PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018
(AUTONOMOUS)

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

REGULATIONS 2016

(CBCS)

CURRICULUM AND SYLLABUS
V – VI SEMESTER

M.C.A.Programme

(3 Years Duration)

PAAVAI ENGINEERING COLLEGE

(Autonomous)

Vision

To strive to be a globally model Institution all set for taking 'lead-role' in grooming the younger generation socially responsible and professionally competent to face the challenges ahead.

Mission

- To provide goal- oriented, quality – based and value – added education through state – of – the – art technology on a par with international standards.
- To promote nation – building activities in science, technology, humanities and management through research
- To create and sustain a community of learning that sticks on to social, ethical, ecological, cultural and economic upliftment.

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

Vision

To strive to be globally model institutions all set for taking lead role in grooming the younger generation socially responsible and professionally competent to face the challenges ahead

Mission

- To upgrade the academic activities by continuous improvement in the teaching - learning process with value based education.
- To enhance social responsibilities of the students necessary for successful practice of the profession.
- To facilitate research and industrial interaction.
- To mould the students into competent and creative technocrats to meet the growing global changes and challenges.
- To encourage the students as entrepreneurs and leaders of the society for the betterment of the Country.

Programme Educational Objectives (PEOs)		
Master of Computer Applications Graduates will be able to :		
PEO1	Global Reputation	To create value added, disciplined high profile Master of Computer Applications professionals for successful careers in their related industry that makes them globally reputed.
PEO2	Fundamental Knowledge	To develop the students with a sound foundation in mathematical, scientific and engineering fundamentals necessary to synthesize the technical core concepts focusing on skill development and knowledge up gradation which will lead to technical innovations.
PEO3	Continuous Learning	To practice and demonstrate the ability to use the domain knowledge and expertise through periodic assignments, performances and projects to continuously prove the functionality of Master of computer applications learning in social environmental aspects and to make allowances for further improvements.

Programme Outcomes (POs)		
Master of Computer Applications Graduates will be able to :		
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem Analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communications	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)		
PSO1	Core Competencies:	Foundation of Computer System and Software development: Ability to understand the principles and working of computer systems for the development of software solutions
PSO2	Creativity and Design:	Applications of Computing and Research Ability: Ability to use knowledge in various domains to identify research gaps and hence to provide solution with new ideas and innovations.

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

MASTER OF COMPUTER APPLICATIONS

REGULATIONS 2016

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM & SYLLABUS

SEMESTER I

S.No.	Category	Course	Course Title	L	T	P	C
Theory							
1	BS	PMA16108	Mathematical Foundation for Computer Applications	3	2	0	4
2	PC	CA16101	Computer Organization	3	0	0	3
3	PC	CA16102	Problem Solving Techniques	3	0	0	3
4	PC	CA16103	Programming in C	3	0	0	3
5	PC	CA16104	Data structures and Algorithms	3	0	0	3
Practical							
6	PC	CA16105	Programming in C Laboratory	0	0	4	2
7	PC	CA16106	Data Structures and Algorithms Laboratory	0	0	4	2
8	PC	CA16107	Office Automation Laboratory	0	0	4	2
			TOTAL	**15**	**2**	**12**	**22**

SEMESTER II

S.No.	Category	Course	Course Title	L	T	P	C
Theory							
1	PC	CA16201	Object Oriented Programming	3	0	0	3
2	PC	CA16202	Database Management Systems	3	0	0	3
3	PC	CA16203	System Software	3	0	0	3
4	PC	CA16204	Operating Systems	3	0	0	3
5	PC	CA16205	Computer Graphics and Multimedia	3	0	0	3
Practical							
6	PC	CA16206	Object Oriented Programming Laboratory	0	0	4	2
7	PC	CA16207	DBMS Laboratory	0	0	4	2
8	PC	CA16208	Graphics and Multimedia Laboratory	0	0	4	2
			TOTAL	**15**	**0**	**12**	**21**

SEMESTER III

S.No.	Category	Course	Course Title	L	T	P	C
Theory							
1	BS	PMA16301	Resource Management Techniques	3	2	0	4
2	PC	CA16301	Computer Communication Networks	3	0	0	3
3	PC	CA16302	Object Oriented Software Engineering	3	0	0	3
4	PC	CA16303	Enterprise Resource Planning	3	0	0	3
5	PC	CA16304	Internet Programming	3	0	0	3
Practical							
6	PC	CA16405	Case Tools Laboratory	0	0	4	2
7	PC	CA16306	Internet Programming Laboratory	0	0	4	2
8	HS	PEN16201	Communication and Soft Skills Laboratory	0	0	2	1
			TOTAL	**15**	**2**	**10**	**21**

SEMESTER IV

S.No.	Category	Course	Course Title	L	T	P	C
Theory							
1	PC	CA16401	C# and .NET Framework	3	0	0	3
2	PC	CA16402	Data Mining and Data Warehousing	3	0	0	3
3	PC	CA16403	Web Programming	3	0	0	3
4	PC	CA16404	Cloud Computing	3	0	0	3
5	PE	CA16***	Elective I	3	0	0	3
Practical							
6	PC	CA16405	C# and .NET Programming Laboratory	0	0	4	2
7	PC	CA16406	Web Programming Laboratory	0	0	4	2
8	EEC	CA16407	Technical Seminar and Report Writing	0	0	4	2
9	EEC	PCA16408	Career Development Laboratory	0	0	2	1
			TOTAL	**15**	**0**	**14**	**22**

SEMESTER V

S.No	Category	Course	Course Title	L	T	P	C
Theory							
1	PC	CA16501	Mobile Application Development	3	0	0	3
2	PC	CA16502	Big Data Analytics	3	0	0	3
3	PC	CA16503	Agile Software Engineering	3	0	0	3
4	PE	CA16***	Elective II	3	0	0	3
5	PE	CA16***	Elective III	3	0	0	3
Practical							
6	PC	CA16504	Mobile App Development Laboratory	0	0	4	2
7	PC	CA16505	XML and Web Services Laboratory	0	0	4	2
8	EEC	CA16506	Mini Project(Socially Relevant)	0	0	4	2
			TOTAL	**15**	**0**	**12**	**21**

SEMESTER VI

S.No	Category	Course	Course Title	L	T	P	C
1	EEC	CA16601	Project Work	0	0	24	12
			TOTAL	**0**	**0**	**24**	**12**

PROFESSIONAL ELECTIVES (PE)

