KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049.

M.E., COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2018-Version-2

CURRICULUM AND SYLLABI

CHOICE BASED CREDIT SYSTEM

(For those admitted from 2019-2020 onwards)

I to IV Semesters

Signature of BOS Chairman, ME(CSE)

Department of Computer Science and Engineering

VISION

To evolve as a center of excellence with international reputation in the computer science and engineering field to serve the changing needs of industry and society.

MISSION

- Computer Science and Engineering department is committed to bring out career-oriented graduates who are industry ready by adopting best practices of teaching-learning process.
- To cultivate professional approach, strong ethical values and team spirit along with leadership qualities.
- To contribute towards techno-economic and social development of the Nation

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of Computer Science Engineering Postgraduate Program are to prepare the students:

I. Demonstrate and excel in industry, academia, research and in their own enterprise

II. Pursue life-long learning and upgrade their knowledge on the latest technological developments

III. Exhibit professionalism, ethics, maintain team spirit and communicate effectively in their profession

PROGRAM OUTCOMES (POs)

Graduates of the Computer Science Engineering Postgraduate Program should have the ability to:

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: Learn concepts/technologies independently and practice in life-long learning

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M.E., COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2018 -CURRICULUM

SEMESTER I							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18MAT1108	Mathematical foundations for Computer science	Theory	3	1	0	0	4
P18CST1001	Advanced Data Structures	Theory	3	0	0	0	3
P18CSI1202	IOT Architecture and Programming	Embedded	3	0	2	0	4
P18CSI1204	Data Analytics	Embedded	3	0	2	0	4
P18INT0001	Research Methodology and Statistics	Theory	3	0	0	0	3
						Total Credits	**18**
						Total Hours per week	**20**
SEMESTER-II							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18CSI2201	Cloud Services and Virtualization	Embedded	3	0	2	0	4
P18CSI2202	Agile Software Development and Usability Engineering	Embedded	3	0	2	0	4
P18CSI2203	Web Programming	Embedded	3	0	2	0	4
P18CSE---*	Program Elective I	Theory	3	0	0	0	3
						Total Credits	**15**
						Total Hours per week	**18**
SEMESTER-III							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18CSE---*	Program Elective II	Theory	3	0	0	0	3
P18CSP3701	Project Phase I / Industry Project	Project	0	0	0	30	15
						Total Credits	**18**
						Total Hours per week	**33**
SEMESTER-IV							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18CSP4701	Project Phase II / Industry Project	Project	0	0	0	30	15
						Total Credits	**15**
						Total Hours per week	**30**
						Total Number of Credits=66	

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List of Program Electives							
Code No.	**Course Title**	**Course Type**	**L**	**T**	**P**	**J**	**C**
P18CSE0001	Machine learning techniques	Theory	3	0	0	0	3
P18CSE0002	Security for Internet of Things.	Theory	3	0	0	0	3
P18CSE0003	SDN and NFV for IoT	Theory	3	0	0	0	3
P18CSE0004	Blockchain Technology	Theory	3	0	0	0	3
P18INT0002	Product Design and Development	Theory	3	0	0	0	3
P18CSE0005	Applied Cryptography	Theory	2	1	0	0	3
P18CSE0006	Human Computer Interaction	Theory	3	0	0	0	3
P18CSE0007	Intelligent Computing and its Application	Theory	3	0	0	0	3
P18CSE0008	Web Application Security and Secure Software Concepts	Theory	2	1	0	0	3

Details	**Credits to be earned**
List of Core Course	30
Project work	30
List of Elective Courses	6
Total No of Credits	**66**

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SYLLABUS

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L	T	P	PJ	C
3	1	0	0	4

P18MAT1108 MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

COURSE OUTCOMES

On the successful completion of the course, the students would be able to

CO1: Evaluate the validity of logical arguments and construct mathematical proofs K3

CO2: Analyse whether given graphs are isomorphic and apply different algorithms to find the shortest path. K4

CO3: Apply the concept of two-dimensional random variables to correlation, regression and central limit theorem K4

CO4: Learn and apply multivariate analysis necessary for Principal Component Analysis. K3

CO5: Identify the Markovian queueing model in the given system, find the performance measures and analyses the results K2

CO/PO MAPPING				
(S/M/W indicates strength of correlation)			**S-Strong, M-Medium, W-Weak**	
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	S	M		M
CO2	M			
CO3	W			
CO4	M		M	M
CO5	W			

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-term Test-I (Theory component) 2. Assignment, Tutorial assessment, Group Presentation, Case study, Mini project 3. End Semester Examination
INDIRECT
1. Course-end survey

LOGIC **9 + 3 Hours**

Propositional logic – Logical connectives – Truth tables – Normal forms (principal conjunctive and principal disjunctive normal forms) - Predicate logic - Universal and existential quantifiers - Proof techniques – Direct and indirect proofs – Proof by contradiction – Mathematical Induction.

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GRAPH THEORY **9 + 3 Hours**

Introduction to Graphs- Graph terminology and special types of graphs – Matrix representation of Graphs-Graph Isomorphism- Connected Graphs-Euler Graphs- Hamilton paths and Circuits-Shortest path problem.

TWO DIMENSIONAL RANDOM VARIABLES **9 + 3 Hours**

Joint distributions – Marginal and conditional distributions – Expected values of functions of two variables– Correlation and regression - Central limit theorem.

MULTIVARIATE ANALYSIS **9 + 3 Hours**

Random vectors and matrices – Mean vectors and covariance matrices –Principal components - Population principal components – Principal components from standardized variables

QUEUEING MODELS **9 + 3 Hours**

Markovian Queues – Single and Multi-Server Models – Little's formula – Machine Interference Model – Self Service Queue.

REFERENCES

1. Kenneth H. Rosen, "Discrete Mathematics and its applications: With Combinatorics and Graph Theory (Seventh Edition)", Tata McGraw-Hill Edition, 2015
2. J.P.Trembly, R. "Manohar," Discrete Mathematical Structures with applications to Computer Science", TMH International Edition 2017.
3. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", Prentice – Hall, 2016
4. Gupta S.C. & Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 2007.
5. Freund John, E and Miller, Irvin, "Probability and Statistics for Engineering", Duxbury Press; 6 edition, 2003.
6. Veerarajan. T., "Probability, Statistics and Random Process", Tata McGraw Hill,2015
7. Richard A. Johnson and Dean W. Wichern, ―Applied Multivariate Statistical Analysis‖, 5th Edition, Pearson Education, Asia, 2012.
8. Anderson, T. W , An Introduction to Multivariate Statistical Analysis, John Wiley and Sons, 2003

WEBSITES

1. https://www.coursera.org/specializations/mathematics-machine-learning
2. www.coursera.org/learn/datasciencemathskills
3. https://www.cs.cmu.edu/~adamchik/21-127/lectures/graphs_1_print.pdf
4. http://people.brunel.ac.uk/~mastjjb/jeb/or/queue.html
5. https://newonlinecourses.science.psu.edu/stat414/node/107/

Theory: 45 **Tutorial: 15** **Practical: 0** **Project: 0** **Total: 60 Hours**

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P18CST1001 ADVANCED DATA STRUCTURES

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOME

On the successful completion of the course, the students would be able to

CO1: Apply suitable data structure for the given problem. K3

CO2: Analyze and predict suitable data structure for same problem. K4

CO3: Give reason for chosen algorithm performs better for given application. K5

CO4: Justify how the chosen data structures, algorithm is appropriate for a given problem. K5

Pre-requisites: Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)			
	PO1	PO2	PO3	PO4
CO1	M			
CO2	S			
CO3	S	S		M
CO4	S	S	M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-term Test-I (Theory component) 2. Assignment, Journal paper review, Group Presentation, Case study, Mini project 3. End Semester Examination
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

ADVANCED DATA STRUCTURES - I **9 HOURS**

Heaps: Min-Max heap, Binary heaps, Applications of Priority Queues, d-Heaps, Leftist heap, Binomial heap, Fibonacci heap, skew heap

ADVANCED DATA STRUCTURES - II **9 HOURS**

Trees: AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries.

