Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

Course Contents (Syllabus) for

First Year M. Tech.
(Computer Science and Information Technology)

Sem – I to II

AY 2020-21

Odd Semester//Sem-I
Professional Core (Theory)

Title of the Course: Research Methodology 3IC501	L	T	P	Cr
	2	0	0	2

Pre-Requisite Courses:

Textbooks:

1. Kothari C. R, "Research Methodology", New Age international, 2nd Edition, 1990.
2. Chopra Deepak and Sondhi Neena, "Research Methodology : Concepts and cases", Vikas Publishing House, New Delhi,2nd Edition, 2015

References:

1. Melville Stuart and Goddard Wayne, "Research Methodology: An Introduction for Science & Engineering Students" Kenwyn Juta & Co. Ltd., 1st Edition, 1996.
2. G. Ramamurthy, "Research Methodology", Dream Tech Press, New Delhi, 2nd Edition.

Course Objectives :

1. Provide the methods for formulation of research problems and hypothesis.
2. Make able to conduct the research with scientific methods
3. Provide the research artefacts for data and result analysis

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Interpret the thrust area for dissertation	III	Applying
CO2	Identify various data collection methods	IV	Analyzing
CO3	Formulate the research publication.	VI	Design

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1			3	
CO2				3		
CO3	1	3				2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module1: An Introduction	Hrs.
Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Various stages of research, Reference collection.	4
Module2: Research Problem and Design	**Hrs.**
Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a	5

Problem, Fundamentals of Research Design, Need for Research Design, Different Research Designs	
Module3: Data Collection Techniques	**Hrs.**
Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Schedules, Other Methods of Data Collection	**5**
Module4: Processing and Analysis of Data	**Hrs.**
Processing Operations, Types of Analysis, Statistics in Research, Measures of Asymmetry, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression , Partial Correlation, Association of Attributes	**4**
Module5: Computers and Research	**Hrs.**
Role of computer in research process, Data Analysis and Visualization Techniques, Data Storage, Scientific Simulations, Plagiarism Checker	**4**
Module 6: Technical writing methods.	**Hrs.**
Paper Writing, Technical report, Types of Technical report, dissertation/thesis writing. Presentation techniques, Patents and other IPRs, Tools for report writing.	**4**
Module wise Measurable Students Learning Outcomes : **After the completion of the course the student should be able to:** **Module 1:** Realize the process of research. **Module 2:** Formulate of a research problem in respective study domains **Module 3:** Learn the important steps in conducting research **Module 4:** Apply data analytics for research validation. **Module 5**: Design the methods for presenting the research results **Module 6**: Apply research artifacts in respective disciplines of Engineering	

Title of the Course: Advanced Algorithms 3IT501	L	T	P	Cr
	3	0	0	3

Pre-Requisites: Fundamental knowledge in Computer Algorithms

Textbooks:

1. Thomas H. Corman et al, "Introduction to Algorithms", PHI Learning pvt. Ltd, Third Edition

References:

1. E. Horowitz, Sartaj Sahani et al, "Fundamentals of Computer Algorithms", Universities Press, Second Edition

Course Objectives :

1. To introduce concepts of Graph Algorithms.
2. To impart shortest path computing techniques.
3. To explain the algorithms based on complexities.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Generalize graph related algorithms with real world problems	II	Understanding
CO2	Calculate the shortest path for a given distance based scenario	III	Applying
CO3	Verify the given algorithm belongs to NP-C category and find its approximate solution	V	Evaluating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1				3	
CO2	2		3			
CO3				3	1	

Assessments :

Teacher Assessment:

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ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
Elementary Graph Algorithms and MST Representation of Graphs, BFS and DFS, Topological Sort, Strongly Connected Components Growing a Minimum Spanning Tree, Algorithms of Kruskal and Prim.	6
Module 2	**Hrs.**

Single Source Shortest Path Algorithms Bellman-Ford Algorithm, SSSP in Directed Acyclic Graphs, Dijkstra's Algorithm, Difference Constraints and Shortest Paths, Proofs of Shortest-paths Properties	**6**
Module 3	**Hrs.**
APSP and Maximum Flow Shortest Paths and Matrix Multiplication, Floyd-Warshall Algorithm, Johnson's Algorithm for Sparse Graphs Flow Networks, Ford-Fulkerson Method, Maximum Bipartite Matching, Push-relable algorithms	**6**
Module 4	**Hrs.**
Multithreaded Algorithms and Matrix Operations Dynamic Multithreading fundamentals, Multithreaded Matrix Multiplication, Multithreaded merge sort Solving systems of linear equations, Inverting matrices, Symmetric positive-definite matrices and least-squares approximation	**7**
Module 5	**Hrs.**
Computational Geometry and NP-Completeness Line-segment properties, Determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems	**7**
Module 6	**Hrs.**
Approximation Algorithms The vertex-cover problem, The traveling-salesman problem, The set-covering problem, Randomization and linear programming, The subset-sum problem	**7**

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

Module 1: Explain basic concepts of Graph Algorithms
Module 2: Compare and contrast different SSSP algorithms
Module 3: Apply Shortest path algorithm to real word problems
Module 4: Apply multithreading techniques to solve different problems
Module 5: Classify algorithms into different categories
Module 6: Design approximate methods for solving hard problems

Title of the Course: Cryptology 3IT503	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Computer Networks

Textbooks:

1. Stallings William, "Cryptography and Network security: Principles and Practices", Pearson Publication, 7th Ed, 2016

References:

1. Katz Jonathan and Lindell Yehuda, "Introduction to Modern Cryptography", CRC Press, 2nd Ed, 2018
2. Schneier Bruce, "Applied Cryptography: Protocols & Algorithms and Source Code in C", Wiley Publication, 2nd Ed, 2015

Course Objectives :

1. To apprise security services and mechanisms against threats.
2. To impart various encryption and authentication techniques.
3. To make understand security attack model analysis against crypt_complexity.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Discuss vulnerabilities in the information systems.	II	Understanding
CO2	Practice and analyse cryptographic algorithms.	III, IV	Applying, Analyzing
CO3	Classify and propose Confidentiality, Integrity and Authentication services.	V, VI	Evaluating, Creating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1		2				1
CO2	2			3		
CO3			1		2	

Assessments :

Teacher Assessment:

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Course Contents:

Module 1: Information Security Overview	Hrs.
Auditing and Standards, Models, Services and Mechanism, Threats and Attacks,	06

Attack Categories: Physical, Side Channel, Software, Environmental, Network Attacks Cryptography and Cryptanalysis, Classical Encryption Techniques	
Module 2: Number Theory	**Hrs.**
Modular Arithmetic, Euclidean Algorithm, Prime and Relatively Prime Numbers, Primitive Roots, Fermat's Little Theorem, Euler Totient Function, Chinese Remainder Theorem, Discrete Logarithms, Index Calculus Algorithm, Pseudo Randomness	**07**
Module 3: Modern Cryptographic Techniques	**Hrs.**
Modes of Data Operation, Key Length and Perfect Secrecy and Confidentiality, Symmetric & Asymmetric Cryptography, Data Encryption Standard (DES/2DES/3DES),Cracking DES and MIM attack, Advanced Encryption Standard (AES), Design and Analysis of RSA Cryptosystem	**07**
Module 4: Authentication and Integrity Check	**Hrs.**
Session Keys and Management, Key Exchange and Diffie Hellman algorithm, Digital Signature Algorithm, Kerberos Systems, X.509 Digital Certificates, Hash algorithms, Message Authentication Codes	**07**
Module 5: Web and IPSec	**Hrs.**
Secure Socket Layer (SSL), Transport Layer Security (TLS) Secure Electronic Transaction (SET), E-Commerce IP security Architecture, Virtual Private Network (VPN)	**06**
Module 6: Perimeter Security	**Hrs.**
Firewall Types and Configuration, Trusted Systems, Intrusion Detection and Prevention Systems (IDPS), Honeypots	**06**

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

Module 1: Associate core concepts of conventional security architecture.

Module 2: Apply mathematical model for construction of trap door functions.

Module 3: Compare and implement various cryptographic algorithms.

Module 4: Identify authentication and integrity check support systems**.**

Module 5: Recommend transport layer security (TLS) for web services.

Module 6: Devise security mechanisms across network boundaries.

Tutorial: Assignments can be conducted for installation, execution and performance evaluation of information security tools and related case studies.

Title of the Course: Unix Internals 3IT502	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Operating systems, Data Communication & Networking, Computer Networks, Programmable Languages. Preferably C/C++, Java, Python, etc.

Textbooks:

1. Stevens Richard W., "*Unix Network Programming* ", Prentice Hall (PHI), Second Edition, 1990. (Module 1(first part) and 4)
2. Das Sumitabha, "*Unix Concepts and Applications*", TMGH, Fourth Edition, 2008.
3. Bach Maurice J., "*The Design of Unix Operating System*", PHI. (Module 1(first part), 2, 3)

References:

1. Beej Jorgensen, " *Beej's Guide to Unix IPC*", Brian "Beej Jorgensen" Hall, Version 1.1.2, December 15, 2010. (E-book) (module 4)
2. Beej Jorgensen, "*Beej's Guide to Network Programming: Using Internet Sockets*", Brian "Beej Jorgensen" Hall, Version 3.0.14 September 8, 2009. (module 4)
4. Stevens Richard W., "*UNIX Network Programming: Interprocess Communications*", Volume 2, Prentice Hall, Second Edition, 1999. (module 4)

Course Objectives :

1. Introduce the various IPC's available in OS.
2. Instruct the IPC for solving the real world problems.
3. Prepare students to analyze and interpret functioning of socket programming.