ELECTIVE I

S.No	Category	Course	Course Title	L	T	P	C
1	PE	CA16151	Financial Accounting	3	0	0	3
2	PE	CA16152	Information Security	3	0	0	3
3	PE	CA16153	Network Protocols	3	0	0	3
4	PE	CA16154	Software Testing and Quality Assurance	3	0	0	3
5	PE	CA16155	Game Programming	3	0	0	3
6	PE	CA16156	Advanced Data Base	3	0	0	3

ELECTIVE II

S.No	Category	Course	Course Title	L	T	P	C
1	PE	CA16251	Linux Internals	3	0	0	3
2	PE	CA16252	High Performance Computing	3	0	0	3
3	PE	CA16253	Software Project Management	3	0	0	3
4	PE	CA16254	Data Tuning and Administration	3	0	0	3
5	PE	CA16255	Soft Computing	3	0	0	3
6	PE	CA16256	Ad hoc and Sensor Networks	3	0	0	3
7	PE	CA16257	Python and R Programming	3	0	0	3

ELECTIVE III

S.No	Category	Course	Course Title	L	T	P	C
1	PE	CA16351	Internet of Things	3	0	0	3
2	PE	CA16352	Machine Learning	3	0	0	3
3	PE	CA16353	Health Care Analytics	3	0	0	3
4	PE	CA16354	Green Computing	3	0	0	3
5	PE	CA16355	Human Resource Management	3	0	0	3
6	PE	CA16356	Social Network Analysis	3	0	0	3

BASIC SCIENCES (BS)

S.No	Category	Course	Course Title	L	T	P	C
1	BS	PMA16108	Mathematical Foundation for Computer Applications	3	2	0	4
2	BS	PMA16301	Resource Management Techniques	3	2	0	4
			Total	**6**	**4**	**0**	**8**

PROFESSIONAL CORE (PC)

S.No.	Category	Course	Course Title	L	T	P	C
1	PC	CA16101	Computer Organization	3	0	0	3
2	PC	CA16102	Problem Solving Techniques	3	0	0	3
3	PC	CA16103	Programming in C	3	0	0	3
4	PC	CA16104	Data structures and Algorithms	3	0	0	3
5	PC	CA16105	Programming in C Laboratory	0	0	4	2
6	PC	CA16106	Data Structures and Algorithms Laboratory	0	0	4	2
7	PC	CA16107	Office Automation Laboratory	0	0	4	2
8	PC	CA16201	Object Oriented Programming	3	0	0	3
9	PC	CA16202	Database Management Systems	3	0	0	3
10	PC	CA16203	System Software	3	0	0	3
11	PC	CA16204	Operating Systems	3	0	0	3
12	PC	CA16205	Computer Graphics and Multimedia	3	0	0	3
13	PC	CA16206	Object Oriented Programming Laboratory	0	0	4	2
14	PC	CA16207	DBMS Laboratory	0	0	4	2
15	PC	CA16208	Graphics and Multimedia Laboratory	0	0	4	2
16	PC	CA16301	Computer Communication Networks	3	0	0	3
17	PC	CA16302	Object Oriented Software Engineering	3	0	0	3
18	PC	CA16303	Enterprise Resource Planning	3	0	0	3
19	PC	CA16304	Internet Programming	3	0	0	3
20	PC	CA16405	Case Tools Laboratory	0	0	4	2
21	PC	CA16306	Internet Programming Laboratory	0	0	4	2

				L	T	P	C
22	PC	CA16401	C# and .NET Framework	3	0	0	3
23	PC	CA16402	Data Mining and Data Warehousing	3	0	0	3
24	PC	CA16403	Web Programming	3	0	0	3
25	PC	CA16404	Cloud Computing	3	0	0	3
26	PC	CA16405	C# and .NET Programming Laboratory	0	0	4	2
27	PC	CA16406	Web Programming Laboratory	0	0	4	2
28	PC	CA16501	Mobile Application Development	3	0	0	3
29	PC	CA16502	Big Data Analytics	3	0	0	3
30	PC	CA16503	Agile Software Engineering	3	0	0	3
31	PC	CA16504	Mobile App Development Lab	0	0	4	2
32	PC	CA16505	XML and Web Services Laboratory	0	0	4	2
Total				**60**	**0**	**48**	**84**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	Category	Course	Course Title	L	T	P	C
1	EEC	CA16407	Technical Seminar and Report Writing	0	0	4	2
2	EEC	PCA16408	Career Development Laboratory	0	0	2	1
3	EEC	CA16506	Mini Project (Socially Relevant)	0	0	4	2
4	EEC	CA16601	Project Work	0	0	24	12
Total				**0**	**0**	**30**	**17**

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	Category	Course	Course Title	L	T	P	C
1	HS	PEN16201	Communication and Soft Skills Laboratory	0	0	2	1
Total				**0**	**0**	**2**	**1**

Curriculum Structure

S.No	Category Name	Actual Credit Break Up	No. of Subjects
1	Professional Core (PC)	84	32
2	Professional Elective (PE)	09	03
3	Humanities and Social Sciences (HS)	01	01
4	Basic Science (BS)	08	02
5	Employability Enhancement Courses (EEC)	17	04
Total		119	42

SUMMARY									
S. No	SUBJECT AREA	CREDITS AS PER SEMESTER						CREDITS TOTAL	CREDITS IN %
		I	II	III	IV	V	VI		
1	HS	-	-	1	-	-	-	**1**	**0.84 %**
2	BS	4	-	4	-	-	-	**8**	**6.72 %**
3	PC	18	21	16	16	13	-	**84**	**70.59 %**
4	PE	-	-	-	3	6	-	**9**	**7.56 %**
5	EEC	-	-	-	3	2	12	**17**	**14.29 %**
TOTAL		**22**	**21**	**21**	**22**	**21**	**12**	**119**	**100 %**
Non Credit / Mandatory		-	-	-	-	-	-	-	-

CA16501   **MOBILE APPLICATION DEVELOPMENT**   **3**   **0**   **0**   **3**

COURSE OBJECTIVES

To enable the students to

- understand the basic programming concepts in Android

- relate the need of the different User interface component in an application

- identify the components beyond User Interface and use them in an application

- gain an basic understanding of the architecture of IoS and design an application

- understand the basic concepts related to Windows mobile applications

UNIT I   INTRODUCTION   8

Introduction to mobile applications - Mobility landscape - Mobile platforms - Mobile apps development – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications– Market and business drivers for mobile application

UNIT II   UI DESIGN & APP DEVELOPMENT IN ANDROID   9

App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity – states and life cycle, interaction amongst activities – Threads – Async Task –Services – state and life cycle – Notifications.

