

SATHYABAMA
INSTITUTE OF SCIENCE & TECHNOLOGY
(Established under section 3 of UGC Act, 1956)



SYLLABUS

MASTER OF SCIENCE

SCHOOL OF COMPUTING

CHENNAI - 600119

REGULATIONS 2020

PROGRAMME: M.Sc., CURRICULUM

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SCSA5101	Advanced Data Structures And Algorithms	3	0	0	3	50	50	
2	Theory	SCSA5102	Database Technologies	3	0	0	3	50	50	
3	Theory	SCSA5103	Software Quality Assurance And Testing	3	0	0	3	50	50	
4	Theory	SBSA5101	Web Based Application Development	3	0	0	3	50	50	
5	Practical	SCSA6101	Advanced Data Structures And Algorithms Lab	0	0	4	2	50	50	
6	Practical	SBSA6101	Web Based Application Development Lab	0	0	4	2	50	50	
Total Credits for Semester: 16										
Total Marks for Semester: 600										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBSA5201	Design Thinking	3	0	0	3	50	50	
2	Theory	SBSA5202	Internet Of Things	3	0	0	3	50	50	
3	Theory	SBSA5203	Introduction To Machine Learning	3	0	0	3	50	50	
4	Theory		ELECTIVE 1	3	0	0	3	50	50	
5	Practical	SBSA6201	Internet Of Things Lab	0	0	4	2	50	50	
6	Practical	S734ASEM 1	Seminar	0	0	4	1	25	25	
Total Credits for Semester: 15										
Total Marks for Semester: 550										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBSA5301	Cyber Physical Systems	3	0	0	3	50	50	
2	Theory	SBSA5302	Introduction To AI	3	0	0	3	50	50	
3	Theory	SBSA5303	Data Science	3	0	0	3	50	50	
4	Theory		ELECTIVE 2	3	0	0	3	50	50	
5	Practical	SBSA6301	Cyber Physical System Lab	0	0	4	2	50	50	
6	Project	S734APROJ1	Project Work (Phase – 1)	0	0	0	3	50	50	
Total Credits for Semester: 17										
Total Marks for Semester: 600										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Project	S734APROJ2	Project Work (Phase – 2)	0	0	0	10	50	50	
Total Credits for Semester: 10										
Total Marks for Semester: 100										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

Semester	Theory courses (including elective courses)			Practical Courses (including PT and project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	4	12	400	2	4	200
2	4	12	400	2	3	150
3	4	12	400	1 Project Phase 1	2 3	200
4				Project Phase 2	10	100
Overall Total	12	36	1200	8	22	650

Total credits for M.Sc., Programme	58
Total marks for M.Sc., Programme	1850

LIST OF ELECTIVES

LIST OF PROFESSIONAL ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBSA7001	Advanced Distributed Computing	3	0	0	3	50	50	
2.	SBSA7002	Big Data Tools And Techniques	3	0	0	3	50	50	
3.	SBSA7003	Computer Vision	3	0	0	3	50	50	
4.	SBSA7004	Cyber Forensics	3	0	0	3	50	50	
5.	SBSA7005	Data Analytics	3	0	0	3	50	50	
6.	SBSA7006	Ethical Hacking And Digital Forensics	3	0	0	3	50	50	
7.	SBSA7007	Mobile Computing	3	0	0	3	50	50	
8.	SBSA7008	Network Security	3	0	0	3	50	50	
9.	SBSA7009	Object Oriented Systems Engineering	3	0	0	3	50	50	
10.	SBSA7010	Open Source Tools	3	0	0	3	50	50	
11.	SBSA7011	Social Network Analysis	3	0	0	3	50	50	
12.	SBSA7012	Software Architecture	3	0	0	3	50	50	
13.	SBSA7013	Software Defined Networks	3	0	0	3	50	50	
14.	SBSA7014	Virtualization Techniques	3	0	0	3	50	50	
15.	SBSA7015	Wireless Sensor Networks	3	0	0	3	50	50	

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

SCSA5101	ADVANCED DATASTRUCTURES AND ALGORITHMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand and analyze fundamental data structures, such as binary search trees, disjoint sets, and self-adjusting lists.
- Understand the implementation and complexity analysis of fundamental algorithms such as RSA, primarily testing, max flow, discrete Fourier transform.
- Will be exposed to algorithmic issues in a variety of areas, including linear programming and game-theory.

UNIT 1**9 Hrs.****INTRODUCTION TO ALGORITHMS**

Role of Algorithms in computing- Analyzing algorithm- Designing algorithm- Asymptotic Notations- Summations -Formulas and properties- Recurrences. SORTING TECHNIQUES: Heap sort – Quick sort-Radix sort- Bucket sort- Analysis of sorting algorithms.

UNIT 2**9 Hrs.****TREE STRUCTURES**

Binary Search Trees- AVL Trees- Red-Black Trees- B-Trees-Splay Trees - HEAP STRUCTURES: Min/Max heaps- Leftist Heaps- Binomial Heaps- Fibonacci Heaps.

UNIT 3 MULTIMEDIA STRUCTURES**9 Hrs.**

Segment Trees- k-d-Trees-Point Quad Trees-MX-Quad Trees-R-Trees-TV-Trees.

UNIT 4 PROBLEM SOLVING TECHNIQUES**9 Hrs.**

Branch and Bound-NP hard and NP complete problems-Huffman Coding-Activity Networks-Flow Shop Scheduling-Randomized Algorithms. ALGORITHMS: Greedy Algorithms-Backtracking-Dynamic programming- Divide and Conquer.

UNIT 5 GRAPH ALGORITHMS**9 Hrs.**

Graph Representation-BFS-DFS-Topological Sort-Connected Components-Minimum Spanning Trees-- Kruskal's Algorithm - Prim's Algorithm – Dijkstra's Algorithm – Floyd's Algorithm – Bellman Ford Algorithm.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, "Introduction to Algorithms", PHI, 2002.
2. Sara Baase, Allen G. Galletta, "Computer Algorithms and Introduction to Design and Analysis", Pearson, 2000.
3. Sahni, "Data Structures algorithm and application in C++", PHI, 2000.
4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Addison Wesley, 3rd Edition.
5. Aho A.V., Hopcroft J.E. and Ullman J.D., "Design and analysis of Computer algorithms".

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 6 Questions of 5 marks each-No choice**30 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 14 marks**70 Marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SCSA5102	DATABASE TECHNOLOGIES	L	T	P	Credits	Total Marks
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		3	0	0	3	100
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COURSE OBJECTIVES

- To give students in depth information about system implementation techniques, data storage, representing data elements, database system architecture.
- Demonstrate principles of design, development and administration relevant to Oracle database technology.
- Formulate a working definition of database development and administration.
- To understand the emerging databases like Mobile, Multimedia, Cloud and Big Data and Hadoop infrastructures.

UNIT 1 INTRODUCTION**9 Hrs.**

Data base system Architecture – Query Optimization Techniques - Transaction Management: Transaction Processing Concepts - Concurrency Control - Recovery Techniques -Database Security.

UNIT 2 PARALLEL DBMS**9 Hrs.**

Architecture-Query evaluation-Query optimization-parallelizing Individual operations. Distributed DBMS: Architecture-storing data-Cataloguing-Query processing-Transactions Concurrency and Recovery.

UNIT 3 MOBILE DATABASES**9 Hrs.**

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models -Concurrency Control - Transaction Commit Protocols

UNIT 4 OBJECT AND MULTIMEDIA DATABASE SYSTEMS**9 Hrs.**

Object Databases-Advantages and disadvantages compared to Relational Databases- Abstract data types, Objects identity and reference types- Inheritance Database design for ORDBMS ODMG data model and ODL OQL.MULTIMEDIA DATABASES: Nature of Multimedia data and applications Data management issues- Components of Multimedia database management system.