COMPUTATIONAL GEOMETRY **9 HOURS**

One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a PrioritySearch Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, K-D Trees.

GREEDY AND FLOW NETWORKS **9 HOURS**

Matroids: Introduction to greedy paradigm, Algorithm to compute a maximum weight maximal independent set, Application of MST.

Flow-Networks: Maxflow-Mincut theorem, Ford-Fulkerson method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

DIVIDE AND CONQUER AND DYNAMIC PROGRAMMING **9 HOURS**

Matrix Computations: Strassen's algorithm - Introduction to divide and conquer paradigm, Inverse of a Triangular matrix.

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm.

Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring, Fast Fourier Transform algorithm, Schonhage-Strassen Integer Multiplication algorithm.

Theory: 45 **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

REFERENCES

1. Ellis Horowitz, SartajSahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Second Edition, Universities Press, Hyderabad, 2008.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, Prentice Hall of India, New Delhi, 2009
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Design & Analysis of Computer Algorithms, 1st Edition, Pearson, 1974.(2002 latest edition)
4. Jon Kleinberg, Eva Tardos , Algorithm Design: Pearson New International Edition,First Edition, Pearson, 2014.
5. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th Edition, Pearson, 2014.

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OTHER WEB REFERENCES:

1. https://www.coursera.org/learn/advanced-data-structures
2. http://www.nptel.ac.in/

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P18CSI1202 IOT ARCHITECTURE AND PROGRAMMING

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOME

On the successful completion of the course, the students would be able to

CO1	Appreciate the evolution and applications of IoT	K2
CO2	Evaluate the available sensors for an application and understand circuits	K5,S2
CO3	Analyze different options for Embedded systems, connectivity and networking protocol and apply the appropriate one for a given application	K4.S3
CO4	Understand MGC Architecture and Arduino Programming	K2
CO5	Analyze major challenges for IoT and design innovative solutions for the same	K4

PRE-REQUISITES: COMPUTER NETWORKS

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)			
	PO1	**PO2**	**PO3**	**PO4**
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M
CO5	S	M	M	M

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COURSE ASSESSMENT METHODS

DIRECT
1. Mid-term Test-I (Theory component) 2. Assignments / Quiz 3. IoT Product / System Development / Lab Assessment 4. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS:

UNIT I- IOT – MOTIVATION AND APPLICATIONS **9 HOURS**

Importance of IoT. Motivating Applications of IoT:

Smart Cities- Smart Waste Management, Smart Street Lights, Smart Street Parking, Security without Surveillance, Connected Vehicles. Healthcare- Baby Monitoring, Elderly Monitoring, Mood Enhancing, Disease Treatment and Progression Monitoring, Enhance Adherence, Challenges. Agriculture- Precision Agriculture, Connected Livestock, Food Safety. Manufacturing and Logistics- Smart Manufacturing- Smart Packaging, SmartLabel. Smart Electricity Grid- Managing Supply and Demand. Home Automation.

UNIT II – SENSORS AND CIRCUITS **7 HOURS**

Sensor – Introduction, Terminology, Behavior, Selection, Circuits – Overview and Applications, Battery Issue and Energy Management, Wireless Link, Digital and Analog – Digital Computing, Analog to Digital Interfaces

UNIT III-EMBEDDED SYSTEMS, CONNECTIVITY AND NETWORKING 11 HOURS

Embedded Systems – Overview, Technology Drivers, Energy, Microcontrollers, Software Connectivity and Networking – Introduction, Connectivity Challenges in IoT, Energy Harvesting Transmitters, Massive Multiple Access, Computation vs Communication

UNIT IV- ARCHITECTURE AND PROGRAMMING **9 HOURS**

IoT Architectures – embedded System, Gateway and Cloud (MGC) Architecture and other reference models and architectures

Arduino vs Raspberry Pi vs Electric Imp – Key features and comparisons

Arduino Interfaces – Arduino IDE - Programming

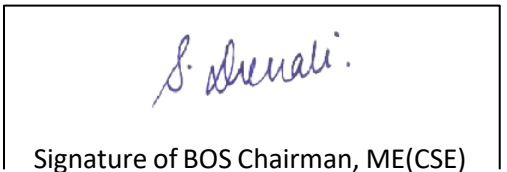
UNIT V: IOT CHALLENGES **9 HOURS**

Technology Challenges – Security, Connectivity, Compatibility and Longevity, Standards, Intelligent Analysis and Actions

Business Challenges – Consumer IoT, Commercial IoT, Industrial IoT

Society Challenges – Privacy, Regulatory Standards

Theory:45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours



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REFERENCES

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley & Sons Ltd., UK, 2014.
3. "Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti (Universities Press)
4. David Boswarthick, Omar Elloumi and OlivierHersent, “M2M Communications: A Systems Approach”, John Wiley & Sons Ltd, UK, 2012.
5. Dieter Uckelmann, Mark Harrison and Florian Michahelles, “Architecting the Internet of Things”, Springer, NewYork, 2011.
6. Olivier Hersent, David Boswarthick and OmarElloumi, “The Internet of Things: Key Applications and Protocols”, John Wiley & Sons Ltd., UK, 2012.
7. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.
8. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
9. Dieter Uckelmann, Mark Harrison and Florian Michahelles, “Architecting the Internet of Things”, Springer, NewYork, 2011.
10. https://iot.ieee.org/newsletter/march-2017/three-major-challenges-facing-iot.html

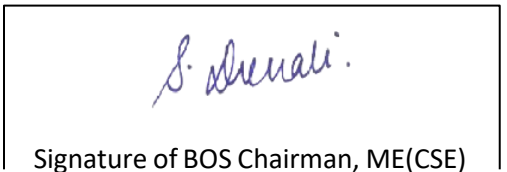
OTHER WEB REFERENCE

1. https://online.stanford.edu/courses/xee100-introduction-internet-things
2. https://onlinecourses.nptel.ac.in/noc17_cs22/course
3. https://www.coursera.org/specializations/internet-of-things
4. https://www.edx.org/micromasters/curtinx-internet-of-things-iot#courses

LAB COMPONENT CONTENTS: 30 Hours

1. Arduino Programming
    a. Basic Arduino Programming
    b. Controlling LED with Arduino
    c. Working with sensors and actuators
    d. Serial Port Programming
    e. Interfacing Arduino with modules and Shields
2. Raspberry Pi Programming
    a. Python Programming in Raspberry Pi
    b. Controlling LED with Raspberry Pi
    c. Working with sensors and actuators
    d. Interfacing with Camera, SMTP, HTTP.
3. Cloud Storage and Data Analytics
    a. Stream Data in public Cloud Storage
    b. Retrieval and Visualization of data
4. Each student to select an IoT Application / Product / System Requirement, that the student will develop during this course after due literature survey and analysis including feasibility and develop an IoT product.

