRODUCTION TO DEEP LEARNING

OE 721 CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks

Credits :3

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 TensorFlow 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:

After completing this course, students will be able to:

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

What is deep learning? 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 TensorFlow - What is TensorFlow? - How Does TensorFlow Compare to Alternatives- Installing TensorFlow - Creating and Manipulating TensorFlow Variables - TensorFlow Operations - Placeholder Tensors - Sessions in TensorFlow - 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

Suggested Reading:

1. Nikhil Buduma and Nicholas Locascio - Fundamentals of Deep Learning : Designing Next-Generation Machine Intelligence Algorithms – First Edition - O'Reilly , 2017

2. Francois Chollet-Deep Learning with Python-Second Edition,Manning Publications, 2017.

3. Josh Patterson and Adam Gibson- Deep Learning: A Practitioner's Approach - First Edition - O'Reilly , 2017

4. Ian Goodfellow, Yoshua Bengio, Aaron Courville - Deep Learning – Second Edition- MIT Press , 2016.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. - VIII SEMESTER
CSE (AI&ML)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	OE-III	Open Elective-III	3	-	-	3	30	70	3	3
3	PE-V	Professional Elective-V	3	-	-	3	30	70	3	3
4	PW861CSM	Project Work-II	-	-	16	16	50	100	3	8
			6	**-**	**16**	**22**	**110**	**240**	**9**	**14**

Professional Elective -V	
PE851CSM	Internet Of Things
PE852CSM	Robotics
PE853CSM	Secure Software Engineering
PE854CSM	Distributed Systems

Open Elective -III	
OE831CSM	Human Computer Interaction

INTERNET OF THINGS

PE851CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks

Credits :3

Course Objectives

1. To introduce the terminology, technology and its applications
2. To introduce the Python Scripting Language which is used in many IoT devices
3. To introduce the Raspberry PI platform, that is widely used in IoT applications
4. To introduce the implementation of web-based services on IoT devices

Course Outcomes

After completing this course, the student will be able to

1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.
2. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules
3. Market forecast for IoT devices with a focus on sensors
4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

UNIT - I:

Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT- II:

IoT Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT – III:

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

UNIT- IV:

Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT –V:

IoT Physical Servers and Cloud Offerings– Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework designing a RESTful web API. Industrial IoT : Agriculture, Healthcare, Activity Monitoring

Suggested Readings:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350239759 3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
3. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
4. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
5. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
6. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
7. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

ROBOTICS

PE852CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks

Credits :3

Course Objectives

1. To understand the functions of the basic components of a Robot.
   To study the use of various types of End of Effectors and Sensors
2. To impart knowledge in Robot Kinematics and Programming
3. To learn Robot safety issues and economics.

Course Outcomes

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

1. To apply the basic engineering knowledge for the design of robotics

UNIT-I

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- II

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-III

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- IV

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 V

Implementation and robot economics

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

Suggested Readings:

1. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.
2. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.
3. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008
4. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.
5. Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co., 1992.
6. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
7. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.
8. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.
9. Surender Kumar, "Industrial Robots and Computer Integrated Manufacturing", Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

SECURE SOFTWARE ENGINEERING

PE853CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks
Credits :3	

Course Objectives

1. To understand that how the security aspects of software development are embedded into the system to be developed.
2. Able to learn secure architecture design, secure coding, secure deployment and secure software development methodologies

Course Outcomes

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

1. Explain why security is a software issue.
2. Detail the principles and practices of secure software design.
3. Describe the principles and practices of secure software coding and testing.
4. Integrate biblical principles within the field of secure software engineering.

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.

Suggested Readings:

1. Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead, “Software Security Engineering: A Guide for Project Managers”, Addison Wesley, 2008
2. Ross J Anderson, “Security Engineering: A Guide to Building Dependable Distributed Systems”, 2nd Edition, Wiley, 2008.
3. Howard, M. and LeBlanc, D., “Writing Secure Code”, 2nd Edition, Microsoft Press, 2003
4. Jason Grembi, “Developing Secure Software”, First Edition, Cengage Learning, 2008.
5. Gary R. McGraw, “Software Security: Building Security”, AddisonWesley Software Security Edition,

2006.

6. Richard Sinn, “Software Security: Theory, Programming and Practice”, First Edition, Cengage Learning, 2009.

DISTRIBUTED SYSTEMS

PE854CSM

Instruction :	3L per week
Duration of SEE :	3 hours
CIE :	30 marks
SEE :	70 marks

Credits :3

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

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

1. List the principles of distributed systems and describe the problems and challenges associated with these principles
2. Know about interposes 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.
6. Know about emerging trends in distributed computing.

UNIT-I

Introduction: **Characteristics & Properties of Distributes Systems – Taxonomy - Types of DistributedSystems 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 MethodInvocation, Message-Oriented Communication, Stream- Oriented Communication, 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, Global Positioningof 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, Consistency and Replication, Fault Tolerance, and Security.**

UNIT-IV

Distributed File Systems: **File system, DFS- definition, Characteristics, Goals, SUN NFS-NFS Architecture, NFS Implementation, Protocols, The CODA file system-Design Overview, An Example,**

Design Rational, Implementation, The GOOGLE file system-Definition, Architectures, GFS

Architecture Distributed Web-Based Systems: **Traditional Web-Based Systems, Web Services Fundamentals, TheApache 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 Map Reduce,Mapreduce.net, Pig and Hive.**

Suggested Readings:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems, PHI 2nd Edition, 2009.
2. Sunita Mahajan and Seema Shah, Distributed Computing, Oxford University
3. R. Hill,L. Hirsch,P.Lake,S.Moshiri, Guide to Cloud Computing,Principles andPractice, Springer, 2013.
4. R. Buyya, J. Borberg, A. Goscinski, Cloud Computing-Principles and Paradigms, Wiley,2013.
5. P. K. Sinha, Distributed Operating Systems, PHI
6. Taunenbaum, Distributed Systems: Principles and Paradigms, Pearson Prentice Hall, 2nd Edition 2007
7. Hagit Attiyaand Jennifer Welch, Distributed Computing, Fundamentals, Simulations and Advanced topics,Wiley India, 2nd Edition
8. G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts and Design, Published by Pearson 5th edition
9. David Reilly, Michael Reill, Java Network Programming & Distributed Computing, Addison-Wesley.

Project Work - II

PW 861 CSM

Instruction:	3L per week
Duration of SEE:	3 hours
CIE:	30 marks
SEE:	70 marks

Credits: 3

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 comprising 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.

Human Computer Interaction

OE 831 CSM

Instruction:	3L per week
Duration of SEE:	3 hours
CIE:	30 marks
SEE:	70 marks

Credits: 3

Course Objectives:

- To introduce interaction frameworks and styles
- To learn about interaction design process, design standards and principles
- To introduce the concept of usability and usability testing
- To familiarize interface components and technical issues of concern

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

Suggested reading:

1. Steven Heim, The Resonant Interface: HCI Foundations for Interaction Design, Addison-Wesley, 2007
2. J. Preece, Y. Rogers, and H. Sharp, Interaction Design: Beyond Human-Computer Interaction, Wiley & Sons,2nd Ed., 2007
3. Ben Shneiderman, Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th edition,, Addison-Wesley, 2009