UNIT 5 BIGDATA AND HADOOP**9 Hrs.**

Big Data-Introduction-Technologies-Reference Architecture- Hadoop- Introduction to Hadoop Distributed File System- Design of HDFS-HDFS Concepts-Interfaces for Hadoop File System-Map Reduce-weather Dataset-Analyzing the data with Hadoop-Anatomy of Map Reduce Job Run.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition McGraw Hill Publications.
2. Korth.H.F. and A.Silberschatz, "Data base system concepts", 3rd Edition, McGraw Hill Publications.
3. Ramez Elmasri and B.Navathe:"Fundamentals of Database Systems", 5th Ed., Addison Wesley, 2008.
4. Stenfro Ceri and Gieusppepelagatti, "Distributed database-principles and systems", 3rd Edition.
5. O'Reilly, "Hadoop-The Definitive Guide", O'Reilly Media.
6. <http://www.oracle.com/technetwork/topics/entarch/articles/info-mgmt-big-data-ref-arch-1902853.pdf>
7. <http://www.comptechdoc.org/independent/database/basicdb/dataobject.html>.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3****Hrs.****PART A:** 6 Questions of 5 Marks each – No choice**30 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 14 Marks**70 Marks**

SCSA5103	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	Credits	Total Marks
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		3	0	0	3	100
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COURSE OBJECTIVES

- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.
- To introduce the concepts of Software quality and its assurance.

UNIT 1 INTRODUCTION**9 Hrs.**

Software testing fundamentals-objectives-principles-Testability-Levels of testing-TMM- Characteristics of a tester-A testing group-Comparison of KPA in ISO,CMM and TMM-Software quality attributes.

UNIT 2 SOFTWARE TESTING METHODS AND STRATEGIES**9 Hrs.**

Test case design-White box testing- Basic path testing-Flow Graph Notation-Cyclomatic Complexity-Deriving Test Cases-Graphic matrices-Control Structure Testing-Deriving Test cases-Dataflow Testing-Loop Testing-Black box Testing-Graph Based Testing Methods-Equivalence partitioning-Boundary value analysis-Comparison testing. Strategic Approach to Software Testing-Verification and Validation-Strategic issues-Unit testing-Consideration Procedures. Integration Testing-Regression Testing- Integration Test Documentation-Validation testing-Configuration Review-Alpha and Beta Testing System Testing-Art of Debugging. Case studies: Writing test cases for white box and black box testing.

UNIT 3 OBJECT ORIENTED TESTING, METRICS AND MEASUREMENTS**9 Hrs.**

Testing OOD Models-OO Testing Strategies-Test Case Design for OO Software-Testing Methods applicable at the class level-Inter class test design-The intent of OO metrics-Distinguishing characteristics of OO metrics. Common software measurements: Code coverage-Cohesion-Comment density, Coupling-Function point analysis- Number of classes and interfaces-Number of lines of customer requirements-Robert Cecil Martin's software package metrics-Bugs per line of code-Source lines of code.

UNIT 4 QUALITY CONSIDERATIONS**9 Hrs.**

Planning for quality – Quality plan – Cost/benefit tradeoff – Feature/bug tradeoff – Modeling quality improvement-Notation of defects-Defects-Defect removal activities-Conditions for each activity-Defect removal goals-Quality improvement teams-quality recognition-Manage Priorities Effectively-Statistical Quality Assurance-Software Reliability.

UNIT 5 OVERVIEW OF STANDARDS**9 Hrs.**

Levels of standards-Quality assurance standards-Project management standards-Dependability standards-Product standards-Process standards-ISO9000-Reviews,Audits and Certification.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. Ilene Barnstein,"Practical Software Testing-A Process Oriented Approach", Springer International Edition.
2. Humphrey, W.S. (2002), "A Discipline for Software Engineering. Reading, MA", Addison-Wesley.
3. Roger S.Pressman, "Software Engineering, A Practitioner's Approach", Tata McGraw Hill, 5th Edition.
4. Marc Roper, "Software Testing", McGraw Hill Professional, 1994.
5. Ian Sommerville, "Software Engineering", Addison-Wesley, 5th Edition, 1996.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3****Hrs.****PART A:** 6 Questions of 5 Marks each – No choice**30 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 14 Marks**70 Marks**

SBSA5101	WEB BASED APPLICATION DEVELOPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To provide knowledge on web architecture, web services, client side and server side scripting technologies to focus on the development of web-based information systems and web services.
- To provide skills to design interactive and dynamic web sites.
- To provide knowledge for implementing web applications using .NET framework.

UNIT I HTML & CSS**9 hrs.**

Introduction to web, Web development overview, HTML Tag, Rules of HTML, Text Formatting & Style, List, Adding Graphics to Html Document, Tables and Layout, Linking Documents, Frame, Forms, Project in HTML, Introduction to DHTML, CSS, Class & DIV, External Style Sheet.

Unit II SCRIPTING**9 Hrs**

Java Script : Introduction, documents, forms, statements, functions, objects, event handling, Advantage of Java Script, JS object model and hierarchy, Handling event, Operators and syntax of JS, Function, Client side JS Vs Server side JS, JS security Introduction to VB Script, Operator & Syntax of VB Script, Dialog Boxes, Control & Loop, Function in VBS.

Unit III SERVER SITE PROGRAMMING**9 Hrs**

Introduction, Internet Information System (IIS), ASP object, Server object File system object, session, Accessing data base with an ASP page, ODBC – ADO connection object, common methods and properties, ADO record set object.

Unit IV XML**9 Hrs.**

XML-XML structure – elements, well formed XML, XML Namespaces - working with DTD- Adding DTDs to documents - defining DTD entities - defining Parameter entities - Working with attributes – Defining attributes, defining multiple attributes, using predefined attributes - CSS basics - Adding CSS to document, CSS selections, Controlling fonts - Need of XSL, XSL basics, XSL transformations, Introduction to Schemas- Defining simple elements and types.
XML query

Unit V PHP**9 Hrs.**

Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form, mail, file upload, session, error, exception, filter, PHP-ODBC.

TEXT/ REFERENCE BOOKS

1. Jeffrey C Jackson, Web Technology – A computer Science perspective, Person Education, 2007.
2. Ivan Bayross, HTML, DHTML, Java Script, Perl & CGI, BPB Publication.
3. Chris Bates, Web Programming – Building Internet Applications, Wiley India, 2006.
4. Deitel & Deitel, Internet and World Wide Web How to Program, Third Edition.
5. Ullman, PHP for the Web: Visual QuickStart Guide, Pearson Education
6. Mark Birbeck, Stev Livingstone, Stephen F. Mohr, Jonathan Pinnock, Steven Livingston, Professional XML, 2nd Edition, Peer Information, 2001
7. Gopalan. N.P, Web Technology A Developer Perspectives, PHI, 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 6 Questions each carrying 5 marks without choice**30 Marks****PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

		L	T	P	Credits	Total Marks
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SCSA6101	ADVANCED DATA STRUCTURES AND ALGORITHMS LAB	0	0	4	2	100
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COURSE OBJECTIVES

- To understand and analyze some fundamental data structures, such as binary search trees, disjoint sets, and self-adjusting lists.
- To understand the implementation and complexity analysis of fundamental algorithms such as RSA, primality testing, max flow, discrete Fourier transform.
- To know about algorithmic issues in a variety of areas, including linear programming and game-theory.
- To understand and implement linear and non linear data structures in real time.
- To analyze the design of algorithms using various performance metrics.