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Investigate the design principal and philosophy of the Unix/Linux OS	IV	Analyzing
CO2	Appraise the architecture of Unix/Linux OS.	IV	Analyzing
CO3	Classify the various IPC's for effective computing.	V	Evaluating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1			1	3		
CO2	2					1
CO3			3	1		

Assessments :

Teacher Assessment:

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MSE: Assessment is based on 50% of course content (Normally first three modules)
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Course Contents:

Module 1: Introduction	Hrs.
Introduction to the KERNEL: Architecture of UNIX OS (Operating system), Introduction	5

to system concepts, Kernel Data Structure, System Administration.	
Module 2: The Unix Model	**Hrs.**
Introduction, Basic Definitions, Input and Output, Signals, Process Control, Daemon Processes, Listing internet daemons and their service capabilities	**6**
Module 3: Internal Representation of Files	**Hrs.**
Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types, The Buffer Cache concept.	**6**
Module 4: Structure of Process and Process Control	**Hrs.**
Process stages and transitions, layout of system memory, the context of a Process, saving context of a process, manipulation of the process address space.	8
Module 5: Process Creation	**Hrs.**
Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process.	**6**
Module 6: Interprocess Communication (IPC)	**Hrs.**
Introduction, File and Record Locking, A Simple Client-Server Example, Pipes, FIFOs (First in first out), Streams and Messages, Name Spaces, System-V IPC, Message Queues, Semaphores, Shared Memory, TCP/UDP Sockets, Threads, MPI (Message passing interface), OpenMP, Cuda, Difference between Unix & Windows IPC mechanisms.	8

Module wise Measurable Students Learning Outcomes :

Module 1: Examine the signaling system, process control.
Module 2: Assess the kernel data structures for process and file.
Module 3: Verify the operations on processes
Module 4: Comprehend the various IPC's.
Module 5: Create process for applications
Module 6: Perform IPC for Chatting application

Professional Elective (Theory)

Title of the Course: Professional Elective 1 - Artificial Intelligence **3IT511**	L	T	P	Cr
	3	~~0~~	0	3

Pre-Requisite Courses Discrete structures, probability/statistics, and algorithmic analysis.

Textbook:

1. Rich Elaine and Kelvin Knight ,Nair," Artificial Intelligence," McGraw Hills 3rd edition,1991.
2. Janakiraman et al., "Foundations of Artificial Intelligence and Expert Systems", Macmilan India Ltd.,2007.
3. Russell and Norvig," Artificial Intelligence – A Modern Approach", Prentice-Hall, 2010 (3rd edition).

References:

1. Kaushik Saroj, "Artificial Intelligence"
2. Townsend, "Introduction to Turbo prolog",Sybex Inc,1987.

Course Objectives :

1. To introduce theory developed in Artificial Intelligence.
2. To impart techniques used in major application areas of Artificial Intelligence.
3. To describe about the state of the art in Artificial Intelligence

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	Apply schemes of knowledge representation.	III	applying
CO2	Build expert system.	VI	Creating
CO3	Evaluate performance of AI systems.	V	Evaluating

CO-PO Mapping :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**					
CO2						**2**
CO3		**2**				

Assessment:

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MSE	30
ISE 2	10
ESE	50

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Course Contents:

Module 1: Introduction and searching in AI	**6 Hrs.**
Problem, Problem Spaces and Search, Application, Characteristics of AI, Heuristic, A*,AO*.	
Module 2: Knowledge Representation & Logic	**7 Hrs.**
Predicate calculus, Predicates and arguments, ISA hierarchy, Frames, Unification	
Module 3: Logic Programming	**6 Hrs.**
Logic programming in Prolog, writing a Prolog program, Structure of Prolog program, Searching and backtracking in prolog, Lists	
Module 4: Planning	**7 Hrs.**
Introduction, Planning as problem solving, STRIPS, Forward and Backward planning, Non linear planning	
Module 5: Neural Networks	**6 Hrs.**
History and Introduction to Neural network, Working of neurons, Basic components of ANN,ANN Arhitecture, Feedforward network, Applications of Neural Network.	
Module 6: Expert systems & Natural Language Processing	**7 Hrs.**
Introduction, Functionality /components of Expert systems, Architecture of ES, Bulding an Expert system, NLP and Understanding.	
Module wise Measurable Students Learning Outcomes : **Module 1:** Survey the nature of the difficult problems that AI seeks to solve. **Module 2:** Invest variety of methods for encoding knowledge in computer systems. **Module 3:** use the logic programming for problem solution **Module 4:** Provide intelligent problem solution. **Module 5:** Provide solution using constraint satisfaction. **Module 6:** Design the expert system.	

Title of the Course: Professional Elective 1 - Distributed Operating System 3IT513	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Operating Systems, Distributed Network

Textbooks:

1. Sinha Pradeep K. " Distributed Operating Systems Concepts and Design ", , PHI
2. Coulouris George, Dollimore Jean, Kindberg Tim " Distributed Systems: Concepts and Design", Pearson
3. Attiya Hagit and Welch Jennifer, "Distributed Computing, Fundamentals, Simulations and Advanced topics, , Wiley India ,2nd Edition.

References:

1. Mahajan Sunita & Shah Seema "Distributed Computing " OXFORD
2. Tanebaum Andrew S, Van Steen Maarten " Distributed Systems: Principles and Paradigms", PHI

Course Objectives :

1. To introduce the fundamental principles of distributed systems.
2. To Familiarize the Distributed protocols
3. To make the Knowledge of communication, process, naming, synchronization, consistency and replication, and fault tolerance

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain the principles of distributed systems and describe the problems and challenges associated with these principles.	II	Understanding
CO2	Use distributed system that fulfills requirements with regards to key distributed systems properties	III	Applying
CO3	Analyze Distributed web-based system and study Security of the system	IV	Analyzing

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1				2		
CO2			2			2
CO3	1					3

Assessments :

Teacher Assessment:

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Course Contents:

Module 1: Introduction to distributed Systems	**Hrs.**
Definition and goals, Hardware and Software concepts, Design issues	6
Module 2: Communication & Synchronization in distributed systems	**Hrs.**
Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC Remote procedure call Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems	6
Module 3: Processes and processors & Distributed File Systems:	**Hrs.**
Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues, Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study	7
Module 4: Distributed Shared Memory	**Hrs.**
Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing	5
Module 5: Naming & Distributed Web-based Systems	**Hrs.**
Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications	7
Module 6: Security & Case Study	**Hrs.**
Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management ,Java RMI, Sun Network File System, Google case study	6

Module wise Measurable Students Learning Outcomes : After the completion of the course the students should be able to

Module 1: Explain the fundamentals of Distributed systems
Module 2: Describe the communication and synchronization
Module 3: Use the Distributed file systems
Module 4: Express the issues of Distributed Shared Memory
Module 5: Analyze distributed web based systems
Module 6: Study the security of Distributed operating system

Title of the Course: Professional Elective 1 - Machine Learning 3IT512	L	T	P	Cr
	3	0	0	3

Pre-Requisite: Working knowledge of Linear Algebra, Probability Theory.

Textbook:

1. Tom Mitchell, "Machine Learning". McGraw-Hill, 1997.
2. Aurelien Geron,"Hands-on Machine Learning with Scikit-Learn & TensoFlow",O'REILLY

References:

1. Andre NG, "Coursera Machine Learning Course".
2. http://www.stanford.edu/class/cs229/materials.html.

Course Objectives :

1. To Introduce formulation of machine learning problems corresponding to different application.
2. To instruct with the range of machine learning algorithms.
3. To impart the knowledge neural network.

Course Learning Outcomes:

COs	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Summarize the machine learning algorithms.	II	Understanding
CO2	Choose the appropriate learning methods for different problems.	III	Applying
CO3	Compare the results of learning algorithms.	III	Analyzing

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1			
CO2				2		
CO3						1

Course Contents:

Module 1: Introduction and Regression	Hrs.
Machine Learning concept, Supervised Learning, Unsupervised Learning. **Linear regression in one variable:** Cost Function, Gradient descent. **Linear Regression with Multiple Variables:** Gradient descent, Normal Equation. **Logistic Regression:** Classification, Hypothesis representation, Decision Boundary, Cost function, Simplified Cost Function and Gradient Descent, Optimization, One vs All.	7
Module 2: Neural Networks	**Hrs.**
Simple Perceptron, Non Linear Hypothesis, Representation, Multi-class classification One vs all. **Neural Networks Learning:** Back propagation, Gradient checking, Random initialization.	6
Module 3: Learning Theory and SVM	**Hrs.**
Regularization, Bias/Variance trade-off. Union and Checkoff/Holding bounds. Error Analysis, Ensemble methods. Practical advice on how to use learning algorithms. Precision/Recall trade-off. **Support Vector Machines:** Optimization Objective, Mathematics behind Large Margin classification, Kernels, Using an SVM.	7
Module 4: Unsupervised Learning	**Hrs.**

Clustering K means, EM, Principal Component Analysis, Outliers Detection.	**6**
Module 5: Reinforcement Learning	**Hrs.**
Introduction, The Learning Task, Q Learning, Nondeterministic Rewards and Action, Temporal Difference Learning, Generalizing from examples. Relationship to Dynamic Programming	**6**
Module 6: Case Studies in Machine Learning	**Hrs.**
Recommender systems as regression problem, Spam email Classification, MNIST digit recognition challenge. Cat Vs Non Cat Classification using Neural Network. Selected Kaggle problem statements.	**7**

Module wise Measurable Students Learning Outcomes: After the completion of the course the students should be able to

Module 1: Explain the concepts of Machine Learning and Regression.

