SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603203.

(Approved by AICTE, Affiliated to Anna University, 'A' Grade Accredited by NAAC, NBA Accredited, ISO 9001:2015 Certified)

POST GRADUATE CURRICULA AND SYLLABI
MASTER OF COMPUTER APPLICATIONS

REGULATION 2024

Programme: **MASTER OF COMPUTER APPLICATIONS (2 YEARS)**

REGULATIONS – 2024
CHOICE-BASED CREDIT SYSTEM
MASTER OF COMPUTER APPLICATIONS (2 YEARS)

VISION OF THE DEPARTMENT

To create and apply knowledge by thinking and doing, preparing for tomorrow's innovators and conduct cutting-edge research to bring the transformative power of computing to society in a rapidly changing world.

MISSION OF THE DEPARTMENT

1. To bring the most brilliant students and faculty together to understand the strengths and limits of computation, invent next-generation computing systems, and create innovative solutions to real-world problems.
2. To provide conducive environment so as to achieve excellence in teaching-learning, and research and development activities.
3. Deliver knowledge among students through novel pedagogical methods in the varied areas of computer sciences with thrust on applications so as to enable students to undertake research.
4. To facilitate students to nurture skills to practice their professions competently to meet the ever-changing needs of society.

REGULATIONS – 2024
CHOICE-BASED CREDIT SYSTEM
MASTER OF COMPUTER APPLICATIONS (2 YEARS)

1. PROGRAMME EDUCATIONAL COURSE OBJECTIVES (PEOs):

PEO 1: To equip students with a sound foundation to design and develop solutions in mathematical, scientific and business applications.

PEO 2: To develop the ability to plan, analyse, design, code, test, implement and maintain the software product for real time systems.

PEO 3: To practice effectively as individuals and as team members in multidisciplinary projects involving technical, managerial, economic and social constraints.

PEO 4: To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.

2. PROGRAMME COURSE OUTCOMES (POs):

After going through the two years of study, our master's in computer applications graduates will exhibit the ability to:

PO#	PROGRAMME COURSE OUTCOMES
1.	An ability to independently carry out research/investigation and development work to solve practical problems.
2.	An ability to write and present a substantial technical report/document.
3.	An ability to demonstrate a degree of mastery over the design and development of computer applications.
4.	An ability to create, select, adapt and apply appropriate innovative techniques, resources, and modern computing tools to complex computing activities with an understanding of the limitations.
5.	An ability to recognize the need and to engage in independent learning for continual development as a computing professional.
6.	An ability to function effectively as an individual and as a member/leader of a team in various technical environments.

3. PEO / PO Mapping:

PROGRAMME EDUCATIONAL COURSE OBJECTIVES	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
I	3	1	3	3	3	3
II	2	1	3	3	3	3
III	3	3	2	3	2	2
IV	2	1	2	1	1	2

(3 – High, 2 – Medium, 1 – Low)

4. Mapping of Course Outcome and Programme Outcome

YEAR	SEM	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6
YEAR 1	SEMESTER 1	Applied Probability and Statistics	2.4	0.2	2	2	1.2	2.0
		Research Methodology and Intellectual Property Rights	3	2.4	0.4	1.4	-	0.6
		Advanced Data Structures and Algorithms	2.4	0.2	2	2	1.2	2.0
		Advanced Database Technology	2.2	1	3	3	2.2	2.6
		Python Programming	2.2	1	3	3	2.2	2.6
		Computer Networks & Management	2	1	2	2	2	2
		Data Structures Laboratory	1.8	1	3	2.6	2	2.2
		Database Technologies Laboratory	1	2.6	2.2	1	1	1
		Python Programming Laboratory	1	2	2	1	2	2

	SEMESTER 2	Full Stack Web Development	2.2	1	2.4	2	2.6	2.6
		Cloud Computing Technologies	2.2	1	2.2	2	2	2
		Advanced Database Technology	2	1	2.8	2	2.2	2.4
		Cyber Security	2	1	2	2	2	2
		Object Oriented Software Engineering	1.83	1	3	2.66	2	2
		Professional Elective - I						
		Full Stack Web Development Laboratory	2.2	1	2.4	2	2.6	2.6
		Database Technology Laboratory	2	1	2	2	2	2
		Communication Skills Enhancement – I	1.8	1	3	2.6	2	2.2
		Mini Project	2	1	2	1	2	2
YEAR 2	SEMESTER 3	Machine Learning	1.6	1	2	2	2	2
		Mobile Application Development	2	-	3	3	2	2
		Professional Elective II						
		Professional Elective III						
		Professional Elective IV						
		Professional Elective - V						
		Communication Skills Enhancement– II	1	2.6	2.2	1	1	1
		Machine Learning Laboratory	2	1	2	2	2	2
		Mobile Application Development Laboratory	2	1	3	3	2	2
	SEMESTER 4	Project Work						

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REGULATIONS – 2024
CHOICE-BASED CREDIT SYSTEM
MASTER OF COMPUTER APPLICATIONS (2 YEARS)

I TO IV SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MC4121	Applied Probability and Statistics	BSC	4	3	1	0	4
2	BA4171	Research Methods and Intellectual Property Rights	RMC	3	3	0	0	3
3	MC4161	Advanced Data Structures and Algorithms	PCC	3	3	0	0	3
4	MC4162	Advanced Database Technology	PCC	3	3	0	0	3
5	MC4163	Python Programming	PCC	3	3	0	0	3
6	MC4164	Computer Networks & Management	PCC	3	3	0	0	3
7		Audit Course – I*	AC	2	0	0	2	0
PRACTICAL								
8	MC4165	Data Structures Laboratory	PCC	2	0	0	2	1
9	MC4166	Database Technologies Laboratory	PCC	4	0	0	4	2
10	MC4167	Python Programming Laboratory	PCC	4	0	0	4	2
			TOTAL	**31**	**18**	**1**	**12**	**24**

- Audit Course is optional

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MC4261	Full Stack Web Development	PCC	3	3	0	0	3
2	MC4262	Cloud Computing and Mobile App Development	PCC	3	3	0	0	3
3	MC4263	Advanced Data Science	PCC	3	3	0	0	3
4	MC4264	Cyber Security	PCC	3	3	0	0	3
5	MC4265	Object Oriented Software Engineering	PCC	3	3	0	0	3
6	MC42xx	Professional Elective - I	PEC	3	3	0	0	3
PRACTICAL								
7	MC4266	Full Stack Web Development Laboratory	PCC	4	0	0	4	2
8	MC4267	Mobile Application Development Laboratory	PCC	4	0	0	4	2
9	EN4217	Communication Skills Enhancement – I	EEC	2	0	0	2	1
10	MC4268	Mini Project	EEC	2	0	0	2	1
			TOTAL	**30**	**18**	**0**	**12**	**24**

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MC4361	Machine Learning	PCC	3	3	0	0	3
2	MC4362	Internet of Things	PCC	3	3	0	0	3
3	MC43xx	Professional Elective II	PEC	3	3	0	0	3
4	MC43xx	Professional Elective III	PEC	3	3	0	0	3
5	MC43xx	Professional Elective IV	PEC	3	3	0	0	3
6	MC43xx	Professional Elective V	PEC	3	3	0	0	3
PRACTICAL								
7	MC4363	Machine Learning Laboratory	PCC	4	0	0	4	2
8	MC4364	Internet of Things Laboratory	PCC	4	0	0	4	2
9	EN4318	Communication Skills Enhancement – II	EEC	2	0	0	2	1
			TOTAL	**28**	**18**	**0**	**10**	**23**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	MC4441	Project Work	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS: 83

BASIC SCIENCE COURSES (BSC)

Sl. No	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			LECTURE	TUTORIAL	PRACTICAL		
1	MC4121	Advanced Applied Mathematics	4	0	0	4	I

PROFESSIONAL CORE COURSES (PCC)

S.NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			LECTURE	TUTORIAL	PRACTICAL		
1.	MC4161	Advanced Data Structures and Algorithms	3	0	0	3	I
2.	MC4162	Advanced Database Technology	3	0	0	3	I
3.	MC4163	Python Programming	3	0	0	3	I
4.	MC4164	Computer Networks &Management	3	0	0	3	I
5.	MC4165	Data Structures Laboratory	3	0	0	1	I
6.	MC4166	Database Technologies Laboratory	2	0	0	2	I
7.	MC4167	Python Programming Laboratory	3	0	0	2	I
8.	MC4261	Full Stack Web Development	3	0	0	3	II
9.	MC4262	Cloud Computing and Mobile App Development	3	0	0	3	II
10.	MC4263	Advanced Data Science	3	0	0	3	II
11.	MC4264	Cyber Security	3	0	0	3	II

12.	MC4265	Object Oriented Software Engineering	3	0	0	3	II
13.	MC4266	Full Stack Web Development Laboratory	4	0	0	2	II
14.	MC4267	Mobile Application Development Laboratory	4	0	0	2	II
15.	MC4361	Machine Learning	3	0	0	3	III
16.	MC4362	Internet of Things	3	0	0	3	III
17.	MC4363	Machine Learning Laboratory	4	0	0	2	III
18.	MC4364	Internet of Things Laboratory	4	0	0	2	III
						46	

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO	COURSE CODE	COURSETITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			LECTURE	TUTORIAL	PRACTICAL		
1	BA4171	Research Methods and Intellectual Property Rights	3	0	0	3	I
					TOTAL CREDITS	3	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO	COURSE CODE	COURSETITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			LECTURE	TUTORIAL	PRACTICAL		
1	MC4268	Mini Project	0	0	2	1	II
2	EN4217	Communication Skills Enhancement – I	0	0	2	1	II
3	EN4318	Communication Skills Enhancement – II	0	0	2	1	III
4	MC4441	Project Work Phase	0	0	24	12	IV
					TOTAL CREDITS	**15**	

SUMMARY

S. NO.	Name of the Programme : M.C.A.,					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	-
1.	BSC	4	-	-	-	4
2.	PCC	17	19	10	-	46
3.	PEC	-	3	12	-	15
4.	RMC	3	-	-	-	3
5.	EEC	-	2	1	12	15
	TOTAL CREDIT	**26**	**23**	**22**	**12**	**83**

An MCA, student shall select a professional elective courses (15 credits) from semester II Onwards. These courses shall be from the same vertical or a combination of different verticals of the same programmeof study only.

A student shall select a professional elective courses (15 credits) from semester II onwards. All these courses have to be in a particular vertical or across the verticals. Moreover, if the student can register in any one of the following verticals then he/ she can become an expert in the particular domain.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

AI	Software Engineering	Data Science	AI & ML	Cyber Security	Cloud Computing and Data Center Technologies
Artificial Intelligence for Social Good	Software Requirement Engineer	Machine Learningfor Data Science	Natural Language Processing	Database Management Systems and Security	Virtualization
Neural Network & Deep Learning	Software Industrialization	Data Visualization	Predictive Model	Operating Systems and Security	Cloud Services Management
Data Analytics and Computing	Business Intelligence	Data Security & Privacy	Smart Convergent Technologies	Cryptography and Cyber Security	Storage Technologies
Image processing & Machine Vision	Integrated Software Project Management	Big data analytics	Web Analytics	Engineering Secure Software Systems	Software Defined Networks
Introduction to Blockchain Technology	Software Security	Exploratory Analysis	Machine Learning & Deep Learning	Cyber Forensics	Stream Processing

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: ARTIFICIAL INTELLIGENCE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	PMC101	Artificial Intelligence for Social Good	PEC	3	3	0	0	3
2	PMC102	Neural Network & Deep Learning	PEC	3	3	0	0	3
3	PMC103	Data Analytics and Computing	PEC	3	3	0	0	3
4	PMC104	Image processing & Machine Vision	PEC	3	3	0	0	3
5	PMC105	Introduction to Blockchain Technology	PEC	3	3	0	0	3

VERTICAL II: SOFTWARE ENGINEERING

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	PMC201	Software Requirement Engineer	PEC	3	3	0	0	3
2	PMC202	Software Industrialization	PEC	3	3	0	0	3
3	PMC203	Business Intelligence	PEC	3	3	0	0	3
4	PMC204	Integrated Software Project Management	PEC	3	3	0	0	3
5	PMC205	Software Security	PEC	3	3	0	0	3

VERTICAL III: DATA SCIENCE

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	PMC401	Machine Learning for Data Science	PEC	3	3	0	0	3
2	PMC402	Data Visualization	PEC	3	3	0	0	3
3	PMC403	Data Security & Privacy	PEC	3	3	0	0	3
4	PMC404	Big data analytics	PEC	3	3	0	0	3
5	PMC405	Exploratory Analysis	PEC	3	3	0	0	3

VERTICAL IV: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	PMC401	Natural Language Processing	PEC	3	3	0	0	3
2	PMC402	Predictive Model	PEC	3	3	0	0	3
3	PMC403	Smart Convergent Technologies	PEC	3	3	0	0	3
4	PMC404	Web Analytics	PEC	3	3	0	0	3
5	PMC405	Machine Learning & Deep Learning	PEC	3	3	0	0	3

VERTICAL V: CYBER SECURITY

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	PMC501	Database Management Systems and Security	PEC	3	3	0	0	3
2	PMC502	Operating Systems and Security	PEC	3	3	0	0	3
3	PMC503	Cryptography and Cyber Security	PEC	3	3	0	0	3
4	PMC504	Engineering Secure Software Systems	PEC	3	3	0	0	3
5	PMC505	Cyber Forensics	PEC	3	3	0	0	3

VERTICAL VI: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	PMC601	Virtualization	PEC	3	3	0	0	3
2	PMC602	Cloud Services Management	PEC	3	3	0	0	3
3	PMC603	Storage Technologies	PEC	3	3	0	0	3
4	PMC604	Software Defined Networks	PEC	3	3	0	0	3
5	PMC605	Stream Processing	PEC	3	3	0	0	3

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AC4001	English for Research Paper Writing	2	0	0	0
2.	AC4002	Disaster Management	2	0	0	0
3.	AC4003	Constitution of India	2	0	0	0
4.	AC4004	Entrepreneurship Essentials	2	0	0	0

BRIDGE COURSES

(For the M.C.A students admitted under non-computer-science background category)

SL. NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
Classes are to be conducted and completed before the start of the class of first semester,							
1.	BC4101	Data Structures and Algorithms	5	3	0	2	0
Classes are to be conducted and completed before the start of the class of second semester,							
2.	BC4201	Introduction to Computer Organization and Operating Systems	3	3	0	0	0
Classes are to be conducted and completed before the start of the class of third semester,							
3.	BC4301	Mathematical Foundations of Computer Science	3	3	0	0	0

ABBREVIATIONS:

BSC - BASIC SCIENCE COURSES

PCC - PROFESSIONAL CORE COURSES

PEC - PROFESSIONAL ELECTIVE COURSES

RMC - RESEARCH METHODOLOGY AND IPR COURSES

EEC - EMPLOYABILITY ENHANCEMENT COURSES

MC4121 APPLIED PROBABILITY AND STATISTICS L T P C
3 1 0 4

COURSE OBJECTIVES:

- To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
- To enable students to understand the concepts of Probability and Random Variables.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the central limit theorem.
- To apply the small / large sample tests through Tests of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT I LINEAR ALGEBRA 12

Vector spaces — norms — Inner Products — Eigenvalues using QR transformations — QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.

UNIT II PROBABILITY AND RANDOM VARIABLES 12

Probability – Axioms of probability – Conditional probability – Bayes theorem – Random variables
– Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson , Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean , variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 12

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

- Apply the concepts of Linear Algebra to solve practical problems.
- Use the ideas of probability and random variables in solving engineering problems.
- Be familiar with some of the commonly encountered two dimension random variables andbe equipped for a possible extension to multivariate analysis.
- Use statistical tests in testing hypothesis on data.
- Develop critical thinking based on empirical evidence and the scientific approachto knowledge development.

REFERENCES:

1. Dallas E Johnson, “Applied multivariate methods for data Analysis”, Thomson and Duxburypress, Singapore, 1998.
2. Richard A. Johnson and Dean W. Wichern, “Applied multivariate statistical Analysis”, Pearson Education, Fifth Edition, 6th Edition, New Delhi, 2013.
3. Bronson, R.,”Matrix Operation” Schaum’s outline series, Tata McGrawHill, New York, 2011.
4. Oliver C. Ibe, “Fundamentals of Applied probability and Random Processes”, Academic Press, Boston, 2014.
5. Johnson R. A. and Gupta C.B., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson India Education, Asia, 9th Edition, New Delhi, 2017.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	-	2	2	1	2
CO2	2	-	2	2	1	1
CO3	2	-	2	1	1	2
CO4	3	1	2	2	1	2
CO5	3	-	2	3	2	3
AVG	2.4	0.2	2	2	1.2	2.0

BA4171	RESEARCH METHODS AND INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize the students with the scientific methodology involved in research process.
- To comprehend different methods on data collection.
- To understand techniques to code and analyze data using various statistical techniques.
- To know the concept of IPR and ethics in research.
- To understand about patent drafting and filing process.

UNIT I INTRODUCTION 9

Introduction – Sources of Research Problem, Research Process - Criteria of Good Research - Scope and importance, Approaches – Qualitative – Quantitative, Research Design and Types, Types of Variables, Ethics in Research.

UNIT II DATA COLLECTION AND ANALYSIS 9

Sources of Data – Primary – Secondary, Data Collection Methods, Measurement and Scaling, Validity of Findings- Internal and External Validity

UNIT III DATA PREPARATION AND DATA CLEANING 9

Sampling Techniques, Editing – Coding – Tabulation of Data, Validity of data – Qualitative Vs Quantitative, Data analysis – Univariate - Bivariate and Multivariate statistical techniques – Cluster analysis – Multiple regression.

UNIT IV INTELLECTUAL PROPERTY RIGHTS AND PATENTS 9

Introduction to Intellectual Property (IP) - Role of IP in the Economic and Cultural Development of the Society – IP Governance - IP as a Global Indicator of Innovation - Major Amendments in IP Laws and Acts in India, Trademark and secrets - Types and features of IPR, Patents - Conditions for Obtaining a Patent Protection - National Bodies Dealing with Patent Affairs - Registration procedure.