Theory: 0 Tutorial: 0 Practical: 30 Project: 0 Total: 30 Hours



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P18CSI1204 **DATA ANALYTICS**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1:	Discover roles and stages of data analytics process and tools with conventional techniques	K4
CO2:	Examine statistical analysis and test using R and visualize the result.	K4, S2
CO3:	Choose the efficient algorithm for solving the particular real word problems.	K3, S2
CO4:	Analyze the Hadoop distributed file system and explore on data using Hadoop eco system	K4, S3
CO5:	Make use of streaming concept for real time applications	K3

PRE-REQUISITES: NIL

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	M			M
CO2	M			M
CO3	M	M		
CO4	M		S	
CO5	M			S

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-Term Test -I (Theory component)
2. Assignment, Presentation, Project Report, Prototype or Product
3. Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

INTRODUCTION TO DATA SCIENCE **4 Hours**

Introduction to Big Data: Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

DATA ANALYSIS USING R **11 Hours**

Introduction - Basic data types and operations – Manipulating Objects - Data summaries and Graphics - Statistical tests and models – Basic Analysis Techniques- ANOVA- Interactive Graphics-Interactive visualizations - Scalable and parallel computing with Hadoop and Map- Reduce using R-Case studies - Analyzing big data with twitter – Understanding business scenarios- Big data for E- Commerce – Big data for blogs.

MODELING METHODS **12 Hours**

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Association Rules- Rare rule Mining- K-Nearest Neighbors- Decision trees -Naïve Bayes – Memorization Methods – Linear and logistic regression- validating models.

MAP REDUCE **10 Hours**

Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.

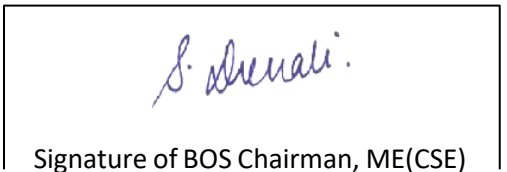
MINING DATA STREAMS **8 Hours**

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

Theory: 45 **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

REFERENCES

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007
2. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
3. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.
4. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012.
5. Nathan Yau, “Visualize This: The FlowingData Guide to Design, Visualization, and Statistics”, Wiley, 2011.
6. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.



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7. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.

E BOOKS AND ONLINE LEARNING MATERIALS

1. http://www.johndcook.com/R_language_for_programmers.html
2. http://bigdatauniversity.com/
3. http://www.michael-noll.com/tutorials/running-hadoop-on-ubuntu-linux-single-node-cluster/

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Perform and setting up and installing Hadoop in single cluster and multiple cluster
2. Programming Examples- Combiner Functions - Distributed MapReduce Job
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
   - Find the number of occurrence of each word appearing in the input file(s)
   - Performing a MapReduce Job for word search count (look for specific keywords in a file)
4. Purchases.txt Dataset
   - Instead of breaking the sales down by store, give us a sales breakdown by product category across all of the stores
5. Implement Linear and Logistic regression
6. Implement Decision trees / Naïve Bayes
7. Implement K-means clustering and Association rules
8. Implement K-Nearest neighbors algorithm
9. Working with Hadoop Eco system
10. Integrating R and Hadoop
11. Working with Data visualization tools
12. Working with Web-based application using R

Theory: 0 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 30 Hours**

ONLINE COURSES AND VIDEO LECTURES:

https://www.coursera.org/specializations/jhu-data-science
https://www.kdnuggets.com/2016/10/top-10-data-science-videos-youtube.html
https://cse6242.gatech.edu/
https://people.cs.umass.edu/~ggrinstein/CS690V.pdf

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P18INT0001 RESEARCH METHODOLOGY AND STATISTICS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

On successful completion of the course, the students should be able to

CO1: Understand and apply the concepts of research K3

CO2: Apply statistical and other research tools to analyze and interpret data K3

CO3: Demonstrate skills in writing research topics. K4

Pre-requisites: Nil

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	**S**	**M**	**M**	**M**
CO2	**M**	**M**	**M**	**M**
CO3	**M**	**S**	**M**	**M**

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-term Test-I (Theory component) 2. Open book test, Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO RESEARCH METHODS 9 Hours

Definition and Objectives of Research, Scientific Methods, Various Steps in Scientific Research, Research planning, Selection of a Problem for Research, Formulation of the Selected Problems, Purpose of the Research, Formulation of research objectives, Formulation of research questions, Hypotheses Generation and Evaluation, Literature search, and review, Research abstract

INTRODUCTION TO STATISTICS 9 Hours

Population and Sample, Sampling and sample size, Population Proportion and Population Mean, Sample Proportion and Sample Mean, Estimation of Standard Error and confidence Interval, Identifying the dependent and independent variables, Introduction to data, Types of data and their

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importance, Descriptive Statistics and Inferential Statistics, Summarizing and describing data, Measures of Central Tendency and Measures of Dispersion, Mean, Median, Mode, Range, Variance, Standard Deviation

STATISTICAL MODELING AND ANALYSIS **12 Hours**

Probability Distributions, Normal, Binomial, Poisson, Fundamentals of Statistical Analysis and Inference, Hypothesis Testing, Confidence interval, Test of Significance, Comparison of Means (T test, Z test), Analysis of variance (ANOVA), Measures of association/Relationship, Chi-square test, Simple Regression Analysis, Multiple Regression analysis, Correlation, Data visualization techniques

RESEARCH DESIGN/PLAN **6 Hours**

Types and Methods of Research, Classification of Research, Research Ethics, Sampling Techniques, Methods of Collecting Primary Data, Use of Secondary Data, Experimentation, Design of Experiments, Survey Research and Construction of Questionnaires, Pilot Studies and Pre-tests, Data Collection methods, Processing of Data, Editing, Classification and Coding, Transcription, Tabulation, Validity and Reliability,

RESEARCH REPORTS **9 Hours**

Structure and Components of Research Report/thesis, Types of Report, Planning of Report/thesis Writing, Research Report Format, Layout of Research Report, Presentation of data and Data Analysis Reporting, Mechanism of writing a research report, Principles of Writing, Writing of Report

Reference Books:

1. C.R. Kothari, Research Methodology Methods and Techniques, 3/e, New Age International Publishers, 2014.
2. Ranjit Kumar, Research Methodology A Step-by-Step Guide for Beginners, 4th Edition, Sage Publishing, 2014
3. R. Pannerselvam, Research Methodology, 2nd edition, Prentice Hall India, 2014
4. Devore, J.L., Probability and statistics for Engineering and the Sciences, Cengage Learning, ebook, 8th edition, 2010