Module 2: Apply Neural Networks technique for solving Machine Learning problem statements.

Module 3: Analyze the Machine Learning algorithms for optimization.

Module 4: Understand Unsupervised learning techniques.

Module 5: Explain and apply Reinforcement Learning.

Module 6: Apply the theory Learned in the course to concrete case studies.

Title of the Course: Professional Elective I - Decision Support System 3IT514	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:

Textbooks:

1. Sauter Vicki L, "Decision Support Systems for Business Intelligence", John Wiley & Sons, 2nd Edition, 2010.

References:

1. Bonczek Robert H, Holsapple Clyde W, Whinston Andrew B, "Foundations of Decision Support Systems", Academic Press , 1st Edition, 1981.
2. Schuff David , Paradice David, Burstein Frada, Power Daniel J., Sharda Ramesh , "Decision Support: An Examination of the DSS Discipline", Springer, 2nd Edition, 2011
3. Bidgoli Hossein, "Decision Support Systems: Principles and Practice", West Pub. Co., 1st Edition 1989

Course Objectives :

1. To make able to understand fundamentals of decision support systems.
2. To provide use of various components of decision support systems(DSS)
3. To make able to correlate object oriented design and decision support system(DSS)

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Summarize the basics of decision support systems	II	Understanding
CO2	Classify various component of decision support systems	III	Applying
CO3	Distinguish design issues of decision support systems	IV	Analyzing

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2			1		
CO2		2				
CO3	3			2		2

Assessments :

Teacher Assessment:

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Course Contents:

Module 1: Introduction to Decision Support Systems	Hrs.
Introduction, What is a DSS? Uses of a decision support system, Decision making, Rational decisions, Nature of managers, Appropriate decision support, Appropriate data support, Group decision making, Intuition, qualitative data, and decision making, Business intelligence and decision making, Analytics, Competitive business intelligence	6
Module 2: DSS Components	**Hrs.**
Data component, Specific view toward included data, Characteristics of information, Databases, Database management systems, Data warehouses, Model component, Models and analytics,	7

Options for models, Problems of models, Data mining, Model-based management systems	
Module 3: Intelligence and Decision Support Systems	**Hrs.**
Programming reasoning, Uncertainty, User interface, Goals of the user interface, Mechanisms of user interfaces, User interface components, Representations.	**6**
Module 4: Issues of DSS Design	**Hrs.**
International decision support systems, Information availability standards, Cross-cultural modeling, Effects of culture on decision support system, Designing a decision support system, Planning for decision support systems, DSS design and reengineering	**7**
Module 5: Object-Oriented Technologies and DSS Design	**Hrs.**
Kinds of development tools, Benefits of object-oriented technologies for DSS, Implementation and evaluation, Implementation strategy, Implementation and system evaluation	**6**
Module 6: Extensions of Decision Support Systems	**Hrs.**
Executive information and dashboards, KPIs and balanced scoreboards, KPIs and balanced scoreboards, Dashboards, Dashboard as driver to EIS, Group Decision Support Systems (GDSS), Groupware, Features of Support	**7**

Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to,

Module 1: Realize basic concepts of DSS.

Module 2: Recognize DSS components.

Module 3: Design and apply intelligence in DSS.

Module 4: Resolve the design issues in DSS.

Module 5: Analyze the benefits of DSS using object oriented approach.

Module 6: Design dashboards and KPI's.

Title of the Course: Professional Elective 2 - Software Reliability and Fault Detection 3IT516	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Software Engineering

Textbooks:

1. Musa John D., "Software Reliability Engineering", Tata McGraw Hill, 2nd Edition, 1999.
2. Lyu, "Software Reliability Engineering", IEEE Computer Society Press, 1st Edition, 1996.

References:

1. Jalote Pankaj, "An Integrated Approach to Software Engineering", Narosa Publication, 3rd Edition, 2010.
2. Sommerville, "Software Engineering", Pearson Education India, New Delhi,2nd Edition, 2006.

Course Objectives :

1. To provide fundamental knowledge of Software Reliability.
2. To make able to understand deployment and reliability
3. To appraise the fault detection of software systems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Grasp scientific concepts of Software Reliability	II	Understanding
CO2	Apply Software Reliability Growth Models in Software Development	III	Applying
CO3	Resolve the Software system fault tolerance	IV	Analyzing

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					
CO2		2			1	
CO3	1			2		1

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module1: Basic Networking Device and SDN	Hrs.

Need and Concepts of Software Reliability, Failure and Faults – Prevention, Removal, Tolerance, Forecast, Dependability Concept – Failure Behavior, Characteristics, Maintenance Policy, Reliability and Availability Modeling, Reliability Evaluation	**7**
Module2: Software Reliability Models	**Hrs.**
Exponential Failure Models – Jelinski-moranda model, Poisson, Musa,Exponential models, Weibull Model, Musa-okumoto Model, Bayseian Model –Littlewood verral Model, Phase Based Model	**7**
Module3: Prediction Analysis	**Hrs.**
Model Disagreement and Inaccuracy – Short & Long Term Prediction, Model Accuracy, Analyzing Predictive Accuracy – Outcomes, PLR, U & Y Plot, Errors and Inaccuracy, Recalibration – Detecting Bias, Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.	**6**
Module4: The Operational Profile and testing	**Hrs.**
Concepts and Development Procedures – Customer Type, User Type, System Mode, Functional and Operational Profile, Test Selection - Selecting Operations, Testing For Reliability Measurement	**6**
Module5: Software Fault Detection	**Hrs.**
Basic terminology of Fault tolerant, Fault detection using fault tree, Fault tolerant in SRE, Techniques for Fault tolerant: Recovery blocks, N- version programming	**7**
Module 6: Software Fault Analysis	**Hrs.**
Fault tree modeling, Fault tree analysis, Analysis of fault tolerant software system, Quantitative analysis of fault tolerant system.	**6**
Module wise Measurable Students Learning Outcomes : **After the completion of the course the student should be able to:** Module 1: Realize the basics of software reliability Module 2: Comprehend the modeling of software reliability. Module 3: Analyze the software reliability prediction. Module 4: Generate operational profile of software system. Module 5: Examine fault detection in system development Module 6: Design the fault detection tree for software reliability engineering	

Title of the Course: Professional Elective-2 Wireless Sensor Network 3IT517	L	T	P	C
	3	0	0	3

Pre-Requisite Courses: Wireless communication technologies

Textbooks:

1. Kazem, Sohraby, Minoli Daniel TaiebZanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2)
2. HolgerKerl, Willig Andreas, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
3. Cauligi Raghavendra, S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network",Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5)

References:

1. B. Krishnamachari, " Networking Wireless Sensors", Cambridge University Press
2. Mahalik N. P, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag

Course Objectives :

1. To introduce Wireless Sensor Network and applications.
2. To Make understand the wireless Sensor Network technologies and protocols
3. To familiarize the Network management issues and performance

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Explain wireless Sensor network technologies.	II	Understanding
CO2	Differentiate between routing protocols for wireless communication	IV	Analyzing
CO3	Design wireless Sensor network scenario for real life application.	VI	Creating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1				1		
CO2			1		2	
CO3	1					3

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction and Overview of Wireless Sensor Networks, Applications of Wireless Sensor Networks	Hrs.
Introduction, Basic Overview of the Technology, Introduction of Applications of WSN, Background, Range of Applications, Examples of Category 2 WSN Applications,	7

Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology	
Module 2: Basic Wireless Sensor Technology, Wireless Transmission Technology and Systems	**Hrs.**
Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Introduction of Wireless Transmission Technology and Systems, Radio Technology Primer, Available Wireless Technologies,	**6**
Module 3: Medium Access Control Protocols for Wireless Sensor Networks	**Hrs.**
Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study	**6**
Module 4: Routing Protocols for Wireless Sensor Networks, Transport Control Protocols for Wireless Sensor Networks	**Hrs.**
Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor Networks, Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols.	**7**
Module 5: Topology control, Operating Systems for Wireless Sensor Networks	**Hrs.**
Motivation and basic ideas, Controlling topology in flat networks – Power control, Hierarchical networks by dominating sets, Hierarchical networks by clustering, Combining hierarchical topologies and power control, Adaptive node activity, Introduction of operating system for WSN, Operating System Design Issues, Examples of Operating Systems	**7**
Module 6: Network Management for Wireless Sensor Networks, Performance and Traffic Management	**Hrs.**
Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues, Example of Management Architecture: MANNA, Other Issues Related to Network Management, Introduction of performance and traffic management, Background, WSN Design Issues, Performance Modeling of WSNs, Case Study: Simple Computation of the System Life Span	**6**

Module wise Measurable Students Learning Outcomes :

Module 1: Explain wireless Sensor Networks architecture
Module 2: Study the wireless Sensor Networks protocols and working
Module 3: Describe & Implementing different MAC protocols
Module 4: Comparing different routing protocols
Module 5: Study the various topology control and operating system
Module 6: Explain the Network Management and performance

Title of the Course: Professional Elective-2 - Cloud and virtualization Techniques 3IT518	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Fundamental knowledge in Operating Systems and Computer Networks

Textbooks:

1. Buyya Rajkumar, Vecchiola Christian, S. Thamarai Selvi, "Mastering cloud computing", Mc Graw Hill Education
2. James E. Smith, Nair Ravi, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier Publications.