SUGGESTED LIST OF EXPERIMENTS

1. Polynomial Differentiation.
2. Printing the node details level wise.
3. Searching the given element from N*N matrix using Binary search.
4. Knapsack Problem using Greedy Method.
5. Traveling salesman Problem.
6. Binary Tree Traversal.
7. Implementing RED BLACK Trees.
8. Minimum Spanning Tree using KRUSKAL'S Algorithm.
9. Minimum Spanning Tree using FLOYD – WARSHALL Algorithm.
10. Implementing Splay trees.
11. Implementing quad trees.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 50****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SBSA6101	WEB BASED APPLICATION DEVELOPMENT LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

List of Programs

1. Create a static web pages by using Text elements, styles, list, Hyperlink , frames ad Table
2. Create an html file by applying the different styles using inline, external & internal style sheets.
3. Create a html page to display a new image & text when the mouse comes over the existing content in the page.
4. Develop a Java script program for validate the registration, user login, user profile and payment by credit card pages
5. Write a java script program for exception handling
6. Create a html page to display a new image & text when the mouse comes over the existing content in the page
7. Develop a simple application using ASP
8. Create an XML document, which contains 10 users information.
9. Create external style sheet by using CSS in xml file.
10. Using XQuery retrieve the details from the xml file
11. Create a PHP program to demonstrate the different file handling methods.
12. Write a PHP to Create a Cookie and add the user ID's and passwords to this Cookie.
13. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
14. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 50****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SBSA5201	DESIGN THINKING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the principles of Design Thinking, a creative solution-based approach to problem solving.
- To understand about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- To understand the basics about development cycles, IT Operations & faster innovation.
- To understand the practice of design thinking for Strategic Innovation
- To understand DevOps the advanced process of software engineering for faster problem resolution & team collaboration.

UNIT 1 INTRODUCTION TO DESIGN THINKING

9 Hrs.

Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking- Design Thinking Framework - Design Thinking Methods - Empathise –Define – Ideate – Prototype – Test- Software Development Methodology – Waterfall model – V –model -Customer Example.

UNIT 2 INTRODUCTION TO AGILE9 Hrs.

History of Agile – Agile principles – Agile Vs Waterfall – Agile Methodology Overview- Agile frameworks – Extreme programming - Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD)- Scrum - Kanban Methodology – Agile and Devops.

UNIT 3 AGILE SOFTWARE DEVELOPMENT9 Hrs.

Software Development- using Extreme Programming – Roles & Rules - Software Development using Scrum Framework – Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.

Unit 4 DESIGN THINKING FOR STRATEGIC INNOVATION

9 Hrs.

Innovation Management-Changing Management Paradigms-Design Thinking related to Science and art-Design Thinking in Business-Linking Design Thinking Solution to Business Challenges

UNIT 5 DEVOPS

9 Hrs.

Introduction to DevOps – DevOpsvs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD &DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration – Continuous Testing –Continuous Monitoring

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1:Apply design thinking concepts to give solution for the problems identified

CO2:Implement Agile software methodology for faster development of quality software

CO3:Describe how to improve collaboration between development andoperations.

CO4: Design innovative products

CO5:Implement Automated Installations and Deployments

CO6:Unresolve different transformations of a product or a service through brainstorming and incremental approach, etc.

TEXT /REFERENCE BOOKS

1. MaurícioVianna, YsmarVianna, Brenda Lucena and Beatriz Russo," Design thinking : Business innovation", MJV Technologies and innovation press, 2011.
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Valueby Thomas Lockwood (Editor) Published February 16th 2010 by Allworth Press.
3. KalloriVikram, –Introduction to DevOps, 1 st Edition, KalloriVikram Publication, 2016.
4. Jackim Verona, –Practical DevOps, 2 nd Edition, Packt. Publication, 2018.
5. Stephen Fleming, Pravin, –DevOps Handbook: Introduction of DevOps Resource Management—, 1st Edition, Createspace Independent Pub. , 2010.

6. Len Bass, Ingo Weber, Liming Zhu, G., —DevOps: A Software Architect's Perspective, 1st Edition, Addison-Wesley Professional, 2015.
7. Alistair Cockburn, "Agile Software Development", 2nd ed, Pearson Education, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.**30 Marks****70 marks**

SBSA5202	INTRODUCTION TO INTERNET OF THINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Internet of Things .
- To identify the various elements of an IoT System
- To understand the various means of communication from Node / Gateway to Cloud Platforms
- To identify types of data analytics and data visualization tools
- To make students aware of security concerns and challenges while implementing IoT solutions

UNIT 1 INTRODUCTION TO IOT**9 Hrs.**

Introduction to IoT, Current technological trends and future prospects, - Evolution of IoT , Business Scope, Relation with embedded system, - Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT, IoT Value Chains, An emerging industrial structure for IoT.

UNIT 2 ELEMENTS OF IOT**9 Hrs.**

Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wearable Development Boards,

UNIT 3 COMMUNICATION AND CONNECTIVE TECHNOLOGIES**9 Hrs.**

IoT Communication Model, Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud, Selecting and Creating cloud service , cloud based IoT platforms - IBM Watson, Google cloud.

UNIT 4 DATA ANALYTICS AND IOT PLATFORM**9 Hrs.**

Big Data Analytics , Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, ApacheStorm, Data Visualization, Visualization tools for IoT

UNIT 5 HANDS-ON PROJECTS**9 Hrs.**

Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), DIY Kits – Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

Max.45 Hours**COURSE OUTCOMES**

On Completion of course the student will be able to

- CO1:** To learn and understand the technology and current trends in Internet of things.
- CO2:** To understand the various elements of IoT system and hardware devices.
- CO3:** To learn the programming languages and platforms for building IoT applications.
- CO4:** To understand the cloud computing and its relevance for developing IoT applications.
- CO5:** To design and implement IoT applications that manages big data with data analytics and visualization tools.
- CO6:** To implement hands-on projects using an appropriate software and hardware devices in various applications.

TEXT / REFERENCE BOOKS

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi
2. Architecting the Internet of Things, Springer publications. Author(s):Dieter Uckelmann, Mark Harrison, Florian Michahelles
3. Internet of Things with Arduino Cookbook, Packt Publications. Author(s): Marco Schwatz
4. Internet of Things and Data Analytics, Wiley Publications.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.**30 Marks****70 marks**

SBSA5203	INTRODUCTION TO MACHINE LEARNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on the construction and study of algorithms that can learn from data.
- To emphasize on the logical, knowledge-based approach.
- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

UNIT 1**9 Hrs.**

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation.

UNIT II**9 Hrs.**

Linear regression, Decision trees, overfitting. Instance based learning, Feature reduction, Collaborative filtering based recommendation.

UNIT III**9 Hrs.**

Clustering: k-means, adaptive hierarchical clustering, Bayes learning, Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM.

UNIT IV**9 Hrs.**

Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.

UNIT V**9 Hrs.**

Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.

COURSE OUTCOMES

On Completion of course the student will be able to

CO1: Comprehend the Machine Learning concepts, classifications of Machine Learning**CO2:** Solve problems using Supervised Learning concepts**CO3:** Apply Support Vector Machine concepts to given problems**CO4:** Implement unsupervised learning concepts on real time datasets**CO5:** Recognise and implement various suitable model parameters for different machine learning techniques**CO6:** Evaluate models generated from data.**REFERENCES**

1. Ethem Alpaydin, Introduction to Machine Learning, MIT press. 2020
2. Andriy Burkov, The Hundred page Machine Learning Book, Andriy Burkov, ISBN:199957950X, 9781999579500, 2019
3. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning, Cambridge University Press. 2017
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, Second Edition. 2009.
5. Avrim Blum, John Hopcroft and Ravindran Kannan, Foundations of Data Science, January 2017.
6. Christopher Bishop, Pattern Recognition and Machine Learning, Springer. 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks

(Out of 100 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.**30 Marks****70 marks**

SBSA6201	Internet of Things Lab	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To identify the different technologies and different platforms in IoT
- To understand how to use sensors and actuators for design of IoT.
- To learn different protocols used in IOT.
- To learn the concepts of smart city development in IOT.
- To learn how to analysis the data in IOT.