Theory: 45 **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

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P18CSI2201 CLOUD SERVICES AND VIRTUALIZATION

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

On successful completion of the course, the students should be able to

CO1: Deploy legacy OSs on virtual machines. K3

CO2: Distinguish the intricacies of server, storage, network, desktop and application virtualizations. K4

CO3: Compare full and para virtualization. K4,S1

CO4: Producing cloud applications in virtual machine platforms. K5,S3

PRE-REQUISITES: NIL

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	PROGRAMME OUTCOMES (POs)			
	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M

COURSE ASSESSMENT METHODS

DIRECT

1. Mid-Term Test 1(Theory component)
2. Assignments / Quiz / Group Presentation
3. Practical implementation / System Development / Lab Assessment / Mini Project
4. End Semester Examination

INDIRECT

1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION 9 Hours

Introduction - Essentials - Benefits - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics - Cloud Adoption. Cloud Models - Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud - Public versus Private Clouds - Cloud Infrastructure Self Service.

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CLOUD SERVICES AND SOLUTIONS **9 Hours**

Principal Technologies - Cloud Strategy - Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined. Cloud Solutions - Introduction - Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.

CLOUD OFFERINGS AND CLOUD MANAGEMENT **9 Hours**

Cloud Offerings - Information Storage, Retrieval, Archive and Protection - Cloud Analytics - Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Cloud Management - Resiliency - Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering

CLOUD ENABLIBNG TECHNOLOGIES **9 Hours**

Data center Technology – Virtualization Technology – Web Technology – Multitenant Technology – service technology – case study in AWS.

CLOUD VIRTUALIZATION **9 Hours**

Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements - Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Center.

Theory: 45 **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

REFERENCES

1. James E. Smith, Ravi Nair, - Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, - Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.
3. Kumar Reddy, Victor Moreno, - Network virtualization, Cisco Press, July, 2006.
4. Chris Wolf, Erick M. Halter, - Virtualization: From the Desktop to the Enterprise, Apress 2005.
5. Danielle Ruest, Nelson Ruest - Virtualization: A Beginner‟s Guide, TMH, 2009
6. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, ―Cloud Computing: Concepts,Technology and Architecture‖, Prentice Hall Service Technology Series, 2013
7. Kenneth Hess, Amy Newman: Practical Virtualization Solutions: Virtualization from the Trenches Prentice Hall 2010
8. John Rittinghouse, James Ransome, Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010
9. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter - Cloud Computing: A Practical Approach,TMH, 2010
10. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas - Cloud Computing Synopsis and Recommendations NIST, May 2011

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11. Tom White - Hadoop: The Definitive Guide Storage and Analysis at Internet Scale O'Reilly Media Press May 2012
12. Dave Shackleford - Virtualization security- Protecting Virtualized Environments, Sybex Publishers, First Edition, 2012

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Examples of Software-as- a-Service (SaaS), Platform-as- a-Service (PaaS), Infrastructure-as- a-Service (IaaS)
2. Creation of virtual Firewall
3. Implementation of virtual LAN
4. Creation of VM backup
5. Implementation of RAID in virtual machine
6. Deployment of VMs in Oracle Virtual box
7. Install storage controller and interact with it.
8. Hosting Web application in cloud.

. **Theory: 0** **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 30 Hours**

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P18CSI2202 **AGILE SOFTWARE DEVELOPMENT AND USABILITY ENGINEERING**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

On successful completion of the course, the students should be able to

CO1	Experiment the Agile development practice	K3
CO2	Perform development with unit tests using Test Driven Development	K5
CO3	Apply design principles and refactoring to achieve Agility	K3
CO4	Deploy and justify automated build tools, version control and continuous integration	K4, S2
CO5	Build testing activities within an Agile project	K5, S2

PRE-REQUISITES: COMPUTER NETWORKS

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
Cos	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1				M
CO2	S	S	M	M
CO3				M
CO4	M	M	S	M
CO5	M	S	S	M

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz 3. Agile Process/System Development / Lab Assessment / Mini Project 4. End Semester Examination
INDIRECT
1. Course-end survey

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THERORY COMPONENT CONTENTS:

FUNDAMENTALS OF AGILE **9 Hours**

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

AGILE SCRUM FRAMEWORK **9 Hours**

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

AGILE TESTING **9 HOURS**

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

AGILE SOFTWARE DESIGN AND DEVELOPMENT **9 HOURS**

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control

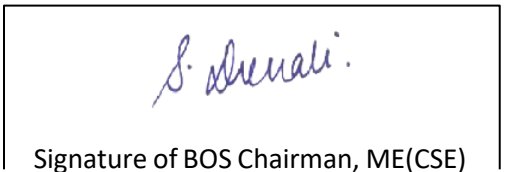
INDUSTRY TRENDS **9 HOURS**

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies.

Theory:45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

1. Agile Software Development with Scrum, Ken Schawber, Mike Beedle, Publisher: Pearson.
2. Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin, Janet Gregory, Publisher: Addison Wesley
3. Agile Software Development, Principles, Patterns and Practices, Robert C. Martin, Publisher: Prentice Hall
4. Agile Software Development: The Cooperative Game, By Alistair Cockburn Publisher: Addison Wesley



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5. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
6. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

OTHER ONLINE COURSES

1. www.it-ebooks.info/tag/agile
2. http://martinfowler.com/agile.html

LAB COMPONENT CONTENTS: 30 Hours

1. Understand a given business scenario and identify product backlog, user stories and sprint tasks
2. Define user stories for a given feature
3. Fill user stories, sprint schedule and sprint tasks in an Agile tool such as AgileFant
4. Write unit tests aligned to x-Unit framework for TDD
5. Refactor a given design for next sprint requirements
6. Execute continuous integration using a tool such as Jenkins

Theory: 0 Tutorial: 0 Practical: 30 Project: 0 Total: 30 Hours

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P18CSI2203 **WEB PROGRAMMING**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course the students should be able to

CO1:	Apply HTML concepts to develop Webpages	K3, S2
CO2:	Build Web applications using Cascading Style Sheets.	K5, S3
CO3:	Choose JavaScript to develop Webpages.	K4
CO4:	Design Web application using JSP and Servlet.	K5, S2
CO5:	Develop PHP program to manipulation a database.	K5,S2

PRE-REQUISITES: NIL

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
Cos	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	M	S	S	M
CO2	S	S	S	M
CO3	S	S	S	M
CO4	S	S	S	M
CO5	S	S	S	M

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz / Group Presentation. 3. Webpage creation /System Development / Lab Assessment / Mini Project 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment. 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

PROGRAMMING HTML **8 Hours**

Overview of HTML- Using the HTML Canvas API- Working with HTML Audio and Video- Using the HTML Geolocation API- Using the Communication APIs- Using the HTML Forms API- Using the HTML Web Storage API.