References:

1. AWS Whitepapers
2. Tanenbaum Andrew S., Maarten Van Steen, "Distributed System: Principles and Paradigms", Second Edition, Pearson Prentice Hall

Course Objectives :

1. To introduce fundamental concept of virtualization
2. To impart parallel computing environment
3. To make aware with cloud platform in industry and applications

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Explain cloud computing environment for parallelism	II	Understanding
CO2	Employ different virtualization techniques to cloud based application	III	Applying
CO3	Use cloud computing platforms for development of resilience cloud infrastructure	III	Applying

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1		**3**	1			
CO2	**3**					2
CO3				**3**		2

Assessments :

Teacher Assessment:

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ISE 1	10
MSE	30
ISE 2	10
ESE	50

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ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction & Principle of parallel and distributed computing	**Hrs.**
Computing Models, Cloud computing at glance, Distributed Systems, Parallel V/s Distributed computing, Utility Oriented Computing. ***Hands-on: Amazon Web Services (AWS) fundamentals and free tier account creation.***.	**5**
Module 2: Virtualization	**Hrs.**

Virtualization structures: *Hosted and Bare-Meta,* Server Virtualization, Terminal Services, Desktop Virtualization, Application Virtualization, Storage Virtualization. ***Hands-on: Virtual Box installation and Virtual Machine Creation***.	**6**
Module 3: Emulation	**Hrs.**
Basic Interpretation, Threaded Interpretation, Predecoding, Binary Translation, Code discovery and dynamic translation.	**8**
Module 4: Cloud Computing Basics	**Hrs.**
Virtualization and Cloud Computing, Cloud Reference Model: Infrastructure as a service (*IAAS), Platform* as a service (*PAAS), Software* as a service (*SAAS)*, Types of Clouds, Open Challenges. ***Hands-on: Managing and creating Amazon EC2 instances.***	**8**
Module 5: Public Cloud and VPC	**Hrs.**
Cloud Storage, Public Cloud Networking: Route53, Content Delivery Networks, Resilience Infrastructure. Virtual Private Cloud (VPC) fundamentals, Security Groups, Network Access Control List, Network Address Translation. ***Hands-on: VPC implementation on AWS, AWS S3 bucket creation, static website hosting using cloud storage.***	**7**
Module 6: Cloud Security	**Hrs.**
Host Security, Challenges with Cloud data, Challenges with data security, data confidentiality and encryption, Cloud Firewall, Virtual Firewall.	**5**

Module wise Measurable Students Learning Outcomes :
Module 1: Explain basic concepts of distributed computing.
Module 2 : Discuss the virtualization of CPU, Memory etc
Module 3: Apply the different emulation processes to implement virtualization.
Module 4: Explain the cloud architecture.
Module 5: Apply the technical aspect of public and private cloud platform.
Module 6: Identify the security aspects of cloud platforms in corporate world.

Title of the Course: Professional Elective 2 - Information Retrieval 3IT519	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:

Textbooks:

1. Manning Christopher D, Raghavan Prabhakar, Schutze Hinrich, "Introduction to Information Retrieval" , Cambridge University Press, 2nd Edition, 2008

References:

1. Frakes William B., Baeza-Yates Ricardo, "Information Retrieval – Data structures and Algorithms" ,Pearson, 1st Edition, 2008

Course Objectives :

1. To provide computational techniques in Information retrieval
2. To make able to search and retrieve real time data storage

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Explain the basics of information retrieval	IV	Understanding
CO2	Apply index selection, searching and information retrieval for real time data storage	III	Applying
CO3	Evaluate probabilistic approach for information retrieval system	V	Evaluating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**3**				**2**	
CO2		**2**				
CO3	**1**				**2**	**1**

Assessments :

Teacher Assessment:

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Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Information retrieval basics	**Hrs.**
An example information retrieval problem, A first take at building an inverted index Processing Boolean queries, The extended Boolean model versus ranked retrieval, References and further reading, **The term vocabulary and postings lists**, Document delineation and character sequence decoding, Determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries, References and further reading, **Dictionaries and tolerant retrieval**, Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction, References and further reading	**6**
Module 2: Index construction and term score	**Hrs.**
Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed	**7**

indexing Dynamic indexing, Other types of indexes, **Index compression**, Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression, References and further reading, **Scoring term weighting and the vector space model,** Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, Variant TF–IDF functions, **Computing scores in a complete search system,** Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction, References and further reading	
Module 3: Evaluation in information retrieval	**Hrs.**
Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance, A broader perspective: System quality and user, Utility, Results snippets, **Relevance feedback and query expansion,** Relevance feedback and pseudo relevance, feedback, Global methods for query reformulation, **Probabilistic information retrieval,** Review of basic probability theory, The probability ranking principle, The binary independence model, An appraisal and some extensions, References and further reading, **Language models for information retrieval,** Language models, The query likelihood model, Language modeling versus other approaches in information retrieval, Extended language modeling approaches	**7**
Module 4: Text classification	**Hrs.**
The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes Feature selection, Evaluation of text classification, **Vector space classification** Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear versus nonlinear classifiers, Classification with more than two classes, The bias–variance tradeoff, **Support vector machines and machine learning on documents,** Support vector machines: The linearly separable case, Extensions to the support vector machine model, Issues in the classification of text documents, Machine-learning methods in ad hoc information retrieval	**7**
Module 5: Clustering	**Hrs.**
Clustering in information retrieval, Problem statement, Evaluation of clustering, K-means, Model-based clustering, **Hierarchical clustering,** Hierarchical agglomerative clustering , Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering Optimality of hierarchical agglomerative, clustering, Divisive clustering, labeling, **Matrix decompositions and latent semantic indexing**, Linear algebra review, Term–document matrices and singular value, decompositions, Low-rank approximations, Latent semantic indexing, References and further reading	**6**
Module 6: Web search	**Hrs.**
Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling, References and further reading, **Web crawling and indexes,** Overview, Crawling, Distributing indexes, Connectivity servers, References and further reading, **Link analysis** , The Web as a graph, PageRank, Hubs and authorities, References and further reading	**6**

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

Module 1: To summarize the basic concepts of information retrieval

Module 2: To apply index selection, term score and searching for information retrieval

Module 3: To analyze models for information retrieval

Module 4: To appraise text classification for information retrieval.

Module 5: To realize the clustering and matrix for indexing and information retrieval

Module 6: To apprehend web searching for information retrieval

Professional Core (Lab)

Title of the Course: Unix Internals Lab 3IT552	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses

Hands on Linux/Unix/Windows system programming, Any network programmable Languages. Preferably C/C++, Java, python, Scala, Ruby etc.

Textbooks:

3. Beej Jorgensen, "Beej's *Guide to Unix IPC*", Brian "Beej Jorgensen" Hall, Version 1.1.2, December 15, 2010. (E-book)
4. Beej Jorgensen, "*Beej's Guide to Network Programming: Using Internet Sockets*", Brian "Beej Jorgensen" Hall, Version 3.0.14 September 8, 2009. (E-book)
5. Stevens Richard W., *"UNIX Network Programming: Interprocess Communications*", Volume 2, Prentice Hall, Second Edition, 1999.

References:

1. Stevens Richard W., "*Unix Network Programming* ", Prentice Hall (PHI), Second Edition, 1990.
2. Das Sumitabha, *"Unix Concepts and Applications",* TMGH, Fourth Edition, 2008.
3. Bach Maurice J., *"The Design of Unix Operating System",* PHI.

Course Objectives:

1. Demonstrate the use of various system call of Unix/Linux OS
2. Introduce the various IPC's available in Unix/Linux OS.
3. Impart the IPC for solving the real world problems.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Compare the various IPC's available in OS.	IV	Analyzing
CO2	Appraise the socket programming functioning.	IV	Analyzing
CO3	Decide the system calls of Linux/Unix for effective processing.	V	Evaluating

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**	**1**				
CO2		**2**	**2**			
CO3			**3**	**1**		

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18submission at the end of	25

			week 18	

Week 1 indicates starting week of the semester
Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.
The experimental lab shall have typically 8-10 experiments.