SUGGESTED LIST OF EXPERIMENTS

1. Monitor the soil moisture level using Raspberry pi.
2. Monitor the surrounding air's quality using Arduino & sensors connected to a Raspberry Pi. 3. Implement Raspberry Pi as a local server by installing Apache, PHP, and MySQL.
4. Interface PIR sensor with ESP8266 WiFi module on NodeMCU platform.
5. Posting temperature and humidity of the environment to Thing speak cloud service using NodeMCU.
6. Implement Raspberry Pi Temperature System with Ubidots cloud service.
7. Implement smart cities Sensor Board v3.0 using Wasp mote platform for measuring temperature, humidity and pressure.
8. Measure light intensity and pollution level using Wasp mote platform.
9. Receiving and storing data in Meslium gateway for Wasp mote platform.
10. Implement barometric pressure monitoring using BMP280 sensor for Zolertia module.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 50****Exam Duration: 3 Hrs**

CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

SBSA5301	CYBER PHYSICAL SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.
- To understand the concepts involved in Cyber Physical Systems Security

UNIT 1 INTRODUCTION TO INDUSTRY 4.0 & CYBER PHYSICAL SYSTEM**9 Hrs.**

Industry 4.0 - Globalization and Emerging Issues, The Fourth Revolution - Smart and Connected Business Perspective, Basics of Industrial IoT - Industrial Processes - Industrial Sensing & Actuation, Industrial Internet Systems - Basic principles of design and validation of CPS - Cyber-Physical Systems (CPS) in the real world- Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

UNIT 2 EMBEDDED SYSTEMS MODELING AND DESIGN AND CPS**9 Hrs.**

Platform components - Embedded Systems definition, specification, and languages. Concepts, requirements, examples. Embedded system models at different abstraction levels. Test benches, design under test, Intellectual Property components. Discrete event simulation, semantics, algorithms. Design, analysis techniques for decentralized computer architectures, communication, and hardware-software systems. -Cyber Physical System Hardware Platform - Processors, Sensors, Actuators - Network - WirelessHart, CAN, Automotive Ethernet – Software stack -Real-Time Operating system (RTOS) -Scheduling Real Time control tasks.

UNIT 3 SENSORS, ACTUATORS AND SENSOR NETWORKS**9 Hrs.**

Sensors, Actuators and Sensor Networks & Real-Time and Distributed Systems - Fundamental principles and applications of sensors, actuators. Smart sensors and microsensor/microactuator array devices. Introduction to signal processing and sensor/actuator networks, deployment and architecture, wireless communication, multiple access control layer, data gathering, routing and querying, collaborating signal processing - Time dependent systems, clock synchronization, real-time communication protocols, specification of requirements, task scheduling. Validation of timelines, real-time configuration management. Middleware architecture for distributed real-time and secure services.

UNIT 4 SECURITY OF CYBER PHYSICAL SYSTEMS**9 Hrs.**

Security of Cyber Physical Systems -Embedded and CPS security - attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, malware attacks and counter-measures, security protocols. Privacy issues - vehicular devices and smart metering. Applications of public key and symmetric cryptography, - digital certificates, credentials. Security and vulnerability of cyber-physical infrastructure networks - Mobile and wireless network security, Robust wireless infrastructure - Cloud computing and data security, Event Awareness and System Monitoring for Cyber Physical Infrastructure.

UNIT 5 CYBER-PHYSICAL SYSTEMS CASE STUDIES AND PROJECTS**9 Hrs.**

Cyber-Physical Systems Case Studies and Projects - Automotive: SW controllers for Antilock braking system, Adaptive Cruise Control, Lane Departure Warning, Suspension Control - Healthcare: Artificial Pancreas/Infusion Pump/Pacemaker - Green Buildings: automated lighting, AC control - power distribution grid - robotics - civil infrastructure – avionics – Transportation.

Max.45 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.
- CO2:** Identify the limitations of some computational models.
- CO3:** Apply the theoretical knowledge the design of compilers.
- CO4:** Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.
- CO5:** Categorize the essential modeling formalisms of Cyber-Physical Systems (CPS)
- CO6:** Ability to understand cyber modeling system.

TEXT / REFERENCE BOOKS

1. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist (Apress)
2. "Industrial Internet of Things: Cyber manufacturingS ystems" Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)
3. Edward A. Lee and Sanjit A. Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, Second Edition, <http://LeeSeshia.org>, ISBN 978-1-312-42740-2, 2015.
4. Rajeev Alur. Principles of Cyber-Physical Systems. MIT Press. 2015.
5. K. J. Astrom and R. M. Murray. Feedback Systems: An Introduction for Scientists and Engineers. Prince- ton University Press, 2009. http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page.
6. Sajal Das, Krishna Kant, and Nan Zhang, Securing Cyber-Physical Critical Infrastructure – Foundations & Challenges, Morgan Kaufmann, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 6 Questions each carrying 5 marks without choice****30 Marks****PART B : 2 Questions from each unit of internal choice, each carrying 14 marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA5302	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know the principles and approaches of artificial intelligence(AI).
- To develop a basic understanding of the building blocks of AI.
- To identify the solution to a problem through reasoning and planning.
- To learn various types and concepts of machine learning.
- To list out various domains and applications of AI.

UNIT1**AI: FOUNDATIONS**
1**2Hrs.**

Introduction – History – Intelligent Agents – Environment – Good behavior – Structure of an Agent – Concept of rationality – Types of agents – Search strategies and its types: BFS and DFS – Uniform Cost Search

**UNIT2
SOLVING****AI: SEARCHING AND**
1**2Hrs.**

Agents for problem solving – Informed searchstrategy – heuristic functions – Optimization: local and global search – Constraint Satisfaction Problems – Pruning - Case Study: Backtracking for CSP

**UNIT3
PLANNING****AI: KNOWLEDGE, REASONING AND**
1**2Hrs.**

Logical agents – Propositional Logic – Inference rules - First Order Logic – Syntax and Semantics – Building a knowledge base – Probabilistic reasoning – Classical Planning and its algorithm

**UNIT4
CONCEPTS****AI: LEARNING**
1**2Hrs.**

Types of learning: Supervised, Unsupervised and Reinforcement Learning – Theory of learning – Classification and Regression problems – Model selection and optimization – Case Study: Linear Regression for Classification

**UNIT5
APPLICATIONS****AI:**
1**2Hrs.**

Speech Processing: NLP basics and tasks – Chatbot applications and its types – Computer Vision: Classifying images and Detecting objects – Robotics: Hardware – Perception – Planning – Control

Max.60Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** Identify and analyze various search algorithms for solving the AI problems.
- CO2:** Apply search algorithms for various AI related problems.
- CO3:** Use various logical forms to represent knowledge.
- CO4:** Discriminate between different types of learning techniques.
- CO5:** Recognize the working behind chatbot applications.
- CO6:** Design user centric applications that use AI concepts

TEXT/REFERENCEBOOKS

1. Stuart J. Russel, Peter Norvig, "Artificial Intelligence A Modern Approach", 4th Edition, Pearson Education, 2020.
2. Kevin Warwick, "Artificial Intelligence: the basics", Routledge Publishers, 2011.
3. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
4. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA5303	DATA SCIENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the basic concepts of Data Science and data life cycle
- To understand the theoretical and mathematical aspects of Data Science models
- To learn common random variables and their uses, and with the use of empirical distributions
- To obtain the knowledge in data management tools
- To explore the major techniques for data science

UNIT 1 INTRODUCTION TO DATA SCIENCE 9 Hrs.

What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Preprocessing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT 2 APPROACHING ANALYTICS PROBLEMS 9 Hrs.

Key roles for successful Analytics project- Discovery- Business domain, Resources, Problem framing, Key stakeholders, Analytics sponsors, Initial hypotheses, Data sources- Data Preparation- Learning about the data, conditioning- Model Planning- Data exploration, Model selection- Model Building- Common tools for model building- Communicate Results- Analysis over the different models- Operationalize- Moving the model to deployment environment-Analytics Plan

UNIT 3 INTRODUCTION TO R 9 Hrs.

Introduction to R- R Graphical user interfaces- Data Import and Export- Attributes and Data Types- Vectors- Arrays and Matrices- Data Frames- Lists- Factors- Contingency Tables- Descriptive statistics- Model building, Evaluation and Deployment- Hypotheses Testing- Null hypotheses and Alternative hypotheses- Probability distributions- Statistical models in R- Data distribution

UNIT 4 MODELING METHODS 9 Hrs.

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

UNIT 5 DELIVERING RESULTS 9 Hrs.

Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph - using graphics parameters. Case studies.

