BRAINWARE UNIVERSITY

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Code	**Course Name**	**L - T - P**	**Credit**	**Total Marks**
PHD – RM01	Research Methodology	4-0-0	4	100
PHD – RPE01	Research and Publication Ethics	2-0-0	2	100
PHD – CSE01	A. Emerging Trends Machine Learning and Soft Computing B. Wireless Sensor Network and Network Security	3-0-0	3	100
PHD – CSE02	Internet Of Things And Applications / Advanced Cloud Computing /Block chain Technologies / Image Processing & Pattern Recognition Case Study Report and Presentation	3-0-0	3	100
	Total	**12**	**12**	**400**

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Course Code: PHD – RM01
Course Name: Research Methodology
Contact: 4L
Credit: 4
Allotted Hours: 60

Course Objective: The primary goal of this course is to introduce the fundamental ideas of research methodology. It discusses the methods and tools that should be used to complete a research project as well as the problems that arise when choosing a research problem. This will also enable the students to prepare report writing.

Pre-requisite*:* Basic understanding about Research Methodology

Course Outcomes: Upon completion of this course, the student shall be able to

CO1: Understand various statistical packages and analyze the sampling techniques to create competency in research techniques.

CO2: Formulate research problem and compare various measurement models to develop proficiency in judging research accuracy.

CO3: Design experimental hypothesis through computational techniques and analyze data through model adequacy checking

CO4: Evaluate various qualitative research methods and analyze various case studies through concept and correlation analysis

Module I: Introduction to Research **[12H]**

Methodology and Method, Types of research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Concept of Interdisciplinary Research, Procedures in research, Identification of the problem- Literature survey, Experimental methods, Quasi-experimental studies-Survey, type of surveys - CATI, CAPI, Mail, Email, Face-to-face, Questionnaire, Discourse analysis, Biographical Data Analysis.

Module II: Sampling and Analysis **[12H]**

Primary and secondary data, Collection and validation, Methods of sampling- Simple random sampling. Stratified random sampling and Systematic sampling, Attitude Measurement- land Scales, Scaling of attitude, Deterministic attitudes, Measurement models, Summative models.

Module III: Experimental design and Hypothesis **[12H]** Factorial experimental design, designing experiments, Basic principles-replication, randomization, blocking. Single Factor Experiment: Hypothesis design, Hypothesis testing using z- test, t-test, ANOVA etc., Analysis of Variance Components (ANOVA) for fixed effect model, Sum of squares of treatments (SST), Sum of squares of error (SSE), Degrees of freedom, Confidence interval, ANOVA for random effects model, Model adequacy checking.

Module IV: Data Collection and Management **[06H]**

Data Collection, Data Extraction, Data Cleansing, Data Sanity and Data Security.

Module V: Computer Application [08H]

Introduction to spread sheet application, Features and functions, using formulas and functions, Data storing. Features for Statistical data analysis, Generating charts/ graph and other features, Power point presentation. Use of software for statistical analysis such as SPSS.

Module VI: Research Report [10H]

Type of research report- contents, Steps in drafting, Editing, and evaluating the final draft, Styles for figures, tables, text, quoting of reference and bibliography, Use and format of appendices- Indexing, Structure and presentation of research report, Research ethics, plagiarism.

Reference books:

1. Legal Research Methodology by Manoj Kumar Sinha, Deepa Kharb, LexisNexis, 1st Edition, 2017
2. Research Methodology Methods and Techniques by C.R. Kothari, Gaurav Garg, New Age Publisher, 04th Edition, 2019
3 Fundamentals of Modern Statistical Methods: Substantially Improving Power and Accuracy by Rand R. Wilcox, Springer, 2nd Edition, 2010
4 Design and Analysis of Experiments by Douglas C. Montgomery, John Wiley & Sons Inc., 8th Edition, 2012.
5 The Data Book: Collection and Management of Research Data by Meredith Zozus, Chapman and Hall/CRC; 1st edition, 2017

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Code: PHD – RPE01
Course Name: Research and Publication Ethics
Contact: 2L
Credit: 2
Allotted Hours: 30

Course Objective: This course aims to educate research applicants on the philosophy of research, research and publishing ethics, accessibility of papers, and publication misconduct. To find publications that are predatory and engage in dishonest research. to comprehend citation and indexing databases, open access papers, and research metrics (citations, h-index, impact Factor, etc.).

Pre-requisite*:* Basic understanding about ethical neutrality on publication and copyright issues.

Course Outcomes: Upon completion of this course, the student shall be able to
CO1: Develop awareness of research philosophy and illustrate the ethical judgements in research

CO2: Predict the concepts of publication ethics through best practices standards and identify publication misconduct through computational techniques.