Course Contents: Sample assignment list

Content	Hours
1. Processing Environment: a. fork, vfork, wait, wait pid(),exec (all variations exec), and exit b. IPC: Interrupts and Signals: signal(any fives type of signal), alarm, kill, signal, sigaction, pause	**8**
2. File system Internals: a. Stat, fstat, ustat. b. Threading concept: clone, threads of java. c. IPC: Semaphores: semaphore. h-semget, semctl, semop.	**6**
3. IPC: Message Queues: msgget, msgsnd, msgrcv.	**6**
4. IPC: Shared memory and sockets: d. IPC: Shared Memory: (shmget, shmat, shmdt. e. IPC: Sockets: socket system call in C/socket programming of Java.	**6**

Even Semester//Sem-II
Professional Core (Theory)

Title of the Course: Data Mining Methods and Applications 3IT521	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Database Engineering

Textbooks:

1. Han Jiawei and Kamber Micheline "Data Mining – Concepts and Techniques" The Morgan Kaufmann Series in Data Management Systems ,3rd Edition, , 2011
2. Dunham M. H, "Data Mining: Introductory and Advanced topics", Pearson, 2nd Edition, 2003

References:

1. Chattamvelli Rajan, "Data Mining Methods : Concepts & Applications", Narosa Publishing House, 2nd Edition, 2010
2. Mitra Sushmita, Acharya Tinku,"Data Mining Multimedia, Soft Computing and Biometrics", WILEY Publication, 3rd Edition, 2003

Course Objectives:

1. To introduce with advanced data mining techniques
2. To narrate various algorithm for real-time application
3. To propose a novice solution for real world problem

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Summarize the basic concepts, techniques and algorithms of Data Mining.	II	Understanding
CO2	To apply data mining techniques and algorithms for solving real life problems.	III	Applying
CO3	To analyze various clustering and classification techniques in data mining.	V	Analyzing

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**2**					
CO2		**3**		**2**	**1**	
CO3	**3**				**2**	**1**

Assessments :

Teacher Assessment:

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MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction to Data Mining and Data Preprocessing	Hrs

Data Mining, Kinds of Data, Kinds of Patterns, Technologies, Major Issues in Data Mining. Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Preprocessing: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization	**6**
Module 2: Mining Frequent Patterns	**Hrs**
Basic Concepts, Frequent Itemset Mining Methods, Pattern Evaluation Methods. Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Patterns. **Advanced Pattern Mining:** Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Patterns.	**6**
Module 3: Classification	
Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy **Classification Advanced Methods:** Bayesian Belief Networks, Classification by Backpropagation, Support Vector Machines, Classification Using Frequent Patterns, Lazy Learners, Other Classification Methods.	**7**
Module 4: Cluster Analysis	**Hrs**
Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering. **Advanced Cluster Analysis:** Probabilistic Model-Based Clustering, Clustering High-Dimensional Data, Clustering Graph and Network Data, Clustering with Constraints.	**7**
Module 5: Outlier Detection	**Hrs**
Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data.	**7**
Module 6: Data Mining Applications	**Hrs**
Graph Mining, Social Network Analysis, Multi-relational Data Mining, Text Mining**,** Web Mining, Spatial Mining, Temporal Mining.	**6**

Module wise Measurable Students Learning Outcomes: After the completion of the course the students should be able to

Module 1: Explain basic concepts of data mining and data processing techniques.

Module 2: Realize frequent pattern mining and apply various pattern mining on different types of data sets.

Module 3: Apprehend data classification methods and apply on different types of data sets.

Module 4: Apply clustering methods different types of data sets.

Module 5: Analyze, validate and removal of outliers within data sets.

Module 6: Apply data mining solution for multimedia data sets.

Title of the Course: Image Processing And Pattern Recognition 3IT522	L	T	P	Cr
	3	0	0	3

Pre-Requisites : MATRIX Operations, Discrete Structures, MATLAB (Recommended but not necessary)

Textbooks:

1. Sonka Milan, Vaclav Hiavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 3rd Edition, CL Engineering ,2013.
2. Rafel C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008.

References:

1. Gose Eark, Richard Johnsonbaugh, "Pattern Recognition and Image Analysis", 1st Edition, Prentice Hall of India Private limited, 2009.

Course Objectives:

1. To introduce the image fundamentals and mathematical transforms necessary for image processing.
2. To explore the image enhancement techniques
3. To show image restoration procedures.
4. To explain the image compression procedures.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Get background knowledge about image processing	II	Understanding
CO2	Implement practical knowledge and skills about image processing tools	III	Applying
CO3	Design prototype of an image processing and pattern recognition application.	VI	Creating

CO-PO Mapping:

	PO1	PO2	[O3	PO4	PO5	PO6
CO1	**1**					
CO2						**3**
CO3				**2**		

Course Contents:

Module 1: Digital images and its properties	**Hrs**
Applications of image processing, image function, image representation, sampling, quantization, color images, metrics and topological properties of digital images, histograms, image quality, noise image.	**7**
Module 2: Image Enhancement	**Hrs**
Pixel brightness transformation, position dependent brightness correction, gray scale transformation; geometric transformation, local preprocessing image smoothening	**6**
Module 3: Image Preprocessing	
Edge detectors, zero-crossing, scale in image processing, canny edge detection, parametric edge models, edges in multi spectral images, local preprocessing and adaptive neighborhood pre-processing; image restoration	**6**
Module 4: Image Segmentation	**Hrs**
Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation- edge image thresholding, edge relaxation, border tracing, border detection,	**7**

Module 5: Mathematical Morphology	Hrs
Basic morphological concepts, four morphological principles, binary dilation, erosion, Hit or miss transformation, opening and closing; thinning and skeleton algorithms; Morphological segmentation –particles segmentation and watersheds, particle segmentation	6
Module 6: Pattern Recognition Fundamentals	**Hrs**
Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model.	7

Module wise Measurable Students Learning Outcomes: After the completion of the course the students should be able to

Module 1: List digital image representation, properties of human visual system and various applications.

Module 2: Differentiate image processing operations for improving image quality through enhancement, restoration and filtering etc.

Module 3: Apply Affine transformation and using registration compressing data to save storage and channel capacity during transmission

Module 4: Apply Image segmentation techniques for partitioning into objects and background

Module 5: Inspect image features, quantifying shapes, patterns in images using pattern recognition algorithms.

Module 6: Summarize knowledge to design a prototype of image processing and pattern recognition application.

Title of the Course: Scientific Computing 3IT523	L	T	P	Cr
	1	0	0	1

Pre-Requisite Programming experience in C,C++,Java

Textbook:

1. Bruce Tate, "Seven Languages in Seven Weeks",2010
2. Dr. Mark Gardenerr, "The Statistical Programming Language",2012.

References:

1. Edx.org, oursera.org

Course Objectives:

5. To introduce the image fundamentals and mathematical transforms necessary for image processing.
6. To explore the image enhancement techniques
7. To show image restoration procedures.
8. To explain the image compression procedures.

Course Learning Outcomes:

COs	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
1.	Compare functional and logical programming.	IV	Analyzing
2.	Use appropriate programming language for solving the problem	III	Applying
3.	Generate scripts to automate data formatting and analysis	VI	Creating

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**2**				
CO2	**1**					
CO3				**3**		

Course Contents:

Module 1 :Using R	**Hrs**
a. Create a scatter plots, including multiple correlation points. b. Create line graphs c. Create bar and pie chart	**2**
Module 2: Analysis in R	**Hrs**
a. Regression Analysis **b.** Classification in R	**2**
Module 3 :AI Programming PROLOG1	**Hrs**
1.1 Write a program for calculating factorial of number. 1.2 Write a program for solution to the water jug problem.	**2**
Module 4: AI Programming PROLOG2	**Hrs**
a. Write a program to solve monkey-banana problem. b. Implement crypt-arithmetic Problem. (**DONALD+GERALD=ROBERT**).	**2**
Module 5: Research report in Latex	**Hrs**
5.1 Prepare a LATEX paper. 5.2 Use of Tables, charts, Figures in Latext	**3**
Module 6: Thesis Report in Latex	**Hrs**
6.1 Use LATEX for preparation of technical reports and conference papers.	**2**

Professional Elective (Theory)

Title of the Course: Professional Elective 3- Deep Learning 3IT531	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Basic knowledge Linear Algebra, Probability Theory. It would be beneficial if the participants have done a course on Machine Learning.