Max.45 Hours**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 : Understand the key concepts in data science, including tools and approaches.

CO2 : Apply a suitable data science technique to solve an information analytics problem.

CO3 : Able to comprehend basic methods of processing data from real world problems

CO4 : Analyze and validate the models using appropriate performance metrics

CO5 : Understand the various techniques in data science

CO6 : Present the results using effective visualization techniques

TEXT/REFERENCE BOOKS

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Services, 2015
2. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014
3. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014
4. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.
5. Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019
6. W.N. Venables, D.M. Smith and the R Core Team, "An Introduction to R", 2013

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SCSA6301	CYBER PHYSICAL SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.
- To understand the concepts involved in Cyber Physical Systems Security

LIST OF EXPERIMENTS

1. Study about embedded components such as sensors and actuators
2. Study about Industrial Revolution and Cyber physical system opportunities and challenges
3. Create a program that blinks the LED on the development board using MBED software.
4. Pick one-one from the available sensors and actuators and find or create code that will display the sensed data on the PC
5. Create a program that displays data from the sensor in regular intervals in a compact format.
6. To Design Basic weather station using embedded components using Lab view software.
7. Login to devicehub.net and create a project then create a virtual device. Add the corresponding sensor and actuator to the virtual device.
8. Study the MQTT protocol. Examine the components of the protocol.
9. Create a connection from an MQTT capable device/software with an MQTT broker then send and receive data using it.
10. To configuring the gateways and exchange the data to local database using Dream factory
11. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots
12. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.
- CO2:** Identify the limitations of some computational models.
- CO3:** Apply the theoretical knowledge the design of compilers.
- CO4:** Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.
- CO5:** Categorize the essential modeling formalisms of Cyber-Physical Systems (CPS)
- CO6:** Implement the real time use case and problem statements

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 50		Exam Duration: 3 Hrs	
CAE	Evaluation of Regular Lab class	25 Marks	50 Marks
	Model practical exam	25 Marks	
ESE	University Practical exam		50 Marks

S734APROJ2	PROJECT	L	T	P	Credits	Total Marks
		0	0	0	12	100

Objectives

To make the student to understand and present a research finding on a topic in the subject related to Chemistry under the guidance of a department staff.

Project report: 60 Marks

Literature review

Problem Identification

Experimental / Results and Discussion

Originality, Technical and logical development

Summary and references

Viva-voce: 40 Marks

Communication

Presentation using Teaching aids

Language and diction

Interpretation of Technical data

LIST OF ELECTIVES

SBSA7001	ADVANCED DISTRIBUTED COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the various message passing and its failure handling
- To understand in detail about the RPC
- More knowledge about the distributed file systems and their security

UNIT I

9 hrs.

Fundamentals and Message Passing :Fundamentals: Evolution of distributing computing system – Distributed computing system Models- Issues in Designing a distributed operating system- Message Passing: Desirable features of a good message passing system – Issues in IPC by message passing –Synchronization – Buffering – Multi datagram messages – Encoding and decoding of message data – process addressing - failure handling – Group Communication

UNIT II

9 hrs.

Remote Procedure Calls: Introduction – The RPC Model – Transparency of RPC – Implementing RPC mechanism – Stub generation– RPC messages – Marshaling arguments and results – Server Management parameter – Passing Semantics– call semantics – Communication protocols for RPC's – Complicated RPC's – Client Server Binding –Exception Handling – Security – some special types of RPC's – RPC in Heterogeneous environments –Light Weight RPC – Optimization for Better performance – Case studies : SUN RPC , DCE RPC

UNIT III

9 hrs.

Distributed Shared Memory and Synchronization: Distributed shared Memory: General Architecture of DSM systems – Design and Implementation issues of DSM – Granularity – Structure of shared memory space – Consistency Models – Replacement strategy – Thrashing – Other approaches to DSM – Heterogeneous DSM – Advantages of DSM. Synchronization: Clock synchronization – Event ordering – mutual exclusion – Deadlock – Election Algorithms

UNIT IV

9 hrs.

Resource and Process Management: Resource Management: Introduction – Desirable features of a good global scheduling algorithm – Task assignment approach – Load Balancing approach – Load sharing approach. –Process management: Introduction – process migration – Threads

UNIT V

9 hrs.

Distributed File Systems and Security: Distributed File Systems: Desirable features of a good distributed file system – File models – File accessing Models – File sharing semantics – File caching schemes – File Replications – Fault tolerance – atomic Transactions– Design principles – case study: DCE distributed file service. Security: Potential attacks to computer systems – cryptography – Authentication – access control – Digital signatures – Design principles – Case study : DCE security service

TEXT / REFERENCE BOOKS:

1. Pardeep K. Sinha, Distributed Operating Systems,Prentic-Hall India -1997.
2. George Coulouris, Jean Dollimore and Tim Kindberg - Distributed Systems Concepts and Design , Pearson Education, 3rd Edition 2002.
3. Sape Mullender - Distributed Systems ,Addison Wesley, 2nd Edition, 1993.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 6 Questions each carrying 5 marks without choice

PART B : 2 Questions from each unit of internal choice, each carrying 14 marks

Exam Duration : 3 Hrs.

30 Marks

70 marks

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7002		L	T	P	Credits	Total Marks

	BIG DATA TOOLS AND TECHNIQUES	3	0	0	3	100
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COURSE OBJECTIVES

- It providing a basic, practical foundation that allows the students to participate in Big Data and Data Analytics projects.

UNIT I**9 hrs.**

INTRODUCTION TO BIG DATA :Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis – Nature of Data – Analytic Processes and Tools – Analysis Vs Reporting – Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re – Sampling – Statistical Inference – Prediction Error.

UNIT II**9 hrs.**

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

UNIT III**9 hrs.**

HADOOP :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 – 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**9 hrs.**

HADOOP ENVIRONMENT :Setting up a Hadoop Cluster – Cluster specification – Cluster Setup and Installation – Hadoop Configuration – Security in Hadoop – Administering Hadoop – HDFS – Monitoring – Maintenance – Hadoop benchmarks – Hadoop in the cloud.

UNIT V**9 hrs.**

FRAMEWORKS :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 InfoSphere BigInsights and Streams. Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications

TEXT/ REFERENCE BOOKS

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
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, McGraw Hill 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.
6. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007.
7. Pete Warden, Big Data Glossary, O'Reilly, 2011.
8. Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques, Second Edition, Elsevier, Reprinted 2008.
9. Da Ruan, Guoqing Chen, Etienne E. Kerre, Geert Wets, Intelligent Data Mining, Springer, 2007.
10. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.
11. Michael Minelli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications, 2013.
12. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 6 Questions each carrying 5 marks without choice**30 Marks****PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7003	COMPUTER VISION	L	T	P	Credits	Total Marks
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		3	0	0	3	100
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COURSE OBJECTIVES

To review image processing techniques for computer vision.

To understand shape and region analysis, Hough Transform and its applications to detect lines, circles, ellipses.

To understand three-dimensional image analysis techniques, motion analysis.

UNIT 1 IMAGE PROCESSING FOUNDATIONS**9 Hrs.**

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT 2 SHAPES AND REGIONS**9****Hrs.**

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT 3 HOUGH TRANSFORM**9 Hrs.**

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT 4 3D VISION AND MOTION**9 Hrs.**

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT 5 APPLICATIONS**9 Hrs.**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
3. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
5. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
6. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7004	CYBER FORENSICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand how to investigate web server attacks, DNS attacks and router attacks and also can learn the importance of evidence handling and storage.
- To understand how to monitor network traffic and detect illicit servers and covert channels.
- To explain the responsibilities and liabilities of a computer forensic investigator

UNIT I OVERVIEW OF COMPUTER FORENSICS TECHNOLOGY**9 hrs**

Computer Forensics Fundamentals: Introduction to Computer Forensics – Use of Computer Forensics – Computer Forensics Assistance – Computer Forensics Services – Benefits of Professional Forensics Methodology – Steps taken by Computer Forensics Specialists – Types of Computer Forensics Technology: Military Computer Forensic Technology – Law Enforcement Computer Forensic Technology – Business Computer Forensic Technology – Specialized Forensics Technique – Hidden Data and finding Hidden Data – Spyware and Adware – Types of Computer Forensics Systems – Computer Forensics Investigative Services.