UNIT III   APP FUNCTIONALITYBEYOND USER INTERFACE IN ANDROID   10

Broadcast receivers, Telephony and SMS APIs– Shared preferences – Mobile databases using SQlite – Content Providers – Animation – Multimedia-Audio/Video Playback and Recor Location Awareness – Native Hardware Access (Sensors such as Accelerometer and Gyroscope).

UNIT IV   MOBILE TECHNOLOGY – iOS   9

Introduction to Objective C – IOS features – UI implementation – Touch frameworks – Data Persistence using Core Data and SQlite – Location awareness using Core location and Map kit Integrating calendar and address book with social media application – Using Wifi – iPhone market place.

UNIT V   MOBILE TECHNOLOGY – WINDOWS   9

Intro to Windows RT 8.1 , Windows phone Runtime – Tiles and Toasts – Push notifications – Launchers and Choosers – Alarms & Reminders - Context Menu – Dialogs – Flyouts – Appbar – Working with Sensors-REST fundamentals – Windows Store app Certification.

                                             TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- explain the architecture, platform and tools required for mobile application
- explore Hadoop distributed system and its components
- design applications using map reducing concept
- install and utilize Hadoop tool
- understanding the Framework applications

REFERENCES

1. Anubhav Pradhan, Anil V. Deshpande, "Composing Mobile Apps Learn|Explore|Apply ", Wiley 2014.
2. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, "Programming Android ",O'Reilly, 2011.
3. Reto Meier, Wrox Wiley, "Professional Android 2 Application Development", 2010.
4. Alasdair Allan, "iPhone Programming", O'Reilly, 2010.
5. Wei-Meng Lee, "Beginning iPhone SDK Programming with Objective-C", Wrox Wiley, 2010

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
COs	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	2	2	-	-	-	-	-	-	-	1	1	2
CO2	2	3	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	2	2	2	-	-	-	-		3	1	1	3
CO4	2	2	3	3	-	-	-	1	-	-	-	-	2	2
CO5	3	2	2	2	-	-	-	2	-	-	-	1	2	2

CA16502   **BIG DATA ANALYTICS**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- understand the Bigdata concept
- understand mining data stream system
- understand the Hadoop concept
- understand usage of file systems
- understand how to buid up framework

UNIT I   INTRODUCTION TO BIG DATA   **8**

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

UNIT II   HADOOP   **9**

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- Basics

UNIT III   MAP REDUCE   **10**

Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures- Job Scheduling- Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

UNIT IV   HADOOP ENVIRONMENT   **9**

Setting up a Hadoop Cluster-Cluster specification-Cluster Setup and Installation- Hadoop Configuration- Securityin Hadoop- Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud

UNIT V   FRAMEWORKS   **9**

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM Info Sphere Big Insights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

                                         TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- identify the need for big data analytics for a domain
- explore Hadoop distributed system and its components
- design applications using Map Reducing Concepts
- install and utilize Hadoop tool.
- understanding the Framework applications

REFERENCES

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2012.

2. Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.

3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data:

Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012

4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press,

2012.

5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced

Analytics", John Wiley & sons, 2012.

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
CO	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	1	2	-	-	-	-	-	-	-	1	1	2
CO2	1	2	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	2	2	2	-	-	-	-		2	1	1	3
CO4	2	1	2	2	-	-	-	2	-	-	-	-	3	2
CO5	1	2	1	2	-	-	-	2	-	-	-	2	2	2

CA16503   **AGILE SOFTWARE ENGINEERING**   **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software

- understanding of software design and a set of software technologies and APIs

- detailed examination and demonstration of Agile development and testing techniques

- benefits and pitfalls of working in an Agile team

- understand Agile development and testing

UNIT I   AGILE METHODOLOGY   9

Theories for Agile management – agile software development – traditional model vs. agile model – classification of agile methods – agile manifesto and principles – agile project management – agile team interactions – ethics in agile teams - agility in design, testing – agile documentations – agile drivers, capabilities and values

UNIT II   AGILE PROCESSES   9

Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Extreme Programming: Method overview – lifecycle – work products, roles and practices

UNIT III   AGILITY AND KNOWLEDGE MANAGEMENT   9

Agile information systems – agile decision making - Earl's schools of KM – institutional knowledge evolution cycle – development, acquisition, refinement, distribution, deployment , leveraging – KM in software engineering– managing software knowledge – challenges of migrating to agile methodologies – agile knowledge sharing – role of story-cards – Story-card Maturity Model (SMM)

UNIT IV   AGILITY AND REQUIREMENTS ENGINEERING   9

Impact of agile processes in RE – current agile practices – variance – overview of RE using agile – managing unstable requirements – requirements elicitation – agile requirements abstraction model – requirements management in agile environment, agile requirements prioritization – agile requirements modeling and generation– concurrency in agile requirements generation

UNIT V   AGILITY AND QUALITY ASSURANCE   9

Agile product development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile approach to Quality Assurance - Test Driven Development – Agile approach in Global Software Development

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- importance of interacting with business stakeholders in determining the requirements for a software system
- iterative software development processes: how to plan them, how to execute them
- the impact of social aspects on software development success
- techniques and tools for improving team collaboration and software quality
- software process improvement as an ongoing task for development teams
- how agile approaches can be scaled up to the enterprise level

REFERENCES

1. David J. Anderson; Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003

2. Hazza & Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer 2009, VIII, 296 p.

3. Craig Larman, Agile and Iterative Development: A manager's Guide, Addison-Wesley, 2004.

4. Kevin C. Desouza, Agile information systems: conceptualization, construction, and management, Butterworth-Heinemann, 2007.

5. Chetankumar Patel, MuthuRamachandran, Story Card Maturity Model (SMM): A Process Improvement Framework for Agile Requirements Engineering Practices, Journal of Software, Academy Publishers, Vol 4, No 5 (2009), 422-435, Jul 2009.

Mapping of Courses Outcomes with Programme Outcomes:													
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
COs	**Programme Outcomes (POs)**												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	1	2	-	-	-	-	-	-	-	1	1	2
CO2	1	2	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	2	2	2	-	-	-	-	-	2	1	1	3
CO4	2	1	2	2	-	-	-	2	-	-	-	-	3	2
CO5	1	2	1	2	-	-	-	2	-	-	-	2	2	2

CA16504   **MOBILE APP DEVELOPMENT LABORATORY**   **0   0   4   2**

COURSE OBJECTIVES

To enable the students to

- understand the platform and tool available for developing mobile application
- gain the basics about micro browser based applications in Android to access the Internet

1. Add a spinner. When the spinner is selected, there should be three option(e.g., android, java, testing). When you click on each option, it should go to another page containing some other components. Each of these pages should have a "back" button,   which on pressing will take you back to the page with the spinner

2. Program a calculator

3. Add two EditText. When a number is entered in Edit Text 1, the square of that number should   be displayed in Edit Text 2 as a separate Activity.