CO3: Identify various Journals and Publishers to explore the research work in the appropriate area

C04: Prepare scientific reports and formulate project proposal to develop competency in designing funding proposals.

Module I: Philosophy of Ethics **[10H]**

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).
4. Redundant publications: duplicate and overlapping publications.
5. Selective reporting and misrepresentation of data.

Module II: Publication Ethics **[10H]**

1. Publication ethics: definition, introduction and importance.
2. Conflicts of interest.
3. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types.
4. Violation of publication ethics, authorship and contributorship.
5. Identification of publication misconduct, complaints and appeals.
6. Predatory publishers and journals PRACTICE.
7. Techniques of paraphrasing.

Module III: Research Metrics [10H]

A. Software tools

Use of plagiarism software like Turnitin, Urkund.

B. Databases

Indexing databases, Citation databases: Web of Science, Scopus, etc.

C. Research Metrics

Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, and Cite Score. Metrics: h-index, g index, i10 index, altimetric.

Reference books:

1. The Ethics of Teaching and Scientific Research, Sidney Hook, Paul Kurtz, and Miro Todorovich, Prometheus Books, 1977
2. Research Ethics: A Psychological Approach, Barbara H. Stanley, Joan E. Sieber, Gary B. Melton, University of Nebraska Press, 1996
3. Research Methods in Applied Settings: An Integrated Approach to Design and Analysis, Jeffrey A. Gliner, George A. Morgan, Nancy L. Leech, Routledge, 2nd Edition, 2009
4. Ethics and Values in Industrial-Organizational Psychology by Joel Lefkowitz Lawrence Erlbaum Associates, 2003.

Note: **Latest references will be added by the teaching faculty during the class**

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Name: Emerging Trends Machine Learning and Soft Computing
Course Code: PHD – CSE01A
Contact: 3L
Credits: 3
Allotted Hours: 45

Course Objective:
The objective of the course is to enable the student with basic knowledge on supervised, unsupervised and semi-supervised learning algorithms so that they can build an intellectual machine for making decisions. They can produce predictive models not only based on linear data but also with non-linear one.

Prerequisite: Basic concepts of AI and Linear Algebra.

Course Outcome:
After the completion of the course, students would be able to:
CO1: Define and classified the characteristics of Supervised, Unsupervised and Semi-Supervised algorithms.
CO2: Understand and distinguished between classification and regression problem.
CO3: Apply different supervised algorithms for classification or regression purpose.
CO4: Understand and illustrate the concept of Artificial Neural Networks.
CO5: Apply and Demonstrate fuzzy logic system and genetic algorithm.

Module 1: Introduction [10H]
Machine Learning, Definition, Example of machine learning applications, Life Cycle, Linear and non-linear data, Datasets and Data pre-processing, Types – Supervised, Unsupervised, Reinforcement Learning, Time Series Analysis - Input representation, Hypothesis class, Version space, Confusion Matrix, Aspects of developing a learning system - Train-test-validation, concept representation, function approximation. Model Selection and Generalization, Dimensionality reduction- Subset selection, Principal Component Analysis. Classification and Regression, Difference with Clustering, Hypothesis space, Overfitting and underfitting, Semi-supervised Learning

Module 2: Supervised Learning Algorithms and Unsupervised Learning Algorithms [10H]
SVM –Support Vectors, Hyperplane, Marginal Distance, Linear and Non-linear SVM. KNN –Methodology, Advantage and disadvantage. Naïve Bayes Classifier – Bayes Theorem, Posterior, likelihood, Prior and Marginal Probability, Methodology, Advantage and disadvantage, Types. Random Forest Classifier – Utility, Application, Methodology, Advantage and disadvantage. Decision Tree – CART, Decision and Leaf node, Terminologies, Methodology, Gini Index, Pruning, Advantage and disadvantage, Performance evaluation of all supervised techniques. K-Means Clustering – Introduction, Centroid, Objective Function, Methodology, Performance improvement by Elbow and Silhouette method. Advantage and Disadvantage. Association Rule Learning – Introduction, Applications, Types: Apriori, Eclat and FPG, Hierarchical Clustering – Introduction, Need of Hierarchical Clustering, Dendrogram, Approaches: Agglomerative and Divisive, Linkage Methods. DBSCAN Method. Performance evaluation of all unsupervised techniques

Module 3: Artificial Neural Network
[10H]
Introduction and basic models, biological neurons and artificial neural network. Learning Methods: Mc-pitt, Hebb's learning, Perceptron, Adaline and Madaline networks, single layer network, Multilayer feed forward network, Back-

propagation network, Different issue regarding convergence multilayer perceptron, Competitive learning, Self-Organizing Maps, Hopfield Networks, Associative Memories, Boltzmann Machine and applications.