UNIT II COMPUTER FORENSICS EVIDENCE AND CAPTURE**9 hrs**

Data Recovery: Definition – Data Backup and Recovery – Role of Backup in Data Recovery – Data Recovery Solution – Hiding and Recovering Hidden Data – Evidence Collection and Data Seizure: Need for Evidence Collection – Collection Options – Obstacles – Types of Evidence - The Rules of Evidence – Volatile Evidence – General Procedure – Collection and Archiving – Methods of Collection – Artifacts – Collection Steps – Controlling Contamination – Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene – Computer Evidence Processing Steps – Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer.

UNIT III COMPUTER FORENSICS ANALYSIS**9 hrs**

Computer Forensics Analysis and Validation: Determining What Data to Collect and Analyze – Validating Forensic Data – Addressing Data Hiding Techniques – Performing Remote Acquisitions – Network Forensics: Network Forensics Overview – Performing Live Acquisitions – Developing Standard Procedures for Network Forensics - Using Network Tools – Processing Crime and Incident Scenes: Identifying Digital Evidence – Collecting Evidence in Private Sector Incident Scenes – Processing Law Enforcement Crime Scenes – Preparing for a Search – Securing a Computer Incident or Crime Scene – Seizing Digital Evidence at the Scene – Storing Digital Evidence – Obtaining a Digital Hash – Reviewing a Case.

UNIT IV COMPUTER FORENSICS TOOLS**9 hrs**

Current Computer Forensic Tools: Need for Computer Forensic Tools – Computer Forensics Software Tools – Computer Forensics Hardware Tools – Validating and Testing Forensics Software – E-Mail Investigations: Role of E-Mail in Investigation – Roles of Client and Server in E-mail – E-Mail Crimes and Violations – Understanding E-Mail Servers – Specialized E-Mail Forensic Tools – Cell Phone and Mobile Device Forensics: Understanding Mobile Device Forensics, Understanding Acquisition Procedures For Cell Phones And Mobile Devices.

UNIT V REPORT WRITING AND TESTIMONY**9 hrs**

Report Writing: Importance of Reports – Guidelines for Writing Reports – Generating Reports Findings with Forensics Software Tools – Expert Testimony: Preparing for Testimony – Testifying in Court – Preparing for a Deposition or Hearing – Preparing Forensics Evidence for Testimony – Working with Windows and DOS Systems: File Systems – Microsoft File Structures – Examining NTFS Disks – Whole Disk Encryption – Windows Registry – Microsoft Startup Tasks – MS-DOS Startup Tasks – Virtual Machines.

TEXT / REFERENCE BOOKS:

- Computer Forensics, Computer Crime Investigation by John R. Vacca, 2nd Edition, Charles River Media, Inc., Boston, Massachusetts.
- Guide to Computer Forensics and Investigations by Bill Nelson, Amelia Phillips, and Christopher Steuart, 4th Edition, Cengage Learning.
- Computer Forensics and Investigations- Bill Nelson, Amelia Phillips, Frank Enfinger, Chris Steuart, Second Indian Reprint 2009, Cengage Learning India Private Limited.
- Digital Evidence and Computer Crime – Eoghan Casey, 3rd Edition, Academic Press, 2011.
- Computer Forensics and Cyber Crime: An Introduction – Marjie Britz, 2nd Edition, Prentice Hall, 2008.
- Practical guide to Computer Forensics- David Benton and Frank Grindstaff, Book Surge Publishing, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 6 Questions each carrying 5 marks without choice**30 Marks****PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks**70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7005	DATA ANALYTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the lifecycle of the data analytics.
- To understand the advanced data analytics methods.

UNIT 1 DATA ANALYTICS INTRODUCTION**9 Hrs.**

Introduction – Challenges of conventional systems –Data Definitions - Web data – Organization/sources of data - Importance of data quality- Dealing with missing or incomplete data-Data Classification.Evolution of Analytic scalability, Analytic processes and tools,Analysis vs reporting - Modern data analytic tools, Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

UNIT 2 DATA ANALYTICS LIFE CYCLE**9 Hrs.**

Data Analytics Lifecycle -Need of Data analytic lifecycle - Key roles forsuccessful analytic projects - various phases of Data analytic lifecycle:Discovery - Data Preparation - Model Planning - Model Building -Communicating Results - Operationalization. Statistical concepts: Sampling distributions, resampling, statistical inference,prediction error - Business drivers for analytics - Typical analytical architecture.

UNIT 3 DATA ANALYSIS TECHNIQUES 9 Hrs.

Theory & Methods: Clustering - Association Rules – Apriorialgorithm -Regression modeling - Linear Regression - Logistics Regression- Multivariate analysis - Bayesian modeling, inference and Bayesian networks - Naïve Bayesian classifiers- Decision Trees-Support vector and kernel methods.

UNIT 4 ADVANCED ANALYTICS 9 Hrs.

Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT 5 STREAMING ANALYTICS**9 Hrs.**

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

Max.45 Hours**TEXT / REFERENCE BOOKS**

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Trevor Hastie - Robert Tibshirani - Jerome Friedman - "The Elements ofStatistical Learning", Springer,2011.
3. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets,Cambridge University Press, 209.
4. Andrew G.Psaltis," Streaming DATA: Understanding the real-time pipeline", Manning Publications,2017.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7006		L	T	P	Credits	Total Marks
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	ETHICAL HACKING AND DIGITAL FORENSICS	3	0	0	3	100
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COURSE OBJECTIVES

- To develop ability to quantitatively assess and measure threats to information assets
- Evaluate where information networks are most vulnerable and perform penetration tests into secure networks for evaluation purposes
- Critique security plans designed at protecting data assets against attacks from the Internet and investigate and mitigate data risk

UNIT I**9 hrs.**

ETHICAL HACKING :Types of Data Stolen, Elements of Information Security, Authenticity and Non-Repudiation, Security Challenges, Effects of Hacking, Types of Hackers, Ethical Hacker, Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking & Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors.

UNIT II**9 hrs.**

FOOT PRINTING AND SOCIAL ENGINEERING: Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking.

UNIT III**9 hrs.**

DATA SECURITY and FIREWALLS:Physical Security – Attacks and Protection, A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks - Privacy attacks, Attacks and Measures, Wireless Hacking, Windows Hacking, Linux Hacking.

UNIT IV**9 hrs.**

NETWORK PROTECTION SYSTEM & HACKING WEB SERVERS :Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking.

UNIT V**9 hrs.**

ETHICAL HACKING LAWS AND TESTS:An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

TEXT / REFERENCE BOOKS

1. Michael T. Simpson, Kent Backman, James E. Corley, Hands On Ethical Hacking and Network Defense, Second Edition, CENGAGE Learning, 2010.
2. Kenneth C.Brancik, Insider Computer Fraud, Auerbach Publications Taylor & Francis, Group 2008.
3. Ankit Fadia, Ethical Hacking, Second Edition Macmillan India Ltd, 2006.
4. Steven DeFino, Barry Kaufman, Nick Valenteen, Official Certified Ethical Hacker Review Guide, CENGAGE Learning, 2009-11-01.
5. Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, Syngress Basics Series –Elsevier, August 4, 2011.
6. Whitaker & Newman, Penetration Testing and Network Defense, Cisco Press, Indianapolis, IN, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7007	MOBILE COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the basic concepts of Wireless Communication and be familiar with the network protocol stack.
- Learn the basics of mobile telecommunication system.
- Be exposed to Mobile Ad-Hoc networks and gain knowledge about different mobile platforms and application development.

UNIT 1 WIRELESS COMMUNICATION FUNDAMENTALS**9 Hrs.**

Introduction - Wireless transmission - Frequencies for radio transmission - Signals - Antennas - Signal propagation - Multiplexing - Modulations - Spread spectrum - MAC - SDMA - FDMA - TDMA - CDMA - Cellular wireless networks.