4. Create applications to include Action Bar, Menus, Dialogs and Notifications in Android.

5. Create a camera application, where you can click a picture and then save it as the wallpaper.

6. Create a user login form and registration form. First time users have to register through the registration form and the details should be stored in the database. Then they can login using the login page.

7. Create an application that works with Android Content Provider, which searches, add, change and remove content of MIME types.

8. Create a media player, which plays an mp3 song and will record the sound.

9. Create a thread, which performs a single task, and perform multithreading in Android.

10. Create Animation apps like a. Bouncing ball b. Moving arrow

                                                        TOTAL PERIODS   60

COURSE OUTCOMES

At the end of the course the students would be able to

- develop useful mobile applications for the current scenario in mobile computing
- construct applications that use animation, media players, and content providers

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
CO	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO2	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16505   **XML AND WEB SERVICES LABORATORY**   **0   0   4   2**

COURSE OBJECTIVES

To enable the students to

- provide fundamental concepts of Service Oriented Architecture

- gain knowledge about SOAP, UDDI and XML to create web services

    1. XML document creation.

    2. Importing and Exporting XML document in database.

    3. XSL Transformation

    4. Internal and External DTD creation

    5. XML Schema creation

    6. Parsing XML document using DOM/SAX parser.

    7. Web Service creation using JAX-WS

    8. Web Service creation using JAX-RS

    9. Web Service creation using .NET

    10. JAXB Marshaling and Unmarshaling

A possible set of applications may be the following:

        a. Currency Conversion

        b. Temperature Conversion

        c. Ticket Booking

        d. Dictionary

                                            TOTAL PERIODS   60

COURSE OUTCOMES

At the end of the course the students would be able to

- known about the basic principles of service oriented architecture, its components and techniques
- understand the architecture of web services

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
COs	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	2	3	-	-	-	2	-	-	-	-	3	2
CO2	2	2	2	2	-	-	-	1	-	-	-	2	2	3

CA15506   **MINI PROJECT (SOCIALLY RELEVANT)**   **0   0   4   2**

COURSE OBJECTIVES

To enable the students to

- team Project with a maximum of two in a team

- students shall select a domain and develop an application with social relevance

                                                              TOTAL PERIODS   60

COURSE OUTCOMES

At the end of the course the students would be able to

- understand the students shall select a domain and develop an application with social relevance

- documentation is to be based on the standards

Mapping of Courses Outcomes with Programme Outcomes:													
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
COs	**Programme Outcomes (POs)**												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	2	3	-	-	-	2	-	-	-	-	3	2
CO2	2	2	2	2	-	-	-	1	-	-	-	2	2	3

CA16251   **LINUX INTERNALS**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- understand an overview of Linux concepts
- know the basics analysis of buffer cache
- understand the knowledge in system calls
- develop the system process concept
- understand and practice of memory management concept

UNIT I   INTRODUCTION   9

General Review of the System-History-System structure-User Perspective-Operating System Services-Assumptions About Hardware. Introduction to the Kernel-Architecture- System Concepts-Data Structures-System Administration.

UNIT II   ANALYSIS OF BUFFER CACHE   9

The Buffer Cache-Headers-Buffer Pool-Buffer Retrieval-Reading and Writing Disk Blocks - Advantages and Disadvantages Internal Representation of Files-Inodes- Structure-Directories-Path Name to Inode - Super Block-Inode Assignment-Allocation of Disk Blocks -Other File Types

UNIT III   SYSTEM CALLS   9

System Calls for the File System-Open-Read-Write-Lseek-Close-Create-Special files Creation -Change Directory and Change Root-Change Owner and Change Mode-Stat- Fstat-Pipes-Dup-Mount-Unmount- Link-Unlink-File System Abstraction-Maintenance.

UNIT IV   SYSTEM PROCESSES   9

The System Representation of Processes-States-Transitions-System Memory-Context of a Process-Saving the Context -Manipulation of a Process Address Space-Sleep Process Control-signals-Process Termination-Awaiting-Invoking other Programs-The Shell-System Boot and the INIT Process.

UNIT V   MEMORY MANAGEMENT   9

Memory Management Policies-Swapping-Demand Paging-a Hybrid System-I/O- Subsystem-Driver Interfaces-Disk Drivers-Terminal Drivers.

                                                          TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- acquire knowledge about the overview of Linux concepts
- explore the basics of buffer cache concept
- learn and understand the system calls concept
- acquire knowledge in memory management control
- able to understand the concept of costing

REFERENCES

1. Maurice J. Bach, "The Design of the Unix Operating System", Pearson Education, 2012

2. UreshVahalia, "UNIX Internals: The New Frontiers", Prentice Hall, 2000.

3. John Lion, "Lion's Commentary on UNIX", 6th edition, Peer-to-Peer Communications, 2004.

4. Daniel P. Bovet & Marco Cesati, "Understanding the Linux Kernel", O'REILLY, Shroff Publishers &Distributors Pvt. Ltd, 2000

5 M. Beck et al, "Linux Kernel Programming", Pearson Education Asia, 2002

Mapping of Courses Outcomes with Programme Outcomes:														
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week														
COs	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	1	-	-	-	-	-	-	1	2	2
CO2	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO3	2	2	3	2	3	-	-	-	-		2	1	1	3
CO4	2	3	1	2	1	-	-	2	-	-	-	-	2	2
CO5	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16252   **HIGH PERFORMANCE COMPUTING**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- know how modern high performance processors are organized their strengths and weaknesses
- study about the architecture of parallel systems
- understand scope of parallel computing
- learn parallel algorithms design
- gain depth knowledge about the analytical parallel algorithms

UNIT I   MODERN PROCESSORS   9

Stored-program computer architecture – General-purpose cache-based microprocessor architecture – Memory hierarchies – Multicore processors - Multithread processors - Vector processors – Basic optimization techniques for serial code - Common sense optimizations - Simple measures – large impact - Role of compilers.

