PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.TECH. INFORMATION TECHNOLOGY

REGULATIONS-2019

CHOICE BASED CREDIT SYSTEM

CURRICULUM

(For the students admitted during the academic year 2019-2020)

SEMESTER – VII

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	IT19701	Cloud Computing	3	0	0	3
2	PC	IT19702	Cryptography and Network Security	3	0	0	3
3	PE	IT1935*	Professional Elective – III	3	0	0	3
4	PE	IT1945*	Professional Elective – IV	3	0	0	3
5	OE	IT1990*	Open Elective – II	3	0	0	3
Practical							
6	PC	IT19703	Cloud Computing Laboratory	0	0	4	2
7	PC	IT19704	Network Security Laboratory	0	0	4	2
8	EE	IT19705	Mini Project	0	0	6	3
			TOTAL	**15**	**0**	**14**	**22**

SEMESTER – VIII

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	IT19801	Big Data Analytics	3	0	0	3
2	PE	IT1955*	Professional Elective – V	3	0	0	3
3	PE	IT1965*	Professional Elective – VI	3	0	0	3
Practical							
4	EE	IT19802	Project Work	0	0	12	6
			TOTAL	**09**	**0**	**12**	**15**

PAAVAI ENGINEERING COLLEGE, NAMAKKAL ★ AUTONOMOUS ★ Approved BOARD OF STUDIES Information Technology

PROFESSIONAL ELECTIVE - III

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	IT19351	Software Defined Networks	3	0	0	3
2	PE	IT19352	Deep Learning	3	0	0	3
3	PE	IT19353	Digital Enterprise Resource Planning	3	0	0	3
4	PE	IT19354	Agile Software Development	3	0	0	3
5	PE	IT19355	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3

PROFESSIONAL ELECTIVE - IV

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	IT19451	Mobile Adhoc Networks	3	0	0	3
2	PE	IT19452	Fundamentals of Blockchain Technologies	3	0	0	3
3	PE	IT19453	Bio Informatics	3	0	0	3
4	PE	IT19454	Soft Computing	3	0	0	3

PROFESSIONAL ELECTIVE - V

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	IT19551	Wireless Sensor Networks	3	0	0	3
2	PE	IT19552	5G Technology	3	0	0	3
3	PE	IT19553	Cyber Forensics	3	0	0	3
4	PE	IT19554	Software Testing	3	0	0	3

PROFESSIONAL ELECTIVE - VI

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	BA19354	Digital and Social Media Marketing	3	0	0	3
2	PE	IT19651	Service Oriented Architecture	3	0	0	3
3	PE	IT19652	Software Project Management	3	0	0	3
4	PE	IT19653	Randomized Algorithms	3	0	0	3

OPEN ELECTIVE - II

S.No	Category	Course Code	Course Title	L	T	P	C
1	OE	IT19903	Fundamentals of Internet of Things	3	0	0	3
2	OE	IT19904	IT Infrastructure Management	3	0	0	3

SEMESTER - VII

IT19701	CLOUD COMPUTING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- understand the concept of cloud computing.
- appreciate the evolution of cloud from the existing technologies.
- have knowledge on the various services in cloud computing.
- be familiar with the security in cloud.
- studythe emergence of cloud as the next generation computing paradigm.

UNIT I INTRODUCTION 9

Introduction to Cloud Computing - Definition of Cloud, Characteristics and Benefits of Cloud Computing; Historical Developments - Distributed systems, Virtualization, Web 2.0, Service–oriented Computing; Building Cloud Computing Environments - Computing Platforms and Technologies; Principles of Parallel and Distributed Computing.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Basics of Virtualization - Characteristics of Virtualized Environments, Levels of Virtualization Implementation, Taxonomy of VirtualizationTechniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples: Para Virtualization, Full Virtualization.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Cloud Reference Model - Architecture, Infrastructure and Hardware as a Service, Platform as a Service, Software as a Service, Case Studies; Types of Clouds - Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud; Open Challenges.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter Cloud Resource Management - Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources; Security Overview - Cloud Security Challenges, Software-as-a- Service - Security management, Security Governance, Virtual Machine Security, Identity Access Management, Security Standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications - Future of Federation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- explain the various technologies of cloud.
- describe the architecture of compute and storage cloud, serviceand delivery models.
- identify the security mechanisms of cloud.
- evaluate and choose the appropriate technologies and approaches for implementation and useof cloud.

TEXT BOOKS

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, " Mastering Cloud Computing", Tata Mcgraw Hill, 2017.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

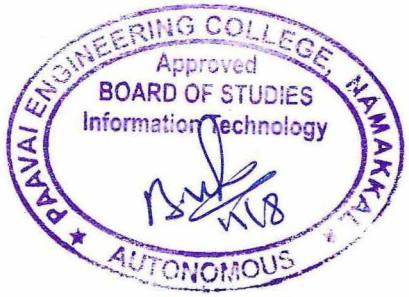
REFERENCES

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Ray J. Rafaels, "Cloud Computing: From Beginning to End", 2015.
3. Zaigham Mahmood, Ricardo Puttini, Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", Pearson, 2013.
4. Sunilkumar Manyi, Gopal Shyam- Cloud Computing: concepts and Technologies, CRC Press 2021.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	1	1	-	3	3	2
CO2	2	3	1	2	3	2	-	-	2	1	-	3	3	2
CO3	2	3	2	2	3	-	-	-	2	1	-	2	3	2
CO4	2	3	1	3	2	-	-	-	2	1	-	2	3	2
CO5	3	3	2	3	3	2	-	-	2	2	-	2	3	2



IT19702 CRYPTOGRAPHY AND NETWORK SECURITY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand cryptography theories, algorithms and systems.
- learn the concepts of symmetric key cryptography.
- analyze the concepts of asymmetric key cryptography.
- apply methods for authentication, access control, intrusion detection and prevention.
- learn about how to provide security in different applications.

UNIT I INTRODUCTION 9

Computer Security Concepts, OSI security architecture, Security attacks, Services and mechanisms, Model for network security; Classical encryption techniques - Substitution techniques, Transposition techniques, Steganography.

UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9

Finite fields - Euclidean algorithm, Modular arithmetic, Euclid's algorithm; SYMMETRIC KEY CIPHERS - Block Cipher Structure, SDES, Data Encryption Standard, Strength of DES, Blockcipher design principles, Block cipher mode of operation, Advanced Encryption Standard, RC4, Key Distribution.

UNIT III ASYMMETRIC KEY CRYPTOGRAPHY 9

Fermat's and Euler's Theorem, Testing for Primality, Chinese Remainder Theorem, Discrete logarithms; ASYMMETRIC KEY CIPHERS - RSA Algorithm, Key management, Diffie-Hellman key exchange, Elgamal cryptographic system, Elliptic curve arithmetic, Elliptic curve cryptography.

UNIT IV MESSAGE AUTHENTICATION AND MUTUAL TRUST 9

Message Authentication Codes - Message Authentication requirements, Message Authentication functions, Requirements for MAC, Security of MACs; Cryptographic Hash functions - Requirements and Security of hash function, Secure Hash Algorithm; Digital signatures - Digital Signature Scheme, Elgamal Digital Signature Scheme; Mutual Trust - X.509 certificates, Kerberos.

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security - Pretty Good Privacy, S/MIME; IP security; System Security - Intruders, Malicious software, Firewalls.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyze the various security attacks and select appropriate security mechanism for designing various security services.
- evaluate the different cryptographic operations of symmetric cryptographic algorithms.

- apply the different cryptographic operations of public key cryptography.
- apply the various authentication schemes to simulate different applications.
- identify appropriate mechanism for providing system security.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 7th Edition, 2017.

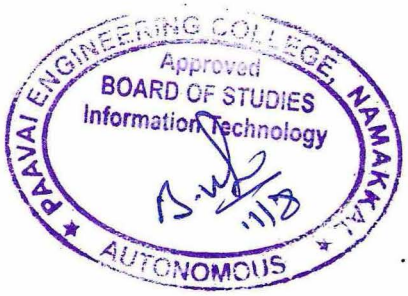
REFERENCES

1. William Stalling, "Network Security Essentails: Applications and Standards", Pearson Education 6th Edition, 2017.
2. Behrouz A.Foruzan, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill 2015.
3. Atul Kahate, "Cryptography and Network Security", 4th Edition, McGraw Hill Education, 2019.
4. C.K.Shyamala, N.Harini and Dr. T.R.Padmanabhan, "Cryptography and Network Security", Wiley India Pvt.Ltd, 2011.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3	-	-	1	2	-	-	2	3	2
CO2	2	3	3	2	2	1	-	2	2	-	-	3	3	2
CO3	3	3	2	3	3	1	-	2	2	2	2	2	3	2
CO4	3	3	3	3	2	-	-	2	2	1	2	2	3	2
CO5	3	2	3	3	3	-	-	1	2	2	2	2	3	2



IT19703 CLOUD COMPUTING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- be exposed to tool kits of cloud environment.
- learn to use Hadoop.
- learn to run virtual machines of different configuration.
- apply Map-Reduce concept to applications.

LIST OF EXPERIMENTS

Use Open Nebula or Equivalent software to set up the cloud and demonstrate thefollowing experiments.

1. Find procedure to run the virtual machine of different configuration. Check howmany virtual machines can be utilized at particular time.
2. Find procedure to attach virtual block to the virtual machine and check whether itholds the data even after the release of the virtual machine.
3. Install a C compiler in the virtual machine and execute a sample program.
4. Show the virtual machine migration based on the certain condition from one node tothe other.
5. Find procedure to install storage controller and interact with it.
6. Find a procedure to transfer the files from one virtual machine to another virtualmachine.
7. Install hadoop single node cluster and run simple applications like word count.
8. Write a program to use the API's of hadoop to interact with it.
9. Write a word count program to demonstrate the use of Map and Reduce tasks.
10. Setup a private cloud using open nebula. Develop a simple application and makeit available to the intended user.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- use the cloud tool kit.
- design and Implement applications on the Cloud.
- create virtual machines from available physical resources.
- implement Map-Reduce concept.