Textbooks:

1. Ian Goodfellow, Yoshua Bengio and Aoron Courville "Deep Learning", The MIT Press Cambridge, Massachusetts London, England.
2. Aurelien Geron,"Hands-on Machine Learning with Scikit-Learn & TensoFlow",O'REILLY

References:

1. Prof.Mitesh M. Khapra, "Deep Learning", course on NPTEL
2. Prof. Andrew Ng, "Deep Learning Specialization", course on coursera

Course Objectives:

1. To explain the paradigm shift technique in deep Learning.
2. To discuss the applications of Deep Learning technology.
3. To impart the journey of research with Deep Learning.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain the fundamentals of Deep Learning.	II	Understanding
CO2	Apply Deep Learning optimization techniques.	IV	Applying
CO3	Analyse Deep Learning architectures.	V	Analysing

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**1**					
CO2			**2**			
CO3				**2**		**1**

Assessments:

Teacher Assessment:

Two components of in Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Neural Networks	Hrs
History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic,Perceptrons, Perceptron Learning Algorithm,Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.	**6**
Module 2: Optimization in Deep Learning	**Hrs**
FeedForward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition.	**6**

Module 3: Auto encoders and relation to PCA	
Principal Component Analysis and its interpretations, Singular Value Decomposition. Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	**7**
Module 4: Regularization	**Hrs**
Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout. Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization	**6**
Module 5: Computer Vision	**Hrs**
Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Object Localization, Object Detection using Convolutional Implementation of Sliding Windows, Bounding Box Predictions, Intersection Over Union, Non-max Suppression, Anchor Boxes,YOLO Algorithm, Region Proposals.	**7**
Module 6: Recurrent Neural Networks	**Hrs**
Learning Vectorial Representations Of Words Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs. Encoder Decoder Models, Attention Mechanism, Attention over images.	**6**

Module wise Measurable Students Learning Outcomes: After the completion of the course the students should be able to

- Module 1: Understand the basics of Neural Networks.
- Module 2: Study Neural Networks/Deep Neural Networks.
- Module 3: Discuss the Auto encoders and relation to PCA.
- Module 4: Apply regularization technique in Deep Learning.
- Module 5: Analyse modern Computer Vision aspects.
- Module 6: Implement basic Recurrent Neural Networks.

Title of the Course: Professional Elective 3- High Performance Computing 3IT533	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Fundamental knowledge in Computer Algorithms

Textbooks:

1. Victor Eijkhout, " Introduction to High Performance Scientific Computing", Second Edition, Lulu.com publishers

References:

1. Shameem Akhtar, Jason Roberts,"Multi-Core Programming", Intel Press

Course Objectives :

1. To introduce concepts of Parallel Computing Architecture.
2. To introduce concepts in numerical algebra.
3. To instruct numerical computations in parallel.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Differentiate the sequential and parallel architecture	II	Understanding
CO2	Study abstraction of sequential numerical algorithms	IV	Analyzing
CO3	Execute the computations in parallel and estimate the performance	III,V	Applying, Evaluating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		2			
CO2	2		3			
CO3	2			3		

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Sequential Computer Architecture	Hrs.
The Von Neumann architecture, Memory Hierarchies, Multi-core chips, Locality and data reuse, Programming strategies for high performance	6
Module 2: Parallel Computer Architecture	**Hrs.**
Introduction, Parallel Computers Architectures, Different types of memory access, Granularity of parallelism, Parallel programming, Topologies, Load balancing, The TOP500 List	6

Module 3 : Computer Arithmetic	Hrs.
Integers, Representation of real numbers, Round-off error analysis, More about floating point arithmetic, Conclusions	6
Module 4: Numerical treatment of differential equations and Numerical linear algebra	**Hrs.**
Initial value problems, Boundary value problems, Initial Boundary value problem, LU factorization, Sparse matrices	7
Module 5: High performance linear algebra	**Hrs.**
Asymptotic, Parallel dense matrix-vector product, Scalability of the dense matrix-vector product, Scalability of LU factorization, Parallel sparse matrix-vector product, Computational aspects of iterative methods, Preconditioned construction, storage, and application, Parallelism and implicit operations, Block algorithms on multicore architectures	7
Module 6: Molecular dynamics	**Hrs.**
Force Computation, Parallel Decompositions, Parallel Fast Fourier Transform, Integration for Molecular Dynamics	7

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

Module 7: Explain basic concepts of Sequential Computing
Module 8: Explain basic concepts of Parallel Computing
Module 9: Evaluate numerical representations and arithmetic
Module 10: Analyze standard problems in Linear Algebra (LA)
Module 11: Implement LA into its parallel counter part
Module 12: Analyze molecular dynamics

Title of the Course: Professional Elective 3 - Big Data Analytics 3IT534	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Data Mining, Database Management Systems

Textbooks:

1. Prajapati Vignesh, "Big Data Analytics with R and Hadoop", Packt Publishing, 1st Edition, 2013.
2. Minelli Michael, Chambers Michehe, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", Ambiga Dhiraj, Wiely CIO Series, 1st Edition, 2013.

References:

1. White Tom, "Hadoop: The Definitive Guide", O'reilly Publications,3rd Edition , 2012.
2. Franks Bill, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series,1st Edition , 2012..

Course Objectives :

1. To impart the fundamental concepts of big data analytics
2. To prepare students for analyzing the big data using various techniques.
3. To provide the visualization techniques & applications of big data analytics

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Comprehend the fundamentals of various big data analytics techniques.	II	Understanding
CO2	Study the Map Reduce technologies associated with big data analytics for business applications.	IV	Analyzing
CO3	Design efficient algorithms for mining the data from large volumes.	V	Creating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2					
CO2		1		3		
CO3	1				3	2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1:	Hrs.
Big Data and its Importance, Four V's of Big Data, Drivers for Big Data –Introduction to	5

Big Data Analytics, Big Data Analytics applications.	
Module 2: Big Data Technologies	**Hrs.**
Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics.	**6**
Module 3: Processing Big Data	**Hrs.**
Detecting Patterns in Complex Data with Clustering and Link Analysis, Identifying previously unknown groupings within a data set, Segmenting the customer market with the K–Means algorithm, Defining similarity with appropriate distance measures, Constructing tree–like clusters with hierarchical clustering, Clustering text documents and tweets to aid understanding	**8**
Module 4: Hadoop Mapreduce	**Hrs.**
Employing Hadoop Map Reduce, Creating the components of Hadoop MapReduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs, Monitoring the progress of job flows, Building Blocks of Hadoop Map Reduce, Distinguishing Hadoop daemons -Investigating the Hadoop Distributed File System, Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.	**8**
Module 5: Advanced Analytics Platform	**Hrs.**
Real-Time Architecture, Orchestration and Synthesis Using Analytics Engines, Discovery using Data at Rest, Implementation of Big Data Analytics, Big Data Convergence, and Analytics Business Maturity Model.	**7**
Module 6: Analytic Tools	**Hrs.**
PIG overview, SQL vs. PIG, PIG Latin, User Defined Functions, Data Processing Operators, Overview of Hive, Hive QL, Tables, Querying Data.	**5**

Module wise Measurable Students Learning Outcomes :

Module 1: Generalize distributed , parallel, cloud computing and SQL concepts
Module 2: Gain conceptual understanding of data analytics
Module 3: Knowledge of prominent algorithms used to mine the data
Module 4: Realize of concepts of map and reduce and Hadoop File System.
Module 5: Classify the fundamental techniques and tools used analyze large volumes of data.
Module 6: Summarize the data analysis with visualization techniques.

Title of the Course: Professional Elective 4 Database Design and Performance Tuning 3IT536	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Database Engineering

Textbooks:

1. Singh S.K, "Database systems: Concepts, Design and Application ", Pearson Education, 2nd Edition , 2011
2. Ramakrishnan Raghu, Gehrke Johannes, "Database Management Systems", 2nd Edition, Tata McGraw Hill Inc, 2008.

References:

1. Mullins Craig S, "Database Administration: The Complete Guide to Practices and Procedures", Addison-Wesley Professional, 2nd Edition, 2002.
2. Shasha Dennis and Bonnet Philippe, Database Tuning, Principles, Experiments and Troubleshooting Techniques, Elsevier Reprint, 3rd Edition, 2005.

Course Objectives :

1. Preparing to interpret database design, constructing and tuning according to the specifications.
2. To impart database security and administrative and performance monitoring tasks.
3. To discuss about the requirements, data structures, retrieval techniques of complex database systems.

Course Learning Outcomes:

CO	After completion of the course student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Comprehend the database design cycle and administration	2	Understanding
CO2	Evaluating database performance on the basis of KPI's guidelines	5	Evaluating
CO3	Propose optimized query plans for parallel and distributed transactions	6	Creating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2					
CO2		1		2		
CO3	3				1	2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1 Concepts of Database Design and administration	Hrs.

Introduction, Software Development cycle (SDLC), Database Development cycle (DDLC), Automated Design tools, Normalization concepts **Database Administration** DBA Tasks, Defining the Organization's DBMS Strategy, Managing User access, Database performance management	**6**
Module 2: Query Processing and Optimization	**Hrs.**
Introduction, Query processing, syntax analyzer, query decomposition, query optimization (cost estimation), pipelining and materialization, Heuristics in Query Optimization, structure of query evaluation plans.	**7**
Module 3: Parallel and distributed transaction processing	**Hrs.**
Parallel and distributed database architectures, Distributed transactions, Optimization of Distributed Queries, Multi-database Query Processing, Distributed concurrency control and recovery	**6**
Module 4: Database security	**Hrs.**
Introduction, database security issues, Access control in database systems (DAC, MAC, RAC), Inference control, multilevel database security, statistical database recovery, Intrusion tolerant database systems, SQL injection	**6**
Module 5: Physical Database Design and Tuning	**Hrs.**
Physical DB Design, Index selection, Guidelines for Index Selection, Clustering and Indexing, Overview of Database Tuning, Choices in Tuning the Conceptual Schema, Choices in Tuning Queries, DBMS Benchmarks	**7**
Module 6: Complex database systems	**Hrs.**
Introduction to Spatial Databases: Spatial Data Structures, Spatial Storage and Indexing, spatial queries, Multimedia databases, Temporal and sequential databases	**7**

Module wise Measurable Students Learning Outcomes :

Module 1: Describe a database by applying development cycle and automated tools.