UNIT 2 TELECOMMUNICATION NETWORKS**9 Hrs.**

Telecommunication systems - GSM - GPRS - DECT - UMTS - IMT-2000 - Satellite networks - Basics - Parameters and configurations.

UNIT 3 MOBILE NETWORK LAYER**9 Hrs.**

Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

UNIT 4 MOBILE AD HOC NETWORKS (MANETS)**9 Hrs.**

Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

UNIT 5 PROTOCOLS AND TOOLS**9 Hrs.**

Wireless Application Protocol - WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2004.
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004,
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
5. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, second edition, 2003.
6. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7008	NETWORK SECURITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study various cryptographic techniques to secure the network.
- To study security issues in mathematical form.
- To study authentication applications.
- To understand algorithms for security.

UNIT 1 SECURITY TRENDS**9 Hrs.**

Attacks and services – Classical crypto systems – Different types of ciphers – LFSR sequences – Basic Number theory – Congruence's – Chinese Remainder theorem – Modular exponentiation – Fermat and Euler's theorem – Legendre and Jacobi symbols.

UNIT 2 DES AND SDES**9 Hrs.**

Simplified DES – Differential cryptanalysis – DES – Modes of operation – Triple DES – AES – RC4 – RSA – Attacks.

UNIT 3 DISCRETE LOGARITHMS AND CRYPTOSYSTEMS**9 Hrs.**

Discrete Logarithms – Computing discrete logs – Diffie-Hellman key exchange – ElGamal Public key cryptosystems – Hash functions – Secure Hash – Birthday attacks - MD5 – Digital signatures – RSA – ElGamal – DSA-SHA1.

UNIT 4 AUTHENTICATION APPLICATIONS**9 Hrs.**

Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET.

UNIT 5 SYSTEM SECURITY**9 Hrs.**

Intruders – Malicious software – viruses – Firewalls - Firewall Design Principles— Security Standards – Case Study: Practical Implementation of Cryptography and Security.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd Edition, Pearson, 2007.
2. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI, 4th Edition, 2006.
3. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2nd Edition, 2007.
4. Bruce Schneider, Neils Ferguson, "Practical Cryptography", Wiley Dreamtech India, 1st Edition, 2003.
5. Charles P. Pfleeger, Shari Lawrence Pfleeger – "Security in computing" 3rd Edition, Prentice Hall of India, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100
Hrs.

Exam Duration: 3**PART A:** 6 Questions of 5 Marks each – No choice**30 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 14 Marks**70 Marks**

SBSA7009	OBJECT ORIENTED SYSTEMS ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To investigate principles of object-oriented software engineering, from analysis through testing.
- To study and experiment with alternative models of the software development process.

UNIT I**9 hrs.**

UML DIAGRAMS: Introduction to OOAD – Unified Process – UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams

UNIT II**9 hrs.**

DESIGN PATTERNS: GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller – Design Patterns – creational – factory method – structural – Bridge – Adapter -behavioral – Strategy – observer

UNIT III**9 hrs.**

CLASSICAL PARADIGM AND PROCESS MODELS :System Concepts – Project Organization – Communication – Project Management - Life cycle models – Unified Process – Iterative and Incremental – Workflow – Agile Processes

UNIT IV**9 hrs.**

ANALYSIS AND DESIGN: Requirements Elicitation – Use Cases – Unified Modeling Language, Tools – Analysis Object Model(Domain Model) – Analysis Dynamic Models – Non-functional requirements – Analysis Patterns-System Design, Architecture – Design Principles - Design Patterns – Dynamic Object Modeling – Static Object Modeling – Interface Specification – Object Constraint Language.

UNIT V**9 hrs.**

IMPLEMENTATION, DEPLOYMENT AND MAINTENANCE :Mapping Design (Models) to Code – Testing - Usability – Deployment – Configuration Management –Maintenance

TEXT/REFERENCE BOOKS:

1. Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005.
2. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearson Education, 2004.
3. Simon Bennett, Steve Mc Robb and Ray Farmer, Object Oriented Systems Analysis and Design Using UML, Fourth Edition, Mc-Graw Hill Education, 2010.
4. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
5. Martin Fowler, UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003.
6. Paul C. Jorgensen, Software Testing- A Craftsmans Approach, Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SCSA7010	OPEN SOURCE TOOLS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand how to investigate various open source tools and also can learn the importance of program management..
- To understand how to perform shell programming

UNIT 1**9 Hrs.**

Introduction : Open Source – Open Source vs. Commercial Software – Introduction to Linux - Linux Distributions - Operating Systems and Linux - Open Source Software -Software Repositories - Third-Party Linux Software Repositories - Linux Office and Database Software - Internet Servers - Development Resources - Online Linux Information Sources - Install Issues - accessing Your Linux System - The Display Managers: GDM and KDM - Switching Users -Accessing Linux from the Command Line Interface- Command Line Interface - Help Resources - Context-Sensitive Help - Application Documentation –The Man Pages - The Info Pages - Software Repositories.

UNIT 2**9 Hrs.**

The Shell - The Command Line - History - Filename Expansion: *, ?, [] – Standard Input/Output and Redirection - Pipes - Redirecting and Piping the Standard Error: >&, 2> - Jobs: Background, Kills, and Interruptions - Ending Processes: ps and kill - The C Shell: Command Line Editing and History - The TCSH Shell - The Z-shell

UNIT 3**9 Hrs.**

The Shell Scripts and Programming - Shell Variables - Shell Scripts - User-Defined Commands - Environment Variables and Subshells: export and setenv - Conditional Control Structures - Linux Files, Directories, and Archives- Linux Files - The File Structure - Listing, Displaying, and Printing File - Managing Directories - File and Directory Operations - Archiving and Compressing Files – vi editor

UNIT 4**9 Hrs.**

PHP – Create and run PHP page – Mixing PHP and HTML – Printing text and HTML – Echo – Here – Command Line PHP – Comments – Variables – Strings – Constants – Data types – Operators and flow control.

UNIT 5**9 Hrs.**

String and Array – String functions – Convert and format string – Arrays – Creating function – Reading data in web pages.

TEXT / REFERENCE BOOKS

- 1.R. Peterson , 2007, Linux: The Complete Reference, Sixth Edition, TMH
- 2.S. Holzner, 2008, PHP: The Complete Reference, TMH
- 3.R. Stones, N. Matthew, 2011, Beginning Linux Programming, 4th Edition, Wiley India Pvt. Ltd.-New Delhi
- 4.R. Nixon, Learning PHP, MySQL, JavaScript, and CSS, 2012, 2nd Edition, O'Reilly Media.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7011	SOCIAL NETWORK ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To use social network data in statistical analysis as independent or dependent variables
- To understand the usage of graphs and formulas to represent the structure of the social network data.
- To integrate the use and interpretation of social network data with sociological, psychological or other theory.

UNIT I**9 hrs.**

INTRODUCTION :Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web -Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis -Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II**9 hrs.**

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION :Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language -Modeling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III**9 hrs.**

MINING COMMUNITIES :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**9 hrs.**

EVOLUTION :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**9 hrs.**

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS :Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare -Collaboration networks - Co-Citation networks.

TEXT/ REFERENCE BOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
3. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition Springer, 2011.
4. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer, 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7012	SOFTWARE ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the software process and develop architectural thinking
- To analyze the complex problem using activity, component and deployment diagram
- To explore the knowledge of structural and behavioural patterns of software architecture
- To understand the architectural patterns and different styles
- To gain knowledge of using software design tools.

UNIT 1 SOFTWARE PROCESS**9 Hrs.**

Analysis modeling and best practices, process, process modeling; process notations - traditional best practice diagrams such as DFDs and ERDs.

UNIT 2 ARCHITECTURAL MODELING**9 Hrs.**

UML diagrams, Structural static modeling, behavioural modeling - interactions - use cases - use case, interaction & Activity diagrams. Component and deployment diagrams - analysis case studies, analysis patterns. Documenting quality attributes.