Module 4: Fuzzy sets and Fuzzy logic systems: [10H]

Introduction, Fuzzy sets versus crisp sets, operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, Fuzzy relations and properties of fuzzy relations. Membership functions: Features of membership functions, standard forms and boundaries, fuzzification, for fuzzy sets, Defuzzification methods: Lambda Cuts, Alpha cuts Fuzzy Logic, Approximate reasoning and Fuzzy Implication. Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System-Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic, fuzzy logic controllers, fuzzy pattern recognition, fuzzy image processing.

Module 5: Genetic Algorithm

[5H]

Introduction, different operators of GA: crossover and mutation, analysis of selection operations, Hypothesis and building block, Multi-objective Genetic Algorithm (MOGA), GA in search and optimization and applications.

Text Books

1. Machine Learning, Tom. M. Mitchell, McGraw Hill International Edition.
2. Introduction to Machine Learning, Ethern Alpaydin, Prentice Hall of India, 2005.
3. Machine Learning : An Artificial Intelligence Approach, Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, ,Tioga Publishing Company.
4. Principles of Soft Computing, S.N. Sivanandam and S.N. Deepa, John Wiley & Sons, 2nd Edition, 2007.
5. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall Publishing, 1st Edition, 1996.
6. Genetic Algorithms in search, Optimization & Machine Learning, David E. Goldberg Pearson Education India, 1st Edition, 2002.

Reference Books

1. Introduction to Machine Learning (Adaptive Computation and Machine Learning), Ethern Alpaydın, MIT Press, 2004.
2. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 2006.
3. Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, J-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani, 1st Edition, Prentice Hall Publishing
4. Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms, Samir Roy & Udit Chakraborty, 1st Edition, Pearson, 2013

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Name: Wireless Sensor Network and Network Security
Course Code: PHD – CSE01B
Contact: 3L
Credits: 3
Allotted Hours: 45

Course Objective:

- To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
- Understand the Sensor management, sensor network middleware, operating systems.
- Learn key routing protocols for sensor networks and main design issues.

Prerequisite:

Wireless Communication.

Course Outcome:

After the completion of the course, students would be able to:

CO1: Apply and demonstrate the concepts of wireless sensor networks, sensing, computing and communication tasks.

CO2: Understand and illustrate the standards and communication protocols adopted in wireless sensor networks and security required for each protocol.

CO3: Describe and integrate among the hardware, software and communication for wireless sensor network nodes for enhancing network security.

CO4: Understand and justify the architectures, features, and performance for wireless sensor network systems and platforms

CO5: Describe and analyze the specific requirements of applications in wireless sensor networks for energy efficiency, computing, storage and transmission.

Module 1 [5]

Wireless Sensor Networks (WSN), Characteristics of wireless sensor networks, advantages of sensor network, Challenges of wireless sensor networks, Limitations in wireless sensor networks, Applications of WSN, Challenges for WSN, Ad-hoc network

Module 2 **[5]**

Hardware Components, Energy Consumption of Sensor nodes, Operating Systems and Execution Environments, Examples of Sensor Nodes, Network Architecture: WSN Scenarios, Design principles for WSNs, Gateway Concepts.

Module 3 **[5]**

Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.11, IEEE 802.15.4.

Module 4 **[5]**

Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Module 5 [5]

Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Open Issues for Future Research, and Enabling Technologies in Wireless Sensor Network, Simulation and Experimental Platforms Like Open Source (Ns-2) and Commercial (QUALNET, OPNET)

Module 6 **[10]**

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module 7 **[10]**

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC. Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

Text Books

1. Fundamentals of Wireless Sensor Networks: Theory and Practice, Waltenegus Dargie, Christian Poellabauer, Wiley, 2010.
2. Principles of Wireless Sensor Networks, Mohammad S. Obaidat, Sudip Misra, Cambridge, 2014.
3. AdHoc Wireless networks, C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008.

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Code: PHD – CSE02
Course Name: Internet Of Things And Applications / Advanced Cloud Computing /Blockchain Technologies / Image Processing & Pattern Recognition Case Study Report and Presentation
Contact: 3L
Credit: 3
Allotted Hours: 45

Course Objective: An activity course involving practical experience in planning a research investigation, designing questionnaires, sampling, interpreting results and preparing a research report. Students will grow a critical awareness of research issues, methodologies, and methods used in business and management and an understanding of potential ethical problems of the research.

Pre-requisite*:* Knowledge on documents handling.