UNIT V DOCUMENTATION AND REPORT WRITING 9

Research report – Report format – Title of the report - Contents of report - Different types, Report Presentation – Oral Presentation – Written Presentation, IPR Document – Forms of IPR – IPR Guidelines

TOTAL: 45 PERIODS

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.

4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.
5. C.R. Kothari,"Research Methodology: Methods and Trends", New Age International,2015
6. Dipankar Deb Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13- 2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0
7. Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwa
8. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488- 4
9. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

OUTCOMES:

1. Formulate and design research problem.
2. Understand and comprehend the data collection methods.
3. Perform data analysis and acquire Insights.
4. Understand IPR and follow research ethics.
5. Understand and practice drafting and filing a Patent in research and development.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	-	-	-	-	-
CO2	-	2	-	-	-	-
CO3	-	-	1	-	-	-
CO4	-	-	1	-	-	-
CO5	-	-	-	-	1	-
AVG	1	2	1	-	1	-

MC4161 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To learn the concepts of linear data structures and its applications.
- To understand the concepts of non-linear data structures like trees and graphs.
- To learn the usage of sorting techniques.
- To familiarize the concepts of hashing.
- To understand about algorithm analysis and design techniques.

UNIT I LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) — List ADT — Array-Based Implementation — Linked List Implementation Doubly-Linked Lists – Circular Linked Lists – Stack ADT: Implementation of Stacks – Queue ADT: Implementation of Queues – Applications.

UNIT II ALGORITHMS IN COMPUTING 9

Introductions to Algorithms – Iterative and Recursive Algorithms – Designing Algorithms – Analyzing Algorithms – Growth of Functions: Asymptotic Notations – Standard Notations and Common Functions – Recurrences: The Substitution Method – The Recursion – Tree Method.

UNIT III HIERARCHICAL DATA STRUCTURES & HASHING 9

Trees: Preliminaries – Implementation of Trees – Tree Traversals with an Application – Binary Trees: Implementation – Expression Trees – Search Tree ADT – Binary Search Trees – Applications of Trees - Fundamentals of Hashing – Hash Function – Separate Chaining – OpenAddressing.

UNIT IV SORTING AND GRAPHS 9

Sorting Algorithms: Insertion Sort, Quick Sort, Heap Sort - Graphs: Representation of Graphs, Graph Traversals – Topological Sort – Shortest Path Algorithms: Dijkstra's Algorithm – Minimum Spanning Tree: Prim's and Kruskal's Algorithm.

UNIT V ALGORITHM DESIGN TECHNIQUES 9

Greedy Algorithms: Huffman Codes — Divide and Conquer: Merge Sort — Dynamic Programming: Using a Table instead of Recursion – Ordering Matrix Multiplications – Introduction to NP Completeness.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Use abstract data types including stacks, queues and lists for any application.
2. Design and implement tree data structures.
3. Analyze and implement hashing techniques that solve in linear time.
4. Apply sorting algorithms for a given problem.
5. Design algorithms using graph structures to solve real life problems.
6. Choose appropriate data structure and implement a given application.

REFERENCES:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition,Pearson Education, 1997.
2. V. Alfred, J. E. Hopcroft, J. D. Ullman, “Data Structures and Algorithms”, Pearson education Asia, 1983.
3. Robert Kruse & Bruce Leung, “Data Structures & Program Design in C”, Pearson Education, 2007.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introductionto Algorithms”, Third Edition, PHI Learning, 2002.
5. S. Sridhar, “Design and Analysis of Algorithms”, Oxford University Press, 2014.
6. Anany Levitin, “Introduction to Design and Analysis of Algorithms”, Third Edition,Pearson Education, 2012.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	-	2	2	1	2
CO2	2	-	2	2	1	1
CO3	2	-	2	1	1	2
CO4	3	1	2	2	1	2
CO5	3	-	2	3	2	3
AVG	2.4	0.2	2	2	1.2	2.0

MC4162 **ADVANCED DATABASE TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the working principles and query processing of distributed databases.
- To understand the basics of spatial, temporal and mobile databases and their applications.
- To distinguish the different types of NoSQL databases.
- To understand the basics of XML and create well-formed and valid XML documents.
- To gain knowledge about information retrieval and web search.

UNIT I DISTRIBUTED DATABASES 9

Distributed Systems – Introduction – Architecture – Distributed Database Concepts – Distributed Data Storage — Distributed Transactions — Commit Protocols — Concurrency Control — Distributed Query Processing

UNIT II SPATIAL AND TEMPORAL DATABASES 9

Active Databases Model – Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries – Spatial Indexing and Mining – Applications -– Mobile Databases: Location and Handoff Management, Mobile Transaction Models – Deductive Databases - Multimedia Databases.

UNIT III NOSQL DATABASES 9

NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding– Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features

UNIT IV XML DATABASES 9

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases –XML Querying — XPath — XQuery

UNIT V INFORMATION RETRIEVAL AND WEB SEARCH 9

IR concepts – Retrieval Models – Queries in IR system – Text Preprocessing – Inverted Indexing – Evaluation Measures – Web Search and Analytics – Current trends.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student will be able to:

CO1: Design a distributed database system and execute distributed queries.
CO2: Manage Spatial and Temporal Database systems and implement it in corresponding applications.
CO3: Use NoSQL database systems and manipulate the data associated with it.
CO4: Design XML database systems and validate with XML schema.
CO5: Apply knowledge of information retrieval concepts on web databases.

REFERENCES:

1. Abraham Silberschatz, Henry F Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education/Addison Wesley, 2017.
3. Guy Harrison, "Next Generation Databases, NoSQL, NewSQL and Big Data", First Edition, Apress publishers, 2015
4. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques",Third Edition, Morgan Kaufmann, 2012.
5. Brad Dayley, "Teach Yourself NoSQL with MongoDB in 24 Hours", Sams Publishing,First Edition, 2014.
6. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems",Eighth Edition, Pearson Education, 2006

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	3	2	2	2
CO3	2	1	3	2	2	3
CO4	2	1	3	2	3	3
CO5	2	1	3	2	2	2
AVG	2	1	2.8	2	2.2	2.4

MC4163 **PYTHON PROGRAMMING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To develop Python programs with conditionals, loops and functions.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python
- To use modules, packages and frameworks in python
- To define a class with attributes and methods in python

UNIT I BASICS OF PYTHON 9

Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements. Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement-Continue statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions

UNIT II DATA TYPES IN PYTHON 9

Lists, Tuples, Sets, Strings, Dictionary, Modules: Module Loading and Execution – Packages –Making Your Own Module – The Python Standard Libraries.

UNIT III FILE HANDLING AND EXCEPTION HANDLING 9

Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –FilePosition –Exception: Errors and Exceptions, Exception Handling, Multiple Exception.

UNIT IV MODULES, PACKAGES AND FRAMEWORKS 9

Modules: Introduction – Module Loading and Execution – Packages – Making Your Own Module – The Python Libraries for data processing, data mining and visualization-NUMPY, Pandas, Matplotlib, Plotly-Frameworks- -Django, Flask, Web2Py

UNIT V OBJECT ORIENTED PROGRAMMING IN PYTHON 9

Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class methodvs. static methods, Python object persistence.

COURSE OUTCOMES:

On completion of the course the student would be able to :

CO1: Develop algorithmic solutions to simple computational problems
CO2: Represent compound data using Python lists, tuples and dictionaries.
CO3: Read and write data from/to files in Python Programs
CO4: Structure simple Python programs using libraries, modules etc.
CO5: Structure a program by bundling related properties and behaviors into individual objects.

TOTAL : 45 PERIODS

REFERENCES

1. Reema Thareja, “Python Programming using Problem Solving Approach”, Oxford UniversityPress, First edition, 2017
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition,Shroff, O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/
3. Guido van Rossum, Fred L. Drake Jr., “An Introduction to Python – Revised and Updated for Python 3.2, Network Theory Ltd., First edition, 2011
4. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and Expanded Edition, MIT Press, 2013
5. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley India Edition, First Edition, 2016.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	1	3	3	2	3
CO2	1	1	3	3	1	2
CO3	2	1	3	3	2	2
CO4	3	1	3	3	3	3
CO5	2	1	3	3	3	3
AVG	2.2	1	3	3	2.2	2.6

MC4164 COMPUTER NETWORKS AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of networking, network security and network programming.
- To explore the end to end issues in data communication and possible secure solutions.
- To study about routing algorithms and protocols, IP and related protocols
- To understand medium access control and LANs
- To learn about networking devices and the techniques required to monitor and manage them

UNIT I ARCHITECTURE AND APPLICATION 9

Data networks –Network Architecture - ISO/OSI and TCP/IP reference models – HTTP and HTTPS,FTP, E-mail and DNS

UNIT II SOCKET PROGRAMMING 9

System calls and socket programming, Elementary TCP and UDP socket - Developing client/server applications –Socket Options - Advanced Socket IP options for IPv6 server and client's interoperability- Raw Sockets.

UNIT III SECURE COMMUNICATION 9

Secured Data Networks – CIA triangle - Encryption and Decryption – Symmetric and AsymmetricCryptosystems -End to end issues – Transport layer protocols – TCP extensions –IPSec — SSL and TLS protocols.

UNIT IV L2 AND L3 PROTOCOLS AND DEVICES 9

Medium Access Control — Ethernet — CSMA/CD — IEEE 802.11 WLAN CSMA/CA — IPv4 – Addressing, VLSM, CIDR - IPv6 – Network devices – Hubs, Bridges, Switches, Routers, L3Switches.

UNIT V DEVICES, MONITORING AND MANAGEMENT 9

Edge and Core Networks – Introduction to SDN- data plane- control plane Honeypots – Firewalls –Network monitoring - IDS – Network Management System – SNMP and its variants

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Design and implement simple client/server programs using socket options.
2. Design and implement simple cryptosystems
3. To configure various transport layer level parameters in setting up a network
4. To configure various network level parameters in setting up a network
5. Experiment with various tools to manage a network
6. Design a network as per the given specifications, monitor and manage the networks

REFERENCES

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, SeventhEdition, Pearson Education, 2016.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, FifthEdition,Morgan Kaufmann Publishers Inc., 2011.
3. William Stallings, “Data and Computer Communications”, Eighth Edition, PearsonEducation,2011.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, " Computer Networks: An Open SourceApproach", First Edition, McGraw Hill, 2011.
5. W. Richard Stevens, “TCP/IP illustrated-The Protocols”, Volume 1, Pearson Education,2012.
6. W. Richard Stevens, Bill Fenner, Andrew M Rudoff “UNIX Network Programming: TheSockets Networking API“, Volume 1, Third Edition, Pearson Education, 2015.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	1	3	3	2	3
CO2	1	1	3	3	1	2
CO3	2	1	3	3	2	2
CO4	3	1	3	3	3	3
CO5	2	1	3	3	3	3
AVG	2.2	1	3	3	2.2	2.6

MC4165	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To understand the usage of advanced tree structures.
- To familiarize the usage of heap structures.
- To learn the usage of graph data structures and spanning trees.
- To learn how to analyze the complexities of algorithms.
- To explore the various design strategies of algorithms.

EXPERIMENTS:

1. Implementation of Stack ADT and Queue ADT
2. Implementation of Binary Search tree and its operations.
3. Implementation of AVL tree and its operations.
4. Implementation of Hashing techniques such as separate chaining.
5. Implementation of representation of graphs and topological sort.
6. Implementation of a spanning tree for a given graph using Prim's algorithm.
7. Implementation of shortest path algorithms such as Dijkstra's algorithm.
8. Implementation of iterative and recursive algorithms with its complexity analysis.
9. Implementation of Merge sort algorithm analysis using divide and conquer approach.
10. Implementation of matrix chain multiplication using dynamic programming approach.
11. Implementation of Huffman coding using greedy approach

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

1. Implement basic and advanced data structures extensively.
2. Choose and apply suitable hierarchical data structures for real time problems.
3. Apply suitable heap data structures based on the problem requirements.
4. Design and apply algorithms using graph structures.
5. Design and implement iterative and recursive algorithms with minimum complexity.
6. Design and develop efficient algorithms by adopting suitable algorithm design strategies.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	3	2	2
CO2	2	1	3	3	2	2
CO3	1	1	3	2	2	2
CO4	2	1	3	2	2	2
CO5	2	1	3	3	2	3
AVG	1.8	1	3	2.6	2	2.2

MC4166 DATABASE TECHNOLOGIES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To understand the process of distributing tables across multiple systems
- To understand the process of storing, retrieving spatial and temporal data
- To understand the process of storing, retrieving objects in a database
- To understand the process of storing and retrieving data from a XML Database
- To use the open source database for building a mobile application

LIST OF EXPERIMENTS:

1. NOSQL Exercises
   a) MongoDB – CRUD operations, Indexing, Sharding
   b) Cassandra: Table Operations, CRUD Operations, CQL Types
   c) HIVE: Data types, Database Operations, Partitioning – HiveQL
   d) OrientDB Graph database – OrientDB Features
2. MySQL Database Creation, Table Creation, Query
3. MySQL Replication – Distributed Databases
4. Spatial data storage and retrieval in MySQL
5. Temporal data storage and retrieval in MySQL
6. Object storage and retrieval in MySQL
7. XML Databases , XML table creation, XQuery FLWOR expression
8. Mobile Database Query Processing using open source DB (MongoDB/MySQL etc)

TOTAL: 60 PERIODS

SOFTWARE REQUIREMENTS

1. Java / Python / R / Scala
2. Oracle, MySQL, MongoDB, Casandra, Hive

COURSE OUTCOMES:

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

CO1: Design and implement advanced databases.
CO2: Use big data frameworks and tools.
CO3: Formulate complex queries using SQL.
CO4: Create an XML document and perform Xquery.
CO5: Query processing in Mobile databases using open source tools.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	1	2	2	2	2
AVG	2	1	2	2	2	2

MC4167 **PYTHON PROGRAMMING LABORATORY** **L T P C**

0 0 4 2

LIST OF EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor isexpected to design other problems on similar lines.

1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Scientific problems using Conditionals and Iterative loops.
3. Linear search and Binary search
4. Selection sort, Insertion sort
5. Merge sort, Quick Sort
6. Implementing applications using Lists, Tuples.
7. Implementing applications using Sets, Dictionaries.
8. Implementing programs using Functions.
9. Implementing programs using Strings.
10. Implementing programs using written modules and Python Standard Libraries (pandas,numpy, Matplotlib, scipy)
11. Implementing real-time/technical applications using File handling.
12. Implementing real-time/technical applications using Exception handling.
13. Creating and Instantiating classes

HARDWARE/SOFTWARE REQUIREMENTS

1. Processors: Intel Atom® processor Intel®Core™i3 processor
2. Disk space: 1GB.
3. Operating systems: Windows 7,macOS and Linux
4. Python versions:2.7, 3.6, 3.8

TOTAL : 60 PERIODS

COURSE OUTCOMES:

On completion of the laboratory course, the student should be able to

CO1: Apply the Python language syntax including control statements, loops and functions tosolve a wide variety of problems in mathematics and science.

CO2: Use the core data structures like lists, dictionaries, tuples and sets in Python to store,process and sort the data

CO3: Create files and perform read and write operations

CO4: Illustrate the application of python libraries.

CO5: Handle exceptions and create classes and objects for any real time applications

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, 2013.
3. David M.Beazley "Python Essential Reference". Addison-Wesley Professional; Fourth edition, 2009.
4. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition (June 1, 2013).
5. http://www.edx.org/

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	3	2	2
CO2	2	1	3	3	2	2
CO3	1	1	3	2	2	2
CO4	2	1	3	2	2	2
CO5	2	1	3	3	2	3
AVG	1.8	1	3	2.6	2	2.2

MC4261 FULL-STACK WEB DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of web programming and client-side scripting.
- To learn server-side development using NodeJS.
- To understand API development with Express Framework.
- To understand and architect databases using NoSQL and SQL databases.
- To learn the advanced client-side scripting and ReactJS framework

UNIT I INTRODUCTION TO CSS and JAVASCRIPT 9

Introduction to Web: Server - Client - Communication Protocol (HTTP) – Structure of HTML Documents – Basic Markup tags – Working with Text and Images with CSS– CSS Selectors – CSS Flexbox - JavaScript: Data Types and Variables - Functions - Events – AJAX: GET and POST

UNIT II SERVER-SIDE PROGRAMMING WITH NODE JS 9

Introduction to Web Servers – JavaScript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files - async/await - Fetching JSON from Express

UNIT III ADVANCED NODE JS AND DATABASE 9

Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS

UNIT IV ADVANCED CLIENT-SIDE PROGRAMMING 9

React JS: ReactDOM - JSX - Components - Properties — Fetch API - State and Lifecycle -JS Local storage - Events - Lifting State Up - Composition and Inheritance

UNIT V APP IMPLEMENTATION IN CLOUD 9

Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) –Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course the students should be able to:

CO1: Write client-side scripting HTML, CSS and JS.
CO2: Implement and architect the server side of the web application.
CO3: Implement Web Application using NodeJS.
CO4: Architect NoSQL databases with MongoDB.
CO5: Implement a full-stack Single Page Application using React, NodeJS and MongoDB anddeploy on Cloud.