UNIT II   PARALLEL COMPUTERS   9

Data access optimization - Balance analysis and light speed estimates - Storage order - Taxonomy of parallel computing paradigms - Shared memory computers - Distributed memory computers - Hierarchical systems – Networks - Basics of parallelization- Parallelism – Parallel scalability

UNIT III   INTRODUCTION TO PARALLEL COMPUTING   9

Motivating parallelism - Scope of parallel computing - Parallel programming platforms: Implict parallelism trends in microprocessor architectures - Limitations-Dichotomy - Physical organizations - Communication costs– Routing mechanisms for interconnected networks- Impact of process.

UNIT IV   PRINCIPLES OF PARALLEL ALGORITHM DESIGN   9

Preliminaries - Decomposition techniques - Characteristics of tasks and interactions – Mapping techniques for load balancing-Methods for containing interaction overheads- Parallel algorithm models - Basic Communication operations.

UNIT V   SORTING AND GRAPH ALGORITHMS   9

Dense matrix Algorithm: Matrix-vector multiplication - Martix- matrix multiplication- Issues in sorting on parallel computing - Sorting networks - Bubble sorts and its variants - Quick sort – Graph algorithms – Definition and representation - Prims algorithm - Dijkstra's algorithm - All pairs shortest path - Transitive closure – Connected components.

                                                                      TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

* apply basic principles and practices of Computer Science and Engineering research

* design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability

* apply routing mechanisms for interconnected networks

* analyze algorithm models

* identify, analyze, formulate and solve engineering problems

REFERENCES

1. Georg Hager and Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers

2. Ananth Grama and George Karypis, Introduction to parallel computing, Addison-Wesley 2009.

3. John Levesque and Gene Wagenbreth, High Performance Computing: Programming and Applications

4. John L. Hennessy and David Patterson, Computer Architecture- A Quantitative Approach, Elsevier, 2012.

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
CO														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	1	2	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	3	2	3	-	-	-	-		2	1	1	3
CO4	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO5	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16253   **SOFTWARE PROJECT MANAGEMENT**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- know of how to do project planning for the software process
- learn the cost estimation techniques during the analysis of the project
- understand the quality concepts for ensuring the functionality of the software
- understand the knowledge and skills needed for the construction of highly reliable software project
- understand to create reliable, replicable cost estimation that links to the requirements of
  project planning and managing

UNIT I   SOFTWARE PROJECT MANAGEMENT CONCEPTS   9

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and Allocate resources.

UNIT II   SOFTWARE EVALUATION AND COSTING   9

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, Cost - benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing Technologies, choice of process models, Structured methods.

UNIT III   SOFTWARE ESTIMATION TECHNIQUES   9

Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model.

UNIT IV   RISK MANAGEMENT   9

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.

UNIT V   SOFTWARE QUALITY MANAGEMENT   9

TQM, Six Sigma, Software Quality: defining software quality, ISO9126, External Standards, Comparison of Project management software's: dot Project, Launch pad, Open Project. Case study:PRINCE2

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

* understand the activities during the project scheduling of any software application
* learn the risk management activities and the resource allocation for the projects
* can apply the software estimation and recent quality standards for evaluation of the software projects
* acquire knowledge and skills needed for the construction of highly reliable software project
* able to create reliable, replicable cost estimation that links to the requirements of project planning

REFERENCES

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012.
2. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition, 2013.
3. Richard H.Thayer "Software Engineering Project Management,": IEEE Computer Society
4. Futrell , "Quality Software Project Management", Pearson Education India, 2012
5. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012.
6. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition, 2013.
7. Richard H.Thayer "Software Engineering Project Management,": IEEE Computer Society
8. Futrell , "Quality Software Project Management", Pearson Education India, 2012

Mapping of Courses Outcomes with Programme Outcomes:													
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
COs	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	1	-	-	-	-	-	-	1	2	2
CO2	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO3	2	2	3	2	3	-	-	-	-	-	2	1	1	3
CO4	2	3	1	2	1	-	-	2	-	-	-	-	2	2
CO5	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16254   **DATA TUNING AND ADMINISTRATION**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- learn the fundamentals of database tuning
- study the indexing mechanisms for organizing data
- understand the significance of Query Optimization
- learn to troubleshoot database issues
- understand the need for time series and distributed databases

UNIT I   FUNDAMENTALS OF TUNING   9

Review of relational databases–Relational algebra - Locking and concurrency control – Correctness consideration– Lock tuning – Logging and the recovery subsystem – Principles of recovery – Tuning the recovery subsystem –Operating systems considerations – Hardware tuning

UNIT II   INDEX TUNING   9

Types of queries – Data structures – B tree – B+ Tree - Hash structures – Bit map indexes – Clustering indexes– Non clustering indexes – Composite indexes – Hot tables – Comparison of indexing and hashing techniques

UNIT III   QUERY OPTIMIZATION   9

Techniques - Tuning relational systems – Normalization – Tuning denormalization – Clustering two tables – Aggregate maintenance–Record layout–Query tuning–Triggers–Client server mechanisms–Objects, application tools and performance – Tuning the application interface – Bulk loading data – Accessing multiple databases

UNIT IV   TROUBLESHOOTING   9

Query plan explainers – Performance monitors – Event monitors – Finding "Suspicious" queries – Analyzing a query's access plan – Profiling a query execution – DBMS subsystems

UNIT V   CASE STUDIES   9

Transaction chopping – Time series databases – Understanding access plans – Configuration parameters: Oracle; SQL Server; DB2 UDB – Distributed database - Implementation

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- analyze different execution plans for queries
- analyze different execution tuning for queries
- create an execution plan for a query to reduce the execution time
- optimize the retrieval in query processing
- analyze the query response using data dictionaries

REFERENCES

1. Dennis Shasha and Philippe Bonnet "Database Tuning, Principles, Experiments, and Troubleshooting Techniques", Elsevier Reprint 2005.

2. Thomas Connoly and CarlolynBegg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education 2003.

3. M.TamerOzsu, Patrick Valduriez and S.Sridhar "Principles of Distributed Database Systems", Pearson Education 2007.

4. RamezElmasri and Navathe, "Fundamentals of Database Systems", Sixth Edition, Addison Wesley

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
CO	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	1	2	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	3	2	3	-	-	-	-		2	1	1	3
CO4	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO5	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16255   **SOFT COMPUTING**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- learn the key aspects of Soft computing
- know about the components and building block hypothesis of Genetic algorithm
- understand the features of neural network and its applications
- study the fuzzy logic components
- gain insight onto Neuro Fuzzy modeling and control.

UNIT I   INTRODUCTION TO SOFT COMPUTING   9

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence-Machine Learning Basics

UNIT II   GENETIC ALGORITHMS   9

Introduction, Building block hypothesis, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem),Differences & similarities between GA & other traditional methods, Applications of GA.