Module 2: Summarize the steps of query processing and optimized query evaluation plans.

Module 3: Classify parallel and distributed transactions without deadlocks using various concurrency control techniques.

Module 4: Propose good database security at various levels.

Module 5: Apply various DBMS benchmarks and tuning parameters to improve performance of database systems.

Module 6: Distinguish database systems like spatial database, Multimedia databases, Temporal and sequential databases.

Title of the Course: Professional Elective 4 - Software Defined Network 3IT537	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Computer networks, Cloud Computing, Virtualization

Textbooks:

1. Black Chuk, Culver Timothy "Software Defined Networks: A Comprehensive Approach", Wiley publication, 2nd Edition, 2016.
2. Kurose James F, Ross Keith, "Computer Networking: A Top-Down Approach",Pearson Publication, 6th Edition, 2014.

References:

1. Thomas D. Nadeau ,"Software Defined Networks, An Authoritative Review of Network Programmability Technologies", Ken Gray Publisher,2nd Edition, 2013
2. Behrouz A. Forouzan , "Data Communication and Networking" Tata McGraw-Hill, 4th edition, 2008.

Course Objectives :

. 1. To provide fundamental knowledge of Software Defined Network.
2. To make able to understand the data center operation with SDN
3. To explore the network performance through virtualization and open flow.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Comprehend the concept of abstracting and centralizing the control plane in SDN	II	Understanding
CO2	Analyze the implications of SDN on data center	IV	Analyzing
CO3	Evaluate the network functions virtualization.	V	Evaluating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					
CO2		3		1		
CO3	2				3	2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module1: Basic Networking Device and SDN	Hrs.

Basic Packet Switching Terminology, The Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Packet Forwarding IQ.	**7**
Module2: Introduction to SDN	**Hrs.**
SDN Implications:Research and Innovation, Cost, Industry, Data Center Innovation, Data Center Needs, Real Time Case Study of Data Center, Virtualization, Network Virtualization, Network Function Virtualization	**7**
Module3: Open Flow Protocol and SDN	**Hrs.**
OpenFlow: Flow Table structure, Flowtable Actions, Flow messages, Legacy Mechanisms Evolve Toward SDN, SDN Applications, and Alternate SDN Methods.	**6**
Module4: SDN in Data Center	**Hrs.**
Data Center Definition, Data Center Demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations,	**6**
Module5: SDN in Other Environments	**Hrs.**
Consistent Policy Configuration, Global Network View, Wide Area Networks, Service Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile Networks, In-Line Network Functions, Optical Networks, SDN vs. P2P/Overlay Networks, Players in SDN	**7**
Module 6: : Network Function Virtualization	**Hrs.**
Existing Network Virtualization Framework (VMWare and others), Mininet based examples, Virtualization and Data Plane I/O, Services Engineered Path, SDN open source, SDN Application.	**6**
Module wise Measurable Students Learning Outcomes : **After the completion of the course the student should be able to:** Module 1: Recognize the origin of SDN and medium of access. Module 2: Grasp the control plane and data plane structure of SDN. Module 3: Analyze the SDN operation in smart network. Module 4: Scrutinize the SDN in Data Center and web applications. Module 5: Examine various standards of SDN in real-time environment. Module 6: Design the network function for virtualization	

Title of the Course: Professional Elective-4 Computer Security and Forensics 3IT538	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Number Theory

Textbooks:

1. Godbole Nina, Belapure Sunit, "Cyber Security: Understanding Cyber Crimes, Computer Forensics & Legal Perspectives", Willy India, 1st Ed. 2011
2. Bainbridge David, "Introduction to Computer Law", LPE, 5th Ed. 2004
3. Stallings William, "Effective Cybersecurity: A Guide Using Best Practices and Standards", Google books 1st Ed. 2018

References:

1. Schneier Bruce, "Applied Cryptography: Protocols & Algorithms and Source Code in C", Willy Publication, 2nd Ed, 2007
2. Nelson Bill , Phillips Amelia , Steuart Christopher, " Guide to Computer Forensics & Investigations", Cengage Learning, 6th Ed, 2018
3. Farooq Ahmad, "Cyber Law in India- Law on Internet", New EraLaw Publication, 4th Ed, 2015

Course Objectives :

1. To introduce Cyber Laws, Ethics & Intellectual property rights associated with Computer works involving Hardware, Software & Ideaware.
2. To inform about probable threats related to Malwares, Cyber Crimes and Investigation.
3. To make understand and implement Information Security Mechanisms & Services.

Course Learning Outcomes:

CO	**After completion of the course student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Discuss about intentional computer attacks and provisional aspects towards Information Security	II	Understanding
CO2	Experiment and test the knowledge base for digital forensics	III, IV	Applying, Analyzing
CO3	Verify and propose Computer Security mechanism to generate an effective IT solution	V, VI	Evaluating, Creating

CO-PO Mapping :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**2**				**1**
CO2	**1**		**2**			
CO3				**3**	**1**	

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normal last three modules) covered after MSE.

Course Contents:

Module 1: Malicious Software	**Hrs.**
Advanced Persistent Threat, Infected Content Viruses, Vulnerability Exploit Worms, SPAM E-Mail, Trojans, Attack Agent Zombie, Bots, Keyloggers, Phishing, Spyware, Backdoors, Rootkits	**7**
Module 2: Cyber Crime & Computer Forensics	**Hrs.**
Cyber Crimes, , ITA 2000, Digital Evidence and Storages, Digital Forensics Life Cycle, Tools & Methods used in Cybercrimes: Case studies	**7**
Module 3: Computer Laws & Ethics	**Hrs.**
Intellectual Property Rights- Copyright Law & Publishing, Patent Law, The Law of Confidence, The Law relating to Designs, Trade Mark and Passing off, Semiconductor Regulation, IPR Infringement and Handling, Technology Transfer Agreements, Digital Contracts and Checklists	**6**
Module 4: Data Hiding & Forensic Detection	**Hrs.**
Data Hiding Types, Steganography, Steganalysis, Access Control and Password Management, Marcov Chains & Types, Network Security Monitoring and Analysis: Case studies	**7**
Module 5: Software Security	**Hrs.**
DoS Attacks, Buffer Overflow, SQL Injection, Session Hijacking, Software Security Issues, Handling Safe Program Code	**6**
Module 6: Operating System Security	**Hrs.**
Introduction, System Security Planning & Maintenance, Operating Systems Hardening, Linux/UNIX Security, Windows Security, Virtualization Security	6

Module wise Measurable Students Learning Outcomes :

Module 1: To outline the behavioral study of malwares in sense of payload infection, propagation and corresponding vulnerability exploits.

Module 2: To discuss about cyberspace, cybercrimes and forensic processing of sized computer data and their terminologies along with case studies guiding the defense challenges.

Module 3: To explain a newbie about Judicial and Computer Law Enforcement extending knowledge of computer handling ethics, IPR, patenting and prosecutions.

Module 4: To illustrate data hiding techniques estimating against computer intrusions in terms of User and S/W trespass.

Module 5: To practice writing safe program codes resolving the issue of software security.

Module 6: To recommend OS security producing safe environment towards data protection achieving Confidentiality, Integrity & Authentication.

Title of the Course: Professional Elective-4 Data Warehousing 3IT539	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Database Engineering

Textbooks:

1. Ponniah Phulraj "Data warehousing fundamentals – A comprehensive guide for IT professionals", Wiley Publication,2nd Edition, 2010
2. Matthias Jarke, Maurizio Lenzerini, Yannis Vassiliou, Panos Vassiliadis,"Fundamentals of Data Warehouses", Springer, 1st Edition, 2000

References:

1. Inmon W. H, "Building the Data Warehouse", Wiley Publication, 4th Edition, 2005
2. Humphries Mark , Hawkins Michael W, Michelle C, "Data Warehousing: Architecture and Implementation", Dy, Prantice Hall Publication, 1st Edition, 1999

Course Objectives :

1. To introduce fundamental concept of Data warehousing
2. To provide fundamental concepts of various data model for data warehousing
3. To interpret data design and data warehouse implementation process

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	To summarize the basic concepts of Data warehousing.	II	Understanding
CO2	To analyze various data model for data warehouse.	IV	Analyzing
CO3	To propose various solutions for information access	VI	Creating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					
CO2		2		1		
CO3	1				2	1

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: The compelling need for data warehousing	Hrs.
Need for strategic information, Failures of past decision-support systems, Operational versus decision-support systems, Data warehousing—the only viable solution, Evolution of business intelligence. **Data Warehouse: The Building Blocks**, Data warehouses and data marts, Architectural types, Overview of the components, Metadata in the data warehouse, **Trends In Data Warehousing,** Continued growth in data warehousing, Significant trends, Emergence of standards, Web-enabled data warehouse.	6