CASCADING STYLE SHEETS (CSS) **9 Hours**

Properties Table: Using the style Attribute, Creating Classes and IDs, Generating External Style Sheets, Typography, Consistency, Types of styles, specifying class within HTML document, Style placement: Inline style, Span & div tags, header styles, Text and font attributes: Font Vs CSS, changing fonts, text attributes, Advance CSS properties: Backgrounds, Box properties and Positioning.

JAVASCRIPT **9 Hours**

Client-Side Programming: Introduction to JavaScript – Functions – Objects – Arrays – Built - in Objects - JavaScript Debuggers.

Host Objects: Browsers and the DOM - Introduction to the Document Object Model DOM History and Levels - Intrinsic Event Handling - Modifying Element Style - The Document Tree -DOM Event Handling

JSP and SERVLETS **10 Hours**

JSP application Basics: Introducing Java Server Pages-HTTP and Servlet Basics-JSP Overview-Setting up the JSP Environment. JSP Application Development: Generating Dynamic Content- Using JavaBean Components in JSP Pages-Using Custom Tag Libraries and the JSP Standard Tag Library-Processing Input and Output-Error Handling and Debugging-Sharing Data between JSP Pages, Request, and Users-Accessing a Database.

PHP **9 Hours**

PHP: Introduction – Programming in Web Environment – Variables – Constants –Data; Types – Operators – Statements – Functions – Arrays – OOP – String Manipulation and Regular Expression – File Handling and Data Storage – PHP and SQL Database – PHP and LDAP – PHP Connectivity – Sending and Receiving E-mails – Debugging and Error Handling – Security – Templates.

Theory: 45 **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

REFERENCES

1. Peter Lubbers, Brian Albers, Frank Salim-Pro HTML5 Programming Powerful APIs for Richer Internet Application Development-Apress (2010)
2. Jeffrey C.Jackson, "Web Technologies-A Computer Science Perspective", Pearson Education, 2013. (Unit 2 &3).
3. Hans Bergsten, “JavaServerPages”, Second Edition, O’Reilly Publication, 2002.

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4. Steven Holzner, “PHP: The Complete Reference”, Second edition, Tata McGraw-Hill, Indian Reprint, 2009.
5. Rasmus Lerdorf and Levin Tatroe, “Programming PHP”, O’Reilly, 2002.

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Create a HTML webpage to play/Pause a video and if the video is paused, resize it by small, normal and big.
2. Create a HTML webpage that contains a button to retrieve Latitude and Longitude.
3. Develop a webpage that consists of three types of CSS implementation
4. Develop a webpage that contains form validation using JavaScript.
5. Develop a webpage to perform mouse event handling.
6. Develop a webpage to add two numbers using JSP and servlet.
7. Develop a JSP program to use Java Bean component.
8. Develop a webpage to retrieve the database table using JSP
9. Develop a webpage to perform CRUD operation using PHP
10. Develop a PHP program to use the send mail configuration.

Theory: 0 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 30 Hours**

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P18CSP3701 Project Phase I / Industry Project

L	T	P	J	C
0	0	0	30	15

COURSE OUTCOMES

After successful completion of this course the students should be able to

CO1:	Identify a problem which addresses an emerging research issue	K3
CO2:	Analyze the literature survey carried out to gain in-depth understanding about the contemporary methodologies.	K4
CO3:	Identify the methodologies and modularize the entire proposed solution	K3
CO4:	Identify the required tools/software/hardware for implementation	K3

PRE-REQUISITES: NIL

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
Cos	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	S	M	S	S
CO2	S	S	S	S
CO3	S	M	S	S
CO4	S	M	S	M

COURSE ASSESSMENT METHODS

DIRECT
1. Review 1 2. Review 2 3. Review 3 4. End Semester Examination
INDIRECT
1. Course-end survey

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P18CSP4701 Project Phase II / Industry Project

L	T	P	J	C
0	0	0	30	15

COURSE OUTCOMES

After successful completion of this course the students should be able to

CO1:	Implement the methodologies using appropriate techniques identified during Phase-1	K4
CO2:	Analyze and evaluate the performance of the proposed work	K4
CO3:	Develop a dissertation report to summarize the research findings and publish it in a journal or conference	K3

PRE-REQUISITES: NIL

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
Cos	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	**S**	**M**	**S**	**S**
CO2	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**M**

COURSE ASSESSMENT METHODS

DIRECT
1. Review 1 2. Review 2 3. Review 3 4. End Semester Examination
INDIRECT
1. Course-end survey

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ELECTIVE COURSE

P18CSE0001 MACHINE LEARNING TECHNIQUES

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

On successful completion of the course, the students should be able to

CO1:	Compare and contrast various about regression methods	.K4
CO2:	Illustrate various supervised learning algorithms.	K4, S2
CO3:	Create and deploy deep neural network applications.	K5, S3
CO4:	Synthesize the usage of unsupervised learning algorithms.	K5, S2

PRE-REQUISITES: NIL

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	M	M		M
CO2	M	M		M
CO3	S	S	S	M
CO4	S	S		M

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz/ Lab Assessment / Mini Project/ Group Presentation 3. End Semester Examination
INDIRECT
1. Course End Survey

THEORY COMPONENT CONTENTS

STATISTICAL THEORY AND REGRESSION **9 HOURS**

Linear methods for Regression – Gauss-Markov theorem – Multiple regression – Subset selection – Ridge regression – Principal components regression – Partial least squares - Linear discriminant analysis – Logistic regression.

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SUPERVISED LEARNING **9 HOURS**

Decision Tree Learning - Bayesian Learning - Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm.

DEEP LEARNING **9 HOURS**

Neural Network Representation – Problems – Perceptron – Multilayer Networks and Back Propagation Algorithms - Convolutional neural networks - Recurrent neural networks – Create and deploy neural networks using Tensor Flow and Keras.

UNSUPERVISED LEARNING **9 HOURS**

Association rules – Cluster analysis – Self organizing maps – Principal components, curves and surfaces – Non-negative matrix factorization – Independent component analysis – Multidimensional scaling – Ensemble learning.

REINFORCEMENT LEARNING **9 HOURS**

Introduction - Single State Case - Elements of Reinforcement Learning – Model Based Learning - Temporal Difference Learning – Q Learning Algorithm – Generalization - Partially Observable States.

Theory: 45 Hours **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

REFERENCES

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Springer; Second Edition, 2009.
3. Alpaydin Ethem, "Introduction to Machine Learning", MIT Press, Second Edition, 2010.
4. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning: with Applications in R", Springer; First Edition 2013

ONLINE COURSES AND VIDEO LECTURES:

1. https://www.coursera.org/learn/machine-learning
2. https://www.coursera.org/specializations/statistics
3. https://cs229.stanford.edu/notes/

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P18CSE0002 SECURITY FOR INTERNET OF THINGS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

On successful completion of this course, the students should be able to

CO1	Discover the security requirements in IoT	K4
CO2	Examine the cryptographic fundamentals for IoT	K4
CO3	Choose the Block chain protocols for IOT networks	K5,S3
CO4	Illustrate the authentication credentials and access control for IoT	K3
CO5	Conduct a research project in the domain of IOT security and building on recent results from literature	K6,S3

PRE-REQUISITES: IOT Architecture and Programming **(**P18CSI1202)

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	M	S		
CO2		M		S
CO3	S	S		S
CO4			S	
CO5	S	S	S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz/ Lab Assessment / Mini Project/ Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

GENERAL OVERVIEW **9 HOURS**

IoT and cyber-physical systems, IoT security (vulnerabilities, attacks and countermeasures), security engineering for IoT development, IoT security lifecycle.