Course Outcomes: Upon completion of this course, the student shall be able to
CO1: To know the basic data collection methods with emphasis on secondary and compose research.
CO2: To obtain skills to handle primary data and data handling instruments and develop skills on field works and its various techniques.
CO3: To be able to compile basic samples for use in studies research and validate how and when to use different sampling techniques.
CO4: To understand and validate the relevance of basic data analysis techniques.

Case study and finding the gaps in the existing literature and comparative analysis and design a detailed report. To prepare a presentation and delivery it in a seminar.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Code: PHD – CSE02
Course Name: Internet Of Things And Applications
Contact: 3L
Credit: 3
Allotted Hours: 45

Module I: Introduction to Internet of Things [9H]

Introduction- The IOT Today & Progression to Tomorrow – Success Factors –Strategic Research & Innovation Directions. Sensing – Sensors, Transducers, Sensor Features, Resolution, Hysteresis Error. Actuation – Hydraulic, Pneumatic, Electrical, Thermal/ Magnetic, Mechanical Actuators. Functional Components of IoT - Component for interaction and communication with other IoT devices, processing and analysis of operations, Internet interaction, Internet interaction, handling Web services of applications, integrate application, interface to access IoT services.

Module II: Basics of IoT Networking and Sensor Networks [9H]

Connectivity Technologies - 6LoWPANs, Introduction to RFID, IoT Data Protocol, MQTT, SMQTT, CoAP, XMPP, AMQP, Wireless Multimedia Sensor Networks, Nano networks, WSN Coverage, Stationary Wireless Sensor Networks, Mobile Wireless Sensor Networks, UAV Networks, MANETs, FANETs, VANETs

Module III: Communication Protocols [9H]

Communication Protocols - IEEE 802.15.4, Zigbee, HART & Wireless HART, NFC, Bluetooth, Z WAVE, Wireless Sensor Networks, Node Behavior in WSNs. Layer Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: IPv6 Technologies forthe IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, MigrationStrategies to IPv6.

Module IV: Software-Defined Networking [9H]

SDN –restructuring current network infrastructure, SDN Architecture, Architecture of SDN – Application, Control and Infrastructure layers, Components/Attributes of SDN, OpenFlow protocol –flow-rule and math-fields, Software-Defined WSN, Integrating SDN in IoT, SDN-WISE Protocol Stack

Module V: Interoperability in IoT [9H]

Interoperability, Interoperability is Important in Context of IoT, Types of Interoperability - User Interoperability, Device Interoperability, Semantic Interoperability for Device Interaction, Arduino Programming - Operators in Arduino, Control Statement, Loops, Arrays, String, Math Library, Random Number, Interrupts and Approach to presentation delivery in a seminar

REFERENCE BOOKS:

1. "Internet of Things – From Research & Innovation to Market Deployment", Ovidiu Vermesan, Peter Friess, River Publishers, 2014
2. "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, Elsevier Ltd, 2014
3. "Internet of Things – A hands-on approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
4. "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Manoel Carlos Ramon, Apress, 2014.
5. "Internet of Things with the Arduino Yun", Marco Schwartz, Packt Publishing, 2014

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Name: Advanced Cloud Computing
Contact: 3L
Credit: 3
Allotted Hours: 45

Course Objective: A wide range of businesses and industries are utilizing cloud computing services. Cloud computing is simply the supply of computing as a service through a network, whereby distributed resources are rented, rather than owned, by an end user as a utility. This domain will be introduced, and subjects like cloud infrastructures, virtualization, software defined networks and storage, cloud storage, and programming models will all be covered in the course. We will explore service models, security, illustrative cloud service providers, use cases, and the drivers, advantages, and difficulties of the cloud as an introduction.

Pre-requisite*:* Understanding of programming, debugging, and computer systems.

Course Outcomes: Upon completion of this course, the student shall be able to
CO1: Illustrate and Differentiate the concept of cloud and types of computing.
CO2: Explain and Distinguish various service-oriented architecture and deployment model.
CO3: Design and Implement various virtualization technologies in cloud platform.
CO4: Validate the security issues in cloud and infer security oversight.
CO5: Analyze and Formulate report on variety of cloud management solutions.
CO6: Assess and Construct writing skills imbibe with accurate formatting and academic Ethics.