Module 2 : Planning and Requirements	Hrs.
Planning and project management, the data warehouse project, the development phases The project team, Project management considerations, defining the business requirements Dimensional analysis, Information packages—a useful concept, Requirements gathering methods Requirements definition: scope and content, Data design, the architectural plan, Data storage specifications, Information delivery strategy	7
Module 3: Architecture and Infrastructure	**Hrs.**
Understanding data warehouse architecture, Distinguishing characteristics, Architectural framework, Technical architecture, Architectural types. **Infrastructure as the foundation,** Infrastructure supporting architecture, Hardware and operating systems, Database software Collection of tools, Data warehouse appliances. **The Significant Role of Metadata,** Why metadata is important, Metadata types by functional areas, Business metadata, Technical metadata, How to provide metadata.	6
Module 4: Data design and data preparation	**Hrs.**
Principles of dimensional modeling, From requirements to data design, Star schema keys, Advantages of the star schema, STARjoin and STARindex. **Dimensional Modeling: Advanced Topics,** Updates to the dimension tables, Miscellaneous dimensions, The snowflake schema, Aggregate fact tables, Families of stars. **Data Extraction, Transformation, and Loading,** ETL overview, ETLrequirements and steps, Data extraction, Data transformation, Data loading, ETL summary and ETL tool options, Other integration approaches.**Data Quality: A Key To Success,** Why is data quality critical?, Data quality challenges, Data quality tools, Data quality initiative, Master data management (MDM), MDM Categories, MDM Benefits, MDM and Data Warehousing.	7
Module 5: Information access and delivery	**Hrs.**
Matching information to the classes of users, Information from the data warehouse, Who will use the information?, Information delivery, Information delivery tools. **OLAP in The Data Warehouse,** Demand for online analytical processing, Major features and functions, OLAP models, ROLAP versus MOLAP, OLAP implementation considerations, OLAP platforms, OLAP tools and products. **Data Warehousing And The Web,** Web-enabled data warehouse, Web-based information delivery, OLAP and the web, Building a web-enabled data warehouse. **Data Mining Applications**	7
Module 6: Data warehouse implementation.	**Hrs.**
Physical Design Process, Physical design steps, Physical design considerations, Indexing the data warehouse, Performance enhancement techniques. **Data Warehouse Deployment,** Data warehouse testing, Major deployment activities, Considerations for a pilot, Security, Backup and recovery. **Growth and maintenance,** Monitoring the data warehouse, User training and support, Managing the data warehouse.	6

Module wise Measurable Students Learning Outcomes :
After the completion of the course the student should be able to:
Module 1: Realize basic concepts of data warehousing.
Module 2: Explain project planning of data warehouse and its specifications.
Module 3: Design architecture of data warehouse.
Module 4: Apply dimension modelling and ETL process to data warehouse.
Module 5: Study the OLAP and web for data warehouse.
Module 6: Design process of data warehouse for data model.

Professional Core (Lab)

Title of the Course: Data Mining Methods and Applications Lab 3IT571	L	T	P	Cr
	--	--	2	1

Pre-Requisite Courses:

Textbooks:

1. Han Jiawei and Kamber Micheline "Data Mining – Concepts and Techniques" The Morgan Kaufmann Series in Data Management Systems ,3rd Edition, , 2011
2. Dunham M. H, "Data Mining: Introductory and Advanced topics", Pearson, 2nd Edition, 2003

References:

1. Chattamvelli Rajan, "Data Mining Methods : Concepts & Applications", Narosa Publishing House, 2nd Edition, 2010
2. Mitra Sushmita, Acharya Tinku,"Data Mining Multimedia, Soft Computing and Biometrics", WILEY Publication, 3rd Edition, 2003

Course Objectives :

1. To provide hands-on experience techniques in data mining and applications.
2. To demonstrate the data mining methods through various tools

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Implement–the basic concepts, techniques and algorithms of Data Mining.	III	Applying
CO2	Analyze data mining techniques for solving real life problems.	IV	Analyzing
CO3	Propose a solution for real world problem	VI	Creating

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2				1	
CO2		2	3	2		
CO3	1				1	2

Assessments :

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments.

Course Contents:

Programming assignments based on following broad topics :

1. Study of Data mining tools (WEKA, KNIME, ORANGE, Excel Miner etc.)
2. Perform data preprocessing tasks.
3. Implement and carryout association rule analysis.
4. Implement similarity measures, Correlation coefficient measures, regressions and statistical measures for any dataset and analyze the results.
5. Implement various clustering algorithms.
6. Implement various classification algorithms.
7. Perform advance data mining tasks on text, spatial and image dataset.
8. A small case study involving all stages of KDD. (Datasets are available online like UCI Repository etc.)

Title of the Course: Image Processing And Pattern Recognition Lab 3IT572	L	T	P	Cr
	--	--	2	1

Pre-Requisite: Applied Mathematics, MATRIX operations, Any computer programming Knowledge.

Textbook:

1. Millan sonka, Vaclav Hiavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 3rd Edition, CL Engineering, 2013.
2. Rafel C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008.

References:

1. Earl Gose, Richard Johnsonbaugh, "Pattern Recognition and Image Analysis", 1st Edition, Prentice Hall of India Private limited, 2009.

Course Objectives :

1. Introduce foundational techniques of image processing and analysis techniques. to solve image processing problems of real world application
2. Provide directives to build a statistical classifier and know how to use other classifiers
3. Impart image processing and pattern recognition techniques to detect objects and activities in images and video.
4. Instruct Matlab/python scripts to apply image processing algorithms.

Course Learning Outcomes:

COs	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Bloom's Cognitive Descriptor
1.	Implement image enhancement techniques for image qualities.	III	Applying
2.	Analyze the different segmentation techniques.	IV	Analyze
3.	Perform various image operations and morphological operations.	VI	Creating

CO-PO Mapping :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1				**1**		
CO2			**2**			
CO3	**3**					

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25

LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18submission at the end of week 18	25

Week 1 indicates starting week of the semester
Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.
The experimental lab shall have typically 8-10 experiments.

List of Assignments (using MATLAB/Python)

Sr.No.	Experiment list
01	Program to perform digital negative of an image
02	Program to perform (a) Down sampling of an image and (b) Enhance image using Histogram equalization.
03	Program to introduce noise in an image
04	(a) Program to find contrast stretching of an image (b) Program to perform bit plane slicing on an image
05	Program to perform Rotation, Scaling & Translation operation on an image
06	Program to find Edge using LOG and DOG functions
07	Program to implement Morphological operations on an image
08	Program to perform Huffman Coding on an Image
09	Program to perform image compression using RLE encoding
10	Develop mini project in image processing

Title of the Course: **Scientific Computing Lab 3IT573**	L	T	P	Cr
	~~0~~	0	2	1

Pre-Requisite Programming experience in C,C++,Java

Textbook:

3. Bruce Tate, "Seven Languages in Seven Weeks",2010
4. Dr. Mark Gardenerr, "The Statistical Programming Language",2012.

References:

2. Edx.org, oursera.org

Course Objectives :

1. To explain how to use different programming paradigms in scientific computing.
2. To demonstrate how to apply appropriate programming language for solving the problem
3. To provide guidelines to prepare scientific report using LATEX software.

Course Learning Outcomes:

COs	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
1.	Compare functional and logical programming.	IV	Analyzing
2.	Use appropriate programming language for solving the problem	III	Applying
3.	Generate scripts to automate data formatting and analysis	VI	Creating

CO-PO Mapping :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**2**				
CO2	**1**					
CO3				**3**		

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments .

Title of the Course: Industrial Project 3IT574	L	T	P	Cr
	0	0	4	2

Pre-Requisites:

Textbooks: -

References:

Course Objectives : -

1. To instruct knowledge, recent methods and trends in selected industrial projects.

Course Learning Outcomes:

CO	After completion of the course student should be able to :	Bloom's Cognitive	
		level	Descriptor
CO1	Summarize various aspects, methodologies and recent trends in the identified area of industry	II	Understanding
CO2	Experiment with new trends in industry	III	Applying
CO3	Demonstrate verbal and written skills by comparing and reviewing literature survey.	III, IV	Applying, Analyzing

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2				1	
CO2		2	1	2		
CO3	1				3	2

Assessments :

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	By Course Faculty/Guide	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty/Guide	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty/Guide	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty/Guide	During week 15 to week 18submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on online github.

Students should maintain a project log book containing weekly progress of the project.

Course Contents:

Topic Selection: Significance and Scope of comprehensive topic with exploration at each level, technical competency with Research oriented topic, literature survey of reliable and valid sources. Responsibly summarized literature

Relevance to Dissertation: At least three topics in relevance to thirst area of dissertation need to be overlooked.

Scope of Topic: Relevance, significance and expected outcome discussion in stated problem statements for area of dissertations.

Report writing: Proper citation of sources, organized section of chapters, standard and valid references, nearly absolute contents.

This course will include carrying out a project considering the social needs, innovative designing, and implementation as well as exploring its commercialization / patenting of the project.