CRYPTO FOUNDATIONS **9 HOURS**

Block ciphers, message integrity, authenticated encryption, hash functions, Merkle trees, elliptic curves, public-key crypto (PKI), signature algorithms.

BLOCKCHAINS **9 HOURS**

Crypto-currencies, Bitcoin P2P network, distributed consensus, incentives and proof-of-work, mining, scripts and smart contracts, wallets: hot and cold storage, anonymity, altcoins.

CREDENTIAL MANAGEMENT FOR CONNECTED DEVICES **9 HOURS**

Security credential management system (SCMS), Vehicle Based Security System (VBSS), PKI design, certification provisioning, pseudonyms (privacy-by design), misbehavior detection, revocation.

CLOUD SERVICES AND IOT **9 HOURS**

Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing

Theory: 45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

1. Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren
2. B. Rusell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.
3. Narayanan et al., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction," Princeton University Press, 2016.
4. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations
5. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies," O'Reilly, 2014.
6. T. Alpcan and T. Basar, "Network Security: A Decision and Game-theoretic Approach," Cambridge University Press, 2011.

ONLINE COURSES AND VIDEO LECTURES:

1. https://www.udemy.com/fundamentals-of-iot-security/
2. https://datafloq.com/read/securing-internet-of-things-iot-with-blockchain/2228
3. https://csrc.nist.gov/CSRC/media/Presentations/Leveraging-Blockchain-based-Protocols-in-IoT-Syste/images-media/1_iot_stavrous.pdf
4. https://www.ibm.com/blogs/research/2018/10/blockchain-internet-of-things/

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P18CSE0003 SDN AND NFV FOR IOT

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

On successful completion of the course, the students will be able to:

CO1	Make use of Modern Network approaches such as SDN NFV to emerging network problems.	K3
CO2	Apply data center topologies and virtualized environment	K3
CO3	Identify various components for building an IoT application	K3
CO4	Build algorithms for virtualization over multi-tenant environments.	K3
CO5	Choose appropriate security features for the SDN and NFV	K3

PRE-REQUISITES: NIL

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)			
	PO1	**PO2**	**PO3**	**PO4**
CO1	S			
CO2	S	M	S	M
CO3	M	M	S	
CO4	M	S		M
CO5	M			

COURSE ASSESSMENT METHODS

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz/ Lab Assessment / Mini Project/ Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COURSE CONTENT

MODERN NETWORKING **9 HOURS**

Internet of Things - Types of Network and Internet Traffic - Demand: Big Data, Cloud Computing, and Mobile Traffic - Requirements: QoS and QoE – Routing Congestion Control - SDN and NFV - Modern Networking Elements

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SOFTWARE DEFINED NETWORKS **9 HOURS**

Network Requirements - The SDN Approach - SDN- and NFV-Related Standards – SDN Data Plane - Open Flow Logical Network Device - Open Flow Protocol - SDN Control Plane Architecture - REST API - SDN Application Plane Architecture

VIRTUALIZATION **9 HOURS**

Background and Motivation for NFV - Virtual Machines - NFV Concepts – NFV Reference Architecture - NFV Infrastructure - Virtualized Network Functions – NFV Management and Orchestration - NFV Use Cases - SDN and NFV

THE INTERNET OF THINGS: COMPONENTS **9 HOURS**

The IoTEra - Scope of the Internet of Things - Components of IoT-Enabled Things – IoT World Forum Reference Model - ITU-T IoT Reference Model - IoTivity - Cisco IoT System - ioBridge - SDN and NFV over IoT Deployment

SECURITY **9 HOURS**

Security Requirements - SDN Security - NFV Security - ETSI Security Perspective – IoT Security - The Patching Vulnerability - IoT Security and Privacy Requirements Defined by ITU- T - An IoT Security Framework - The Impact of the New Networking on IT Careers.

Case Study: A study about Defense4All security SDN application

Theory: 45 **Tutorial: 0** **Practical: 0** **Project: 0** **Total: 45 Hours**

REFERENCES

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud”, Pearson Education, 2015.
2. Jim Doherty, “SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization”, First Edition, Pearson Education, 2016.
3. Paresh Shah, Syed Farrukh Hassan, Rajendra Chayapathi, “Network Function virtualization with a touch of SDN”, Addison-Wesley, Pearson Education, 2016.
4. Paul Goransson, Chuck Black, “Software Defined Networks: A Comprehensive Approach”, First Edition, Elsevier Inc, 2014.

ONLINE REFERENCES

1. https://www.udemy.com/sdn-openflow-nfv-introduction/
2. https://www.coursera.org/learn/sdn

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L	T	P	J	C
3	0	0	0	3

P18CSE0004 BLOCKCHAIN TECHNOLOGY

COURSE OUTCOMES

On successful completion of the course, the students will be able to:

CO1	Discover the secure and efficient transactions with crypto-currencies	K4
CO2	Experiment with cryptocurrency trading and crypto exchanges	K3
CO3	Develop private blockchain environment and develop a smart contract on Ethereum	K3, S2
CO4	Build the hyperledger architecture and the consensus mechanism applied in the hyperledger	K5,S2

Pre-requisites: Cryptography and Network security

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
Cos	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	M	M	M	M
CO2	M	M	M	M
CO3	M	M	M	M
CO4	S	S	S	M

COURSE ASSESSMENT METHOD

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz 3. System Development / Lab Assessment / Mini Project 4. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS:

CRYPTOCURRENCY AND BLOCKCHAIN- INTRODUCTION 9 HOURS

Blockchain- An Introduction, Distinction between databases and blockchain, Distributed ledger. Blockchain ecosystem - Consensus Algorithms & Types, Blockchain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain - Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains

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CRYPTO CURRENCIES **9 HOURS**

Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies - Digital Signatures - Cryptocurrency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks

BITCOIN **9 HOURS**

Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions- Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem

ETHEREUM **9 HOURS**

The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain- Deploying contract from web and console

HYPERLEDGER **9 HOURS**

Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers- Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants

Theory:45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018
2. Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016

OTHER ONLINE REFERENCES

1. https://www.coursera.org/learn/ibm-blockchain-essentials-for-developers
2. https://museblockchain.com/
3. https://www.provenance.org/
4. https://www.coursera.org/learn/blockchain-basics https://steemit.com/
5. https://101blockchains.comhttps://followmyvote.com/

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P18INT0002 **PRODUCT DESIGN AND DEVELOPMENT**
(Common to all branches)

L	T	P	C
3	0	0	3

Course Objectives

- Understand the basic concepts of product design and development.
- Know the implications in product architecture and the importance of industrial design.
- Understand prototyping basics and influence of diverse factors on project success.