REFERENCES:

1. David Flanagan, “Java Script: The Definitive Guide”, O’Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
3. Alex Banks, Eve Porcello, "Learning React", O’Reilly Media, Inc, 2nd Edition, 2020
4. Marc Wandschneider, “Learning Node”, Addison-Wesley Professional, 2nd Edition, 2016
5. Joe Beda, Kelsey Hightower, Brendan Burns, “Kubernetes: Up and Running”, O’ReillyMedia, 1st edition, 2017
6. Joe Paul Zikopoulos, Christopher Bienko, Chris Backer, Chris Konarski, Sai Vennam, “Cloud Paul Without Compromise”, O’Reilly Media, 1st edition, 2021

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	3	2	3	2
CO4	2	1	3	2	3	3
CO5	2	1	3	2	3	3
AVG	1.8	1	2.6	2	2.6	2.4

MC4262 CLOUD COMPUTING AND MOBILE APP DEVELOPMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain the fundamental concepts, key technologies, strengths, and limitations of cloudcomputing, and deploy applications on commercial cloud infrastructures.
- To Acquire knowledge about cloud computing and virtualization, including the process of migration tothe cloud.
- To Select appropriate technologies, algorithms, and approaches for implementing a cloud environment using OpenStack, AWS, and Google App Engine.
- To Design mobile applications that are mindful of the resource constraints of mobile devices.
- To Understand the complexities of deploying cellular networks and developing mobile applications using resilient programming practices.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9

Introduction– Evolution–Characteristics -Elasticity in Cloud – On-demand Provisioning – NIST Reference Architecture –Architectural Design Challenges – Cloud Deployment Models –Cloud Service Models- Benefits of Cloud Computing – Overview of Cloud Standards.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Basics of Virtualization – Full and Para Virtualization– Implementation Levels of Virtualization – Toolsand Mechanisms – Virtualization of CPU – Memory – I/O Devices – Desktop Virtualization – ServerVirtualization – Application and Database Virtualization with Multitenancy – Virtual Desktop Infrastructure — Docker Containers.

UNIT III CLOUD SOFTWARE AND COMPUTING PLATFORMS 9

Google App Engine (GAE) – Programming Environment for GAE – Google Cloud Platform – AWS–OpenStack — VMWARE.

UNIT IV APPLICATION DESIGN 9

Mobile Memory Management – Design Patterns for Limited Memory – Work Flow for Application Development – Techniques for Composing Applications – Dynamic Linking – Plug-ins and Rule of Thumb for Using DLLs – Concurrency and Resource Management.

UNIT V APPLICATION DEVELOPMENT 9

Android Application Architecture – Event Based Programming – iOS Platform -Event Handling and Graphics Services – Layer Animation – Location Based Services – Resilient Programming Practices – Packaging and Deployment – Security And Hacking.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Articulate the main concepts, key technologies, strengths and limitations of cloud computing and deploy applications over commercial cloud computing infrastructures.

CO2: Gain knowledge about cloud and virtualization along with it how one can migrate over it.

CO3: Choose the appropriate technologies, algorithms and approaches for implementation of cloud environment using Openstack, AWS and Google App engine.

CO4: Design the mobile applications that are aware of the resource constraints of mobile devices.

CO5: Understand the intricacies in deploying cellular networks and developing mobile applications based on resilient programming practices.

REFERENCES:

1. Kai Hwang, Geofrey C. Fox and Jack J. Dongarra, Distributed and Cloud Computing,MorganKaufmann, First Edition, 2012. [Unit 1,2,3 eBook Available]
2. Tommi Mikkonen, Programming Mobile Devices an introduction for practitioners, John Wiley andSons Ltd, 2007 – [Unit 4 eBook Available]
3. Reto Meier, PROFESSIONAL Android™ 4 Application Development , John Wiley and Sons Ltd,2012– [Unit 5 eBook Available]

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	1	2	3	2	3
CO2	2	1	2	3	2	3
CO3	2	1	3	3	2	3
CO4	3	1	3	3	3	1
CO5	3	3	3	2	3	3
AVG	3	3	3	3	2	3

MC4263 ADVANCED DATA SCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:

- Be exposed to basic introduction of big data
- To impart necessary knowledge of the mathematical foundations
- Be familiar with basic concepts on Machine Learning
- Learn the different classification algorithm for appropriate decision making.
- To learn the tools to implement Data science and its application.

UNIT - I: INTRODUCTION TO DATA SCIENCE 9

Introduction to Data Science-Concept of Data Science-Traits of Big data-Web Scraping-Analysis vs reporting

UNIT - II: MATHEMATICAL FOUNDATIONS 9

Linear Algebra: Vectors, Matrices- Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox-Correlation and Causation- Probability: Dependence and Independence, Conditional Probability, Bayes's-Theorem, Random Variables-Continuous Distributions- the Normal Distribution the Central Limit Theorem.

UNIT - III: MACHINE LEARNING 9

Overview of Machine learning concepts –Types of Machine learning - Linear Regression-model assumptions-Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression- support vector machines (SVM), decision trees, and random forest.

UNIT - IV:PROGRAMMING TOOLS FOR DATA SCIENCE 9

Introduction to Programming Tools for Data Science-Toolkits using Python: Matplotlib, NumPy, Scikit- learn, NLTK-Visualizing Data: Bar Charts, Line Charts and Scatterplots-Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs).

UNIT - V: CASE STUDIES OF DATA SCIENCE APPLICATION 9

Weather forecasting-Stock market prediction-Object recognition- Real Time Sentiment Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Basic foundations of Big data.
- Demonstrate understanding of the mathematical foundations needed for data science.
- Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression,

  decision trees.
- Build data science applications using Python based toolkits.
- Familiar in Data science applications and implementation.

TEXT BOOKS:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media First edition(April 30, 2015) [ebook available]
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow:
3. Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, 2017, O' Reilly Media.

REFERENCE BOOKS:

1. Stephen Marsland, —Machine learning: An Algorithmic Perspectivell, CRC Press, SecondEdition, 2009.
2. G. Strang (2016). Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition,USA.
3. lan Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, First Edition(November 18, 2016)
4. Montgomery, D. C. and G. C. Runger (2011). Applied Statistics and Probability for Engineers.5th Edition. John Wiley & Sons, Inc., NY, USA.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	-	-	-	-	2	-
CO2	3	-	3	-	-	-
CO3	-	-	-	2	-	-
CO4	3	-	-	-	3	-
CO5	-	-	-	-	2	2
AVG	3	-	3	2	2	2

MC4264	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the principles of cyber security and to identify threats and risks.
- To learn how to secure physical assets and develop system security controls.
- To understand how to apply security for Business applications and Network Communications.
- To learn the technical means to achieve security.
- To learn to monitor and audit security measures.

UNIT I PLANNING FOR CYBER SECURITY 9

Best Practices-Standards and a plan of Action-Security Governance Principles, components and Approach-Information Risk Management-Asset Identification-Threat Identification-Vulnerability Identification-Risk Assessment Approaches-Likelihood and Impact Assessment-Risk Determination, Evaluation and Treatment-Security Management Function-Security Policy-Acceptable Use Policy- Security Management Best Practices - Security Models: Bell La Padula model, Biba Integrity Model

- Chinese Wall model

UNIT II SECURITY CONTROLS 9

People Management-Human Resource Security-Security Awareness and Education-Information Management- Information Classification and handling-Privacy-Documents and Record Management- Physical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device Security- System Development-Incorporating Security into SDLC - Disaster management and Incident response planning.

UNIT III CYBER SECURITY FOR BUSINESS APPLICATIONS ANDNETWORKS 9

Business Application Management-Corporate Business Application Security-End user Developed Applications-System Access- Authentication Mechanisms-Access Control-System Management- Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security- Electronic Communications - Case study on OWASP vulnerabilities using OWASP ZAP tool.

UNIT IV TECHNICAL SECURITY 9

Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-Intrusion Detection-Digital Rights Management-Cryptographic Techniques-Threat and Incident Management- Vulnerability Management-Security Event Management-Forensic Investigations-Local Environment Management-Business Continuity.

UNIT V SECURITY ASSESSMENT 9

Security Monitoring and Improvement-Security Audit-Security Performance-Information Risk Reporting-Information Security Compliance Monitoring-Security Monitoring and Improvement Bestpractices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student will be able to

CO1: Develop a set of risk and security requirements to ensure that there are no gaps in an Organization's security practices.

CO2: Achieve management, operational and technical means for effective cyber security.

CO3: Audit and monitor the performance of cyber security controls.

CO4: Spot gaps in the system and devise improvements.

CO5: Identify and report vulnerabilities in the system

REFERENCES

1. William Stallings, "Effective Cyber Security - A guide to using Best Practices and Standards", Addison-Wesley Professional, First Edition, 2019.
2. Adam Shostack, "Threat Modelling - Designing for Security", Wiley Publications, First Edition,2014.
3. Gregory J. Touhill and C. Joseph Touhill, "Cyber Security for Executives - A Practical Guide",Wiley Publications, First Edition, 2014.
4. Raef Meeuwisse, "Cyber Security for Beginners", Second Edition, Cyber Simplicity Ltd, 2017.
5. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking andPenetration Testing Made Easy", 2nd Edition, Syngress, 2013.
6. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security in Computing", FifthEdition, Prentice Hall, 2015

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	1	2	2	2	2
AVG	2	1	2	2	2	2

MC4265 OBJECT ORIENTED SOFTWARE ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the phases in object oriented software development
- To gain fundamental concepts of requirements engineering and analysis.
- To know about the different approach for object oriented design and its methods
- To learn about how to perform object oriented testing and how to maintain software
- To provide various quality metrics and to ensure risk management.

UNIT I SOFTWARE DEVELOPMENT AND PROCESS MODELS 9

Introduction to Software Development – Challenges – An Engineering Perspective – Object Orientation – Software Development Process – Iterative Development Process – Process Models– Life Cycle Models – Unified Process – Iterative and Incremental – Agile Processes.

UNIT II MODELING OO SYSTEMS 9

Object Oriented Analysis (OOA / Coad-Yourdon), Object Oriented Design (OOD/Booch), Hierarchical Object Oriented Design (HOOD), Object Modeling Technique (OMT) – Requirement Elicitation – Use Cases – SRS Document – OOA - Identification of Classes and Relationships, Identifying State and Behavior – OOD - Interaction Diagrams – Sequence Diagram – Collaboration Diagrams - Unified Modeling Language and Tools.

UNIT III DESIGN PATTERNS 9

Design Principles – Design Patterns – GRASP – GoF – Dynamic Object Modeling – Static ObjectModeling.

UNIT IV SYSTEM TESTING 9

Software testing: Software Verification Techniques – Object Oriented Checklist:- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing

UNIT V SOFTWARE QUALITY AND METRICS 9

Need of Object Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality - Object Oriented Metrics

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student would be able to :

CO1: Design object oriented software using appropriate process models.

CO2: Differentiate software processes under waterfall and agile methodology.

CO3: Design and Develop UML diagrams for software projects.

CO4: Apply Design Patterns for a software process.

CO5: Categorize testing methods and compare different testing tools for software processes.

CO6: Analyze object oriented metrics and quality for software engineering processes.

REFERENCES:

1. Yogesh Singh, RuchikaMalhotra, " Object – Oriented Software Engineering", PHI LearningPrivate Limited ,First edition,2012
2. Ivar Jacobson. Magnus Christerson, PatrikJonsson, Gunnar Overgaard, "Object OrientedSoftware Engineering, A Use Case Driven Approach", Pearson Education, Seventh Impression, 2009
3. Craig Larman, "Applying UML and Patterns, an Introduction to Object-Oriented Analysis andDesign and Iterative Development", Pearson Education, Third Edition, 2008.
4. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen Kelli A.Houston, "Object Oriented Analysis & Design with Applications, Third Edition, PearsonEducation,2010
5. Roger S. Pressman, "Software Engineering: A Practitioner's Approach, Tata McGraw-Hill Education, 8th Edition, 2015

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	3	3	2	2
CO2	2	1	3	2	2	2
CO3	2	1	3	3	2	2
CO4	2	1	3	3	1	2
CO5	2	1	3	3	3	2
CO6	1	1	3	2	2	2
AVG	1.83	1	3	2.66	2	2

MC4266 FULL STACK WEB DEVELOPMENT LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To implement the client side of the web application using javascript.
- To understand Javascript on the desktop using NodeJS.
- To develop a web application using NodeJS and Express.
- To implement a SPA using React.
- To develop a full stack single page application using React, NodeJS, and aDatabase (MongoDB or SQL).

LIST OF EXPERIMENTS:

1. Create a form and validate the contents of the form using JavaScript.
2. Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
3. Create a NodeJS server that serves static HTML and CSS files to the user without usingExpress.
4. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
5. Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the usershould be obtained from a HTML form.
6. Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
7. Create a counter using ReactJS
8. Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
9. Create a simple Sign up and Login mechanism and authenticate the user using cookies.The user information can be stored in either MongoDB or MySQL and the server shouldbe built using NodeJS and Express Framework.
10. Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.
11. Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

TOTAL: 60 PERIODS

SOFTWARE REQUIREMENTS

1. NodeJS/Express JS,ReactJS,Docker,any IDE like NOTEPAD++/visualstudio code/ sublime text etc.,
2. MySQL, MongoDB

COURSE OUTCOMES:

CO1: To implement and deploy the client side of the web application.

CO2: To develop and deploy server side applications using NodeJS.

CO3: To use Express framework in web development.

CO4: To implement and architect database systems in both NoSQL and SQL environments.

CO5: To develop a full stack single page application using React, NodeJS, and a Database and deploy using containers.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	1	3	2	3	3
CO2	2	1	2	2	3	3
CO3	2	1	2	2	3	2
CO4	2	1	3	2	2	3
CO5	2	1	2	2	2	2
AVG	2.2	1	2.4	2	2.6	2.6

MC4267 MOBILE APPLICATION DEVELOPMENT LABORATORY L T P C
0 0 4 2

LIST OF EXPERIMENTS:

1. Install and configure Java Development Kit (JDK), android studio and android SDK.
2. Develop an application that uses GUI components, fonts and colours.
3. Design an application that uses Layout Managers, Event listeners, Event handling and pushnotification in Android.
4. Build a simple native calculator application to do simple arithmetic operations.
5. Create animations and graphical primitives in Android environment.
6. Develop an application that makes use of SQL Lite mobile database.
7. Develop an application that makes use of internet for communication using Firebase to send SMSand E-Mail services.
8. Implement an android application that writes data into the SD card and makes use of NotificationManager.
9. Develop a native application that uses Location based services such as GPS tracking, Geo fencing,and activity recognition using Google play services.
10. Implement simple gaming application using open-source tools like flutter or Unity.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Design the right user interface for mobile application.

CO2: Implement mobile application using UI toolkits and frameworks.

CO3: Design mobile applications that are aware of the resource constraints of mobile devices.

CO4: Develop web based mobile application that accesses internet and location data.

CO5: Implement android application with multimedia support.

CO6: Configure open source tools like Flutter or Unity.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3		3	2	2	2
CO2	3		3	3	2	2
CO3	3		3	3	2	2
CO4	3	1	3	3	2	2
CO5	3		3	3	2	2
AVG	3	1	3	3	2	2

EN4217 COMMUNICATION SKILLS ENHANCEMENT – I L T P C
0 0 2 1

COURSE OBJECTIVES:

- To provide opportunities to learners to practice English and thereby make them proficient users of the language.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of technology.
- To improve the performance of students' listening, speaking, reading and writing skills and thereby enhance their career opportunities.

LIST OF ACTIVITIES:

1. Listening:
   - Listening and practicing neutral accents
   - Listening to short talks and lectures and completing listening comprehension exercises
   - Listening to TED Talks
2. Speaking:
   - Giving one minute talks
   - Participating in small Group Discussions
   - Making Presentations
3. Reading:
   - Reading Comprehension
   - Reading subject specific material
   - Technical Vocabulary
4. Writing:
   - Formal vs Informal Writing
   - Paragraph Writing
   - Essay Writing
   - Email Writing

REFERENCES / MANUALS / SOFTWARE: Open Sources / websites

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Listen and comprehend lectures in English
- Articulate well and give presentations clearly
- Participate in Group Discussions successfully
- Communicate effectively in formal and informal writing
- Write proficient essays and emails

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	2	1	1	1
CO2	1	3	2	1	1	1
CO3	1	2	3	1	1	1
CO4	1	3	2	1	1	1
CO5	1	3	2	1	1	1
AVG	1	2.6	2.2	1	1	1

MC4361 **MACHINE LEARNING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain knowledge on foundations of machine learning and apply suitable dimensionalityreduction techniques for an application
- To select the appropriate model and use feature engineering techniques
- To gain knowledge on Probability and Bayesian Learning to solve the given problem
- To design and implement the machine learning techniques for real world problems
- To analyze, learn and classify complex data without predefined models also

UNIT I INTRODUCTION **9**

Human Learning - Types – Machine Learning - Types - Problems not to be solved - Applications - Languages/Tools– Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Pre-processing

UNIT II MODEL EVALUATION AND FEATURE ENGINEERING **9**

Model Selection - Training Model - Model Representation and Interpretability - Evaluating
Performance of a Model - Improving Performance of a Model - Feature Engineering: FeatureTransformation - Feature Subset Selection

UNIT III BAYESIAN LEARNING **9**

Basic Probability Notation- Inference ― Independence - Bayes' Rule. Bayesian Learning: Maximum Likelihood and Least Squared error hypothesis-Maximum Likelihood hypotheses for predicting probabilities- Minimum description Length principle -Bayes optimal classifier - Naïve Bayes classifier - Bayesian Belief networks -EM algorithm.

UNIT VI PARAMETRIC MACHINE LEARNING **9**

Logistic Regression: Classification and representation – Cost function – Gradient descent – Advanced optimization – Regularization - Solving the problems on overfitting. Perceptron – Neural Networks – Multi – class Classification - Backpropagation – Non-linearity with activation functions (Tanh, Sigmoid, Relu, PRelu) - Dropout as regularization

UNIT V NON PARAMETRIC MACHINE LEARNING **9**

k- Nearest Neighbors- Decision Trees – Branching – Greedy Algorithm - Multiple Branches – Continuous attributes – Pruning. Random Forests: ensemble learning. Boosting – Adaboost algorithm. Support Vector Machines – Large Margin Intuition – Loss Function - Hinge Loss – SVM Kernels

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand about Data Preprocessing, Dimensionality reduction

CO2: Apply proper model for the given problem and use feature engineering techniques

CO3:Make use of Probability Technique to solve the given problem.