UNIT III   NEURAL NETWORKS   9

Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in neural networks.

UNIT IV   FUZZY LOGIC   9

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

UNIT V   NEURO-FUZZY MODELING   9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

                                                        TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- implement machine learning through neural networks
- gain Knowledge to develop Genetic Algorithm and Support vector machine based machine learning system
- write Genetic Algorithm to solve the optimization problem
- understand fuzzy concepts and develop a Fuzzy expert system to derive decisions
- model Neuro Fuzzy system for data clustering and classification

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003

2. KwangH.Lee, "First course on Fuzzy Theory and Applications", Springer–Verlag Berlin Heidelberg, 2005.

3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.

4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

5. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
CO	Programme Outcomes (POs)													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	2	2	2	3	3	-	-	-	-	-	-	2	1	2
CO3	2	2	3	2	3	-	-	-	-	-	2	1	1	3
CO4	1	2	3	2	-	-	-	2	-	-	-	-	2	2
CO5	2	2	1	2	-	-	-	2	-	-	-	3	2	3

CA16256   **AD-HOC AND SENSOR NETWORKS**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- understand the basics of Ad-hoc & Sensor Networks

- learn various fundamental and emerging protocols of all layers in ad-hoc network

- study about the issues pertaining to major obstacles in establishment and efficient management of ad-hoc and sensor networks

- understand the nature and applications of ad-hoc and sensor networks

- understand various security practices and protocols of Ad-hoc and Sensor Networks

UNIT I   ADHOC NETWORKS FUNDAMENTALS AND MAC PROTOCOLS   9

Fundamentals Of WLans – IEEE 802.11 Architecture - Self Configuration And Auto Configuration Issues in Ad-Hoc Wireless Networks – MAC Protocols For Ad-Hoc Wireless Networks – Contention Based Protocols -TCP Over Ad-Hoc Networks-TCP Protocol Overview - TCP And MANETs – Solutions For TCP Over Ad-HocNetworks.

UNIT II   ADHOC NETWORK ROUTING AND MANAGEMENT   9

Routing in Ad-Hoc Networks- Introduction -Topology based versus Position based Approaches - Proactive, Reactive, Hybrid Routing Approach - Principles and issues – Location services – DREAM – Quorums based Location Service – Grid – Forwarding Strategies – Greedy Packet Forwarding – Restricted Directional Flooding-Hierarchical Routing- Other Routing Protocols.

UNIT III   SENSOR NETWORK COMMUNICATION PROTOCOLS   9

Introduction–Architecture- Single Node Architecture – Sensor Network Design Considerations – Energy Efficient Design Principles for WSN's – Protocols for WSN – Physical Layer – Transceiver Design Considerations –MAC Layer Protocols – IEEE 802.15.4 Zigbee – Link Layer and Error Control Issues – Routing Protocols –Mobile Nodes and Mobile Robots - Data Centric & Contention Based Networking – Transport Protocols &QoS– Congestion Control Issues – Application Layer Support.

UNIT IV   SENSOR NETWORK MANAGEMENT AND PROGRAMMING   9

Sensor Management - Topology Control Protocols and Sensing Mode Selection Protocols - Time Synchronization - Localization and Positioning – Operating Systems and Sensor Network Programming – Sensor Network Simulators.

UNIT V   SOFTWARE TESTING AND QUALITY METRICS   9

Security in Ad-Hoc and Sensor Networks – Key Distribution and Management – Software based Antitamper Techniques – Water Marking techniques – Defense against Routing Attacks – Secure Adhoc Routing Protocols– Broadcast Authentication WSN Protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- work with existing Ad-hoc and sensor network protocols and standards.

- create a Sensor network environment for different type of applications

- design ad-hoc and sensor network architectures using QOS and Congestion control mechanisms

- interpret the various control fields of the protocol in each layer

- select appropriate routing algorithms for different network environments

REFERENCES

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", Second Edition, World Scientific Publishing, 2011.

2. Holger Karl, Andreas willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Inc .2005.

3. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.

4. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.

5. ErdalÇayırcı , Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
	Programme Outcomes (POs)													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	2	3	2	3	3	-	-	-	-	-	-	2	2	2
CO3	2	2	3	2	2	-	-	-	-		2	1	2	3
CO4	1	3	2	3	-	-	-	2	-	-	-	-	2	2
CO5	1	2	2	2	-	-	-	3	-	-	-	2	1	3

CA16257   **PYTHON AND R PROGRAMMING**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge in Python and R programming
- develop Python programs with conditionals and loops and data structures
- learn how to design and programs Python applications
- learn how to build and package Python modules for reusability
- understand and practice web development techniques on client-side and server side

UNIT I   INTRODUCTION TO PYTHON PROGRAMMING   9

Python interpreter and interactive mode; values and types variables, expressions, statements, tuple assignment, Order of operations, comments, debugging; modules and functions: function Calls, adding new functions, Definitions and Uses, flow of execution, parameters and arguments. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, range, break, continue, pass; recursion; Strings: string slices, immutability, string and methods, string module; Lists as arrays.

UNIT II   LISTS, TUPLES, DICTIONARIES   9

Lists: Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries: operations and methods; advanced list processing - list comprehension; Tuples: tuple assignment, tuple as return value.

UNIT III   FILES, MODULES, PACKAGES: 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and Exceptions, handling exceptions, modules, packages: PANDAS, NUMPY, SCIKIT-LEARN;

UNIT IV   INTRODUCTION TO R PROGRAMMING: 9

Introduction and Preliminaries, numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and matrices, Lists and data frames, Grouping, loops and conditional execution, functions.

UNIT V   STATISTICAL MODELS, GRAPHICAL PROCEDURES, PACKAGES   9

Statistical models : Defining statistical models; formulae, Linear models, Generic functions for extracting model information, Analysis of variance and model comparison, Updating fitted models, Generalized linear models, Nonlinear least squares and maximum likelihood models; Graphical procedures: High-level and low-level plotting commands, graphics parameters and list, Dynamic graphics. Packages: Standard packages, Contributed packages and CRAN, Namespaces.