Course Outcomes

After successful completion of this course, the students should be able to

CO1	Apply concepts of product development and outline product planning process	K3
CO2	Apply relative importance of customer needs in establishing product Specifications	K3
CO3	Identify concept generation activities and summarize the methodology involved in concept selection and testing	K2
CO4	Outline supply chain considerations in product architecture and understand the industrial design process	K2
CO5	Apply design for manufacturing concepts in estimating manufacturing costs	K3
CO6	Apply principles of prototyping in product development economics and highlight importance of managing projects	K3

Pre-requisite: Nil

CO/PO MAPPING				
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	M		M	M
CO2			M	M
CO3	M	M	M	
CO4		M	S	
CO5			S	M
CO6	M		M	M

COURSE ASSESSMENT METHOD

DIRECT
1. Mid-Term Test 1 (Theory component) 2. Assignments / Quiz 3. System Development / Lab Assessment / Mini Project 4. End Semester Examination
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS:

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS

PRODUCT PLANNING **9 Hours**

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.
A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization. The product planning process, identify opportunities.
Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS **9 Hours**

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process. Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING 9 Hours

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process, Overview of methodology, concept screening, concept scoring, caveats. Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING **9 Hours**

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues. Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design. Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS

9 Hours

Prototyping basics, principles of prototyping, technologies, planning for prototypes, Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis. Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

Theory:45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

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REFERENCES

1. Karl Ulrich,T, Steven Eppinger, D, “Product Design and Development”, McGrawHill, 2015.
2. Chitale, AK, Gupta, RC, “Product Design and Manufacturing” PHI, 2013.
3. Timjones, “New Product Development:An Introduction to a multifunctional process”, Butterworth-Heinemann, 1997.
4. Geoffery Boothroyd, Peter Dewhurst and Winston Knight,A, “Product Design for Manufacture and Assembly”, CRC Press, 2011.

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P18CSE0005 **APPLIED CRYPTOGRAPHY**

L	T	P	J	C
2	1	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Apply cryptographic primitives for meeting security requirement

CO2: Understand the Symmetric Cipher Algorithms

CO3: Analyze how hard problems in number theory are applied to construct Public-Key Cryptography

CO4: Understand how message integrity and authentication are achieved through Hashing, MAC and Digital Signatures.

CO5: Understand how key is distributed and managed.

Pre-requisites :Nil

CO/PO MAPPING

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak				
COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	S		M	
CO2	S		M	
CO3	S		S	
CO4		M	M	M
CO5		M	M	M

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COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I 2. Assignment, Latest Crypto Review, Journal paper review, Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY AND TUTORIAL COMPONENT CONTENTS

INTRODUCTION **(4+2 Hours)**

Security Attacks, Services and Mechanisms, Cryptography and Cryptanalysis, Unconditional vs Computationally Security, Classical Cryptography: Substitution Techniques: Caesar, Monoalphabetic, Playfair, Hill, Polyalphabetic Ciphers and One Time Pad, Transposition Techniques, Steganography,

SYMMETRIC CIPHERS **(6+3 Hours)**

Shannon's Principles of Confusion and Diffusion, Feistel Cipher Structure, DES, Attacks on DES. Basic Concepts in Number Theory – Euclidean and Extended Euclidean Algorithms and Modular Arithmetic. Groups, Rings and Fields. AES, Principles of Pseudorandom Number Generation, Stream Cipher – RC4.

ASYMMETRIC CRYPTOGRAPHY **(6+3 Hours)**

Number theory: Fermat's Theorem, Euler's Totient Function, Euler's Theorem. Principles of Public Key Cryptosystems. Factorization Problem and RSA Algorithm, Discrete Logarithm Problem and Diffie Hellman Key Exchange Algorithm, Key management, Diffie-Hellman key exchange algorithm, Elliptic Curve Cryptography (ECC), Case study.

HASH FUNCTIONS and MESSAGE AUTHENTICATION **(7+3 Hours)**

Introduction, Applications, Requirements and security, Secure Hash Algorithm (SHA -512), SHA-3- Sponge Construction.

Authentication requirements, Authentication functions, Message Authentication Codes (MAC), Hash-based Message Authentication Code (HMAC), Authenticated Encryption

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DIGITAL SIGNATURES **(4+2 Hours)**

Digital Signatures, Elgamal, Schnorr Digital Signature Schemes, NIST Digital Signature Algorithm

KEY MANAGMENT **(3+2 Hours)**

Symmetric Key Distribution using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure

Theory: 30	Tutorial: 15	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. William Stallings, "Cryptography and Network Security – Principles and Practice", Prentice Hall, New Delhi, 2011.
2. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2011.
3. Alfred J Menezes, Paul C van Oorschot and Scott A.Vanstone, "Handbook of Applied Cryptography", CRC Press, New York, 2010.
4. Wenbo Mao, "Modern Cryptography - Theory and Practice", Pearson Education, New Delhi, 2013.

S. Sheela.

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P18CSE0006 **HUMAN COMPUTER INTERACTION**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1:	Understand the requirements and specifications for the interaction design.
CO2:	Describe the different types of interactions and interfaces.
CO3:	Understand the techniques to support data analysis, interpretation and presentation
CO4:	Analyze the evaluation techniques of human interaction
CO5:	Determine the most appropriate HCI methods to meet the needs of a practical software development project

Pre-requisites :Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	**PROGRAMME OUTCOMES (POs)**			
	PO1	**PO2**	**PO3**	**PO4**
CO1	S		M	
CO2	S		S	
CO3	M	M	S	M
CO4	M		M	
CO5	S	M	S	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I

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2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTERACTION DESIGN, CONCEPTUALIZING INTERACTION AND COGNITIVE ASPECTS **7 Hours**

Introduction – Good and poor design – User experience – The process of interaction design –interaction design and the user experience – Understanding the problem space and conceptualizing design – Conceptual models – Interface metaphors – Interaction types – Paradigms, theories, models and frameworks – Cognition – Cognitive frameworks.

SOCIAL, EMOTIONAL INTERACTION AND INTERFACES **11 Hours**

Introduction – Face-to-face conversations – Remote conversations – Telepresence – Co-presence – Emergent social phenomena - Emotional interaction: Introduction – Emotions and the user experience – Expressive interfaces – Frustrating interfaces - Persuasive technologies and behavioral change – Anthropomorphism and zoomorphism – Models of emotion – Interface types.

DATA GATHERING, ANALYSIS, INTERPRETATION AND PRESENTATION **10 Hours**

Introduction – Five key issues – Data recording – Interviews – Questionnaires –Observation –Choosing and combining Techniques- Qualitative and quantitative – Simple quantitative analysis– Simple qualitative analysis – Tools to support data analysis – Using theoretical frameworks.

EVALUATION FRAMEWORK **8 Hours**

Goals of evaluation – Types of evaluation – Evaluation case studies – DECIDE: A framework to

guide evaluation – Usability testing –Conducting experiments – Field studies – Inspections-Heuristic evaluation and walkthroughs – Analytics –Predictive models.