CO4: Analyze the working model and features of Decision tree

CO5:choose and apply appropriate algorithm to learn and classify the data

REFERENCES

1. Ethem Alpaydin, “Introduction to Machine Learning 3e (Adaptive Computation and MachineLearning Series)”, Third Edition, MIT Press, 2014
2. Tom M. Mitchell, “Machine Learning”, India Edition, 1st Edition, McGraw-Hill EducationPrivate Limited, 2013
3. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "MachineLearning", 1st Edition, Pearson Education, 2019
4. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Revised Edition,Springer, 2016.
5. Aurelien Geron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”,2nd Edition, O‟Reilly, 2019
6. Stephen Marsland, “Machine Learning – An Algorithmic Perspective‖, Second Edition,Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	2	2	2	2
CO2	1	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	1	2	2	2	2
AVG	1.6	1	2	2	2	2

MC4362 **INTERNET OF THINGS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the concepts of IoT and its working models
- To know the various IoT protocols
- To understand about various IoT Physical devices and Endpoints
- To know the security and privacy issues connected with IoT
- To apply the concept of Internet of Things in a real world scenario.

UNIT I FUNDAMENTALS OF IOT **9**

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

UNIT II IOT PROTOCOLS **9**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols
– Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4– BACNetProtocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT III IOT PHYSICAL DEVICES AND ENDPOINTS **9**

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

UNIT IV INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE **9**

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a SecurePlatform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

UNIT V APPLICATIONS **9**

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

SUGGESTED ACTIVITIES:

1: Study of 5 different types of sensors and actuators available in Market
2: Study of commercial IoT available in any one domain
3: Study the recent developments in IoT Protocol
4: Implement simple Python programs for IoT
5: Study on the latest government policies on IoT security and Privacy
6: A study on how to use IoT to solve some problems in your neighborhood.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Able to

CO1: Define the infrastructure for supporting IoT deployments

CO2: Understand the usage of IoT protocols for communication between various IoT devices

CO3: Design portable IoT using Arduino/Raspberry Pi /equivalent boards.

CO4: Understand the basic concepts of security and governance as applied to IoT

CO5: Analyze and illustrate applications of IoT in real time scenarios

REFERENCES

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things — Key applications and Protocols", Wiley, 2012. .
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals, Networking Technologies, Protocols, and Use cases for the Internet of Things", Cisco Press, First Edition,2017.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet Of Things", Springer, 2011
5. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
6. Peter Friess,'Internet of Things — From Research and Innovation to Market Deployment',River Publishers, 2014

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	3	2	2	3
CO4	2	1	2	2	2	2
CO5	2	1	3	2	2	3
AVG	2	1	2.4	2	2	2.4

MC4363	MACHINE LEARNING LABORATORY	L T P C
		0 0 4 2

COURSE OBJECTIVES:

- To understand about data cleaning and data preprocessing
- To familiarize with the Supervised Learning algorithms and implement them inpractical situations.
- To familiarize with unsupervised Learning algorithms and carry on theimplementation part.
- To involve the students to practice ML algorithms and techniques.
- Learn to use algorithms for real time data sets.

LIST OF EXPERIMENTS:

1. Demonstrate how do you structure data in Machine Learning
2. Implement data preprocessing techniques on real time dataset
3. Implement Feature subset selection techniques
4. Demonstrate how will you measure the performance of a machine learning model
5. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.
6. Write a program to construct a Bayesian network considering medical data. Usethis model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file.
8. Write a program to implement k-Nearest Neighbor algorithm to classify the dataset.
9. Apply the technique of pruning for a noisy data monk2 data, and derive the decision tree from this data. Analyze the results by comparing the structure of pruned and unpruned tree.
10. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
11. Implement Support Vector Classification for linear kernels.
12. Implement Logistic Regression to classify problems such as spam detection.Diabetes predictions and so on.

TOTAL: 60 PERIODS

LAB REQUIREMENTS:

Python or any ML tools like R

COURSE OUTCOMES:

On completion of the laboratory course, the student should be able to

CO1: apply data preprocessing technique and explore the structure of datato prepare for predictive modeling
CO2: understand how to select and train a model and measure the performance.
CO3: apply feature selection techniques in Machine Learning
CO4: construct Bayesian Network for appropriate problem
CO5: learn about parametric and non-parametric machine Learning algorithms andimplement to practical situations

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	1	2	2	2	2
AVG	2	1	2	2	2	2

MC4364 **INTERNET OF THINGS LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES:

- To design applications to interact with sensors
- To design and develop IoT application Arduino/Raspberry pi for real world scenario.
- To enable communication between IoT and cloud platforms
- To develop applications using Django Framework

EXPERIMENTS:

1. To study various IoT protocols – 6LowPAN, IPv4/IPv6, Wifi, Bluetooth, MQTT.
2. IoT Application Development Using sensors and actuators (temperature sensor, lightsensor,infrared sensor)
3. To study Raspberry Pi development board and to implement LED blinking applications.
4. To develop an application to send and receive data with Arduino using HTTP request
5. To develop an application that measures the room temperature and posts the temperaturevalue on the cloud platform.
6. To develop an application that measures the moisture of soil and post the sensed data overGoogle Firebase cloud platform.
7. To develop an application for measuring the distance using ultrasonic sensor and postdistance value on Google Cloud IoT platform
8. Develop a simple application based on sensors.
9. Develop IoT applications using Django Framework and Firebase/ Bluemix platform.
10. Develop a commercial IoT application.

TOTAL: 60 PERIODS

HARDWARE/SOFTWARE REQUIREMENTS:

1. The universal microcontroller development board
2. 8051 Daughter Board
3. Raspberry Pi 3B+ Original
4. Arduino Daughter Board
5. Humidity + IR Sensor Interface
6. Ultrasonic Sensors
7. Open source softwares Django Framework
8. Open cloud architectures like Bluemix, Development platforms like Firebase

COURSE OUTCOMES:

On completion of the course, the students will be able to:
CO1: To understand the various IoT protocols
CO2: Test and experiment different sensors for application development
CO3: To develop applications using Arduino/Raspberry Pi/ Equivalent boards.
CO4: To develop applications that would read the sensor data and post it in Cloud
CO5: Develop IOT applications with different platforms and frameworks.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	1	2	2	2	2
AVG	2	1	2	2	2	2

EN4318 COMMUNICATION SKILLS ENHANCEMENT – II L T P C
0 0 2 1

COURSE OBJECTIVES:

- To provide opportunities to learners to practice their communication skills to make thembecome proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology tocommunicate globally.
- To enhance the performance of learners at placement interviews and group discussions andother recruitment procedures

1. **SOFT SKILLS**
   - People skills
   - Interpersonal skills
   - Team building skills
   - Leadership skills
   - Problem solving skills

2. **PRESENTATION SKILLS**
   - Preparing slides with animation related to the topic
   - Introducing oneself to the audience
   - Introducing the topic
   - Presenting the visuals effectively – 5 minute presentation

3. **GROUP DISCUSSION SKILLS**
   - Participating in group discussions
   - Brainstorming the topic
   - Activities to improve GD skills.

4. **INTERVIEW SKILLS**
   - Interview etiquette – dress code – body language
   - Attending job interviews
   - Answering questions confidently
   - Technical interview – telephone/Skype interview
   - Emotional and cultural intelligence
   - Stress Interview

TOTAL: 30 PERIODS

REFERENCES / MANUALS / SOFTWARE: Open Sources / websites

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Students will be able to make presentations and participate in Group discussionswith confidence.

CO2: Students will be able to perform well in the interviews.

CO3: Students will make effective presentations.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	2	1	1	1
CO2	1	3	2	1	1	1
CO3	1	2	3	1	1	1
CO4	1	3	2	1	1	1
CO5	1	3	2	1	1	1
AVG	1	2.6	2.2	1	1	1

PMC101 ARTIFICIAL INTELLIGENCE FOR SOCIAL GOOD L T P C
3 0 0 3

COURSE OBJECTIVE:

- To understand the fundamental concepts and principles of artificial intelligence.
- To explore the applications of AI in addressing social, environmental, and humanitarian challenges.
- To learn how to design and implement AI solutions that promote social good.
- To investigate case studies where AI has been successfully applied for social impact.
- To evaluate the potential benefits and risks associated with AI technologies in societal contexts.
- To encourage critical thinking and problem-solving skills in the context of AI for social betterment.

UNIT I **9**

Introduction, Logistics, Course Project, Basics of Optimization, Convex optimization, Linear Programming (LP) and Mixed Integer Linear Programming (MILP), Conservation Planning, Wildlifecorridor design, Basics of Regression and Classification, Linear and Logistic Regression, Kernel Regression, Decision Trees, Data-based Prediction

UNIT II **9**

Food rescue, detecting social bots on Twitter, Basics of Game Theory, Cover: Equilibrium concepts, Security Games, Bayesian Persuasion and Security Games, Autonomous Driving, Basics of Reinforcement Learning, Markov Decision Process (MDP), Q-Learning, Policy Gradient, Reinforcement Learning for Bike Repositioning

UNIT III **9**

AI and Ethics and Policy, Basics of Deep Learning, Feedforward Neural Networks, Convolutional Neural Networks, Learning from Remote Sensing Data, Poverty and crop yield prediction

UNIT IV **9**

Basics of Influence Maximization, Influence propagation models, submodular function optimization,Dynamic Influence Maximization under Uncertainty, AI/ML/DS for social good: opportunities and challenges, Mixture Models and Probabilistic Graphical Models, Gaussian Mixture Models (GMMs),Dynamic Bayesian Networks (DBNs), Markov Random Fields (MRFs), Response to COVID-19

UNIT V **9**

Cover: Object detection using Faster R-CNN, Detect human and wildlife from video data, Coordinatedrone patrol and human patrol

TOTAL: 45 PERIODS

Reference: 1. http://www.andrew.cmu.edu/user/feif/08737S18/08737_S18_Syllabus.pdf

Books and References:

1. Artificial Intelligence and Social Work Edited by MilindTambe, Eric Rice, Cambridge UniversityPress.
2. Artificial Intelligence and Conservation Edited by Fei Fang, MilindTambe, BistraDilkina, Andrew J.Plumptre, Cambridge University Press

Course Outcomes (COs):

1. To understand artificial intelligence concepts and range of problems that can be handled bymachine learning and deep learning.
2. To develop knowledge of decision making and learning methods
3. To expose students to the frontiers of AI-intensive computing and information systems.
4. To describe and list the key aspects of planning in artificial intelligence.
5. To provide a sufficiently strong foundation to encourage further research.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	2	1	2	1	2	1
CO3	2	1	1	2	2	2
CO4	1	1	1	2	2	1
CO5	1	1	2	1	2	1
AVG	2	1	2	1.5	2	1

PMC102 NEURAL NETWORK & DEEP LEARING **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts and working principles of artificial neurons.
- To explore various types of neural networks based on their architectures and learning rules.
- To grasp the fundamental concepts of Deep Neural Networks (DNN) and their different types,including their working principles.
- To analyze and implement advanced neural network architectures for complex tasks.
- To understand the applications of neural networks and deep learning in real-world scenarios.

UNIT I INTRODUCTION **9**

Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm, Type of network architecture, Activation functions, Basic Learning rules.

UNIT II FEEDFORWARD NETWORKS **9**

Multilayer Neural Network, Gradient Descent learning, Back propagation, Empirical Risk Minimization,regularization, Radial Basis Neural Network

UNIT III RECURRENT NEURAL NETWORKS **9**

Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs,Bidirectional RNNs.

UNIT IV DEEP NEURAL NETWORKS **9**

Introduction, Difficulty of training deep neural networks, Greedy layer wise training. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks. Auto Encoders , Deep Reinforcement Learning , Deep Learning Tools: Caffe, Theano, Torch.

UNIT V PARAMETER TUNING **9**

Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout,drop connect, batch normalization).

Text Books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Golub, G., H., and Van Loan, C., F., Matrix Computations, JHU Press, 2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

COURSE OUTCOMES (COS):

1. To understand basic concepts of artificial neuron and its working principle.
2. To understand different kinds of Neural Networks based on architectures and learning rules.
3. To understand the basic concepts of Deep Neural Networks (DNN) and its different kinds withworking principle.
4. To understand the various parameter tuning and optimization methods.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	2	1	2	1
CO2	2	1	2	1	2	1
CO3	1	2	2	2	1	1
CO4	2	2	2	1	2	1
CO5	2	2	2	1	2	1
AVG	1.5	1.5	2	1	2	1

PMC103 DATA ANALYTICS AND COMPUTING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamental concepts of data analytics.
- To understand the underlying behavior of data through various data exploration and visualizationtechniques.
- To present various feature selection techniques for effective feature engineering.
- To introduce and evaluate different machine learning techniques and their correspondingmetrics.
- To develop skills in deploying data analytics solutions using appropriate computational tools and platforms.

UNIT I INTRODUCTION 9

Introduction to Data, Data types, Introduction to Stages of Data Processing: Data Pre Processing; DataImputation; Data Cleaning; Data Transformation; Data Visualization; Data Analysis; Data Engineering,Data Management.

UNIT II EXPLORATORY DATA ANALYSIS AND VISUALIZATION 9

Introduction to the Chicago Train Ridership data, Visualizations for Numeric Data: Exploring Train Ridership Data, Visualizations for Categorical Data: Exploring the OkCupid Data, Visualizing Relationships between Outcomes and Predictors, Exploring Relationships between Categorical Predictors, Post Modelling Exploratory Visualizations.

UNIT III FEATURE SELECTION AND ENGINEERING 9

Feature Selection, Classes of Feature Selection Methodologies: intrinsic (or implicit) methods, filter methods, and wrapper methods, Feature Engineering, Feature Engineering techniques: Binning, Feature Hashing, Log Transforms, n-grams, Binarisation, Bag-of-words.

UNIT IV MODEL SELECTION AND EVALUATION 9

Model Selection, Introduction to machine learning, Supervised and unsupervised learning, machine learning algorithms, model evaluation approaches: Cross Validation, Confusion Matrix, Gain and Lift cgart, Kolmogorov-Smirnov Chart, Chi Square, ROC curve, Gini Coefficient, L^1 version of RSME.

References:

1. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning withapplications in R. Springer, 2013.
2. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann, 2011.
3. Hastie, T., Tibshirani, R., Friedman, J. The Elements of Statistical Learning, 2nd edition. Springer, 2009.
4. Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press, 2012.
5. Zumel, N. , Mount, J. Practical Data Science with R". Manning, 2014.
6. G. Strang (2016). Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA.

7. Bendat, J. S. and A. G. Piersol (2010). Random Data: Analysis and Measurement Procedures. 4thEdition. John Wiley & Sons, Inc., NY, USA:
8. Montgomery, D. C. and G. C. Runger (2011). Applied Statistics and Probability for Engineers. 5thEdition. John Wiley & Sons, Inc., NY, USA.
9. David G. Luenberger (1969). Optimization by Vector Space Methods, John Wiley & Sons (NY)

COURSE OUTCOMES (COS):

1. To introduce basic concepts of Data Analytics.
2. To understand underlying behavior of data using different data exploration and data visualizationtechniques.
3. To introduce different feature selection techniques for feature engineering.
4. To introduce different kinds of ML techniques and their evaluation matrices.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	2	1	2	2	2	1
CO3	1	1	2	2	2	1
CO4	2	1	2	1	2	2
CO5	1	1	2	1	2	1
AVG	1.5	1	2	1	2	1

PMC104 IMAGE PROCESSING AND MACHINE VISION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamental principles and techniques of image processing and machine vision.
- To understand the mathematical foundations and algorithms used in image processing tasks such as filtering, segmentation, and feature extraction, image restoration, enhancement, andcompression.
- To learn about the principles and algorithms for machine vision tasks such as object detection, recognition, and tracking.
- To develop practical skills in implementing image processing and machine vision algorithms usingprogramming languages and software tools.
- To study the applications of image processing and machine vision in various fields such as medicine, surveillance, robotics, and autonomous systems.

UNIT I INTRODUCTION 9

Background, definition, Digital Image Fundamentals, Origin of DIP, Digital image representation, fundamental steps in image processing, elements of digital image processing systems, image acquisition, storage, processing, communication and display, data structures for image analysis.

UNIT II IMAGE ENHANCEMENT 9

Image Enhancement in the spatial domain (Basic gray level transformations, histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering-comparison between smoothing and sharpening spatial filters),Image Enhancement in the frequency domain (1D Fourier transform-2D Fourier transform and its Inverse-Smoothing & sharpening frequency domain filters (Ideal, Butterworth, Gaussian), homomorphic filtering)

UNIT III IMAGE COMPRESSION AND SEGMENTATION 9

Image compression (Fundamentals, Error-free compression, Huffman coding, block coding, constant area coding, variable length coding, bit-plane coding, lossless predictive coding-source and channel encoding-decoding-Lossy compression, lossy predictive coding, transform coding.), Image Segmentation (Thresholding, Edge Based Segmentation, Region Based Segmentation, Mean shift segmentation, Graph cut algorithm, Matching, Evaluation Issues in Segmentation, Watersheds)

UNIT IV COLOR IMAGE PROCESSING 9

Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images.

UNIT V MACHINE VISION 9

Introduction, definition, Active vision system, Machine vision components, hardware's and algorithms, image function and characteristics, segmentation, data reduction, feature extraction, edge detection, image recognition and decisions, application of machine vision such as in inspection of parts, identification, industrial robot control, mobile robot application, Competing technologies, CCD line scan and area scan sensor, Videcon and other cameras, Triangulation geometry, resolution passive and active stereo imaging, laser scanner, data processing.

Text Books

1. Rafael C.Gonzalez and Richard E. Woods,"Digital Image Processing", Richard E. Woods.
2. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing using MATLAB", Mainpurpose-Practical
3. Bershold Klaus, Paul Holm, "Robot vision", The MIT press.

Course Outcomes (COs):

1. To understand the fundamentals of digital images and perform image related operations by imageprocessing techniques.
2. To articulate the valuable information from images after pre-processing by using various imageenhancement operations.
3. To learn and Implement the suitable compression and segmentation techniques on digital images and explore the methods to manipulate the color properties of digital images.
4. To discuss the applications of digital image processing concepts in the development and design of acomputer vision system using digital images.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	1	1	1	1	2	2
CO3	2	1	2	2	2	1
CO4	2	2	2	1	2	1
CO5	2	1	2	1	1	1
AVG	2	1	2	1	2	1

PMC105 INTRODUCTION TO BLOCKCHAIN TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamental concepts and principles of blockchain technology.
- To understand the architecture and components of a blockchain system.
- To explore different types of blockchains (public, private, permissioned) and their respective usecases.
- To learn about the cryptographic principles and mechanisms underlying blockchain technology.
- To develop practical skills in deploying and interacting with blockchain networks using relevanttools
  and platforms.