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- problem solving and programming capability
- construct and execute basic programs in Python
- use external libraries and packages with Python
- construct and execute basic programs in R using programming techniques
- use external R-packages in statistical and graphics

REFERENCES

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. William N. Venables, David M. Smith, An Introduction to R: A Programming Environment for Data Analysis and Graphics, 2nd edition, Network Theory Ltd, 2009.
4. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016. 21

COs	Programme Outcomes													
Mapping of Courses Outcomes with Programme Outcomes:														
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
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CO3	2	3	3	3	3	-	-	-	-		2	2	1	3
CO4	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO5	2	2	3	2	-	-	-	1	-	-	-	2	2	2

CA16351   **INTERNET OF THINGS**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- learn the basic issues, policy and challenges in the Internet
- understand the components and the protocols in Internet
- build a small low cost embedded system with the internet
- understand the various modes of communications with internet
- learn to manage the resources in the Internet

UNIT I   INTRODUCTION   9

Definition–phases – Foundations – Policy– Challenges and Issues - identification - security –privacy Components in internet of things: Control Units – Sensors – Communication modules –Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks –Mobile Internet – Wired Communication

UNIT II   PROGRAMMING THE MICROCONTROLLER FOR IOT   9

Basics of Sensors and actuators – examples and working principles of sensors and actuators –Cloud computing and IOT – Arduino/Equivalent Microcontroller platform – Setting up the board - Programming for IOT – Reading from Sensors Communication: Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using wifi / ethernet

UNIT III   RESOURCE MANAGEMENT IN THE INTERNET OF THINGS   9

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture-The Role of Context- Design Guidelines -Software Agents for Object – Data Synchronization-Types of Network Architectures - Fundamental Concepts of Agility and Autonomy- Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behavior of Objects

UNIT IV   BUSINESS MODELS FOR THE INTERNET OF THINGS   9

The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiYService Creation Framework-Device Integration - Middleware Technologies Needed for a DiY Internet of Things Semantic Interoperability as a Requirement for DiY Creation -Ontology- Value Creation in the Internet of Things -Application of Ontology Engineering in the Internet of Things-Semantic Web-Ontology - The Internet of Things in Context of EURIDICE – Business Impact

UNIT V   FROM THE INTERNET OF THINGS TO THE WEB OF THINGS   9

Resource-oriented Architecture and Best Practices-Designing REST ful Smart Things– Web enabling onstrained Devices - The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud –Case studies – Open Source e-Health sensor platform – Be Close Elderly monitoring – Other recent projects.

TOTAL PERIODS   45

COURSE OUTCOMES

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

- identify the components of IOT
- design a portable IOT using appropriate boards
- program the sensors and controller as part of IOT
- develop schemes for the applications of IOT in real time scenarios
- establish the communication to the cloud through wifi/ Bluetooth

REFERENCES

1. CharalamposDoukas , Building Internet of Things with the Arduino, Create space, April 2012

2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

3. Luigi Atzor et.al, "The Internet of Things: A survey, ", Journal on Networks, Elsevier Publications, October, 2010

COs	**Mapping of Courses Outcomes with Programme Outcomes:** **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week**
COs	**Programme Outcomes (POs)**
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	2	2	2	3	3	-	-	-	-	-	-	2	1	2
CO3	2	2	3	2	3	-	-	-	-		2	1	1	3
CO4	1	2	3	2	-	-	-	2	-	-	-	-	2	2
CO5	2	2	1	2	-	-	-	2	-	-	-	3	2	3

CA16352   **MACHINE LEARNING TECHNIQUES**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- understand the machine learning theory
- implement linear and non-linear learning models
- implement distance-based clustering techniques
- build tree and rule based models
- apply reinforcement learning techniques

UNIT I   FOUNDATIONS OF LEARNING   9

Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization– generalization bound – approximation generalization tradeoff – bias and variance – learning curve

UNIT II   LINEAR MODELS   9

Linear classification – univariate linear regression – multivariate linear regression –beyond regularized regression – Logistic regression – perceptions – multilayer neural networks – learning neural networks structures– support vector machines–soft margin SVM – going linearity – generalization and over fitting – regularization – validation

UNIT III   DISTANCE-BASED MODELS   9

Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – k-d trees –locality sensitive hashing–non-parametric regression ensemble learning – bagging and random forests– boosting– meta learning

UNIT IV   TREE AND RULE MODELS   9

Decision trees–learning decision trees–ranking and probability estimation trees–regression trees – clustering trees– learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining– first-order rule learning

UNIT V   REINFORCEMENT LEARNING   9

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal-difference learning – active reinforcement learning – exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- explain theory underlying machine learning
- construct algorithms to learn linear and non-linear models
- implement data clustering algorithms
- construct algorithms to learn tree and rule-based models
- apply reinforcement learning techniques

REFERENCES

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AML Book Publishers, 2012
2. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012.
3. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
4. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
5. D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012.

COs	Mapping of Courses Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
CO	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	2	2	3	3	1	3	1
CO2	-	-	-	2	3	-	1	2	-	3	3	1	2	2
CO3	-	-	-	-	-	-	-	-	-	3	1	1	2	-
CO4	-	-	-	-	3	1	1	-	2	3	3	1	3	2
CO5	-	-	-	-	-	2	-	2	1	3	1	1	3	2
CO	0	0	0	1	3	1.5	1	2	1.6	3	2.2	1	2.6	1.7

CA16353   **HEALTH CARE ANALYTICS**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts of health care system
- know about creating and maintaining health care information systems
- understand information architecture
- ensure access of clinical information system on the fly
- understand IT governance and assessment of health care information system

UNIT I   INTRODUCTION   9

Introduction to health care information – Health care data quality – Health care information regulations, laws and standards.

UNIT II   HEALTH CARE INFORMAION SYSTEMS   9

History and evolution of health care information systems – Current and emerging use of clinical in formation systems – system acquisition – System implementation and support.

UNIT III   INFORMATION TECHNOLOGY   9

Information architecture and technologies that support health care information systems – Health care information system standards – Security of health care information systems.

UNIT IV   MANAGEMENT OF IT CHALLENGES   9

Organizing information technology services – IT alignment and strategic planning – IT governance and management.

UNIT V   T INITIATIVES   9

Management's role in major IT initiatives – Assessing and achieving value in health care information systems. Case study

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- develop an understanding of basic research skills applicable to the design
- apply evaluation and implementation of appropriate Healthcare Information Systems (HIS)
- analyze the impact, strengths and weaknesses of various HIS in any healthcare settings
- write reports on the roles of HIS and their impact on facilitating superior healthcare delivery Design a suitable HIS architecture
- use research methods and analysis together to plan the successful implementation of an appropriate HIS solution

REFERENCES

1. Karen A Wager, Frances Wickham Lee, John P Glaser, "Managing Health Care Information Systems: A Practical Approach for Health Care Executives", John Wiley, 2nd edition 2009.