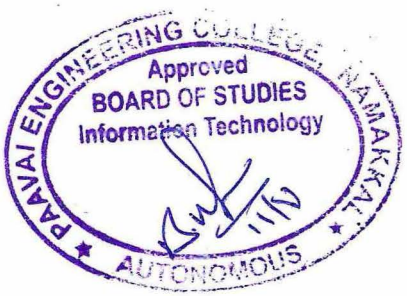
LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS

SOFTWARE: Open Nebula or Equivalent, CloudSim (Open Source Software), Eualyptus (Open SourceSoftware).

HARDWARE: Stand alone desktops 30Nos.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes: (3/2/1 indicatesstrength of correlation) 3-Strong,2-Medium,1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	2	1	2	-	1	-	-	-	-	2	3	2
CO3	3	3	2	1	2	3	1	-	-	-	-	2	3	1
CO4	3	3	-	1	1	3	1	-	-	-	-	2	3	2



IT19704 NETWORK SECURITY LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- learn different cipher techniques.
- construct code for authentication algorithms.
- implement the algorithms DSS, RSA,MD5,SHA-1.
- use network security tools and vulnerability assessment tools.

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
   (i) Ceaser cipher, (ii) Playfair cipher (iii) Hill Cipher (iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   (i) Rail fence (ii) row & Column Transformation
3. Apply DES algorithm for practical applications
4. Apply AES algorithm for practical applications
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem
7. Calculate the message digest of a text using the SHA-1 algorithm
8. Implement the SIGNATURE SCHEME – Digital Signature Standard
9. Demonstrate intrusion detection system (ids) using any tool
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
11. Defeating Malware (i) Building Trojans ii) Root kit Hunter

TOTAL PERIODS 60

COURSE OUTCOMES

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

- develop code for classical encryption techniques to solve the problems.
- build cryptosystems by using symmetric and public key encryption algorithms.
- develop a digital signature standard.
- demonstrate the network security system using open source tools.

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS

SOFTWARE: C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent.

HARDWARE: Standalone desktops – 30 Nos. (or) Server supporting 30 terminals or more.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes: (3/2/1 indicatesstrength of correlation) 3-Strong,2-Medium,1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	-	-	-	-	-	2	3	2
CO2	3	3	2	1	2	2	1	-	-	-	-	2	3	2
CO3	3	3	2	1	2	3	1	-	-	-	-	2	3	1
CO4	3	3	2	1	1	3	1	-	-	-	-	2	3	2

IT19705 MINI PROJECT 0 0 6 3

COURSE OBJECTIVES

To enable students to

- recognize the significance of scope and the problems of project
- understand the strategic plans, project prioritization methods and projects
- analyze the importance of scheduling / allocating resources to a project
- understand the importance of project management as it effects strategy and business success

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members for a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of the beginning of 7th semester.
3. The group has to identify and select the problem to be addressed as their project work and study literature survey to finalize a comprehensive aim and scope of their work.
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

TOTAL PERIODS 90

COURSE OUTCOMES

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

- formulate a real world problem, identify the requirement and develop the design solutions.
- identify technical ideas, strategies and methodologies.
- utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- test and validate through conformance of the developed prototype and analysis the cost effectiveness.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	1	1	1	2	3	2
CO2	3	2	2	1	1	1	-	-	1	1	1	2	3	2
CO3	3	2	2	1	1	1	-	-	1	1	1	2	3	2
CO4	3	2	2	1	1	1	-	-	1	1	1	2	3	2

SEMESTER - VIII

IT19801	BIG DATA ANALYTICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

- understand the architectures and common features of the main types of No SQL databases .
- installation and understanding of hadoop Architecture and its ecosystems.
- learn about the fundamental concept of data analytics with hadoop.
- learn about the fundamental concept of data analytics using R.
- understand the working environment of pig and hive for processing the structured and unstructured data.

UNIT I INTRODUCTION TO BIG DATA 9

BIG DATA - Big Data Overview, State of practice in Analytics, Key roles for New Big Data Ecosystem, Examples for Big Data Analytics; NoSQL - Value of Relational Databases, The emergence of NoSQL; Aggregate Data Models - Aggregate, Key value and Document Data Models, Column Family Stores, Relationships, Graph Database, Schemaless Database, Materialized views, Modeling for Data Access.

UNIT II HDFS AND MAP REDUCE 9

Hadoop - Data Storage and Analysis; Map Reduce - MapReduce Programming Basics, Analyzing the data with Hadoop, Scaling Out, Hadoop Streaming; Hadoop Distributed File system - Concepts, Hadoop File systems, Java Interface and Data flow; Hadoop I/O - Data Integrity, Compression, Serialization, File based Data Structures.

UNIT III DATA ANALYTICS USING HADOOP 9

Data Analytics Lifecycle - Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communication results, Operationalize; Case Study: Global Innovation Network and Analysis

UNIT IV DATA ANALYTICS USING R 9

Introduction to R, Data types, Expression, variables and function, methods for reading data; Exploring data in R; Exploratory Data Analysis; Statistical Method for Evaluation. Case Study - Log Analysis.

UNIT V TECHNOLOGY AND TOOLS 9

Analytics for Unstructured Data, Hadoop Ecosystem - PIG, Hive, HBASE, MAHOUT, NoSQL; In-database Analytics - SQL Essentials, In-database Text Analysis, Advanced SQL; Case Studies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- differentiate and identify right database models for real time applications
- analyse the big data using map-reduce programming in hadoop.
- analyze the data using hadoop.
- apply Machine Learning Techniques using R.
- illustrate the usage of data on different Big data ecosystems.

TEXT BOOKS

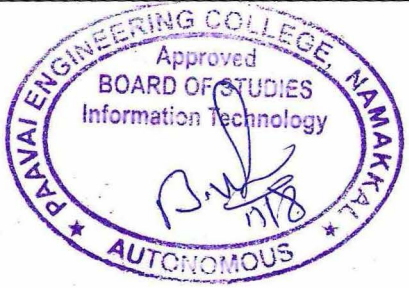
1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, New Delhi, 2018.
2. Seema Acharya, "Data Analytics using R", MC-Graw Hill Education private Limited, 2018.

REFERENCES

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications, Second Edition, 2019.
2. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'reily Media, 2015.
3. Martin Fowler and Pramod J. Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison Wesley, New Delhi, 2013.
4. "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization", DT Editorial Services, Dreamtech Press, 2016.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1-Weak														
COs	Programme Outcomes(Pos)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	1	-	1	-	-	2	3	2
CO2	3	3	2	1	2	2	-	-	-	-	1	2	3	2
CO3	3	3	2	1	2	1	-	-	-	-	1	2	3	1
CO4	3	3	2	-	1	3	1	-	-	-	-	2	3	2
CO5	3	3	1	1	1	3	1	-	1	-	1	2	3	2



IT19802	PROJECT WORK	0	0	12	6

COURSE OBJECTIVES

To enable students to

- recognize the significance of scope and the problems of project
- understand the strategic plans, project prioritization methods and projects
- understand the importance of scheduling / allocating resources to a project
- develop strategies for developing and reinforcing high performance teams

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 3 members for a project.
2. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of the beginning of 8th semester.
3. The group has to identify and select the problem to be addressed as their project work and study literature survey to finalize a comprehensive aim and scope of their work.
4. A project report has to be submitted by each student group for their project work.
5. Three reviews have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

TOTAL PERIODS 180

COURSE OUTCOMES

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

- prepare a literature survey in a specific domain as a team/ individual to motivate lifelong learning.
- identify the problem by applying acquired knowledge
- choose efficient tools for designing project modules
- design engineering solutions to complex problems utilizing a systems approach and combine all the modules for efficient testing.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes
(3/2/1 indicates strength of correlation) 3-Strong,2-Medium,1- Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	2	1	1	1	-	-	1	1	1	2	3	2
CO2	3	2	2	1	1	1	-	-	1	1	1	2	3	2
CO3	3	2	2	1	1	1	-	-	1	1	1	2	3	2
CO4	3	2	2	1	1	1	-	-	1	1	1	2	3	2

IT19351 SOFTWARE DEFINED NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the overview of Software Defined Networks and its working
- know about the Open Flow specification & SDN working.
- analyse the SDN limitations and data center.
- learn the SDN Ecosystem and applications.
- familiarise the Juniper SDN Network

UNIT I INTRODUCTION TO SDN AND HOW ITS WORKS 9

Introduction: Basic Packet Switching Terminology- Historical Background- The Modern Data Center- Traditional Switch Architecture- Autonomous and Dynamic Forwarding Tables- Can We Increase the Packet Forwarding IQ?- Open Source and Technological Shifts; SDN; Evolution of Switches and Control Planes – Cost - SDN Implications for Research and Innovation- SDN Implications for Research and Innovation - Data Center Innovation- Data Center Needs ; GENESIS OF SDN - The Evolution of Networking Technology- Forerunners of SDN- Legacy Mechanisms Evolve Toward SDN - Software Defined Networking is Born- Sustaining SDN Interoperability - Open Source Contributions- Network Virtualization.

UNIT II SDN WORKS - THE OPENFLOW SPECIFICATION 9

SDN Working: Fundamental Characteristics of SDN - SDN Operation- SDN Devices - SDN Controller- SDN Applications- Alternate SDN Methods; OPENFLOW SPECIFICATION: Chapter- Specific Terminology- OpenFlow Overview - OpenFlow 1.0 and OpenFlow Basics - OpenFlow 1.1 Additions - OpenFlow 1.2 Additions - OpenFlow 1.3 Additions - OpenFlow 1.4 Additions - OpenFlow 1.5 Additions - Improving OpenFlow Interoperability- Optical Transport Protocol Extensions.