UNIT I INTRODUCTION 9

Overview of Blockchain, History of Blockchain, Technical Concepts of Blockchain Technology, Blockchain Characteristics, Design Methodology for Blockchain Applications, Domain Specific Blockchain Applications, Research Aspects, Blockchain Benefits and Challenges.

UNIT II CRYPTO PRIMITIVES AND OVERVIEW OF CRYPTOCURRENCIES 9

Cryptographic Hash Functions, Digital Signature; Hashchain to Blockchain; Overview of Crypto currencies, Bitcoin overview, Mining and Consensus, Mathematical analysis of properties of Bitcoin.

UNIT III BLOCKCHAIN COMPONENTS 9

Ethereum, Ethereum Virtual Machine (EVM), Ethereum Languages, Smart Contracts, Structure of a Contract, Smart contracts Vulnerabilities, Development Tools and Frameworks- Metamask, Truffle, Decentralized Applications(Dapps).

UNIT IV INTEGRATION OF ARTIFICIAL INTELLIGENCE (AI) WITH BLOCKCHAIN9

How to adopt AI in Blockchain, Role of AI in Blockchain, Methods to implement AI in Blockchain, Concept of Internet of Things (IoT), Secure and Smart IoT, Blockchain-enabled smart IoT with AI.

UNIT V BLCOKCHAIN USE-CASES 9

Blockchain for Healthcare Informatics, Blockchain for Agricultural Supply chain Management, Blockchain for Financial Technology, Blockchain for Smart Applications, Blockchain for Government Applications.

References:

1. Arshdeep Bahga and Vijay K. Madisetti, Blockchain Applications: A Hands-on Approach, ISBN:9780996025560,2018.
2. Josh Thompsons, Blockchain: The Blockchain For Beginners Guide To Blockchain Technology And Leveraging Blockchain Programming, Kindle Edition,ISBN : 1546772804
3. Arvind Narayanan, J. Bonneau, E Felten, A Miller, and S Goldfeder, Bitcoin and Crypto currencyTechnologies: A comprehensive Introduction, Princeton University Press, 2016.
4. Andreas M. Antonopoulos, Mastering Bitcoin: Programming The Open Blockchain, O'Reilly,ISBN: 9789352135745, 2017

Course Outcomes (COs):

1. To state concepts, benefits, and the challenges of Blockchain Technology.
2. To analyse and use some of the commonly used Crypto techniques for Blockchain.
3. To use different development platforms to build applications on Blockchain.
4. To integrate AI techniques, IoT with Blockchain.
5. To design and develop secure systems for different application domains.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	1	2	2	1	2	2
CO3	1	1	2	1	2	1
CO4	2	1	1	1	2	1
CO5	2	1	2	2	2	1
AVG	1.5	1	2	1	2	1

PMC201 SOFTWARE REQUIREMENTS ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

The student should be able to

- Understand the basics of requirements engineering
- Learn different techniques used for requirements elicitation
- Know the role played by requirements analysis in requirement integration
- Appreciate the use of various methodologies for requirements development
- Study the current trends in requirements prioritization and validation.

UNIT I REQUIREMENTS ENGINEERING OVERVIEW 9

Software Requirement Overview – Software Development Roles –Software Development Process Kernels – Commercial Life Cycle Model – Vision Development – Stakeholders Needs & Analysis – Stakeholder needs –Stakeholder activities.

UNIT II REQUIREMENTS ELICITATION 9

The Process of Requirements Elicitation – Requirements Elicitation Problems – Problems of Scope – Problems of Understanding – Problems of Volatility – Current Elicitation Techniques – Information Gathering – Requirements Expression and Analysis – Validation – An Elicitation Methodology Framework – A Requirements Elicitation Process Model – Methodology over Method – Integration of Techniques – Fact-Finding – Requirements Gathering – Evaluation and Rationalization – Prioritization– Integration and Validation.

UNIT III REQUIREMENTS ANALYSIS 9

Identification of Functional and Non Functional Requirements – Identification of Performance Requirements – Identification of safety Requirements – Analysis – Feasibility and Internal Compatibility of System Requirements – Definition of Human Requirements Baseline.

UNIT IV REQUIREMENTS DEVELOPMENT 9

Requirements analysis – Requirements Documentation – Requirements Development Workflow – Fundamentals of Requirements Development – Requirements Attributes Guidelines Document – Supplementary Specification Document – Use Case Specification Document – Methods for Software Prototyping – Evolutionary prototyping –Throwaway prototyping.

UNIT V REQUIREMENTS VALIDATION 9

Validation objectives – Analysis of requirements validation – Activities – Properties – Requirement reviews – Requirements testing – Case tools for requirements engineering.

TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of this course, the students should be able to:

- Prepare SRS including the details of requirements engineering
- Describe the stages of requirements elicitation
- Analyze software requirements gathering

REFERENCES:

1. Dean Leffingwe, Don Widrig, Managing Software Requirements A Use Case Approach‖,Second Addition, Addison Wesley, 2003
2. Ian Graham, Requirements Engineering and Rapid Development‖, Addison Wesley, 1998
3. Ian Sommerville, Pete Sawyer, Requirements Engineering: A Good Practice Guide‖, SixthEdition, Pearson Education, 2004
4. Karl Eugene Wiegers, Software Requirements‖, Word Power Publishers, 2000
5. Wiegers, Karl, Joy Beatty, ‖Software requirements‖, Pearson Education, 2013

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	2	1	2	1	2	1
CO3	1	1	2	1	1	1
CO4	2	1	2	2	2	1
CO5	1	1	1	1	2	2
AVG	2	1	2	1	2	1

PMC202 **SOFTWARE INDUSTRIALIZATION** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

The student should be able:

- To point out the need for industrialization in software development
- To understand the non functional requirements in software engineering
- To carry out performance analyses
- To study the various types of scalability
- To acquire the art of capacity planning
- To Understand the techniques for infrastructure management

UNIT I INDUSTRIALIZATION OF SOFTWARE DEVELOPMENT 9

The Fragile Hand Weaving – Features Vs Robustness – Components and Services Based Development – Agile and Dev Ops - Software Factory – Automation

UNIT II NON FUNCTIONAL REQUIREMENTS and ENGINEERING 9

NFRs - Cost of Quality – Business and System View – Industrialization Process in SDLC – Performance and Scalability – Capacity Planning –Production Operations

UNIT III PERFORMANCE and SCALABILITY ENGINEERING 9

Engineering for Performance and Scalability -Performance Modelling, Measurement and Testing – Workload Characterization – Latency and Throughput Requirements – Resource Usage Measurements Processor, Memory, Disk, Network – Performance Testing and Profiling – Bottleneck and Hotspot Identification – Vertical and Horizontal Scalability – Load, Space and Structural Scalability – Endurance Engineering – Analysis and Presenting Recommendations – Tools for Performance and Scalability

UNIT IV THE ART OF CAPACITY PLANNING 9

Capacity Planning Art Vs Science – Budgetary Capacity Planning - Utilization, Service Demand, The Forced Flow, Interactive Response Time, Little's Laws – Using Queuing Models – Markov Models – M/M/1 M/G/1 Single Queue Systems – Mean Value Analysis- Multi Class Models – Priority Scheduling Fork/Join Queuing Networks – Production Capacity Forecasting With Regression and Time Series Models — Tools for Capacity Planning

UNIT V PRODUCTION SYSTEMS MANAGEMENT 9

Infrastructure Management and Support – Systems, Storage and Network Monitoring – High Availability Service Levels – Change and Configuration Management- Capacity Augmentation - Modernizing and Cloud Enablement – Automation

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Understand SOA and DevOps
- Understand the non-functional requirements in software engineering
- Apply various performance analysis techniques
- Analyze software systems for scalability
- Apply capacity planning methods
- Apply infrastructure management techniques

REFERENCES:

1. Andre B. Bondi, —Foundations of Software and System Performance Engineering‖, AddisonWesley, 2015
2. Daniel A. Menasce, Dowdy, Almeida, —Computer Capacity Planning by Example‖, Prentice Hall, 2004 3. L. Chung, B. Nixon, E. Yu and J. Mylopoulos, —Non-Functional Requirements inSoftware Engineering‖, Springer, 2000 4. Rich Schiesser, —IT Systems Management‖, Pearson Education, 2010

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	1	1	2	1	2	1
CO3	2	1	1	1	1	2
CO4	2	1	1	1	2	1
CO5	1	1	2	1	2	1
AVG	2	1	2	1	2	1

PMC203 **BUSINESS INTELLIGENCE** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The student should be able to

- Identify the enormous opportunities that currently exists in providing business intelligenceservices
- Gain a practical understanding of the key data mining methods of classification, prediction, datareduction and exploration
- Understand and help develop the strategies of modern enterprise decision makers
- Acquire knowledge in many scientific and technological fields including data warehouses, data mining, content analytics, business process management, visual analytics
- Gain competences in information systems, web science, decision science, software engineering, and innovation and entrepreneurship.

UNIT I INTRODUCTION **9**

BI Basics – Meeting the BI challenge – BI user models – Basic reporting and querying – BI Markets - BI and Information Exploitation – Value of BI – BI cycle – Bridging the analysis gap – BI Technologies BI Decision Support Initiatives – BI Project Team.

UNIT II BI BIG PICTURE **9**

Advanced Emerging BI Technologies – Human factors in BI implementations – BI design and development – OO Approach to BI - BI Environment – BI business process and information flow – Identifying BI opportunities – Evaluating Alternatives - BI solutions – BI Project Planning.

UNIT III BI ARCHITECTURE **9**

Components of BI Architecture – BI Design and prototyping – Importance of Data in Decision Making- Data requirements Analysis - Using OLAP for BI – Data warehouse and Technical BI Architecture – Business Rules – Data Quality – Data Integration – High performance BI - BI 2.0 – Goo LAP Fact Retrieval Framework.

UNIT IV BI TECHNOLOGIES **9**

Successful BI – LOFT Effect – Importance of BI Tools – BI standardization - Creating business value through location based intelligence – Technologies enabling BI – technologies for information integration - Building effective BI Systems – Strategic, Tactical, Operational and Financial Intelligence.

UNIT V FUTURE OF BI **9**

Knowledge Discovery for BI – Markov Logic Networks – BI Search and Text Analytics – Advanced Visualisation – Semantic Web Technologies for building BI - Service oriented BI – Collaborative BI -Evaluating BI – Stakeholder model of BI.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students should be able to:

- Assess the business intelligence potential of today_s data rich environment
- Plan how to decide when to use which technique
- Outline how to implement major techniques using Excel add-ins
- Gain the intellectual capital required to provide business analytics services.

REFERENCES:

1. CindiHowson,"Successful Business Intelligence‖, Tata McGraw-Hill Education, 2007
2. David Loshin,‖ Business Intelligence: The Savvy Manager's Guide‖, Morgan Kaufmann, 2ndEdition, Newnes Publishers, 2012
3. Elizabeth Vitt, Michael Luckevich, Stacia Misner, —Business Intelligence‖, O'Reilly Media, Inc.,2010.
4. Larissa Terpeluk Moss, S. Atre, ‖Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications, Addison-Wesley Information Technology Series‖, illustrated edition, Addison-Wesley Professional, 2003
5. Marie - Aude Aufaure, Esteban Zimány, —Business Intelligence‖, First European Summer SchooleBISS, 2011.
6. Murugan Anandarajan, Asokan Anandarajan, Cadambi A. Srinivasan, ‖Business IntelligenceTechniques: A Perspective from Accounting and Finance‖, illustrated Springer, 2003 7. Rajiv Sabherwal, Irma Becerra-Fernandez, —Business Intelligence‖, illustrated Edition, John Wiley &Sons, 2010

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	2	1	1	2	2
CO2	2	2	1	1	2	2
CO3	2	2	1	1	2	2
CO4	2	2	1	1	2	2
CO5	2	2	1	1	2	2
AVG	2	2	1	1	2	2

PMC204 INTEGRATED SOFTWARE PROJECT MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

The student should be able to

- Understand the basic concept of project management.
- Learn the various costing and life cycle management.
- Understand the role played by risk in software project.
- Appreciate the use of metrics for software project management.
- Know the challenges in people management.

UNIT I PROJECT MANAGEMENT & COSTING 9

Software Project Management approaches - Project Acquisition – Initiation – Planning – PERT– Execution and Control – CPM – Change Management – Project Closure – Agile SPM Problems in Software Estimation – Algorithmic Cost Estimation Process, Function Points, COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card.

UNIT II PROCESS MODELS & LIFECYCLE MANAGEMENT 9

Software Engineering Process Models – Adaptive Software Development (ASD) – DSDM – SCRUM –Crystal -Feature Driven Development (FDD) - ISO 9000: 2000 – SPICE – SIX SIGMA – CMMI. SLIM (Software Life cycle Management) – PLM (Product Lifecycle Management) – PDM (Product Data Management) - PLM, PDM Applications – Pre-PLM Environment – Change Management.

UNIT III RISK MANAGEMENT 9

Perspectives of Risk Management - Risk Definition – Risk Categories – Risk Assessment: Approaches, techniques and good practices – Risk Identification / Analysis / Prioritization – Risk Control (Planning / Resolution / Monitoring) – Risk Retention – Risk Transfer - Failure Mode and Effects Analysis (FMEA) – Operational Risks – Supply Chain Risk Management.

UNIT IV METRICS 9

Need for Software Metrics – scope – basics – framework for software measurement - Classification of Software Metrics: Product Metrics (Size Metrics, Complexity Metrics, Halsteads Product Metrics, Quality Metrics), and Process metrics (Empirical Models, Statistical Models, Theory- based Models, Composite Models, and Reliability Models) – measuring internal and external product attributes.

UNIT V PEOPLE MANAGEMENT 9

Leadership styles — Developing Leadership skills – Leadership assessment – Motivating People – Organizational strategy – Management – Team building – Delegation – Art of Interviewing People - Team Management – Rewarding - Client Relationship Management.

TOTAL : 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Identify the various elements of software management process framework
- Use available open source estimation tools for cost estimation
- Identify existing risk and perform risk assessment
- Design a software metric for software project management
- Modify the art of interviewing people for a given scenario.

REFERENCES:

1. Antonio Borghesi, Barbara Gaudenzi, —Risk Management: How to Assess, Transfer and Communicate Critical Risks: Perspectives in Business Culture‖,Illustrated Edition, Springer, 2012
2. Murali Chemuturi, Thomas M. Cagley, —Mastering Software Project Management: BestPractices, Tools and Techniques‖, J. Ross Publishing, 2010
3. Norman Fenton, James Bieman, —Software Metrics: A Rigorous and Practical Approach‖, 3rd edition, CRC Press, 2015.
4. Stark, John, —Decision Engineering: Product Lifecycle Management:21st Century Paradigm forProduct Realisation‖, 2nd Edition.,Springer London,2011

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	1	1	2	2
CO2	2	1	1	1	2	2
CO3	2	1	1	1	2	2
CO4	2	1	1	1	2	2
CO5	2	1	1	1	2	2
AVG	2	1	1	1	2	2

PMC205 SOFTWARE SECURITY L T P C
3 0 0 3

COURSE OBJECTIVES:

The student should be able to

- Know the importance and need of software security
- Know about various attacks
- Learn about secure software design
- Understand risk management in secure software development
- Know the working of tools related to software security

UNIT I INTRODUCTION 9

Need for software security – Memory based attacks – low level attacks against heap and stack -stack smashing – format string attacks – stale memory access attacks – ROP (Return oriented programming) – malicious computation without code injection. Defense against memory based attacks stack canaries – non-executable data - address space layout randomization (ASLR), memory-safety enforcement, control-flow Integrity (CFI) – randomization

UNIT II SECURE DESIGN 9

Isolating the effects of untrusted executable content - stack inspection – policy specification languages – vulnerability trends – buffer overflow – code injection - Generic network fault injection –local fault injection - SQL injection - Session hijacking. Secure design - threat modeling and security design principles - good and bad software design - Web security-browser security: cross-site scripting (XSS), cross-site forgery (CSRF) – database security – file security.

UNIT III SECURITY RISK MANAGEMENT 9

Risk Management Life cycle – Risk Profiling – Risk exposure factors – Risk Evaluation and Mitigation - Risk Assessment Techniques – Threat and Vulnerability Management.

UNIT IV SECURITY TESTING 9

Traditional software testing – comparison - secure software development life cycle - risk based security testing – prioritizing security testing with threat modeling – shades of analysis: white, grey and black box testing.

UNIT V ADVANCED SOFTWARE SECURITY 9

Advanced penetration testing – planning and scoping – DNS groper – DIG (Domain Information Graph) –Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for penetration testing

TOTAL : 45 PERIODS

OUTCOMES:

At the end the student will be able to

- Use tools for securing software
- Apply security principles in software development
- Involve selection of testing techniques related to software security in testing phase of software development

REFERENCES:

1. Bryan Sullivan and Vincent Liu, ―Web Application Security, A Beginner's Guide‖, Kindle Edition,McGraw Hill, 2012
2. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, ―The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)‖, Addison-Wesley Professional, 2006
3. Evan Wheeler, ―Security Risk Management: Building an Information Security Risk ManagementProgram from the Ground Up‖, First edition, Syngress Publishing, 2011
4. Lee Allen, ―Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)‖, Kindle Edition, Packt Publishing,2012
5. Mike Shema, ―Hacking Web Apps: Detecting and Preventing Web Application Security Problems‖,First edition, Syngress Publishing, 2012
6. Robert C. Seacord, ―Secure Coding in C and C++ (SEI Series in Software Engineering)‖, Addison-Wesley Professional, 2005

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	2	2	2	1	2	2
CO3	1	1	2	1	2	1
CO4	2	1	2	2	2	2
CO5	2	1	2	1	2	1
AVG	2	1	2	1	2	1.5

PMC401 MACHINE LEARNING FOR DATA SCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand neural network and learn combination of classifiers
- To understand and build unsupervised learning models.
- To design and analysis of probabilistic graphical models.