Unit-I: Basic Concept of Cloud Computing [9H]

Basic Concept of computer network, Overview of Computing Paradigm, Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloud computing: Business driver for adopting cloud computing. Introduction to Cloud Computing: Cloud Computing (NIST Model), History of Cloud Computing, Cloud service providers and its Necessity; Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Comparative study of Cloud vs. Cluster vs. Grid computing; Role of Open Standards Cloud

Unit-II: Cloud Computing Architecture **[9H]**

Cloud Computing Architecture: Cloud computing stack: Comparison with traditional computing architecture (client/server), The Workings of Cloud Computing, Role of Networksin Cloud computing, protocols used, Role of Web services; Service Models(Introduction,Functionality, Architecture, Advantage, Disadvantage and Application : XaaS, IaaS, PaaS, SaaS; Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud; Service Oriented Architecture (SOA)

Unit-III: Virtualization **[9H]**

Introduction to virtualization, Different approaches to virtualization and Load balancing, Hypervisors, Machine Image, Virtual Machine (VM). Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service); System virtualization technologies-architectures and internals. KVM, Xen, VMware, DEVOPS. Memory virtualization-virtualization techniques, ballooning, deduplication and sharing; Network and storage virtualization; Virtual machine migration and replication techniques pre-copy and post-copy techniques, applicability to system availability. Examples: Amazon EC2, Renting, EC2 Compute Unit, Platform and Storage, pricing, customers, Eucalyptus Cloud Platform andManagement, Computation, Storage, Examples, Google App Engine, Microsoft Azure, Salesforce.com platform.

Unit-IV: Cloud Security **[9H]**

Cloud Security: Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Unit- V: Review of various cloud management solutions [9H]

Discuss on various cloud management solutions, Comparative study on contemporary cloud tools and software's, Review-based Report preparation on Cloud Management Tooling and presentation in a seminar

REFERENCE BOOKS:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Name: Blockchain Technologies
Contact: 3L
Credit: 3
Allotted Hours: 45

Unit-I: Introduction of Cryptography and Blockchain **[7H]**
What is Blockchain, Blockchain Technology
Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

Unit-II: **BitCoin and Cryptocurrency:** **[7H]**
What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process,
Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain And Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency.

Unit-III: **Introduction to Ethereum**: [7H]
What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How
Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction?, Smart Contracts.

Unit-IV: Introduction to Hyperledger: [7H]
What is Hyperledger? Distributed Ledger Technology & its
Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer.

Unit-V: Solidity Programming:Solidity **[9H]**
Language of Smart Contracts, Installing Solidity & Ethereum
Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real,String, Bytes, Arrays, Mapping, Enum, address)

Unit-VI: Blockchain Applications **[8H]**
Internet of Things, Medical Record Management System, Domain Name
Service and Future of Blockchain, Alt Coins.

Reference Book:

- Blockchain Technology: Concepts and Applications: Kumar Saurabh,Ashutosh Saxena, WILEY

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PH. D. IN ENGINEERING (COMPUTER SCIENCE AND ENGINEERING)

Course Name: Image Processing & Pattern Recognition
Contact: 3L
Credit: 3
Allotted Hours: 45

Unit-I: Introduction: **[4H]**
Digital Image representation; Fundamental steps in Image processing, Elements of digital Image processing systems.

Unit-II: Digital Image Fundamentals **[4H]**
Sampling and quantization, imaging geometry.

Unit-III: Image Transforms **[4H]**
Fourier, Walsh, Hademord, discrete cosine and Hotelling transforms and their properties.

Unit-IV: Image Enhancement **[5H]**
Enhancement by point processing, spatial filtering, Frequency domain enhancement, Color image processing.

Unit-V: Image Restoration: [4H]
Unconstrained and constraint restoring, inverse filtering, Wiener Filter, Geometric transforms. Image Compression:

Unit-VI: Image Compression **[4H]**
Image Compression models, Error-free compression, Lossy compression, Image compression standards.

Unit-VII: Image Segmentation **[5H]**
Detection of discontinuities, edge linking, Thresholding. Representations and Descriptions: Chain codes, shape numbers, moments and Fourier and other descriptors. Recognition & Interpretations.

Unit-VIII: Pattern Recognition **[15H]**
Definitions, data sets for Pattern Recognition, Different Paradigms of Pattern Recognition, Representations of Patterns and Classes Metric and non-metric proximity measures, Feature extraction, Different approaches to Feature Selection , Nearest Neighbor Classifier and variants, Efficient algorithms for nearest neighbour classification, Different Approaches to Prototype Selection, Bayes Classifier, Decision Trees, Linear Discriminant Function, Different Approaches to Prototype Selection, Bayes Classifier Decision Trees, Linear Discriminant Function, Support Vector Machines, Clustering, Clustering Large datasets, Combination of Classifiers, Applications - Document Recognition

Reference Book:

- Image Processing and Pattern Recognition: Fundamentals and Techniques, Frank Y. Shih, Wiley