UNIT III OPENFLOW LIMITATIONS-EMERGING PROTOCOL, CONTROLLER AND APPLICATION MODELS 9

OPENFLOW limitations: Potential Drawbacks of Open SDN - SDN via APIs - SDN via Hypervisor-Based Overlays- SDN via Opening Up the Device - Network Functions Virtualization - Alternatives Overlap and Ranking.; Emerging Protocol, Controller, and Application Models : Expanded Definitions of SDN- Additional SDN Protocol Models - Additional SDN Controller Models - Additional Application Models - New Approaches to SDN Security - The P4 Programming Language ; SDN in the Data Center: Data Center Definition - Data Center Demands- Tunneling Technologies for the Data Center- Path Technologies in the Data Center- Ethernet Fabrics in the Data Center - SDN Use Cases in the Data Center- Comparison of Open SDN, Overlays, and APIs - Real-World Data Center Implementations.

UNIT IV NETWORK FUNCTIONS VIRTUALIZATION 9

Definition of NFV- Standards- Leading NFV Vendors- SDN vs NFV- In-Line Network Functions; **PLAYERS IN THE SDN ECOSYSTEM:** Academic Research Institutions - Industry Research Labs - Network Equipment Manufacturers - Software Vendors - White-Box Switches - Merchant Silicon Vendors - Original Device Manufacturers - Cloud Services and Service Providers - Standards Bodies and Industry Alliances ; **SDN APPLICATIONS:** Terminology- Application Types - A Brief History of SDN Controllers - Using Floodlight for Training Purposes- A Simple Reactive Java Application - Controller Considerations - Network Device Considerations- Creating Network Virtualization Tunnels - Offloading Flows in the Data Center - Access Control for the Campus - Traffic Engineering for Service Providers.

UNIT V SDN OPEN SOURCE, BUSINESS RAMIFICATIONS 9

SDN Open Source: SDN Open Source Landscape - The OpenFlow Open Source Environment - Chapter-Specific Terminology - Open Source Licensing Issues - Profiles of SDN Open Source Users - OpenFlow Source Code - Switch Implementations - Controller Implementations - SDN Applications- Orchestration and Network Virtualization - Simulation, Testing, and Tools- Open Source Cloud Software - Example: Applying SDN Open Source; **Business Ramifications:** Everything as a Service - Market Sizing - Classifying SDN Vendors - Impact on Incumbent NEMs- Impact on Enterprise Consumers- Turmoil in the Networking Industry - Venture Capital - Major SDN Acquisitions - SDN Startups - Career Disruptions.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know about the overview of Software Defined Networks
- understand about the Open Flow & SDN Controllers
- analyse the SDN Protocols, controllers
- study and learnt the SDN Ecosystem and application of virtualization
- evaluate the Juniper SDN Open Source and Business Ramifications.

TEXTBOOK

1. Paul Göransson, Chuck Black, Timothy Culver – "Software Defined Networks_ A Comprehensive Approach"-Morgan Kaufmann (2016).

REFERENCES

1. Thomas D. Nadeau, Ken Gray, —"SDN: Software Defined Networks, O'Reilly Media", 2013.
2. Siamak Azodolmolky, —"Software Defined Networking with Open Flow, Packet Publishing", 2013.
3. Vivek Tiwari, —"SDN and Open Flow for Beginners, Amazon Digital Services", Inc.,2013.
4. Fei Hu, Editor, —"Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 2014.

CO-PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
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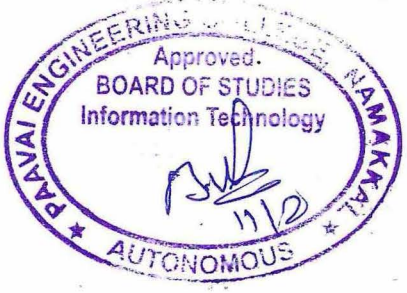
CO4	3	3	3	2	2	1	-	-	3	2	2	3	3	3
CO5	3	3	3	2	2	1	-	-	3	2	2	3	3	3



IT19352 DEEP LEARNING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basic ideas and principles of neural networks.
- understand the basic principles of deep learning.
- familiarize with image processing facilities.
- understand and implement deep learning architectures.
- learn the applications of deep learning

UNIT I DEEP NETWORKS 9

Basic Concept of Neurons - Perceptron Algorithm; Deep Feed forward Networks - Learning XOR; Gradient Based Learning - Hidden Units, Architecture Design; Back-Propagation and Other Differentiation Algorithms.

UNIT II REGULARIZATION FOR DEEP LEARNING 9

Regularization for Deep Learning - Parameter Norm Penalties, Norm Penalties as Constrained Optimization; Regularization and Under-Constrained Problems; Dataset Augmentation; Noise Robustness; Semi -Supervised Learning; Multitask Learning; Early Stopping; Parameter Tying and Parameter Sharing; Sparse Representations - Bagging and Other Ensemble Methods Dropout; Adversarial Training -TangentDistance, Tangent Prop and Manifold Tangent Classifier.

UNIT III CONVOLUTIONAL NETWORKS 9

The Convolution Operation - Motivation, Pooling; Convolution and Pooling as an Infinitely Strong Prior - Variants of the Basic Convolution Function; Structured Outputs; Data Types - Efficient Convolution Algorithms; Random or Unsupervised Features; The Neuroscientific Basis for Convolutional Networks.

UNIT IV RECURRENT AND RECURSIVE NETS 9

Unfolding Computational Graphs; Recurrent Neural Networks; Bidirectional RNNs; Encoder-Decoder Sequence-to-Sequence; Architectures; Deep Recurrent Networks; Recursive Neural Networks; The Challenge of Long-Term Dependencies-Echo State Networks.

UNIT V APPLICATIONS 9

Images segmentation - Object Detection, Automatic Image Captioning, Image generation with Generative adversarial networks; Video to Text with LSTM models - Attention models for Computer Vision, Case Study: Named Entity Recognition - Opinion Mining using Recurrent Neural Networks - Parsing and Sentiment Analysis using Recursive Neural Networks, Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the role of deep learning in machine learning applications.
- design and implement deep learning applications.
- critically analyze different deep learning models in image related projects.
- understand and implement deep learning architectures.
- know the various NLP and image processing applications that utilizes deep learning methods.

TEXT BOOKS

1. Ian Goodfellow , Yoshua Bengio , Aaron Courville , "Deep Learning", MIT Press,2017.
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

REFERENCES

1. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2017.
2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
3. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
4. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

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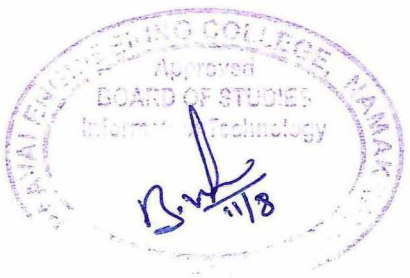
CO3	3	2	1	1	1	1	-	-	-	2	1	1	2	2
CO4	3	2	3	1	2	1	-	-	-	1	1	1	2	2
CO5	3	2	3	1	2	1	-	-	-	-	2	2	2	2



IT19353 DIGITAL ENTERPRISE RESOURCE PLANNING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand why information systems are so important today for business and management.
- know the role of the major types of information systems in a business environment and their relationship to each other.
- acquire the impact of the Internet and Internet technology on business electronic commerce and electronic business.
- understand the major management challenges to building and using information systems and learnhow to find appropriate solutions to those challenges.
- familarize an IT infrastructure and describe its components.

UNIT I INTRODUCTION 9

Overview of Enterprise Systems - Evolution; Risks and Benefits - Fundamental Technology - Issues to be consider in Planning Design and Implementation of cross Functional Integrated ERP Systems.

UNIT II ERP IMPLEMENTATION 9

Implementation Challenges; Strategies; Life Cycle; Pre-Implementation Tasks; Requirements Definition; Methodologies; Package Selection; Project Teams; Process Definitions; Vendors and Consultants; Data Migration; Project Management; Post Implementation Activities.

UNIT III BUSINESS MODULES 9

Business Modules in an ERP Package; Finance; Manufacturing; Human Resources; Plant Maintenance; Materials Management; Quality Management; Sales and Distribution.

UNIT IV ERP MARKET 9

Marketplace, Dynamics; SAP AG; Oracle; PeopleSoft; JD Edwards; QAD Inc. – SSA Global, Lawson Software, Epicor, Intuitive.

UNIT V MORDEN ERP 9

Modern ERP introduction - Characteristics of Modern ERP, Deploy Modern ERP Systems; ERP with Cloud Computing – Modern ERP tools , Role of Modern ERP in Marketing Industry, Latest Trends in ERP.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basic concepts and technologies used in the field of management information Systems.
- identify the knowledge of the different types of management information systems.

- describe the ethical, social, and security issues of information systems.
- understand the role of information systems in organizations, the strategicmanagement processes, and the implications for the management.
- create how various information systems work together to accomplishthe information objectives of an organization.

TEXT BOOKS

1. Alexis Leon, - "ERP DEMYSTIFIED", Tata McGraw Hill, Second Edition, 2008.
2. Mary Sumner, -"Enterprise Resource Planning", Pearson Education, 2007.

REFERENCES

1. Jagan Nathan Vaman, "ERP in Practice", Tata McGraw-Hill, 2008.
2. Vinod Kumar Grag and N.K. Venkitakrishnan, "ERP- Concepts and Practice", Prentice Hallof India, 2006.
3. Jose Antonio Fernandz, -" The SAP R /3 Handbook", Tata McGraw Hill, 1998.
4. Biao Fu, -"SAP BW: A Step-by-Step Guide", First Edition, Pearson Education, 2000.