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Machine Learning – Basic concepts – Types of Machine learning – Examples & Applications – Data Pre-processing – Noise Removal – Normalization – Bias & Variance, Review on Probability – Conditional probability – Bayesian conditional probability

UNIT II SUPERVISED LEARNING 9

Linear Regression Models: Multiple regression – Logistic regression, Naïve Bayes classifier, Nearest Neighbour and KNN Algorithm, Decision Trees, Support Vector Machines, Kernel functions

UNIT III NEURAL NETWORKS, ENSEMBLE TECHNIQUES 9

Artificial Neural Network(ANN), perceptron, multilayer perceptron, Back propogation network(BPN) activation functions, gradient descent optimization, error back propagation, Unit saturation (vanishing gradient problem) - ReLU, hyper parameter tuning, batch normalization, regularization, Ensemble Methods — Bagging, Boosting

UNIT IV UNSUPERVISORY & REINFORCEMENT LEARNING 9

Clustering – Distance Function, Minimum, maximum & average connection, Hierarchical Clustering, agglomerative – K Means clustering, Self-organizing Map, Reinforcement Learning overview

UNIT V GRAPHICAL MODELS & DIMENSION REDUCTION 9

Directed Graphical Models, Bayesian Networks, Markov Models, Hidden Markov Models, Inference-Learning Generalization, Dimension reduction-Curse of Dimensinality, PCA

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Explain the basic concepts of machine learning.

CO2: Construct supervised learning models.

CO3: Construct unsupervised learning algorithms.

CO4: Evaluate and compare different models

CO5: Design of experiments using machine learning

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014
3. Sridhar S & Vijayalakshmi M, “Machine Learning”, Oxford University Press, 2021
4. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
5. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, . 2018.
6. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
7. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019.
8. Francois Chollet, “Deep Learning with Python”, Second Edition,Manning Publications, 2021.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	2	2	2	1
CO2	1	1	2	2	2	1
CO3	1	1	2	2	2	1
CO4	1	1	2	2	2	1
CO5	1	1	2	2	2	1
AVG	1	1	2	2	2	1

PMC402	DATA VISUALIZATION	L T P C
		3 0 0 3

Course Objectives:

- To understand the fundamentals of data visualization.
- To know the working principles of various information visualization depth tools.
- To acquire knowledge about the issues in data representation.
- To visualize the Data using tools Tableau
- To gain skill in designing real time interactive information visualization system.

UNIT I INTRODUCTION 9

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools. Mapping - Time Series – Connections and Correlations – Scatterplot Maps – Trees, Hierarchies, and Recursion – Networks and Graphs

UNIT II VISUALIZATION TECHNIQUES FOR TIME-SERIES, TREES & GRAPHS 9

Mapping – Time series - Connections and correlations – Indicator – Area chart-Pivot table- Scatter charts, Scatter maps – Tree maps, Space filling and non-space filling methods – Hierarchies and Recursion - Networks and Graphs-Displaying Arbitrary Graphs-node linkgraph-Matrix representation for graphs- Info graphics

UNIT III TEXT AND DOCUMENT VISUALIZATION 9

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Web Techniques, Parsing data - Levels of Effort, Tools for Gathering Clues, Text Markup Languages, Regular Expressions, Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT IV INTERACTIVE DATA VISUALIZATION 9

Drawing with data — Scales — Axes — Updates, Transition and Motion — Interactivity - Layouts —Geomapping – Exporting, Framework – D3.js, Tableau Dashboards

UNIT V SECURITY IN DATA VISUALIZATION 9

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems – Creating secured visualization system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

- Apply mathematics and basic science knowledge for designing information visualizing System.
- Collect data ethically and solve engineering problem in visualizing the information.
- Implement algorithms and techniques for interactive information visualization.
- Conduct experiments by applying various modern visualization tool and solve the space layoutproblem.
- Analyze and design system to visualize multidisciplinary multivariate Data individually or in teams.
- Develop a cost effective and a scalable information visualization system.

References

1. Robert Spence, “Information Visualization An Introduction”, Third Edition, Pearson Education, 2014.
2. Colin Ware, “Information Visualization Perception for Design”, Third edition,Margon Kaufmann Publishers, 2012.
3. Robert Spence, “Information Visualization Design for Interaction”, Second Edition, PearsonEducation, 2006.
4. Benjamin B. Bederson and Ben shneiderman, “The Craft of Information Visualization”, MorganKaufmann Publishers, 2003.
5. Thomas strothotte, “Computational Visualization: Graphics, Abstraction and Interactivity”, Springer,1998.
6. Matthew O. Ward, George Grinstein, Daniel Keim, “Interactive Data Visualization: Foundation,Techniques and Applications”, Second Edition, A. K. Peters/CRC Press, 2015.
7. Joerg Osarek, “Virtual Reality Analytics”, Gordon’s Arcade, 2016.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	2	2	1	1	1
CO2	2	2	2	1	1	1
CO3	2	2	2	1	1	1
CO4	2	2	2	1	1	1
CO5	2	2	2	1	1	1
AVG	2	2	2	1	1	1

PMC403	DATA SECURITY AND PRIVACY	L T P C
		3 0 0 3

UNIT I ATTACKS AND PRIVACY 9

Attacks: Analysing common attack vectors — Data Security — Probabilistic reasoning about attacks —Data security mitigations. Privacy aware Machine learning and Data Science: Privacy preserving techniques in ML - Open-source libraries for PPML Architecting privacy in Data and ML projects

UNIT II ENCRYPTED COMPUTATION 9

Encrypted computation – Types of encrypted computation: Secure Multi-party computation – Homomorphic encryption. Real-world encrypted computation: Private set intersection – Private join and compute – Secure Aggregation – Encrypted Machine Learning. PSI and Moose

UNIT III DATA GOVERNANCE AND PRIVACY APPROACHES 9

Data Governance – Identifying sensitive data – Documenting data for use - Basic Privacy – Anonymization – Differential privacy – Privacy loss – Differential privacy with Laplace mechanism – Gaussian noise for differential privacy – Sensitivity and Privacy units – k-Anonymity – Building Privacy into Data Pipelines

UNIT IV FEDERATED LEARNING AND DATA SCIENCE 9

Distributed data – Distributed Optimization - Federated learning – Architecting federated systems – Open-source federated libraries – Federated data science

UNIT V LEGALITY OF PRIVACY 9

GDPR – CCPA – HIPAA - LGPD - PIPL- Internal policies and contracts – Adhering to contract agreements and law – Interpreting Data protection regulations – Data governance 2.0 - Indian Data Protection Framework - Use case analysis

Total: 45 Periods

COURSE OUTCOMES:

- Gain knowledge on the nature of attacks and threats and security management goals andframework.
- Knowledge on the landscape of hacking and defense mechanisms
- Able to differentiate and integrate strategies for data security and protecting critical infrastructure
- Able to understand policies to mitigate data security breaching
- Knowledge on IT Act, and amendments, copy rights, IPR and cyber law to deal with offenses.

REFERENCES

1. Katharine Jarmul, Practical Data Privacy, O'Reilly Media, Inc, 2023
2. David Evans, Vladimir Kolesnikov and Mike Rosulek, A Pragmatic Introduction to Secure Multi-Party Computation, NOW Publishers, 2022 (Free access at https://securecomputation.org/)

3. William Stallings, Cryptography and Network Security - Principles and Practice, Seventh Edition,Pearson, 2017
4. Indian Data Protection Framework https://www.meity.gov.in/data-protection-framework

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	1	2	1
CO2	1	1	1	1	1	1
CO3	2	2	2	2	1	2
CO4	2	1	1	2	2	1
CO5	1	1	2	1	2	2
AVG	2	1	2	1	2	1

PMC404	BIG DATA ANALYTICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand big data.
- To learn and use NoSQL big data management.
- To learn map reduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics.

UNIT I UNDERSTANDING BIG DATA 9

Introduction to big data – convergence of key trends – unstructured data – industry Examples of big data – web analytics – big data applications – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency – Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III MAP REDUCE APPLICATIONS 9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of Map Reduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling –shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Haddop pipes design of Haddop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file- based data structures – Cassandra – Hadoop integration.

UNIT V HADOOP RELATED TOOLS 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts.Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation– HiveQL queries.

Total: 45 Periods

COURSE OUTCOMES:

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

- Describe the big data and use cases from selected business domains.
- Explain NoSQL big data management.
- Install, configure and run Hadoop and HDFS.
- Perform map-reduce analytics using Hadoop.
- Use Hadoop-related tools such as HBase, Cassandra, Pig and Hive for big data analytics.

REFERENCES

1. Michael Minelli, Michael Chambers, and AmbigDhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Businesses”, Wiley, 2013.
2. Eric Sammer, “Hadoop Operations”, O’Reilley, 2012.
3. Sadalage, Pramod J. “NoSQL distilled”, 2013
4. E. Capriolo, D. Wrampler, and J. Rutherglen, “Programming Hive”, O’Reilley, 2012.
5. Lars George, “HBase: The Definitive Guide: O’Reilley, 2011.
6. Eben Hewitt, “Cassandra: The Definitive Guide: O’Reilley, 2010.
7. Alan Gates, “Programming Pig”, O’Reilley, 2011.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	1	1	2	1
CO2	2	1	1	1	2	1
CO3	2	1	1	1	2	1
CO4	2	1	1	1	2	1
CO5	2	1	1	1	2	1
AVG	2	1	1	1	2	1

PMC405	EXPLORATORY DATA ANALYSIS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science - Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Visual Aids for EDA –Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT II EDA USING PYTHON 9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.

UNIT III UNIVARIATE ANALYSIS 9

Introduction to Single Variable: Distribution Variables – Numerical Summaries of Level and Spread –Scaling and Standardizing — Inequality

UNIT IV BIVARIATE ANALYSIS 9

Relationships between Two Variables – Percentage Tables – Analysis Contingency Tables –Handling Several Batches – Scatterplots and Resistant Lines.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Chracteristics of time series data – Data Cleaning –Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the fundamentals of exploratory data analysis.
CO2: Implement the data Visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis.
CO4: Apply bivariate data exploration and analysis.
CO5: Use Data exploration and visualization techniques for multivariate and time series data.

REFERENCES:

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, PacktPublishing, 2020. (Unit 1)
2. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”. FirstEdition, O Reilly, 2017. (Unit 2)
3. Catherine Mars, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”,Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)
4. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
5. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly Publications, 2019.
6. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations,Techniques, and Applications”, 2nd Edition, CRC press, 2015.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	2	2	1	2	1
CO2	2	2	2	1	2	1
CO3	2	2	2	1	2	1
CO4	2	2	2	1	2	1
CO5	2	2	2	1	2	1
AVG	2	2	2	1	2	1

PMC401 NATURAL LANGUAGE PROCESSING L T P C
2 0 2 3

COURSE OBJECTIVES:

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

UNIT I INTRODUCTION 6

Natural Language Processing – Components - Basics of Linguistics and Probability and Statistics –Words-Tokenization-Morphology-Finite State Automata

UNIT II STATISTICAL NLP AND SEQUENCE LABELING 6

N-grams and Language models –Smoothing -Text classification- Naïve Bayes classifier – Evaluation- Vector Semantics – TF-IDF - Word2Vec- Evaluating Vector Models - Sequence Labeling – Part ofSpeech – Part of Speech Tagging -Named Entities – Named Entity Tagging

UNIT III CONTEXTUAL EMBEDDING 6

Constituency –Context Free Grammar –Lexicalized Grammars- CKY Parsing – Earley's algorithm- Evaluating Parsers -Partial Parsing — Dependency Relations- Dependency Parsing -Transition Based - Graph Based

UNIT IV COMPUTATIONAL SEMANTICS 6

Word Senses and WordNet – Word Sense Disambiguation – Semantic Role Labeling – PropositionBank- FrameNet- Selectional Restrictions - Information Extraction - Template Filling

UNIT V DISCOURSE ANALYSIS AND SPEECH PROCESSING 6

Discourse Coherence – Discourse Structure Parsing – Centering and Entity Based Coherence –Question Answering –Factoid Question Answering – Classical QA Models – Chatbots and Dialogue systems – Frame-based Dialogue Systems – Dialogue– State Architecture

30 PERIODS

SUGGESTED ACTIVITIES:

1. Probability and Statistics for NLP Problems
2. Carry out Morphological Tagging and Part-of-Speech Tagging for a sample text
3. Design a Finite State Automata for more Grammatical Categories
4. Problems associated with Vector Space Model
5. Hand Simulate the working of a HMM model
6. Examples for different types of work sense disambiguation
7. Give the design of a Chatbot

PRACTICAL EXERCISES: **30 PERIODS**

1. Download nltk and packages. Use it to print the tokens in a document and the sentencesfrom it.
2. Include custom stop words and remove them and all stop words from a given documentusing nltk or spaCY package
3. Implement a stemmer and a lemmatizer program.
4. Implement asimple Part-of-Speech Tagger
5. Write a program to calculate TFIDF of documents and find the cosine similarity betweenany two documents.
6. Use nltk to implement a dependency parser.
7. Implement a semantic language processor that uses WordNet for semantic tagging.
8. Project - (in Pairs) Your project must use NLP concepts and apply them to some data.
   a. Your project may be a comparison of several existing systems, or it may propose a newsystem in which case you still must compare it to at least one other approach.
   b. You are free to use any third-party ideas or code that you wish as long as it is publiclyavailable.
   c. You must properly provide references to any work that is not your own in the write-up.
   d. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you willneed to write, and papers (2-3) you plan to read.

List of Possible Projects

1. Sentiment Analysis of Product Reviews
2. Information extraction from News articles
3. Customer support bot
4. Language identifier
5. Media Monitor
6. Paraphrase Detector
7. Identification of Toxic Comment
8. Spam Mail Identification

COURSE OUTCOMES:

CO1: Understand basics of linguistics, probability and statistics associated with NLP

CO2: Implement a Part-of-Speech Tagger

CO3: Design and implement a sequence labeling problem for a given domain

CO4: Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP

CO5: Implement a simple chatbot using dialogue system concepts

TOTAL : 60 PERIODS

REFERENCES

1. Daniel Jurafsky and James H.Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”(Prentice Hall Series in Artificial Intelligence), 2020
2. Jacob Eisenstein. “Natural Language Processing “, MIT Press, 2019
3. Samuel Burns “Natural Language Processing: A Quick Introduction to NLP with Python andNLTK, 2019
4. Christopher Manning, “Foundations of Statistical Natural Language Processing”, MIT Press, 2009.
5. Nitin Indurkhya,Fred J. Damerau, “Handbook of Natural Language Processing”, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010
6. Deepti Chopra, Nisheeth Joshi, “Mastering Natural Language Processing with Python”,Packt Publishing Limited, 2016
7. Mohamed Zakaria Kurdi “Natural Language Processing and Computational Linguistics:Speech, Morphology and Syntax (Cognitive Science)”, ISTE Ltd., 2016
8. Atefeh Farzindar,Diana Inkpen, “Natural Language Processing for Social Media (Synthesis Lectures on Human Language Technologies)”, Morgan and Claypool Life Sciences, 2015

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	3	-	2	1	-
CO2	-	1	3	2	-	3
CO3	3	2	1	-	-	2
CO4	1	-	3	-	2	-
CO5	2	3	-	1	3	1
AVG	2	2	1	1	1	1

PMC402 PREDICTIVE MODELLING L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the terms and terminologies of predictive modeling.
- To study the various predictive models, their merits, demerits and application.
- To get exposure to various analytical tools available for predictive modeling.
- To learn the predictive modeling markup language.
- To get familiar with the technologies in predictive modeling.

UNIT I INTRODUCTION TO PREDICTIVE MODELING 9

Core ideas in data mining - Supervised and unsupervised learning - Classification vs. Prediction - Steps in data mining- SEMMA Approach - Sampling -Pre-processing - Data cleaning - Data Partitioning - Building a model - Statistical models - Statistical models for predictive analytics.

UNIT II PREDICTIVE MODELING BASICS 9

Data splitting **—** Balancing- Over fitting –Oversampling –Multiple Regression Artificial neural networks (MLP) - Variable importance- Profit/loss/prior probabilities - Model specification - Model selection - Multivariate Analysis.

UNIT III PREDICTIVE MODELS 9

Association Rules-Clustering Models –Decision Trees- Ruleset Models- KNearest Neighbors – Naive Bayes - Neural Network Model – Regression Models – Regression Trees – Classification & Regression Trees (CART) – Logistic Regression – Multiple Linear Regression Scorecards – Support Vector Machines – Time Series Models - Comparison between models - Lift chart Assessment of a single model.

UNIT IV PREDICTIVE MODELING MARKUP LANGUAGE 9

Introduction to PMML – PMML Converter - PMML Structure – Data Manipulation in PMML – PMML Modeling Techniques - Multiple Model Support – Model Verification.

UNIT V TECHNOLOGIES AND CASE STUDIES 9

Weka – Rapid Miner – IBM SPSS Statistics- IBM SPSS Modeler – SAS Enterprise Miner – Apache Mahout – R Programming Language.-Real time case study with modeling and analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

CO1: Design and analyze appropriate predictive models.
CO2: Define the predictive models using PMML.
CO3: Apply statistical tools for analysis.
CO4: Use various analytical tools available for predictive modeling.
CO5: Apply predictive modeling markup language in data manipulation.

REFERENCES:

1. Kattamuri S. Sarma, “Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications”, 3rd Edition, SAS Publishing, 2017.
2. Alex Guazzelli, Wen-Ching Lin, Tridivesh Jena, James Taylor, “PMML in Action Unleashing the Power of Open Standards for Data Mining and Predictive Analytics”, 2nd Edition, Create Space Independent Publishing Platform,2012.
3. Ian H. Witten, Eibe Frank , “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann,3rd Edition, 2011.
4. Eric Siegel , “Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die”, 2nd Edition, Wiley, 2016.
5. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.
6. Jeremy Howard, Margit Zwemer, Mike Loukides, “Designing Great Data Products-Inside the Drivetrain train Approach, a Four-Step Process for Building Data Products – Ebook”, 1stEdition, O'Reilly Media, March 2012.