UNIT 3 SOFTWARE ARCHITECTURE DESIGN**9 Hrs.**

Design best practices, Design patterns - Creational patterns - structural patterns - behavioural patterns, Component technology, object oriented frameworks, distributed objects, interoperability standards, and case studies.

UNIT 4 SOFTWARE ARCHITECTURE**9 Hrs.**

Architectural styles, architectural patterns, patterns and software architecture, analysis of architectures, formal descriptions of software architectures, Architectural views.

UNIT 5 ARCHITECTURAL DESCRIPTION LANGUAGES ADL AND TOOLS**9 Hrs.**

Requirements of Architecture – Need for formal Languages, Description languages, Tools for Architectural design, scalability and interoperability issues, Web application architectures, case studies.

Max.45 Hours**COURSE OUTCOMES**

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

- CO1:** Analyze software process and process modelling.
CO2: Ability to draw UML diagrams for a given problem statement.
CO3: Understand various design patterns.
CO4: Evaluate the applicability of an architectural style for a product.
CO5: Build web application architecture using ADL tools.
CO6: Compare and contrast formal languages and description languages.

TEXT / REFERENCE BOOKS

1. Lenn Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Third Edition, Addison- Wesley Publication, 2011
2. George H. Fairbanks Just, " Enough Software Architecture: A Risk-Driven Approach", First Edition, Marshal Publication, 2010
3. Robert C. Martin, "Clean Architecture" Prentice Hall Publication, 2016.
4. Grady Booch, Robert Maksimchuk, Michael Engle, Jim Conallen, Kelli Houston, Young Bobbi." Object-Oriented Analysis and Design with Applications", Addison-Wesley Object Technology Series, 3rd Edition, 2007.
5. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides," Design Patterns, Elements of reusable Object Oriented Software", Pearson, 2015.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

SBSA7013	SOFTWARE DEFINED NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.
- To study about the various applications of SDN
- To learn the SDN Framework

UNIT 1 INTRODUCTION**9Hrs.**

How SDN Works – History and Evolution of Software Defined Networking (SDN)-Separation of Control Plane and Data Plane, IETF Forces, Active Networking.

UNIT 2 OPEN FLOW AND SDN CONTROLLERS**9Hrs.**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, and SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

UNIT 3 DATA CENTERS**9Hrs.****Multitenant**

and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE. Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework (VMWare and others), and Mininet based examples.

UNIT 4 SDN PROGRAMMING**9Hrs.**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT 5 SDN**9Hrs.**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Centre Orchestration

Max.45 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** Analyse the evolution of software defined networks
- CO2:** Express the various components of SDN and their uses
- CO3:** Explain the use of SDN in the current networking scenario
- CO4:** Design and develop various applications of SDN
- CO5:** Understand and explain SDN Programming
- CO6:** An Ability to understand the SDN Framework

TEXT/REFERENCE BOOKS

1. Paul Goransson and Chuck Black, – Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, – SDN: Software Defined Networks, O'Reilly Media, 2013.
3. Siamak Azodolmolky, – Software Defined Networking with Open Flow, Packet Publishing, 2013.
4. Vivek Tiwari, – SDN and Open Flow for Beginners, Amazon Digital Services, Inc., 2013.
5. Fei Hu, Editor, – Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A :** 6 Questions each carrying 5 marks without choice**PART B :** 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)

SBSA7014	VIRTUALIZATION TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of virtualization and virtual machines.
- Introduce Virtualization and Cloud Computing concepts and technologies.
- Provide information on networked storage for virtualization infrastructure needs.

UNIT 1 OVERVIEW OF VIRTUALIZATION**9 Hrs.**

Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization- Virtualization Advantages - Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines - System Virtual Machines – Hypervisor - Key Concepts - Hardware Virtualization – Virtual Hardware Overview - Server Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Server Virtualization – Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform.

UNIT 2 BINARY TRANSLATION AND OPTIMIZATION**9 Hrs.**

Virtual Machine basics – Interpretation – Interpreting Complex Instruction Set – Binary Translation – Dynamic Translation – Instruction Set issues – case Study Dynamic Binary Optimization: Program behaviour – profiling –optimizing translation blocks – framework – code reordering –optimization – ISA optimization system – VM Architecture: Object oriented high level language virtual machines – JVM architecture –Microsoft Common Language Infrastructure.

UNIT 3 NETWORK VIRTUALIZATION**9 Hrs.**

Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design - WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 -VLANs Layer 3 VRF Instances Layer 2 - VFI's Virtual Firewall Contexts Network Device Virtualization - Data-Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – IPSec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF -Aware Routing Multi-Topology Routing.

UNIT 4 VIRTUALIZING STORAGE**9 Hrs.**

SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.

UNIT 5 VIRTUAL MACHINES PRODUCTS**9 Hrs.**

Xen Virtual machine monitors- Xen API – VMware – VMware products – VMware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.
2. Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, A Press 2005.
3. Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.
4. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
5. David Marshall, Wade A. Reynolds, Advanced Server Virtualization:VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3****Hrs.****PART A:** 6 Questions of 5 Marks each – No choice**30 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 14 Marks**70 Marks**

SBSA7015	WIRELESS SENSOR NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide awareness about challenges wireless sensor networks.
- To acquire knowledge of various networking sensors.
- To comprehend the infrastructure establishment.
- To discuss sensor network platforms and tools.

UNIT 1 NETWORK ARCHITECTURE**9 Hrs.**

Concept of sensor network – Introduction, Applications, Sensors. Single Node Architecture: Hardware and software component of a sensor node-Tiny OS operating system-C language. Wireless Sensor Network architecture: Typical network architectures-Data relaying strategies Aggregation-Role of energy in routing decisions.

UNIT 2 MAC LAYER**9 Hrs.**

MAC Layer Strategies: MAC Layer Protocols-Scheduling Sleep Cycles-Energy Management-Contention Based Protocols-Schedule Based Protocols, 802.15.4 Standard. Naming and Addressing: Addressing Services - Publish-Subscribe Topologies. Clock Synchronization: Clustering For Synchronization-Sender-Receiver-Receiver Synchronization-Error Analysis. Power Management – Per Node -System-Wide-Sentry Services-Sensing Coverage.

UNIT 3 NODE LOCALIZATION AND DATA GATHERING**9 Hrs.**

Node Localization: Absolute and Relative Localization-Triangulation-Multi-Hop Localization and Error Analysis-Anchoring - Geographic Localization-Target Tracking - Localization and Identity Management-Walking GPS-Range Free Solutions. Data Gathering - Tree Construction Algorithms and Analysis - Asymptotic Capacity- Lifetime Optimization Formulations- Storage and Retrieval. Deployment & Configuration - Sensor deployment, scheduling and coverage issues-Self configuration and topology control.

UNIT 4 ROUTING AND DISTRIBUTED COMPUTATION**9 Hrs.**

Routing: Agent-Based Routing -Random Walk-Trace Routing Data Centric-Hierarchical - Location-Based – Energy Efficient Routing Querying-Data Collection And Processing-Collaborative Information Processing And Group Connectivity.

UNIT 5 SENSOR NETWORK TOOLS**9 Hrs.**

Sensor Network Platforms and Tools: Sensor node hardware- Programming challenges-Node level software platform-Node level simulators-Programming beyond individual nodes-Security-Privacy issues-Attacks and counter measures.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Feng Zhao and LeonidasJ Guibas, "Wireless Sensor Networks" Morgan Kaufmann Publishers, Elsevier, 2004.
2. Raghavendra.C.S., KrishnaM.Sivalingam,TaiebF.Znati,"WirelessSensorNetworks",2nd edition, Springer,2004.
3. HolgerKarl, AndreasWillig,"ProtocolsandArchitecturesforWirelessSensorNetworks",JohnWileyandSons,2005.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A** : 6 Questions each carrying 5 marks without choice**PART B** : 2 Questions from each unit of internal choice, each carrying 14 marks**Exam Duration : 3 Hrs.****30 Marks****70 marks**

(Out of 100 marks, maximum of 10% problems may be asked)