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CO4	3	2	2	2	2	2	3	2	3	2	-	-	3	2
CO5	3	2	1	2	-	-	2	-	2	3	-	-	3	3

IT19354 AGILE SOFTWARE DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn about fundamentals of agile .
- study about agile scrum framework.
- familarise about project execution.
- familarise about scrum master.
- understand about the various scrum applications.

UNIT I OVERVIEW OF AGILE SOFTWARE DEVELOPMENT 9

History of Project Management - Waterfall Approach, Project Management Triangle, Modified Waterfall Models, Milestone and Regular Integration, Incremental Development - Lean Software Development; Project Management 2.0; Agile Manifesto; Scrum; Test Driven Development Extreme Programming; Rational Unified Process; Agile Unified Process; Agile Model Driven Development.

UNIT II TOOLING AND CONSIDERATIONS ON TEAMING ANDLEADERSHIP 9

Project Management Tools: Collaboration Tools - Development Infrastructure and Environment - Source Control and Version Management; Automated Test Environment; Code-Build-Test; Considerations on Teaming and Leadership: A ''Lean'' Hierarchy , Defining the Goals, Cross-functional Teams, The Wisdom of Crowds, Considerations on Planning and Architecture; Balance Flexibility and Structure; Reducing Complexity-Architectural Considerations.

UNIT III CONSIDERATIONS ON PROJECT EXECUTION 9

The Big Bang - Continuous Integration - The Rhythm of the Project: Iterations- Integration Fest - Juggling Content Within an Iteration - Planning in an Agile Project – Estimating - Metrics for an Agile Project – Defects - Mix and Match: About WebSphere Portal - Scaling Agile - Tiger Teams in WebSphere Portal: Mix and Match, The Tragedy of Being Successful- Tiger Teams in WebSphere Portal.

UNIT IV SCRUM 9

Introduction: The scrum master, Scrum Practices, Product backlog, scrum teams ,Daily scrum Meetings, Sprint Plan Meetings; Sprint Review; Applying Scrum.

UNIT V ADVANCED SCRUM APPLICATIONS 9

Applying Scrum to Multiple Related Projects; Applying Scrum to Larger Projects; Scrum and the Organizations: Scrum Values.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the background and driving forces for taking an agile approach tosoftware development.
- understand the business value of adopting agile approaches and agile development practices.
- drive development with unit tests using test driven development.
- apply design principles and refactoring to achieve agility.
- deploy automated build tools, version control and continuous integration andperform testing activities within an agile project

TEXT BOOKS

1. Thomas Stober, Uwe Hansmann – "Agile Software Development_ Best Practices for Large Software Development Projects"-Springer-Verlag Berlin Heidelberg (2010)
2. Ken Schawber, Mike Beedle,"Agile Software Development with Scrum", Pearson , 21 Mar2008.

REFERENCES

1. By Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices, Prentice", 25 Oct 2002.
2. Lisa Crispin, Janet Gregory," Agile Testing: A Practical Guide for Testers and Agile Teams," Wesley, 30 Dec 2008.
3. Alistair Cockburn, "Agile Software Development: The Cooperative Game ", Addison Wesley, 19 Oct2006.
4. Mike Cohn,"User Stories Applied: For Agile Software" , Addison Wesley, 1 Mar 2004.

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CO4	2	3	-	-	2	-	-	-	-	1	-	1	2	-
CO5	2	3	-	3	3	-	-	-	-	-	-	1	2	1

IT19355 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

COURSE OBJECTIVES **0 0 6 3**

To enable the students to

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

This course is a four months immersive program to keep up with the industry demand and to havecritical thinking, team based project experience and timely delivery of modules in a project that solves world problems using emerging technologies.

To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. **This is an EEC category course offered as an elective, under the type,"Experiential Project Based Learning".**

Highlights of this course:

- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approachesand methodologies.
- Collaborate in teams with other students working on the same topic
- Have a dedicated mentor to guide

COURSE OUTCOMES

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

- Upskill in emerging technologies and apply to real industry-level use cases
- Understand agile development process
- Develop career readiness competencies, Team Skills / Leadership qualities
- Develop Time management, Project management skills and Communication Skills
- Use Critical Thinking for Innovative Problem Solving
- Develop entrepreneurship skills to independently work on products

The course will involve 40-50 hours of technical training, and 40-50 hours of project development. The activities involved in the project along with duration are given in Table 1.

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on trainingon selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to beuploaded to cloud based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverablesas per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

COURSE OUTCOMES

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

- understand the background and driving forces for taking an agile approach tosoftware development.
- understand the business value of adopting agile approaches and agile development practices.
- drive development with unit tests using test driven development.
- apply design principles and refactoring to achieve agility.
- deploy automated build tools, version control and continuous integration andperform testing activities within an agile project

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CO4	2	3	-	-	2	-	-	-	-	1	-	1	2	-
CO5	2	3	-	3	3	-	-	-	-	-	-	1	2	1

IT19451 MOBILE ADHOC NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- acquire the different types of MAC protocols.
- familiarize with different types of adhoc routing protocols.
- to know the TCP issues in adhoc networks.
- understand the architecture and protocols of AD-HOC networks.
- to know about the various quality wireless networks.

UNIT I INTRODUCTION 9

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum, Radio Propagation Mechanisms, Characteristics of the Wireless Channel; Mobile Ad-Hoc Networks (MANETs) and Wireless Sensor Networks (WSNs)- Concepts and Architectures, Applications of Ad-Hoc and Sensor Networks, Design Challenges in Ad- Hoc and Sensor Networks.

UNIT II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9

Issues in designing a MAC Protocol - Classification of MAC Protocols; Contention based Protocols- Contention based Protocols with Reservation Mechanisms, Contention based Protocols with Scheduling Mechanisms; Channel MAC-IEEE 802.11.

UNIT III NETWORK PROTOCOLS 9

Addressing issues in AD-HOC Network; Routing Protocols- Design issues, Goals and Classification ,Proactive vs. Reactive Routing, Unicast Routing Algorithms, Multicast Routing Algorithms, Hybrid Routing Algorithm, Power/ Energy aware Routing Algorithm, Hierarchical Routing, QOS aware Routing.

UNIT IV END -TO - END DELIVERY AND SECURITY 9

Transport Layer- Issues in Designing- Transport Layer Classification, ADHOC Transport Protocols; Security Issues in ADHOC Networks- Issues and Challenges, Network Security Attacks, Secure Routing Protocols.

UNIT V CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G 9

Cross Layer Design- Need for Cross Layer Design, Cross Layer Optimization, Parameter Optimization Techniques, Cross Layer Cautionary Perspective; Co-operative Networks- Architecture, Methods of Co- operation, Co-operative Antennas; Integration of Ad-Hoc Network with other Wired and Wireless Networks.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- implements the concepts, network architectures and applications of ad hoc and wireless sensor networks.
- create the unique issues in ad-hoc/sensor networks.
- identify the protocol design issues of ad hoc and sensor networks.
- understand routing protocols for ad hoc and wireless sensor networks with respect to someprotocol design issues.
- to apply the quos related performance measurements of ad hoc and sensor networks.

TEXT BOOKS

1. C. Siva Ram Murthy, and B. S. Manoj, -"Ad Hoc Wireless Networks: Architectures andProtocols" - Prentice Hall Professional Technical Reference, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal –"Ad Hoc & Sensor Networks:Theory and applications‖", World Scientific Publishing Company, 2006.

REFERENCES

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivanstoj menovic, "Mobile adhoc networking", Wiley-IEEE press, 2004.
2. Feng Zhao and LeonidesGuibas, -"Wireless Sensor Networks", Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig –"Protocols and Architectures for Wireless Sensor Networks", Wiley,2005.
4. Department of English and Foreign Languages SRM University, -Rhythm of Life‖, SRM Publications,2013.

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CO5	3	3	2	1	1	1	-	-	-	-	-	1	3	1

IT19452 FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGIES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand blockchain's fundamental components, and examine decentralization usingblockchain.
- understand bitcoin and its limitations by comparing with other alternative coins.
- explain the components of ethereum and programming languages for ethereum.
- study the basics of hyper ledger and web3.
- know the alternative blockchain technologies

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Introduction - Elements of Blockchain, Types of Blockchain, benefits, Challenges; Consensus ;Decentralization using Blockchain - Blockchain and Full Ecosystem Decentralization

UNIT II BITCOIN 9

Bitcoin - Digital Keys and Addresses ,Transactions , blockchain - Mining , Bitcoin Networks and Payments , Wallets ; Alternative Coins - Theoretical Limitations , Bitcoin limitations , Namecoin, ,Primecoin , Zcash ; Smart Contracts - Ricardian Contracts.

UNIT III ETHEREUM 9

Introduction Ethereum– Components of Ethereum ; Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain,, Fee Schedule ;Supporting Protocols – Solidity Language

UNIT IV WEB3 AND HYPERLEDGER 9

Introduction to Web3 - Contract Deployment, POST Requests, Development Frameworks; Hyperledger as a Protocol - The Reference Architecture, Hyperledger Fabric - Distributed Ledger; Corda.

UNIT V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS 9

Kadena, Ripple, Rootstock ,Quorum, Tendermint - Scalability, Privacy, Other Challenges; Blockchain Research - Notable Projects, Miscellaneous Tools.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the technology components of blockchain and how it works behind thescenes.
- understand bitcoin and its limitations by comparing with other alternative coins.

- devise solution using the ethereum model.
- understand and use hyperledger and its development framework.
- know the alternative blockchain and various research in blockchain technology.

TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach",VPT, 201
2. Alexander Lipton,Adrien Treccan,"Blockchain and Distribiuted Ledgers:Mathematics,Technolo and Econmics",Word Scientific,2021.
3. Elard Elrom,"The Blockchain Developer-A practical guide for designing, Implementing,publishing,Testing, and securing Distributed blockchain-based projects",Apress,2019.
4. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

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CO5	2	1	1	1	3	1	3	1	-	-	1	1	2	1

IT19453 **BIO INFORMATICS** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn about fundamentals of bioinformatics .
- study about challenges in integration of biological information .
- familarise about machine learning in bioinformatics.
- learn about modeling biological information systems
- understand the visualization and fractal analysis in bioinformatics.

UNIT I INTRODUCTION 9

Overview - An Overview of Bioinformatics Technologies, Overview of Structural Bioinformatics, Organization of Structural Bioinformatics, Primary Resource; Protein Data Bank; Secondary Resources and Applications; Using Structural Bioinformatics; Approaches in Drug Design ; The Future.

UNIT II DATABASE WAREHOUSING IN BIOINFORMATICS 9

Introduction - Bioinformatics Data, Transforming Data to Knowledge , Data Warehouse Architecture , Data Quality, Data Mining for Bioinformatics; Biomedical Data Analysis, DNA Data Analysis, Protein Data Analysis.

UNIT III MACHINE LEARNING IN BIOINFORMATICS 9

Artificial Neural Network: Neural Network Architectures and Applications, Genetic Algorithm, Systems Biotechnology, a New Paradigm in Biotechnology Development; Tools for Systems Biotechnology, Integrative Approaches, In Silico Modeling and Simulation of Cellular Processes; Statistical Modeling, Dynamic Modeling.

UNIT IV COMPUTATIONAL MODELING 9

Hybrid Petri Net and Hybrid Dynamic Net ; Hybrid Functional Petri Net; Hybrid Functional Petri Net with Extension; Modeling of Biological Processes with HFPNe; Genomic Object Net - GON, Visualizer , BPE, Hidden Markov Modeling for Biological Data Analysis, Comparative Modeling, Probabilistic Modeling, Molecular Modeling; Pattern Matching for Motifs; Gene Regulation; Motif Recognition; Motif Detection Strategies.

UNIT V VISUALIZATION AND FRACTAL ANALYSIS 9

Fractal Analysis ; DNA Walk Models - Chaos Game Representation of Biological Sequences, Two-Dimensional Portrait Representation of DNA Sequences, One-Dimensional Measure Representation of Biological Sequences, Microarray Data Analysis- Introduction; Microarray Technology for Genome Expression Study, Image Analysis for Data Extraction.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand about fundamentals of bio informatics.
- study about challenges in integration of biological information.
- understand about data management in bio informatics.
- learn about designing biological information systems
- deploy the various integration platform in bioinformatics.

TEXT BOOKS

1. Zoe Lacroix and Terence Critchlow, "Bioinformatics - Managing Scientific Data", Elsevier, 2003.

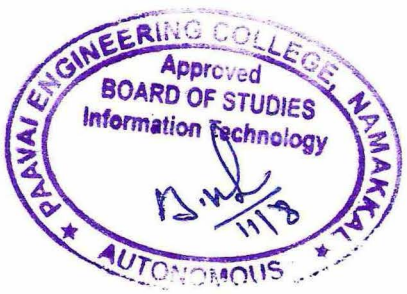
REFERENCES

1. Arthur M.Lesk, "Introduction to Bioinformatics", Oxford University press, India, 2005.
2. Attwood.T.K., et al., " Introduction to Bioinformatics", Pearson education, 1999.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	1	-	-	-	-	-	-	-	1	2	1
CO2	3	3	-	1	-	-	-	-	-	2	-	1	2	1
CO3	3	2	-	1	1	-	-	-	-	2	-	1	2	2
CO4	3	2	-	1	2	-	-	-	-	1	-	1	2	2
CO5	3	2	-	1	2	-	-	-	-	-	-	1	2	1



IT19454 SOFT COMPUTING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge on the preliminaries of evolutionary computing.
- learn the fundamentals of intelligent systems.
- acquire knowledge on neural networks.
- learn the fundamentals of artificial neural networks.
- know how cooperative neuro-fuzzy systems work.

UNIT I EVOLUTIONARY AND SOFT COMPUTING 9

Introduction; Overview of evolutionary computing, Genetic algorithms and optimization, Genetic algorithm operators, Integration of genetic algorithms with neural networks, Evolutionary strategies, ES applications.

UNIT INTRODUCTION TO INTELLIGENT SYSTEMS AND SOFT 9

Introduction, Intelligent systems, Knowledge-based systems - Architectures of knowledge-based systems, Production systems, Frame-based systems, Blackboard systems, Object-oriented programming, Expert systems, Knowledge representation and processing, Soft computing.

UNIT III DYNAMIC NEURAL NETWORKS 9

Background, Training algorithms – Back propagation through time (BPTT), Real-time back propagation learning; Fields of applications of RNN, Dynamic neural networks for identification and control, Neural network-based control approaches, Dynamic neural networks for chaos time series prediction, Artificial neural networks for chaos prediction.

UNIT IV ARTIFICIAL NEURAL NETWORKS 9

Introduction, Learning and Acquisition of Knowledge, Features of Artificial Neural Networks, Fundamentals of Connectionist Modeling; Major Classes of Neural Networks - Multilayer Perceptron, Radial Basis Function Networks.

UNIT V NEURO-FUZZY SYSTEMS 9

Background, Architectures of Neuro Fuzzy Systems - Cooperative Neuro Fuzzy Systems, Neural Network Driven Fuzzy Reasoning, Hybrid Neuro Fuzzy Systems; Construction of Neuro Fuzzy Systems – Structure Identification Phase, Parameter Learning Phase.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the concept of genetic algorithm
- implement the basic concept of intelligent systems.
- illustrate the Network based approach of Dynamic neural networks.
- identify the key features of artificial neural systems.
- illustrate the concept of Neuro fuzzy systems.

TEXT BOOKS

1. Fakhereddine O Karray and Clarence De Silva, —"Soft Computing and Intelligent Systems Design: Theory,Tools and Applications", Pearson, 2009.

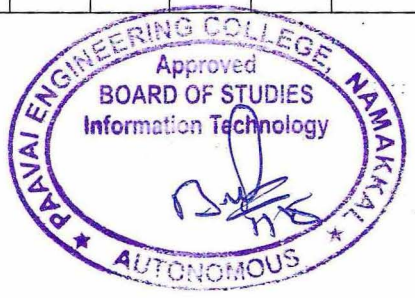
REFERENCES

1. Madan M Gupta and Naresh K Sinha, —"Soft Computing and Intelligent Systems: TheoryandApplications", Academic Press, 1999
2. S Rajasekaran and G A Vijayalakshmi Pai, —"Neural Networks, Fuzzy Logic and Genetic Algorithms Synthesis and Applications", Prentice Hall India, 2003.
3. S N Sivanandam, S Sumathi and S N Deepa, —"Neural Networks using MATLAB", Tata McGraw- Hill,2005.
4. "Neural Networks and Learning Machines", (3rd Edn.), Simon Haykin, PHI Learning, 2011.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	-	1	1	3	1	1	1	2	1
CO2	2		1			1	2	-	2	2	1	1	1	1
CO3	1	2	1	1	1	-	-	-		1	3	1	2	2
CO4			2		2	1	1	-	2	1	-	-	1	-
CO5	2	2	1	2	1	-	-	-		1	-	1	2	1



IT19551 WIRELESS SENSOR NETWORKS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the overview of wireless sensor networks.
- describe the design methodology for transmission and wireless sensor network.
- know about the MAC protocols features and wireless sensor technology.
- understand the use of routing protocol and transport control protocol.
- analyse the characteristics of middleware and network management.

UNIT I INTRODUCTION 9

Introduction- Basic Overview of the Technology; Applications of Wireless Sensor Networks; Background- Range of Applications - Examples of Category 2 WSN Applications - Examples of Category 1 WSN Applications- Another Taxonomy of WSN Technology.

UNIT II BASICS, TRANSMISSION TECHNOLOGY AND SYSTEMS 9

Sensor Node Technology- Sensor Taxonomy- WN Operating Environment - WN Trends - Radio Technology Primer - Available Wireless Technologies.

UNIT III MAC PROTOCOLS 9

Background- Fundamentals of MAC Protocols - MAC Protocols for WSNs - Sensor-MAC Case Study - IEEE 802.15.4 LR - WPANs Standard Case Study.

UNIT IV ROUTING PROTOCOLS AND TRANSPORT CONTROL PROTOCOLS 9

Background - Data Dissemination and Gathering - Routing Challenges and Design Issues in WirelessSensor Networks- Routing Strategies in Wireless Sensor Networks; Traditional Transport Control Protocols- Transport Protocol Design Issues - Examples of Existing Transport Control Protocols - Performance of Transport Control Protocols.

UNIT V MIDDLEWARE AND NETWORK MANAGEMENT 9

WSN Middleware Principles - Middleware Architecture - Existing Middleware; Network Management; Network Management Requirements - Traditional Network Management Models- Network Management Design Issues- Example of Management Architecture - WSN Design Issues - Performance Modeling of WSNs.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basics of Wireless Sensor Networks.
- study about the basics and systems of wireless sensor networks .
- analyse Medium Access Control Protocol.
- know about the routing protocols and transport control protocol for WSN.
- apply the network management and the middleware.

TEXTBOOKS

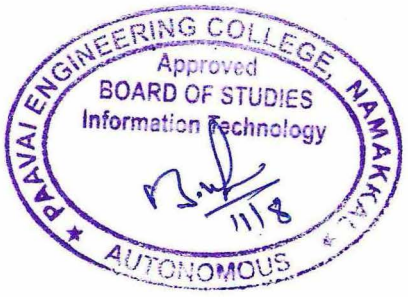
1. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks: Technology, Protocols and Applications", John Wiley and sons, 2007.