WEB REFERENCES:

1. *https://nptel.ac.in/courses/108108111/*
2. *https://www.coursera.org/learn/predictive-modeling-analytics*

ONLINE RESOURCES:

1. *https://bookdown.org/egarpor/PM-UC3M/*
2. *https://cics.nd.edu/research/applications/materials/*

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	2	3	3	2	2
CO2	1	2	3	3	2	2
CO3	3	2	2	2	2	2
CO4	2	3	3	1	2	2
CO5	2	3	2	1	3	3
AVG	2	3	3	2	2	2

PMC403 SMART CONVERGENT TECHNOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about Fundamentals of IoT and Security
- To know about IoT applications in Industry
- To learn about RFID Pervasive networks
- To gain fundamental concepts in 5G and Next Gen networks
- To know about IoT implementation

UNIT I TOWARDS THE IOT UNIVERSE 9

Internet of Things Vision - IoT Strategic Research and Innovation Directions - IoT Applications - Internet of Things and Related Future Internet Technologies -Infrastructure - Networks and Communication - Processes - Data Management, Security, Privacy & Trust - Device Level Energy Issues.

UNIT II IOT APPLICATIONS — VALUE CREATION FOR INDUSTRY 9

Introduction - IoT Applications for Industry —– Value Creation and Challenges - Future Factory Concepts - Brownfield IoT: Technologies for Retrofitting - Smart Objects, Smart Applications – Four Aspects in your Business to Master IoT - Value Creation from Big Data and Serialization in the Pharmaceutical Industry - IoT for Retailing Industry- IoT for Oil and Gas Industry - Opinions on IoT Application and Value for Industry- Data Aggregation for the IoT in Smart Cities.

UNIT III RFID PERVASIVE NETWORKS 9

RFID Tags- RFID Automatic Identification and Data Capture RFID Data Warehousing and analysis,- RFID Data Management Issues, Solutions, and Directions- RFID Security: Threats and Solutions- RFIG Geometric Context of Wireless Tags- RFID Application in Animal Monitoring- RFID Enabled Logistics Services - Location Tracking in an Office Environment: The Nationwide Case Study- Pervasive Computing Security: Bluetooth's Example- Internet of Things: A Context- Awareness Perspective - Index.

UNIT IV INTRODUCTION TO INDUSTRIAL INTERNET OF THINGS 9

Industrial Internet- Key IIoT Technologies- Innovation and the IIoT - Key Opportunities and Benefits the Digital and Human Workforce - Logistics and the Industrial Internet- IOT Innovations in Retail Cyber Physical Systems (CPS) – IP Mobility – Network Virtualization - SDN (Software Defined Networks)- The Cloud and Fog

UNIT V IIOT ARCHITECTURE AND DESIGNING INDUSTRIAL INTERNET SYSTEMS 9

Industrial Internet Architecture Framework (IIAF) - Industrial Internet Viewpoints - Architectural Topology: The Three-Tier Topology - Wireless Communication Technologies- Proximity Network Communication Protocols-Gateways: industrial gateways - CoAP (Constrained Application Protocol) — NFC

COURSE OUTCOMES:

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

CO1: Describe the core principles of IoT Network Management

CO2: Identify the applications of IoT in Industry

CO3: Explain the basic concepts in RFID and Pervasive Networks

CO4: Discuss the fundamental concepts in IIoT, CPS and Network Virtualization.

CO5: Design Industrial Internet Systems

TOTAL: 45 PERIODS

REFERENCES:

1. Ovidiu Vermesan, Peter Friess, “Internet of Things – From Research and Innovation to MarketDeployment”’, River Publishers, 2014(unit I)
2. Ovidiu Vermesan, Peter Friess, “The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems”, River Publications, 2013.(Unit II)
3. Lu Yan, Yan Zhang, Laurence T. Yang and Huansheng Ning “The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems”,. Auerbach Publications, 2019.(Unit III)
4. Gilchrist, Alasdair, “Industry 4.0 The Industrial Internet of Things”, Apress, 2017. (Unit IV and Unit V)

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	2	2	2	2
CO2	1	1	1	3	3	3
CO3	1	3	2	3	2	1
CO4	1	1	2	2	3	3
CO5	2	1	2	2	3	3
AVG	1.2	1.6	1.8	2.4	2.6	2.4

PMC404	WEB ANALYTICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand the Web analytics platform, and their evolution.
- To learn about the various Data Streams Data.
- To learn about the benefits of surveys and capturing of data
- To understand Common metrics of web as well as KPI related concepts.
- To learn about the various Web analytics versions.

UNIT I INTRODUCTION 9

Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations.

UNIT II DATA COLLECTION 9

Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E- commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

UNIT III QUALITATIVE ANALYSIS 9

Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys. Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues.

UNIT IV WEB METRICS 9

Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non-e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files &Cookies,Web Bugs.

UNIT V WEB ANALYTICS 2.0 9

Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities. Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students should be able to:

CO1: Understand the Web analytics platform, and their evolution.
CO2: Use the various Data Streams Data.
CO3: Know how the survey of capturing of data will benefit.
CO4: Understand Common metrics of web as well as KPI related concepts.
CO5: Apply various Web analytics versions in existence.

REFERENCES:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed, 2012.
2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science ofCustomer Centricity, Wiley Publishing, Inc. 1st ed, 2010.
3. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley andSons, 2002

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	2	3	1	1
CO2	1	1	1	1	1	1
CO3	3	1	2	2	1	1
CO4	1	2	2	3	1	1
CO5	2	1	1	1	2	2
AVG	1.6	1.2	1.6	2	1.2	1.2

PMC405 MACHINE LEARNING AND DEEP LEARNING L T P C
3 0 0 3

COURSE OBJECTIVES:

The course is aimed at

- Understanding about the learning problem and algorithms
- Providing insight about neural networks
- Introducing the machine learning fundamentals and significance
- Enabling the students to acquire knowledge about pattern recognition.
- Motivating the students to apply deep learning algorithms for solving real life problems.

UNIT I LEARNING PROBLEMS AND ALGORITHMS 9

Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

UNIT II NEURAL NETWORKS 9

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.

UNIT III MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS 9

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

UNIT IV DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS 9

Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization,convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT V DEEP LEARNING: RNNS, AUTOENCODERS AND GANS 9

State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

TOTAL : 45 PERIODS

COURSE OUTCOMES (CO):

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

CO1: Illustrate the categorization of machine learning algorithms.

CO2: Compare and contrast the types of neural network architectures,activation functions

CO3: Acquaint with the pattern association using neural networks

CO4: Elaborate various terminologies related with pattern recognition and architectures ofconvolutional neural networks

CO5: Construct different feature selection and classification techniques and advanced Neural network architectures such as RNN, Auto encoders, and GANs.

REFERENCES:

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A ComputationalApproach to Learning and Machine Intelligence, 2012, PHI learning
2. Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN:9780262035613, 2016.
3. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman.Second Edition. 2009.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. CambridgeUniversity Press. 2017.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	2	3	1	1
CO2	1	1	1	1	1	1
CO3	3	1	2	2	1	1
CO4	1	2	2	3	1	1
CO5	2	1	1	1	2	2
AVG	1.6	1.2	1.6	2	1.2	1.2

PMC501 DATABASE MANAGEMENT SYSTEMS AND SECURITY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To understand the need of security in Database Management systems
- To learn how to secure Database Management systems

UNIT I RELATIONAL DATABASES 9

Data Models – Relational Data Models – Relational Algebra – Structured Query Language – Entity- Relationship Model — Mapping ER Models to Relations — Distributed Databases — Data Fragmentation — Replication

UNIT II DATABASE DESIGN 9

ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTION MANAGEMENT 9

Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling – Recovery System – Failure Classification – Recovery Algorithm.

UNIT IV DATABASE SECURITY 9

Need for database security – SQL Injection Attacks – The Injection Technique – SQLi Attack Avenues and Types

UNIT V ACCESS CONTROL AND ENCRYPTION 9

Database Access Control – SQL based access definition – Cascading Authorizations – Role- based access control – Inference – Database encryption

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Model an application's data requirements using conceptual modeling and design database schemas based on the conceptual model.

CO2: Formulate solutions to a broad range of query problems using relational algebra / SQL.

CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.

CO4: Run transactions and estimate the procedures for controlling the consequences of concurrent data access.

CO5: Understand and handle security issues in database management systems

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”,Seventh Edition, Tata McGraw Hill, 2021.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”,Seventh Edition, Pearson Education, 2016.
3. William Stallings, Lawrie Brown, “Computer Security: Principles and Practice”, FourthEdition, Pearson, 2019.

REFERENCES:

1. C.J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”,Pearson Education, Eighth Edition, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, ThirdEdition, McGraw Hill, 2014.
3. Narain Gehani and Melliyal Annamalai, “The Database Book: Principles and Practice Using the Oracle Database System”, Universities Press, 2012.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	2	1	1	-
CO2	1	2	2	1	1	-
CO3	2	1	2	1	2	-
CO4	2	2	3	2	1	-
CO5	2	2	3	2	2	-
AVG	2	2	2	1	1	-

PMC502 OPERATING SYSTEMS AND SECURITY L T P C
3 0 2 4

COURSE OBJECTIVES:

- To understand the basic concepts of Operating Systems.
- To explore the process management concepts including scheduling, synchronization, threads and deadlock.
- To understand the memory, file and I/O management activities of OS.
- To understand the requirements of a trust model.
- To learn how security is implemented in various operating systems.

UNIT I OPERATING SYSTEM OVERVIEW 9

Computer-System Organization – Architecture – Operating-System Operations – Resource Management – Security and Protection – Distributed Systems – Kernel Data Structures – Operating-System Services – System Calls – System Services – Why Applications Are Operating- System Specific – Operating-System Design and Implementation - Operating- System Structure – Building and Booting an Operating System .

UNIT II PROCESS MANAGEMENT 9

Process Concept — Process Scheduling — Operation on Processes, Inter-process Communication – Threads – Overview – Multithreading models – Threading issues; CPU Scheduling – Scheduling criteria, Scheduling algorithms; Process Synchronization – critical- section problem, Synchronization hardware, Mutex locks, Semaphores, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Detection, Recovery.

UNIT III MEMORY MANAGEMENT AND FILE SYSTEMS 9

Main Memory **—** Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation – Virtual Memory – Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory. Mass Storage system - HDD Scheduling - File concept, Access methods, Directory Structure, Sharing and Protection; File System Structure, Directory implementation, Allocation Methods, Free Space Management

UNIT IV SECURE SYSTEMS AND VERIFIABLE SECURITY GOALS 9

Security Goals – Trust and Threat Model – Access Control Fundamentals – Protection System Reference Monitor — Secure Operating System Definition — Assessment Criteria — Information Flow – Information Flow Secrecy Models – Denning's Lattice Model – Bell LaPadula Model – Information Flow Integrity Models – Biba Integrity Model – Low-Water Mark Integrity — Clark- Wilson Integrity

UNIT V SECURITY IN OPERATING SYSTEMS 9

UNIX Security – UNIX Protection System – UNIX Authorization – UNIX Security Analysis – UNIX Vulnerabilities — Windows Security — Windows Protection System — Windows Authorization – Windows Security Analysis – Windows Vulnerabilities – Address Space Layout Randomizations – Retrofitting Security into a Commercial Operating System – Introduction to Security Kernels

45 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Basics of UNIX commands, Understand and practice Linux Permissions, special permissions and authentication (various options of chmod, setuid, setgid)
2. Write programs using the following system calls of UNIX operating systemfork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to implement the various CPU Scheduling Algorithms
4. Implementation of Semaphores
5. Implementation of Shared memory
6. Bankers Algorithm for Deadlock Detection &Avoidance
7. Implementation of the following Memory Allocation Methods for fixed partition

a) First Fit b) Worst Fit c) Best Fit

8. Implementation of the following Page Replacement Algorithms

a) FIFO b) LRU c) LFU

9. Program to demonstrate the working of Bell LaPadula Model and Biba Integrity Model
10. Setting up access control lists of files and directories and testing the lists in Linux
11. Learn to enable and disable address space layout randomization

COURSE OUTCOMES:

At the end of this course, the students will be able:

CO1: To gain understanding on the concepts of Operating Systems.

CO2: To acquire knowledge on process management concepts including scheduling, synchronization, threads and deadlock.

CO3: To have understanding on memory, file and I/O management activities of OS.

CO4: To understand security issues in operating systems and appreciate the need for security models

CO5: To gain exposure to the operating systems security models of WINDOWS and UNIX OS.

TOTAL: 75 PERIODS

TEXT BOOK

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, John Wiley & Sons, Inc., 10th Edition, 2021.
2. Trent Jaeger, Operating System Security, Morgan & Claypool Publishers series, 2008.

REFERENCES

1. Morrie Gasser, “Building A Secure Computer System”, Van Nostrand Reinhold, New York, 1988.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.
3. William Stallings, “Operating Systems – Internals and Design Principles”, 9th Edition,Pearson, 2017.
4. Michael Palmer, “Guide to Operating Systems Security”, Course Technology – CengageLearning, New Delhi, 2008.

5. Introduction to Hardware, Security and Trust, book by Mohammad Tehranipoor, CliffWang, Springer, 2012.
6. Gary McGraw, Software Security: Building Security In, Addison Wesley software securityseries, 2005.
7. Gerardus Blokdyk, Security Focused Operating System A Complete Guide - 2020 Edition, 5STARCooks, ISBN: 9781867373353, 2020.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	3	3	3	3	2
CO2	3	3	3	3	2	1
CO3	3	3	3	3	2	2
CO4	3	3	3	3	1	1
CO5	3	3	3	3	1	2
AVG	3	3	3	3	3	2

PMC503 CRYPTOGRAPHY AND CYBER SECURITY L T P C

3 0 0 3

COURSE OBJECTIVES:

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.
- Comprehend the various types of data integrity and authentication schemes
- Understand cybercrimes and cyber security.

UNIT I INTRODUCTION TO SECURITY 9

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II SYMMETRIC CIPHERS 9

Number theory – Algebraic Structures – Modular Arithmetic - Euclid‘s algorithm – Congruenceand matrices – Group, Rings, Fields, Finite Fields

SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY 9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem – Chinese RemainderTheorem – Exponentiation and logarithm

ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos

MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

UNIT V CYBER CRIMES AND CYBER SECURITY 9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods

– Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3: Apply the different cryptographic operations of public key cryptography
CO4: Apply the various Authentication schemes to simulate different applications.
CO5: Understand various cyber crimes and cyber security.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practice",Seventh Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes,Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCES

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security",3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing",Fifth Edition, Prentice Hall, New Delhi, 2015.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	2	**1**	2	2	-
CO2	3	3	3	3	3	-
CO3	3	3	3	3	3	-
CO4	3	3	3	3	3	-
CO5	3	2	3	2	3	-
AVG	**3**	**2.6**	**2.6**	**2.6**	**2.8**	**-**

CB3591 ENGINEERING SECURE SOFTWARE SYSTEMS L T P C
2 0 2 3

COURSE OBJECTIVES:

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 6

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software — Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

UNIT II SECURE SOFTWARE DESIGN 7

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages — Vulnerability Trends — Buffer Overflow — Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

UNIT III SECURITY RISK MANAGEMENT 5

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING 8

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing– Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation -Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection
- Tools for Penetration Testing

UNIT V SECURE PROJECT MANAGEMENT 4

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

30 PERIODS

PRACTICAL EXERCISES

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux.
5. Develop and test the secure test cases
6. Penetration test using kali Linux

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Identify various vulnerabilities related to memory attacks.
CO2: Apply security principles in software development.
CO3: Evaluate the extent of risks.
CO4: Involve selection of testing techniques related to software security in the testing phase of software development.
CO5: Use tools for securing software.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk ManagementProgram from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006

REFERENCES:

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition,McGraw Hill, 2012
5. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012
6. Jason Grembi, “Developing Secure Software”

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	3	2	3	2	-
CO2	2	2	2	3	3	-
CO3	1	2	2	2	1	-
CO4	2	3	2	2	2	-
CO5	2	1	2	2	3	-
AVG	1.8	2.2	2	2.4	2.2	-

PMC505	CYBER FORENSICS	L T P C 3 0 2 4

COURSE OBJECTIVES:

- To learn cyber crime and forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data
- To understand cyber laws and the admissibility of evidence with case studies
- To learn the vulnerabilities in network infrastructure with ethical hacking

UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation — Data Acquisition.

UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime and Incident Scenes — Digital Evidence - Sources of Evidence - Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools

- Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chainof Custody- Forensic Tools

UNIT III ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India - Case Studies

UNIT IV ETHICAL HACKING 9

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats — Sniffing — Email Tracking

UNIT V ETHICAL HACKING IN WEB 9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

45 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Study and Explore the following forensic tools:
   (a) FTK Imager
   (b) Autopsy
   (c) EnCase Forensic Imager
   (d) LastActivityView
   (e) USBDeview
2. Recover deleted files using FTKImager
3. Acquire forensic image of hard disk using EnCase Forensics Imager and also perform integritychecking/validation
4. Restore the Evidence Image using En Case Forensics Imager.
5. Study the following:
   (a) Collect Email Evidence in Victim PC.
   (b) Extract Browser Artifacts (Chrome History view for Google Chrome)
6. Use USB Deview to find the last connected USB to the system
7. Perform Live Forensics Case Investigation using Autopsy
8. Study Email Tracking and Email Tracing and write a report on them.