2. Marion J. Ball, Charlotte Weaver, Joan Kiel ,"Healthcare Information Management Systems: Cases, Strategies, and Solutions", Springer, 2010, 3rd edition

3. Rudi Van De Velde and Patrice Degoulet, "Clinical Information Systems : A Component based approach", Springer 2005.

4. Kevin Beaver,Healthcare Information Systems, Second edition Best Practices, CRC Press, 2002

5. Marion J. BallHealthcare Information Management Systems: A Practical Guide Springer-Verlag GmbH, 1995.

COs	Programme Outcomes (POs)													
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CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	1	2	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	3	2	3	-	-	-	-		2	1	1	3
CO4	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO5	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16354   **GREEN COMPUTING**   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge to adopt green computing practices to minimize negative impacts on the environment
- skill in energy saving practices in their use of hardware
- examine technology tools that can reduce paper waste and carbon footprint by user
- analyze the green compliance
- understand how to minimize equipment disposal requirements

UNIT I   FUNDAMENTALS   9

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT II   GREEN ASSETS AND MODELING   9

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture– Environmental Intelligence- Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT III   GRID FRAMEWORK   9

Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting– Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

UNIT IV   GREEN COMPLIANCE   9

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

UNIT V   GREEN TECHNOLOGY   9

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- acquire knowledge to adopt green computing practices to minimize negative impacts on the environment
- apply green business process management
- analyze GRID framework
- skill in energy saving practices in their use of hardware concept
- understand the technology tools that can reduce paper waste and carbon footprint by user

REFERENCES

1. BhuvanUnhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011

2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

3. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff / IBM rebook, 2011

4. John Lamb, "The Greening of IT", Pearson Education, 2009.

5. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.

COs	Mapping of Courses Outcomes with Programme Outcomes:

	Mapping of Courses Outcomes with Programme Outcomes:													
	(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Week													
COs	**Programme Outcomes (POs)**													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	2
CO2	2	2	2	3	3	-	-	-	-	-	-	2	1	2
CO3	1	2	2	2	2	-	-	-	-		2	1	1	3
CO4	1	2	3	1	-	-	-	1	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	2	-	-	-	2	2	3

CA16355 **HUMAN RESOURCE MANAGEMENT** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the importance of human resources
- describe the steps involved in the human resource planning process
- understand the stages of employee socialization and training needs
- know about the purposes of performance management systems and appraisal
- know the list of occupational safety and health administration enforcement priorities

UNIT I   FUNDAMENTALS OF HRM   9

Introduction- importance of HRM – functions- qualities of HR manager – evolution and growth of HRM – trends and opportunities - HRM in global environment – legal and ethical context – laws for discriminatory practices – equal opportunity employment.

UNIT II   STAFFING, RECRUITMENT AND SELECTION   9

HR Polices - need, type and scope - human resource planning - job analysis - recruiting goals – recruiting sources– global perspective – selection process – pre-employment testing – interviews – job offers – hiring mistakes -key element for successful predictors.

UNIT III   TRAINING AND DEVELOPMENT   9

Socialization – new employee orientation, training, development – organizational development – methods – evaluating training– international training and development issues – career development - value for organization and individual – mentoring and coaching – traditional career stages

UNIT IV   PERFORMANCE EVALUATION, REWARDS AND BENEFITS   9

Appraisal process – methods – factors distort appraisal – team appraisal – international appraisal – rewards – Theories of motivation - compensation administration – job evaluation and pay structure – special cases of compensation – executive compensation programs – employee benefits.

UNIT V   SAFE AND HEALTHY WORK ENVIRONMENT   9

Occupational safety and health act - issues – stress – assistance program – labor management - employee unions– labor legislation. Promotion, demotion, transfer and separation – employee grievances – redressal methods.

TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- identify the primary external influences affecting HRM
- outline the components and the goals of staffing, training and development
- understand the selection procedure in various organizations
- understand the practices used to retain the employees and able to evaluate their performance
- able to identify the stress and the cause of burn out

REFERENCES

1. Decenzo and Robbins, Human Resource Management, Wilsey, 10th edition, 2012.

2. Mamoria C.B. and Mamoria. S., Personnel Management, Himalaya Publishing Company, 1997.

3. Mirza S. Saiyadain Human Resource Management , Tata McGraw Hill , 4th edition 2009.

4. EugenceMckenna and Nic Beach Human Resource Management, Pearson Education Limited, 2002.

5. Dessler, Human Resource Management, Pearson Education Limited, 2002.

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CO2	1	2	2	2	3	-	-	-	-	-	-	2	1	2
CO3	2	2	3	2	3	-	-	-	-		2	1	1	3
CO4	2	2	2	2	-	-	-	2	-	-	-	-	2	2
CO5	1	2	3	1	-	-	-	1	-	-	-	3	2	3

CA16356   **SOCIAL NETWORK ANALYSIS**   **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the components of the social network
- model and visualize the social network
- mine the users in the social network
- understand the evolution of the social network
- mine the interest of the user

UNIT I   INTRODUCTION   9

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis- Key concepts and measures in network analysis - Discussion networks - Blogs and online communities- Web-based networks.

UNIT II   MODELING AND VISUALIZATION   9

Visualizing Online Social Networks-A Taxonomy of Visualizations-Graph Representation-Centrality- Clustering-Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node- Link Diagrams-Hybrid Representations-Modeling and aggregating social network data-Random Walks and their Applications– Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships

UNIT III   MINING COMMUNITIES   9

Aggregating and reasoning with social network data, Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive-Detecting Communities in Social Networks - Evaluating Communities -Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms-Node Classification in Social Networks.

UNIT IV   EVOLUTION   9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence – Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks – Expert Location without Graph Constraints - with Score Propagation–Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction- Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V   TEXT AND OPINION MINING   9

Text Mining in Social Networks-Opinion extraction-Sentiment classification and clustering-Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining- Review Classification–Tracking sentiments towards topics over time.

                                                              TOTAL PERIODS   45

COURSE OUTCOMES

At the end of the course the students would be able to

- work on the internals components of the social network

- model and visualize the social network

- mine the behavior of the users in the social network

- predict the possible next outcome of the social network

- mine the opinion of the user

REFERENCES

1. Charu C. Agarwal, "Social Network Data Analytics", Springer; 2011

2. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007.

3. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010

4. GuandongXu, Yanchun Zhang and Lin Li, Web Mining and Social Networking–Techniques & applications Springer, 1st edition, 2011.

5. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010.

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COs	Programme Outcomes (POs)													
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CO4	1	2	3	1	-	-	-	1	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	2	-	-	-	2	2	3