REFERENCES

1. Holger Karl, Andreas Willing, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.
2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufmann, 2004.
3. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley 2003.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	-	-	3	2	2	3	3	3
CO2	3	2	3	2	3	2	-	-	3	2	2	3	3	3
CO3	3	2	3	3	2	3	-	-	3	2	2	3	3	3
CO4	2	3	3	3	3	2	-	-	3	2	2	3	3	3
CO5	3	2	3	2	3	3	-	-	3	2	2	3	3	3



IT19552 **5G TECHNOLOGY** 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know about the drivers for 5G.
- understand the basics of 5G Internet.
- familiarize about the small cells and mobile clouds for 5G.
- acquire the knowledge about cognitive radio for 5G wireless networks.
- understand the security issues and basics of self-Organizing Network for 5G communication.

UNIT I DRIVERS FOR 5G 9

Historical trend of Wireless Communication ; Evolution of LTE (Long Term Evolution) Technology to Beyond 4G; 5G Roadmap; 10 Pillars of 5G; 5G Architecture.

UNIT II THE 5G INTERNET 9

Internet of Things ; Networking Reconfiguration and Virtualization Support ; Mobility; Quality of Service Control; Emerging Approach for Resource over- Provisioning.

UNIT III SMALL CELLS AND MOBILE CLOUDS FOR 5G 9

Small Cells -WiFi and Femtocells ; Capacity Limits and Achievable Gains; Mobile Data Demand; Small Cell Challenges - The Mobile Cloud, Mobile Cloud Enablers, Network Coding.

UNIT IV COGNITIVE RADIO FOR 5G WIRELESS NETWORKS 9

Overview of Cognitive Radio Technology in 5G Wireless ; Spectrum Optimization using Cognitive Radios Spectrum Optimization Literature in 5G; Cognitive Radio and Carrier Aggregation; Energy Efficient Cognitive Radio Technology.

UNIT V SECURITY AND SELF ORGANIZING NETWORK FOR 5G COMMUNICATION 9

System Architecture - Security Issues and Challenges in 5G Communication; SON (Self Organizing Network) in UMTS (Universal Mobile Telecommunications Services) and LTE – Need for SON in 5G, Evolution towards Small cell Dominant HetNets.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- demonstrate the drivers for 5G.
- implement the basics of 5G Internet.
- design small cells and mobile clouds for 5G.
- create cognitive radio for 5G wireless networks.
- identify the security issues and basics of self-Organizing Network for 5G communication.

TEXT BOOKS

1. A Jonathan Rodriguez- "Fundamentals of 5G Mobile Network"- John Wiley- First Edition 2015.
2. Yang Yang- Jing Xu- " 5G wireless Systems- Simulation and Evaluation Techniques"- Springer2015.

REFERENCES

1. SassanAhmadi- "LTE-Advanced: A Practical Systems Approach to Understanding 3GPP LTE Releases 10and 11 Radio Access Technologies" 1st Edition –Elsevier
2. Vincent W.S. Wong " Key Technologies for 5G Wireless systems"- ISBN -13:978-1107172418.
3. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, - 5G Mobile Communications, Springer, 2017.
4. Afif Osseiran, Jose F. Monserrat and Patrick Marsch, - "5G Mobile and Wireless Communications Technology",Cambridge University Press, 2016.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO2	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO3	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO4	3	-	-	2	2	-	-	-	-	-	-	1	2	1
CO5	3	-	-	2	2	-	-	-	-	-	-	1	2	1

IT19553 CYBER FORENSICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn digital forensics.
- become familiar with forensics tools.
- know and identify crime and dos.
- acquire about the tools and graphics.
- understand the data hiding and virtual machine.

UNIT I INTRODUCTION TO DIGITAL FORENSICS 9

Overview of Digital Forensics, Preparing for Digital Investigations, Digital Forensics Investigations, Private sector High - Tech Investigations, Data recovery workstations, Conducting an Investigation.

UNIT II INVESTIGATOR AND DATA ACQUISITION 9

Investigator Office - Understanding Forensics Lab Accreditation Requirements, Determining the Physical Requirements for a Digital Forensics, Selecting a Basic Forensic Workstation; Data Acquisition - Understanding Storage Formats for Digital Evidence, Using Acquisition Tools, Validating Data Acquisitions, Performing RAID Data Acquisitions, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools.

UNIT III PROCESSING CRIME AND SYSTEMS 9

Processing Crime and Incident Scenes - Identifying Digital Evidence, Preparing for a Search - Seizing Digital Evidence at the Scene, Storing Digital Evidence, Reviewing a Case; Working with Windows and DOS Systems, Understanding File Systems, Examining NTFS Disks, Understanding Whole Disk Encryption, Windows Registry, Microsoft Startup Tasks, Virtual Machines.

UNIT IV TOOLS AND GRAPHICS FILES 9

Computer Forensics Tools - Software/ Hardware Tools, Validating and Testing Forensics Software; Linux and Macintosh File Systems - Examining Linux File Structures, Understanding Macintosh File Structures, Recovering Graphics Files, Recognizing a Graphics File, Locating and Recovering Graphics Files, Identifying Unknown File Formats.

UNIT V ANALYSIS AND VALIDATION 9

Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding techniques; An Overview of Virtual Machine Forensics, Performing Live Acquisitions, Network Forensics Overview; E-mail Crimes and Violations.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basics of digital forensics.
- apply a number of different computer forensic tools to a given scenario.
- analyze and identify the crime and virtual machine in forensics data.
- identify the tools given in a given graphics file.
- implement data hiding and network forensics using virtual machine.

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2016.
2. "CEH official Certfied Ethical Hacking Review Guide", Wiley India Edition, 2015.

REFERENCES

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005
2. MarjieT.Britz, "Computer Forensics and Cyber Crimell: An Introduction", 3rd Edition,Prentice Hall, 2013.
3. AnkitFadia ,"Ethical Hacking", Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik,"Insider Computer Fraud",Auerbach Publications Taylor & FrancisGroup– 2008.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium ,1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	1	2	1	2	2	2	-	2	1	1
CO2	-	2	1	2	2	1	2	-	2	2	1	1	2	1
CO3	3	2	2	1	-	1	1	3	1	1	1	1	1	-
CO4	2	2	3	1	2	1	1	3	1	2	1	2	2	2
CO5	1	1	2	1	-	-	1	-	2	3	1	1	1	2

IT19554 SOFTWARE TESTING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the overview of maths in software testing.
- learning the unit testing design.
- analyze the levels of decision and code-based testing.
- know and study the testing in object-oriented software.
- evaluate the beyond the unit testing.

UNIT I MATH PERSPECTIVE ON TESTING 9

A Perspective on Testing: Basic Definitions -Test Cases-Insights from a Venn Diagram-Identifying Test Cases-Fault Taxonomies-Levels of Testing; **Examples:** Structural Elements of Pseudo - code and Java - The Triangle Problem-The Garage Door Controller - The Windshield Wiper Controller; **Discrete Math for Testers:** Set Theory - Functions - Relations - Propositional Logic; **Graph Theory for Testers:** Graphs - Directed Graphs - Graphs for Testing.

UNIT II UNIT TESTING 9

Boundary Value Testing: Normal Boundary Value Testing- Robust Boundary Value Testing - Worst Case Boundary Value Testing - Special Value Testing – Examples - Random Testing- Guidelines for Boundary Value Testing; **Equivalence Class Testing :** Equivalence Classes-Traditional Equivalence Class Testing-Improved Equivalence Class Testing- Equivalence Class Test Cases for the Triangle Problem - Equivalence Class Test Cases for the Next Date Function-Equivalence Class Test Cases for the complete Order Method-"Edge Testing"-Reflections on Invalid Classes-Guidelines and Observations.

UNIT III DECISION TABLE AND CODE BASED TESTING 9

Decision Table-Based Testing: Decision Tables- Decision Table Techniques- Test Cases for the Triangle Problem- Test Cases for the NextDate Function- Cause and Effect Graphing- Guidelines and Observations; **Code-Based Testing :** Program Graphs- DD-Paths- Code Coverage Metrics- Basis Path Testing- Guidelines and Observations.

UNIT IV TESTING OBJECT-ORIENTED SOFTWARE 9

Testing Object-Oriented Software : Unit Testing Frameworks - Mock Objects and Automated Object Mocking- Dataflow Testing- Object-Oriented Complexity Metrics- Issues in Testing Object-Oriented Software- Slice-Based Testing; **Retrospective on Unit Testing :** The Test Method Pendulum- Traversing the Pendulum- Insurance Premium Case Study- Specification-Based Testing- Guidelines.

UNIT V BEYOND UNIT TESTING 9

Life Cycle-Based Testing: Traditional Waterfall Testing - Testing in Iterative Lifecycles- Remaining Questions- Pros, cons, and Open Questions of TDD- Retrospective on MDD vs. TDD; **Integration Testing:** Decomposition-Based Integration - Call Graph-Based Integration - Path-Based Integration- Example: O-O integrationNextDate -Model-Based Integration Testing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- familiarize the basic concepts used in software testing.
- acquire and apply the various testing design .
- analyze the various levels of testing.
- obtain the Knowledge over object-oriented testing.
- evaluate the process of integration and life cycle testing.

TEXTBOOKS

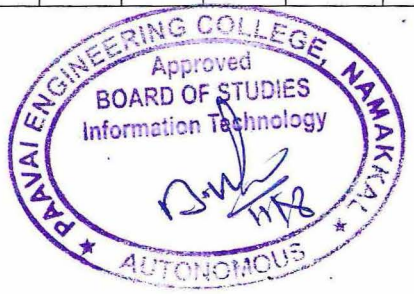
1. Paul C. Jorgensen, Byron DeVries – "Software Testing_ A Craftsman's Approach"-Auerbach Publications (2021).