COURSE OUTCOMES:

CO1: Understand the basics of cyber crime and computer forensics
CO2: Apply a number of different computer forensic tools to a given scenario
CO3: Analyze and validate forensics data
CO4: Understand Admissibility of evidence in India with Cyber laws and Case Studies
CO5: Identify the vulnerabilities in a given network infrastructure
CO6: Implement real-world hacking techniques to test system security

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Christopher Steuart, — Guide to Computer Forensics and Investigations‖, Cengage Learning, India Sixth Edition, 2019.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.
3. Dejey, S. Murugan - Cyber Forensics, Oxford University Press, India, 2018

REFERENCE BOOKS

1. John R.Vacca, “Computer Forensics “, Cengage Learning, 2005
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction 3rd Edition, PrenticeHall, 2013.
3. AnkitFadia “ Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik “Insider Computer Fraud‖ Auerbach Publications Taylor &Francis Group–2008.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	-	-	-	-	-	-
CO2	2	1	1	2	-	-
CO3	2	2	1	1	2	-
CO4	-	-	-	-	-	-
CO5	-	3	-	2	-	-
AVG	2	2	1	2	2	-

PMC601 **VIRTUALIZATION** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT I INTRODUCTION TO VIRTUALIZATION 7

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNIT II SERVER AND DESKTOP VIRTUALIZATION 6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation
– Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III NETWORK VIRTUALIZATION 6

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization

UNIT IV STORAGE VIRTUALIZATION 5

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT V VIRTUALIZATION TOOLS 6

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocatememoryand storage space as per requirement. Install Guest OS on that VMWARE.
2. a.Shrink and extend virtual disk
   b. Create, Manage, Configure and schedule snapshots
   c. Create Spanned, Mirrored and Striped volume
   d. Create RAID 5 volume
3. a. Desktop Virtualization using VNC
   b. Desktop Virtualization using Chrome Remote Desktop
4. Create type 2 virtualization on ESXI 6.5 server
5. Create a VLAN in CISCO packet tracer
6. Install KVM in Linux
7. Create Nested Virtual Machine(VM under another VM)

COURSE OUTCOMES:

CO1: Analyse the virtualization concepts and Hypervisor
CO2: Apply the Virtualization for real-world applications
CO3: Install & Configure the different VM platforms
CO4: Experiment with the VM with various software

TOTAL: 60 PERIODS

TEXT BOOKS

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter,TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg,Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center, Auerbach
4. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress,2005.
5. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems andProcesses”, Elsevier/Morgan Kaufmann, 2005.
6. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center”, Auerbach Publications, 2006.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	-	-	-	-	-	-
CO2	2	1	1	2	-	-
CO3	2	2	1	1	2	-
CO4	-	-	-	-	-	-
CO5	-	3	-	2	-	-
AVG	2	2	1	2	2	-

PMC602 **CLOUD SERVICES MANAGEMENT** **L T P C**

2 0 2 3

COURSE OBJECTIVES:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloudservices
- Select appropriate structures for designing, deploying and running cloud-based services in abusiness environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real worldproblems

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 6

Cloud Ecosystem, the Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, CloudService Deployment Models

UNIT II CLOUD SERVICES STRATEGY 6

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT III CLOUD SERVICE MANAGEMENT 6

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT IV CLOUD SERVICE ECONOMICS 6

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V CLOUD SERVICE GOVERNANCE & VALUE 6

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership

COURSE OUTCOMES:

CO1: Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services

CO3: Solve the real world problems using Cloud services and technologies

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloudsoftwares like Openstack, Eucalyptus, OpenNebula with Role-based access control
2. Create a Cost-model for a web application using various services and do Cost-benefit analysis
3. Create alerts for usage of Cloud resources
4. Create Billing alerts for your Cloud Organization
5. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggestthe best one

TOTAL: 60 PERIODS

TEXT BOOKS

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era byEnamul Haque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini,Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya,Christian Vechhiola, S. Thamarai Selvi

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	3	1	1	1	-
CO2	3	1	2	3	2	-
CO3	1	1	3	1	3	-
CO4	1	1	1	2	3	-
CO5	1	3	3	2	2	-
AVG	1.8	1.8	2	1.8	2.2	-

PMC603	STORAGE TECHNOLOGIES	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. DataCenter Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID 5

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale- out storage
Architecture**.**

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 13

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV BACKUP, ARCHIVE AND REPLICATION 12

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS)**.**

UNIT V SECURING STORAGE INFRASTRUCTURE 6

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
CO2: Illustrate the usage of advanced intelligent storage systems and RAID
CO3: Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
CO4: Examine the different role in providing disaster recovery and remote replication Technologies
CO5: Infer the security needs and security measures to be employed in information storage management

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	1	3	3	-
CO2	3	1	2	3	3	-
CO3	1	1	3	2	2	-
CO4	3	2	1	2	2	-
CO5	1	3	2	1	2	-
AVG	1.8	1.8	1.8	2.2	2.4	-

PMC604 **SOFTWARE DEFINED NETWORKS** **L T P C**

2 0 2 3

COURSE OBJECTIVES:

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I SDN: INTRODUCTION **6**

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLAN **6**

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - DistributedControllers

UNIT III SDN APPLICATIONS **6**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering –Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION **6**

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits andRequirements – Reference Architecture

UNIT V NFV FUNCTIONALITY **6**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFVUse cases — SDN and NFV

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1) Setup your own virtual SDN lab
   i) Virtualbox/Mininet Environment for SDN - http://mininet.org
   ii) https://www.kathara.org
   iii) GNS3
2) Create a simple mininet topology with SDN controller and use Wireshark to capture andvisualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.
3) Create a SDN application that uses the Northbound API to program flow table rules on theswitch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.
4) Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu
5) Install OSM and onboard and orchestrate network service.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Describe the motivation behind SDN

CO2: Identify the functions of the data plane and control plane

CO3: Design and develop network applications using SDN

CO4: Orchestrate network services using NFV

CO5: Explain various use cases of SDN and NFV

TEXTBOOKS:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: AComprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

CO’s- PO’s MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	3	1	3	-
CO2	2	1	2	2	3	-
CO3	2	2	2	3	3	-
CO4	2	2	2	3	1	-
CO5	3	3	1	1	3	-
AVG	2	2	2	2	2.6	-

PMC605 **STREAM PROCESSING** **L T P C**

2 0 2 3

COURSE OBJECTIVES:

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in abusiness environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real worldproblems

UNIT I FOUNDATIONS OF DATA SYSTEMS 6

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 6

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III DATA MODELS AND QUERY LANGUAGES 6

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 6

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, KafkaConnect API

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 6

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerantSemantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning

of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Install MongoDB
2. Design and Implement Simple application using MongoDB
3. Query the designed system using MongoDB
4. Create a Event Stream with Apache Kafka
5. Create a Real-time Stream processing application using Spark Streaming
6. Build a Micro-batch application
7. Real-time Fraud and Anomaly Detection,
8. Real-time personalization, Marketing, Advertising

COURSE OUTCOMES:

CO1: Understand the applicability and utility of different streaming algorithms.

CO2: Describe and apply current research trends in data-stream processing.

CO3: Analyze the suitability of stream mining algorithms for data stream systems.

CO4: Program and build stream processing systems, services and applications.

CO5: Solve problems in real-world applications that process data streams.

TOTAL:60 PERIODS

TEXT BOOKS

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing byTyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media
3. Practical Real-time Data Processing and Analytics : Distributed Computing and EventProcessing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCES

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	3	2	3	1	-
CO2	2	1	1	2	2	-
CO3	3	1	2	3	3	-
CO4	2	1	3	3	3	-
CO5	3	3	1	2	2	-
AVG	2.6	1.8	1.8	2.6	2.2	-

AUDIT COURSES (AC)

AC4001 ENGLISH FOR RESEARCH PAPER WRITING LT P C
2 0 0 0

COURSE OBJECTIVES:

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skillsare needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book1998.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	3	1	1	1	1
CO2	1	3	1	1	1	1
CO3	1	3	1	1	1	1
CO4	1	3	1	1	1	1
CO5	1	3	1	1	1	1
AVG	1	3	1	1	1	1

AC4002 **DISASTER MANAGEMENT** **L T P C**

2 0 0 0

COURSE OBJECTIVES:

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarianresponse.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple Perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION 6

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural andManmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA 6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT 6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1: Ability to summarize basics of disaster

CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management Approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" NewRoyal book Company,2007.
3. Sahni, Pardeep Et.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	1	1	1	1
CO2	1	2	1	1	1	1
CO3	1	2	1	1	1	1
CO4	1	2	1	1	1	1
CO5	1	1	1	1	1	1
AVG	1	1.8	1	1	1	1

AC4003 **CONSTITUTION OF INDIA** **L T P C**

2 0 0 0

COURSE OBJECTIVES:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rightsperspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood inthe early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed officials,Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

SUGGESTED READING

1. The Constitution of India,1950 (Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

COURSE OUTCOMES:

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before thearrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	1	1	1	1
CO2	1	1	1	1	1	1
CO3	1	1	1	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	1	1	1	1
AVG	1	1	1	1	1	1

AC4004 ENTREPRENEURSHIP ESSENTIALS L T P C

2 0 0 0

COURSE OBJECTIVES:

- To understand the fundamental principles and concepts of entrepreneurship.
- To explore the entrepreneurial mindset and skills required for identifying and evaluating businessopportunities.
- To learn about the process of starting and managing a new venture, including business planningand strategy development.
- To develop knowledge of key aspects of entrepreneurship such as marketing, finance, andoperations management.
- To study successful entrepreneurial ventures and case studies to understand factors contributing totheir success.

UNIT I **9**

Entrepreneurship - meaning, elements, determinants and importance of entrepreneurship and creative behaviour- Dimensions of entrepreneurship-Qualities of an Entrepreneur, factors influnecing entrepreneurship

UNIT II **9**

Agencies - commercial banks –district industries center- national small industries corporation –Small industries development organization –small industries service institutions –All India institutions –IDBI- IFCI-ICIIC-IRCBI

UNIT III **9**

Funding new venture - requirement –availability and access to finance –marketing – technology andindustrial accommodation-Role of industries/entrepreneur's associations and self-help groups concept-business incubators-angel investors- venture capital and private equity fund

UNIT IV **9**

Significance of writing the business plan/ project proposal - Contents of business plan/ project proposal - Designing business processes — location - layout — operation - planning & control-preparation of project report - Project submission/ presentation and appraisal by external agencies - financial/non-financial institutions

UNIT IV **9**

Mobilizing resources to start –up Accommodation and utilities – preliminary contracts with the vendors-suppliers-bankers-principal customers-contract management

COURSE OUTCOMES:

- Students will demonstrate an understanding of fundamental entrepreneurship principles and concepts.
- Students will be able to identify and evaluate business opportunities using entrepreneurial skills and mindset.
- Students will develop proficiency in creating business plans and strategies for new ventures.
- Students will acquire knowledge of key functional areas in entrepreneurship including marketing, finance, and operations management.
- Students will analyze and learn from case studies of successful entrepreneurial ventures.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	1	1	1	1	1
CO2	1	1	1	1	1	1
CO3	1	1	1	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	1	1	1	1
AVG	1	1	1	1	1	1

BRIDGE COURSES

BC4101 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	2	0

COURSE OBJECTIVES:

- Be familiar with basic techniques of algorithm analysis.
- Be exposed to the concept of ADTs.
- Learn linear data structures-List, Stack and Queue.
- Learn nonlinear data structures-Tree and Graphs.
- Be exposed to sorting, searching and hashing algorithms

UNIT I INTRODUCTION 3+2

Introduction - Abstract Data Types (ADT) – Arrays and its representation –Structures – Fundamentals of algorithmic problem solving – Important problem types – Fundamentals of the analysis of algorithm – analysis framework – Asymptotic notations, Properties, Recurrence Relation.

Lab Experiments:

1. Develop a program to perform various array operations
2. Write a program to find running time complexity by considering each statement in the program for a given set of numbers.

UNIT II LINEAR DATA STRUCTURES - STACK, QUEUE 3+2

Stack ADT – Operations on Stack - Applications of stack – Infix to postfix conversion – evaluation ofexpression - Queue ADT – Operations on Queue - Circular Queue - Applications of Queue.

Lab Experiments:

1. Write a program to convert infix to postfix using stack data structure
2. Develop a program to perform circular queue operations

UNIT III LINEAR DATA STRUCTURES – LIST 3+2

List ADT - Array-based Implementation - Linked list implementation - Singly Linked Lists – Circularlylinked lists – Doubly Linked Lists - Applications of linked list – Polynomial Addition.

Lab Experiments:

1. Perform Polynomial Manipulation using Single Linked List.
2. Implement the various operations in double linked list.

UNIT IV SEARCHING, SORTING AND HASH TECHNIQUES **3+2**

Searching: Linear search – Binary Search- comparison of linear search and binary search, Sorting algorithms: Insertion sort - Bubble sort – selection sort - Hashing: Hash Functions – Separate Chaining –Open Addressing — Rehashing.

Lab Experiments:

1. Write a program to perform binary search
2. Write a program to sort a given set of numbers and compare among Bubble Sort, Selection Sort and Insertion Sort with respect to computational complexity.

UNIT V NON LINEAR DATA STRUCTURES - TREES AND GRAPHS **3+2**

Trees and its representation – left child right sibling data structures for general trees- Binary Tree – Binarytree traversals — Binary Search Tree - Graphs and its representation - Graph Traversals - Depth-first traversal – breadth-first traversal- Application of graphs.

Lab Experiments:

1. Write a program to delete a node from a given Binary search tree
2. Write a program to perform Graph Traversals

TOTAL : 25 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- analyze algorithms and determines their time complexity.
- understand the concepts of data types, data structures and linear structures
- apply data structures to solve various problems
- apply different Sorting, Searching and Hashing algorithms.
- understand non-linear data structures

REFERENCES

1. Anany Levitin “Introduction to the Design and Analysis of Algorithms” 3rd Edition, Pearson Education
2. A.K. Sharma, “Data Structures using C”, 2nd Edition, Pearson Education Asia, 2013
3. E.Horowitz, Anderson-Freed and S.Sahni, “Fundamentals of Data structures in C”, 2ndEdition,University Press, 2007
4. E.Balagursamy,” Data Structures using C”, Tata McGraw Hill 2015 Reprint
5. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition,
6. Pearson Education,India, 2016
7. Jean Paul Tremblay and Paul G. Sorensen, “An Introduction to Data Structures with Applications”,2nd Edition, Tata McGraw Hill, New Delhi, 2017.

CO's- PO's MAPPING

Course Outcomes	PROGRAM OUTCOMES					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	1	2	2	2	2
CO2	2	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	1	2	2	2	2
AVG	2	1	2	2	2	2

BC4201 **INTRODUCTION TO COMPUTER ORGANIZATION AND OPERATING SYSTEMS** **L T P C 3 0 0 0**

COURSE OBJECTIVES:

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To understand the memory hierarchies, cache memories and virtual memories and to learn thedifferent ways of communication with I/O devices.
- To understand the basic concepts and functions of Operating Systems
- To understand Process and various Scheduling Algorithms of OS

UNIT I BASIC STRUCTURE AND ARITHMETIC OPERATIONS 3

Functional Units – Basic Operational Concepts – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – Decision Making – MIPS Addressing- Arithmetic for Computers

UNIT II PROCESSOR AND CONTROL UNIT 3

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining –Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT III MEMORY & I/O SYSTEMS 3

Memory Hierarchy - Memory technologies – cache memory – measuring and improving cache performance– virtual memory – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure –Interfacecircuits – USB

UNIT IV OPERATING SYSTEMS OVERVIEW 3

Operating system overview-objectives and functions, Evolution of Operating System- Operating SystemStructure - System Calls- Processes – Process Concept, Inter-process Communication

UNIT V PROCESS MANAGEMENT 3

CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Threads Overview– The critical-section problem, Semaphores, Classical problems of synchronization, Criticalregions

TOTAL : 15 PERIODS

COURSE OUTCOMES:

On Completion of the course, the students should be able to:

- Understand the basics structure of computers, operations and instructions.
- Design arithmetic and logic unit, control unit.
- Understand the various memory systems and I/O communication.
- Understand operating system functions, types, system calls
- Analyze Process and various scheduling algorithms

REFERENCES:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer
3. Organization andEmbedded Systems, Sixth Edition, Tata McGraw Hill, 2012
4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne - Operating System Concepts, 9thEdition, John Wiley and Sons Inc., 2012.
5. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
6. John L.Hennessey and David A. Patterson, Computer Architecture — A
7. Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
8. Andrew S. Tanenbaum - Modern Operating Systems, 4th Edition, Pearson Education, 2014.

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CO1	2	1	2	2	2	2
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CO5	2	1	2	2	2	2
AVG	2	1	2	2	2	2

BC4301 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

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3	0	0	0

COURSE OBJECTIVES:

- To introduce Mathematical Logic and their rules for validating arguments and programmes.
- To introduce counting principles for solving combinatorial problems.
- To give exposure to Graph models and their utility in connectivity problems.
- To introduce abstract notion of Algebraic structures for studying cryptographic and its related areas.
- To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems.

UNIT I LOGIC AND PROOFS 3

Propositional Logic – Propositional Equivalences – Predicates and Quantifiers – Nested Quantifiers –Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.

UNIT II COMBINATORICS 3

Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations Solving Linear Recurrence Relations Using Generating Functions – Inclusion – Exclusion – Principle and Its Applications

UNIT III GRAPHS 3

Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representationof Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT IV ALGEBRAIC STRUCTURES 3

Groups – Subgroups – Homomorphisms – Normal Subgroup and Coset – Lagrange‘s Theorem –Definitions and Examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 3

Partial Ordering – Posets – Lattices as Posets – Properties of Lattices – Lattices as Algebraic Systems – Sub Lattices – Direct Product And Homomorphism – Some Special Lattices – Boolean Algebra

TOTAL : 15 PERIODS

COURSE OUTCOMES:

CO1: Apply Mathematical Logic to validate logical arguments and programmes.
CO2: Apply combinatorial counting principles to solve application problems.
CO3: Apply graph model and graph techniques for solving network other connectivity related problems.
CO4: Apply algebraic ideas in developing cryptograph techniques for solving network security problems.
CO5: Apply Boolean laws in developing and simplifying logical circuits.

REFERENCES:

1. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, Tata McGraw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2011.
2. Tremblay J.P. and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill Pub.Co.Ltd, 30th Reprint, New Delhi,2011.
3. Ralph. P.Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, Pearson Education, 3rd Edition, New Delhi, 2014.
4. Thomas Koshy, “Discrete Mathematics with Applications”, 2nd Edition, Elsevier Publications,Boston, 2006.
5. Seymour Lipschutz and Mark Lipson, “Discrete Mathematics”, Schaum‘s Outlines, Tata McGrawHill Pub. Co. Ltd., Third Edition, New Delhi, 2013

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