UBIQUITOUS COMPUTING, HYPERTEXT AND WORLD WIDE WEB **9 Hours**

Ubiquitous computing application research – Virtual & augmented reality –Understanding hypertext – Finding things– Web technology and issues – Static web content – Dynamic web content- Groupware systems – Computer mediated communication – DSS – Frameworks for groupware- Information and data visualization.

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Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Yvonne Rogers, Helen Sharp, Jenny Preece, Interaction Design: beyond human-computer interaction, John-Wiley and Sons Inc., 2011.

2. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, Human Computer Interaction, Pearson Education, 2008.

3. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, Research Methods in Human-Computer Interaction, Wiley, 2010.

4. Dov Te'eni, Jane Carey, Ping Zhang, Human-Computer Interaction: Developing Effective Organizational Information Systems, John-Wiley and Sons Inc., 2007.

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P18CSE0007 INTELLIGENT COMPUTING AND ITS APPLICATION

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1:	Understand the Intelligent computational approaches.
CO2:	Describe the different types of optimization algorithms.
CO3:	Explain the various types of intelligent agents
CO4:	Understand the computational logic and multi agent systems
CO5:	Understand the basics of JADE programming and applications

Pre-requisites: AI

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)			
	PO1	PO2	PO3	PO4
CO1	S		M	
CO2	S	M	M	M
CO3	S		M	
CO4	M		M	
CO5	M		M	

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COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation etc (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION AND EVOLUTIONARY COMPUTATION **8 Hours**

Introduction to basic intelligent computing techniques - Evolutionary Computation Overview - Genetic Algorithms, Evolutionary Strategies - Evolutionary Programming.

OPTIMIZATION ALGORITHMS **10 Hours**

Particle Swarm Optimization and Ant Colony Optimization, Artificial Immune Systems, Other Algorithms Harmony Search, Honey-Bee Optimization, Memetic Algorithms, Co-Evolution, Multi-Objective Optimization, Artificial Life, Constraint Handling.

INTELLIGENT AGENTS **9 Hours**

Intelligent Agents-Deductive reasoning Agents – Agents as theorem provers- Agent Oriented Programming - Concurrent Metate M- Practical Reasoning Agents - Reactive and Hybrid Agents - Brook's and Subsumption Architecture –The Limitations of Reactive Agents - Hybrid Agents.

COMPUTATIONAL LOGIC AND MULTI AGENT SYSTEMS **10 Hours**

Computational Logic: Modal Logic and Temporal Logic. Some applications of Modal Logic and Temporal Logic.

Agent and their characteristics - Multi agent paradigm - Working Together - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing- Coordination – Multi agent Planning and Synchronization - Making group decisions- Co-operative games - Allocating scarce resources

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JADE AND APPLICATIONS **8 Hours**

The JADE Platform – Programming with JADE – Basic Features. Applications – Agents for different domains - intelligent tutoring systems - E-commerce and E-learning.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Eberhart, E. and Y. Shi., Computational Intelligence: Concepts and Implementations, Morgan Kaufmann, San Diego, 2007.

2. S. Rajasekaran and G.A.Vijaylakshmi Pai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.

3. Michael Wooldridge, "An Introduction to Multiagent Systems", II edition, John Wiley & Sons, Ltd. 2009.
4. Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi agent Systems with JADE, John Wiley and Sons Ltd, 2007.

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P18CSE0008 WEB APPLICATION SECURITY AND SECURE SOFTWARE CONCEPTS

L	T	P	J	C
2	1	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Understand the need for Secure Software Development Lifecycle

CO2: Understand and Apply Secure Design Principles

CO3: Understand and Apply Risk Management in Software Development

CO4: Understand Secure Standards, Best Practices

CO5: Understand Enterprise Security Frameworks, Regulations, Privacy and Compliance

CO6: Apply web application hacker's methodology and analyze the vulnerabilities in the given Web application and suggest measures to fix them

Pre-requisites :Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)			
	PO1	PO2	PO3	PO4
CO1	S		M	
CO2	M		M	
CO3	M		M	
CO4	S		S	M
CO5	M	M	M	
CO6	S		M	M

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COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I 2. Periodic Project Presentation and Lab Examination 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

UNIT 1 **6 Hours**

Need for Security Development Lifecycle

Threats have changed, Current Software Development Methods Fail to Produce Secure Software, Security Development Lifecycle for Management, Secure Software Lifecycle Stages vs traditional software lifecycle stages

UNIT 2 **5 Hours**

Security Design Principles

Core Concepts of Secure Software, Security Design Principles: - Least Privilege, Separation of Duties, Defence in Depth, Fail Safe, Economy of Mechanism, Complete Mediation, Open Design, Least Common Mechanism, Psychological Acceptability, Weakest Link, Leveraging Existing Components.

UNIT 3 **5 Hours**

Software Risk Management, Security Policies

Risk Management – Terminologies and Definition, Calculation of Risk, Risk Management for Software, Handling Risk, PCI DSS Applicability. Security Policies- Scope, Prerequisites, Security Policy Development Process.

UNIT 4 **5 Hours**

Security Standards and Best Practices

Types of Security Standards, Internal Coding Standards, NIST Standards, FIPS Standards, ISO/IEC Standards and Software Security, PCI Standards, OASIS Standards. Benefits of Security Standards. Best Practices – OWASP, ITIL

UNIT 5 **9 Hours**

Other Secure Software Concepts

Software Development - Waterfall Model, Iterative Model, Spiral Model, Agile Development Methodologies

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, Software Assurance – Socratic Methodology, Six Sigma, Capability Maturity Model Integration, OCTAVE Model, STRIDE and DREAD, OSSTMM, Flaw Hypothesis Method, Enterprise Application and Security Frameworks – Zachman Framework, COBIT, COSO, SABSA, Regulations, Privacy and Compliance, Privacy and Software Development, Trusted Computing, Acquisitions

Tutorial Component **15 hours**

Install WebGoat and a proxy like Burp Suite or any such web proxy or any such tool and experiment with top web application vulnerabilities. At the end given any web application the student should be able to use the Web Application Hacker's methodology and assess and report the web application vulnerability and suggest measures of fixing them.

Theory: 30	**Tutorial: 15**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Mano Paul "Certified Secure Software Life Cycle Professional", second Edition, CRC press, 2014.
2. Michael Howard and Steve Lipner, "The Security Development Life Cycle " Microsoft Press, 2006
3. Jason Grembi, "Secure Software Development: A Security Programmer's Guide", 1st Edition, Cengage Learning, 2009
4. Julia H. Allen, Sean Barnum, Robert Julia H. Allen "Software Security Engineering: A guide for Project Managers", Pearson Education, 2008
5. Dafydd Stuttard and Marcus Pinto, " The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" , 2nd edition, Wiley, 2011
6. OWASP Top 10 Vulnerabilities at https://www.owasp.org/index.php/Category:OWASP_Top_Ten_Project and https://www.owasp.org/images/7/72/OWASP_Top_10-2017_%28en%29.pdf.pdf
7. OWASP WebGoat Project: https://www.owasp.org/index.php/Category:OWASP_WebGoat_Project https://github.com/WebGoat/WebGoat
8. BURP Proxy at https://portswigger.net/burp

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