REFERENCES

1. Sagar Naik, Piyu Tripathy –" Software Testing and Quality Assurance Theory and Practice"-Wiley (2008)
2. Srinivasan Desikan and Gopalaswamy Ramesh, -"Software Testing - Principles and Practices", Pearson Education, 2011.
3. Rex Black , "Managing the Testing Process", John Wiley & Sons, 2009.
4. AdityaP.Mathur, —"Foundations of Software Testing", Pearson Education, 2008.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	-	-	1	1	-	-	-	2	2
CO2	3	3	2	1	2	-	-	1	1	1	2	1	2	1
CO3	3	3	3	2	2	-	-	2	2	-	-	1	2	1
CO4	3	3	2	1	2	-	-	2	2	2	2	-	2	1
CO5	3	2	3	2	3	-	-	2	2	2	2	-	2	2



BA19354 DIGITAL AND SOCIAL MEDIA MARKETING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the fundamentals of marketing.
- know the nuances of digital marketing strategies with the e-commerce platform
- recognise the current trends in social media marketing.
- familiarise with the approaches and techniques in CRM.
- realise the significance of e-retailing & its use in B2B marketing

UNIT I INTRODUCTION TO MARKETING 9

Marketing – Definition, Marketing Mix, Marketing Environment - Internal and External; Supply Chain Operations (SCO), Supply Chain Management (SCM) – Techniques of SCM; Marketing in global environment – Prospects and Challenges.

UNIT II DIGITAL MARKETING STRATEGY 9

Digital Marketing – Meaning, Digital Marketing Strategy, An integrated Internet marketing strategy, A generic strategic approach - Strategic goal setting, formulation and Implementation. Online marketing mix - E-product, STP, E-price, E-Promotion.

UNIT III SEARCH ENGINE OPTIMIZATION 9

Social Media Channels, Social Media Strategy, Web PR and Online reputation management.

UNIT IV CUSTOMER RELATIONSHIP 9

Customer relationship management - Approaches to implementing e-CRM; Customer Life Cycle management; Interactive marketing communications – characteristics; Offline promotion techniques, Online promotion techniques.

UNIT V INTERNET MARKETING AND OPTIMIZATION 9

Online customers, E-retailing - E-retail activities, Implications of e-retail marketing strategy, B2B e-context, Trading relationships in B2B markets; Web Analytics – Conversion, Optimization.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyse the internal and external marketing environment.
- adapt the appropriate strategies to be used in digital marketing.
- comprehend the significance of social media and its channels.
- plan and apply the techniques for customer relationship management.

TEXT BOOKS

1. Rob Stokes, (2016), E-Marketing: The Essential Guide to Digital Marketing, 5thedition, Quirk Education.
2. Dave Chaffey, Fiona Ellis-Chadwick, Richard Mayer, Kevin Johnston, (2015), Internet Marketing: Strategy, Implementation and Practice, Prentice Hall.

REFERENCES

1. Liana Li Evans, "Social Media Marketing: Strategies for Engaging in Face book, Twitter & Other Social Media", Que Press; Ed 2010
2. Vandana Ahuja, (2015), Digital Marketing, 1st edition, Oxford University Press
3. G.Shainesh Philip Kotler, Kevin Lane Keller, "Marketing Management", Indian Case Studies Included, 16th Edition/By Pearson. 1 April 2022

CO – PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	2	-	-	-	-	1	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	-	-	-	-	-	1	-	-	-	-	-	-	1
CO4	-	2	-	-	-	-	2	-	-	-	1	-	-	-
CO5	-	-	-	1	-	-	-	-	-	-	-	-	-	-

IT19651 SERVICE ORIENTED ARCHITECTURE 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain understanding of the basic principles of service orientation.
- understand web service oriented analysis.
- learn technology underlying the service design.
- familiarize advanced concepts such as top down and bottom up strategy.
- to know about various ws -specification standards.

UNIT I BASICS OF SOA 9

Fundamental SOA, Evolution and Characteristics of SOA, SOA Timeline, ROOTS of SOA - Comparing SOA to past Architectures, SOA vs. Client server architecture, SOA vs. Distributed internet architecture, and SOA vs. Hybrid web service architecture, service orientation and object orientation.

UNIT II WEB SERVICES 9

Web services –Web services framework, Services, Service descriptions, Messaging with SOAP; Web Services and Contemporary SOA - Message exchange Patterns, Service Activity, Coordination, Atomic Transactions, Business activities, Orchestration, Choreography.

UNIT III PRINCIPLES OF SERVICE-ORIENTATION 9

Introduction - Service-orientation and the enterprise, Anatomy, Principles of service-orientation; Service Layers - Service layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Service layer configuration scenarios.

UNIT IV PLANNING AND ANALYSIS 9

SOA Delivery Strategies - SOA delivery lifecycle phases, The top-down strategy, The bottom-up strategy, The agile strategy; Service Modeling.

UNIT V BUILDING SOA-BASED APPLICATIONS 9

WS-BPEL basics –Process elements, partner Links and partner Links elements, partner Link Type element, variable element, get variable Property, sequence element, invoke element, receive element, reply element, reply element, Switch case and otherwise elements, assign, copy, from and to elements, WS- Coordination overview; SOA Platforms.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design the basics of SOA.
- desire about the service layers of web services.
- understand and discuss service and design in SOA.
- demonstrate the basic Modelling of SOA.
- describe the various applications of SOA.

TEXT BOOKS

1. Thomas Erl —"Service -Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2008.
2. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.

REFERENCES

1. Thomas Erl, "SOA Principles of Service Design —(The Prentice Hall Service –Oriented Computing Series from Thomas Erl)", 2005.
2. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education,2005.
3. Ron Schmelzer et al. " XML and Web Services", Pearson Education, 2002.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1- Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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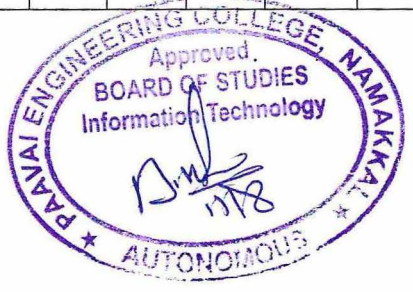
CO2	1	1	2	1	-	-	1	-	3	1	2	-	-	2
CO3	1	1	2	1	-	-	-	-	2	2	1	-	2	2
CO4	2	2	1	2	1	-	-	-	2	1	1	1	2	1
CO5	1	1	2	1	1	-	-	-	3	1	1	2	2	-



IT19652 SOFTWARE PROJECT MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the importance of project planning and project evaluation techniques.
- acquire knowledge in software effort estimation and calculating the project duration.
- analyze the risk and allocate the resources.
- gain knowledge about the monitoring and controlling the software projects and its quality.
- learn the fundamental issues in project management.

UNIT I INTRODUCTION TO PROJECT PLANNING AND EVALUATION 9

Project Definition, Importance of Software Project Management, Software Projects Vs Other Projects, Activities Covered by SPM, Setting Objectives; Cost Benefit Evaluation Techniques; Stepwise Project Planning.

UNIT II SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING 9

Project Approach , Agile Methods, Extreme Programming, Scrum; Software Effort Estimation - Problems with over and under estimates, Software effort estimation techniques, Bottom-up estimating, Top down estimating, Estimating by analogy, Albrecht function point analysis.

Activity Planning, Objectives of Activity planning, Project Schedules, Project and Activities, Sequencing and Scheduling, Activity on Arrow Networks, Forward Pass, Backward Pass, Identifying Critical Path, Activity Float, Shortening Project Duration.

UNIT III RISK MANAGEMENT AND RESOURCE ALLOCATION 9

Risk Management - Categories of Risk, A Framework for dealing Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Risk Evaluation, Applying the PERT technique, Monte Carlo Simulation; Resource Allocation - The Nature of resources, Identifying Resource Requirements, Scheduling Resources, Creating critical paths, Counting the cost, Publishing the resource schedule, The Scheduling Sequence.

UNIT IV MONITORING AND CONTROLLING OF PROJECTS AND ITS QUALITY 9

Monitoring and Controlling of Software Projects - Collecting the data, Visualizing Progress, Cost monitoring, Earned value analysis, Prioritizing monitoring; Software Quality - The importance of Software Quality, Software Quality Definition, ISO9126, Product Vs Process Quality Management, Process Capability Models, and Techniques to help enhance software quality.

UNIT V GLOBALIZATION ISSUES IN PROJECT MANAGEMENT 9

Globalization issues in project management - Evolution of globalization, challenges in building global Teams, Models for the execution of some effective management techniques for managing global teams; Impact of the internet on project management: Introduction, The effect of the internet on project management, Managing projects for the internet, Effect on project management activities; Comparison of project management software - Dot Project, Launch pad, openProj; Case study - PRINCE2.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- desire the project by applying various evaluation techniques.
- identify the project duration by scheduling the activities.
- understand the risk and allocate the resources accordingly.
- to know the progress of project and find the quality of project.
- implement the issues in project.

TEXT BOOKS

1. Bob Hughes, Mike Cotterell & Rajib Mall "Software Project Management", McGraw- Hill Publications, 6th Edition 2017.
2. Ian Somerville, "Software Engineering", 10th Edition, Pearson Education, 2017.

REFERENCES

1. Robert T. Futrell , "Quality Software Project Management", Pearson Education India, 2008.
2. Gopalaswamy Ramesh, "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models", McGraw Hill Education, 2017.
3. Walker Royce, "Software Project Management", Addison-Wesley, 1998.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes:
(1/ 2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	1	-	-	2	1	-	3	1	3	2	2	1
CO2	-	2	2	1	-	-	1	1	1	2	3	1	1	1
CO3	1	2	1	1	-	-	-	1	2	1	3	-	1	-
CO4	-	3	1	1	-	-	1	-	2	1	2	-	1	1
CO5	1	3	1	-	-	1	1	-	2	1	3	1	2	2

IT19653 RANDOMIZED ALGORITHMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn about tools and techniques .
- study about Randomized data structures.
- familarise about online algorithms.
- understand about distributed algorithms.
- familarise the streaming algorithms.

UNIT I TOOLS AND TECHNIQUES 9

Monte Carlo Algorithms Exemplified by Karger's Min-Cut and Randomized primalitytesting; Las Vegas Algorithms Exemplified by Quicksort, Selection and Binary Planar Partitions.

UNIT II RANDOMIZED DATA STRUCTURES 9

Random Treaps: Skip Lists,Hash Tables, Universal Family of Hash Functions; Perfect Hashing: Randomized Computational Geometry , Illustrations of Randomized Incremental Algorithms like Randomized Convex Hull Construction, Geometric Duality, Half Space Intersections; Delaunay Triangulation; Trapezoidal; Decomposition: Illustrations of Random Sampling like Point, Location in Arrangements and Linear Programming.

UNIT III ONLINE ALGORITHMS 9

Adversary Models: Online Paging Against Oblivious and Adaptive Adversaries, Yao's Minimax Principle, Lower Bound for Online Paging against an Oblivious Adversary, the K-Server Problem.

UNIT IV DISTRIBUTED ALGORITHMS 9

Symmetry Breaking Problems like Leader Election: Byzantine Agreement, Maximal Independent Set and Colouring: Algorithms for Dynamic Networks: the K-Machine Model for Processing Large Graphs.

UNIT V STREAMING ALGORITHMS 9

The Streaming Model: Approximate Counting, Reservoir Sampling; AMS Sketching; **Property Testing Algorithms:** the Property Testing Model, Testing Whether a Graph is Connected, Bipartite (Enforce and Test Paradigm) and Triangle Free (using Szemeredi's Regularity Lemma).

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand about tools and techniques.
- understand about challenges in randomized data structures.
- understand about online algorithms.
- obtain the knowledge over distributed algorithms.
- deploying the various streaming algorithms.

TEXT BOOKS

1. "Randomized Algorithms", by Motwani and Raghavan, Cambridge University Press, 1995.
2. "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", by Mitzenmacherand Upfal, Cambridge University Press, 2nd edition, 2017

REFERENCES

1. "Computational Geometry: Algorithms and Applications", by Mark de Berg, Otfried Cheong,Marcvan Kreveld, and Mark Overmars, 3rd edition, Springer-Verlag, 2008.
2. "Algorithmic and Analysis Techniques in Property Testing", by Dana Ron. Found. Trends Theor.Comput. Sci. 5, 2 (February 2010), 73-205.
3. "Mining of Massive Datasets", by Leskovec, Rajaraman, and Ullman, available
4. http://www.mmds.org.

CO PO MAPPING:

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CO1	3	1	1	-	-	-	-	-	-	-	-	1	3	1
CO2	3	1	1	-	-	1	-	-	-	2	-	1	2	1
CO3	3	1	2	-	1	1	-	-	-	2	-	1	2	1
CO4	3	1	2	-	2	1	-	-	-	1	1	1	2	1
CO5	3	1	3	-	2	-	-	-	-	-	2	1	2	1

IT19903 FUNDAMENTALS OF INTERNET OF THINGS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the overview of internet of things with various design levels and templates.
- describe the generic design methodology for internet of things with python programming.
- know about the raspberry pi and arduino and how to program it using python
- understand the use of cloud platforms & frameworks for developing IoT applications.
- analyze the characteristics and applications of domain specific IoTs for real life scenarios.

UNIT I INTRODUCTION TO IoT 9

Introduction - Definition and Characteristics of IoT; Physical Design of IoT; Logical Design of IoT; IoTEnabling Technologies; IoT Levels and Deployment Templates.

UNIT II IOT SYSTEMS-LOGICAL DESIGN USING PYTHON 9

Motivation for using Python - Logical Design using Python, Python Data Types & Data Structures, Control Flow, Functions, Modules ,Packages, File Handling, Date / Time Operations, Classes, Python Packages of Interest for IoT.

UNIT III IOT PHYSICAL DEVICE P& ENDPOINTS 9

Basic building blocks of IoT device-Raspberry Pi, Board details, Programming Raspberry pi with Python; Arduino; IoT Protocols.

UNIT IV IOT PHYSICAL SERVERS & CLOUD OFFERINGS 9

Introduction to Cloud Storage Models & Communication APIs - WAMP, Xively Cloud; Django; Skynet IoT Messaging Platform; Amazon Web Services for IoT.

UNIT V APPLICATIONS 9

Home Automation; Smart Cities - Environment, Energy; Retail, Logistics; Agriculture; Industry; Health and Lifestyle.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the basic concepts and technologies used in internet of things.
- apply the generic design methodology for internet of things with python programming to design the model.

- gain the knowledge of raspberry pi device and its use in cloud platforms and other frameworks for developing iot applications.
- understand the processes of collecting and analyzing data generated by iot systems in the cloud.
- obtain the knowledge of the different types of domain specific iots for real life applications.

TEXT BOOKS

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things - A hands - on approachl", Universities Press, 2015.
2. Peter Waher ,"Learning Internet of Things",Packt Publications,2015.

REFERENCES

1. Charalampos Doukas, —Building Internet of Things With the Arduino, Volume 1, published by Create space, 2012.
2. Andrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1st edition, John Wiley& Sons Ltd, 2014.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st edition, CRC Press, 2013.

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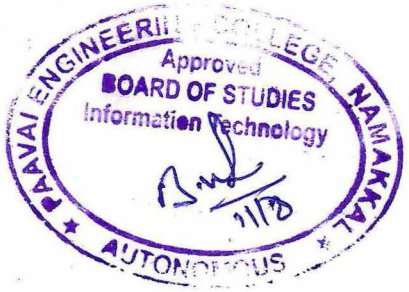
CO3	3	3	3	3	3	1	2	-	2	-	1	2	2	2
CO4	3	2	2	1	3	1	3	-	1	-	1	2	2	1
CO5	3	3	3	3	2	1	3	-	1	-	2	2	2	2



IT19904 IT INFRASTRUCTURE MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the basics of it infrastructure.
- understand the basics of data center and its performance metrics.
- acquire the basics of compute and storage services provided in cloud.
- learn the basics of cloud platforms and technologies.
- study the security issues associated with cloud infrastructure.

UNIT I INTRODUCTION TO INFRASTRUCTURE 9

Introduction to IT Building Blocks – Infrastructure, Nonfunctional Attributes, Calculating Availability, Availability Percentages and Intervals, Mean Time Between Failures (MTBR), Mean Time to Repair (MTTR), Sources of Unavailability, Availability Patterns; Performance concepts – Introduction to Performance, Performance During Infrastructure Design, Performance of a Running System, Performance Patterns.

UNIT II DATA CENTERS 9

Introduction, Datacenter Building Blocks – Datacenter Categories, Location of the Datacenter, Physical Structure, Power Supply, Cooling, Fire Prevention, Detection, And Suppression, Equipment Racks, Datacenter Cabling and Patching, Datacenter Energy Efficiency; Datacenter Availability – Availability Tiers, Redundant Datacenters, Datacenter Performance, Datacenter Security.

UNIT III COMPUTE & STORAGE 9

Introduction, Compute Building Blocks, Memory, Interfaces, Compute Virtualization, Container Technology, Mainframes, Midrange Systems, X86 Servers, Supercomputers; Compute Availability – Compute Performance; Compute Security; Popular Operating Systems, Operating System Availability, Operating System Performance, Operating System Security; Storage - Storage Building Blocks, DAS, NAS, SAN, Software Defined Storage, Storage Availability, Storage Performance, Storage Security.

UNIT IV INFRASTRUCTURE DEPLOYMENTS 9

Introduction, Hosting Options, Enterprise Infrastructure Deployment, Converged Infrastructure, Cloud Computing At A Glance, Cloud Computing Platforms And Technologies, Cloud Reference Model, Types of Cloud, Economics of Cloud, Open Challenges, Cloud Platforms in Industry, Amazon Web Service, Google App Engine, Microsoft Azure.

UNIT V INFRASTRUCTURE SECURITY 9

Introduction, Risk Management, Risk Response, Exploits, Security Controls, Attack Vectors, Identity and Access Management, Segregation of Duties and Least Privilege, Layered Security, Cryptography, Monitoring; Vulnerability Patching, Go Live Process/Checklist, Decommissioning a Service/Device.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design the fundamentals of IT Infrastructure.
- implement the data center infrastructure and its associated performance metrics.
- desire knowledge on infrastructure services (IaaS) provided by different vendors.
- identify various Cloud platforms and associated technologies.
- understand various security issues associated with data centers and cloud applications.

TEXT BOOKS:

1. SJaak Laan, "IT Infrastructure Architecture – Infrastructure Building Blocks and Concepts", Third Edition, Lulu Press Inc, 2017.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Prentice Hall, 2013.

REFERENCES:

1. IBM, "Introduction to Storage Area Networks and System Networking", Redbooks. 2012, https://www.redbooks.ibm.com/Redbooks.nsf/domains/san?Open&start=46.
2. Ray J. Rafael, "Cloud Computing: From Beginning to End", Second Edition, Wiley, 2018.
3. Matthew Portnoy, "Virtualization Essentials", John Wiley, 2012.
4. Lee Brotherson, Amanda Berlin, "Defensive Security Handbook: Best Practices for securing Infrastructure", O'Reilly, 2017.

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