



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

School of Science and Humanities Department of Computer Science

1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

Programme:

S. No.	Course Code	Course Name	Page No.
Employability			
1	SBSB5101	ADVANCED DATA STRUCTURES AND ALGORITHMS	3
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 Employabil

 Entrepreneurs

 Skill

Entrepreneurship			
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Skill Development			
1	SBSB5104	INTRODUCTION TO MATLAB	8
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SBSB5101	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	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 line are programming and game-theory.

UNIT1 INTRODUCTION TO ALGORITHMS

12Hrs.

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.

UNIT2 TREE STRUCTURES

12Hrs.

Binary Search Trees- AVL Trees- Red-Black Trees- BTrees-Splay Trees - HEAP STRUCTURES: Min/Max heaps- Leftist Heaps- BinomialHeaps- Fibonacci Heaps

UNIT3 MULTIMEDIA STRUCTURES

12Hrs.

SegmentTrees-k-d-Trees-PointQuadTrees-MX-QuadTrees-R-Trees-TV-Trees.

UNIT4 PROBLEM SOLVING TECHNIQUES

12Hrs.

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.

UNIT5 GRAPHAL GORITHMS

12Hrs.

GraphRepresentation-BFS-DFS-TopologicalSort-ConnectedComponentsMinimumSpanningtrees- Kruskal's Algorithm - Prim's Algorithm - Dijkstra's Algorithm - Floyd's Algorithm - Bellman Ford Algorithm.

Max.60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Understand the concept of Analyzing and designing algorithms

CO2-Demonstrate the different types of data structures.

CO3-Able to understand multimedia structures

CO4-Summarize searching and sorting techniques.

CO5-Choose appropriate data structure as applied to specified problem definition.

CO6-Understand and implement the various problem-solving techniques.

TEXT/REFERENCE BOOKS

1. ThomasHCoreman,CharlesE.Leiserson,RonaldL.Rivest,“IntroductiontoAlgorithms”,PHI, 2002.
2. SaraBaase,AllenranGelda,“ComputerAlgorithmsandIntroductiontoDesignandAnalysis”, Pearson,2000.
3. Sahni,“DataStructuresalgorithmmandapplicationinC++”,PHI,2000.
4. MarkAllenWeiss,“DataStructuresandAlgorithmsinC++”,AddisonWesley,3rdEdition.
5. AhoA.V.,HopcroftJ.E.andUllmanJ.D.,“DesignandanalysisofComputeralgorithms”

END SEMESTER EXAM QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration:3Hrs.

PART A :10 Questions of 2 marks each uniformly distributed - No choice

20Marks

PARTB:2 Questions from each unit of internal choice, each carrying 16marks

80Marks

SBSB5102	DATABASE TECHNOLOGIES	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	100

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.

UNIT1 INTRODUCTION

12Hrs.

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

UNIT2 PARALLEL DBMS

12Hrs.

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

UNIT3 MOBILE DATABASES

12Hrs.

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

UNIT4 OBJECT AND MULTIMEDIA DATABASE SYSTEMS

12Hrs.

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

UNIT5 BIGDATA AND HADOOP

12Hrs.

Big Data-Introduction-Technologies-Reference Architecture- Hadoop- Introduction -Map Reduce-weather Dataset-Analyzing the data with Hadoop- Anatomy of Map Reduce Job Run.

Max.60Hrs.

COURSE OUTCOMES

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

CO1-Underst and database system architecture.

CO2-Ability to understand and apply parallel DBMS.

CO3-Understand and Implement mobile databases and protocols

CO4-Describe relational databases and its components.

CO5-Familiar with big data and its applications

CO6-Use tools like Hadoop and mapreduce for data analytics.

TEXT/REFERENCE BOOKS

1. RaghuRamakrishnanandJohannesGehrke,“DatabaseManagementSystems”,3rdEdition McGraw Hill Publications.
2. Korth.H.F. andA.Silberschatz,“Databasesystemconcepts”,3rdEdition,McGrawHill Publications.
3. RamezElmasriandB.Navathe:“FundamentalsofDatabaseSystems”,5thEd.,AddisonWesley, 2008.
4. StenfnnoCeriandGieusppepelagatti,“Distributeddatabase-principlesandsystems”,3rdEdition.
5. O'Reilly,“Hadoop-TheDefinitiveGuide“,O'ReillyMedia.
6. <http://www.oracle.com/technetwork/topics/entarch/articles/info-mgmt-big-data-ref-arch-11202853.pdf>
7. <http://www.comptechdoc.org/independent/database/basicdb/dataobject.html>.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration:3Hrs.

PART A:6 Questions of 5 marks each - No choice

30Marks

PARTB:2 Questions from each unit with internal choice, each carrying 14marks
(Outof100 marks, maximumof10%problemsmaybeasked)

70Marks

SBSB5103	SOFTWARE QUALITY ASSURANCE AND TESTING	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	100

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

UNIT1 INTRODUCTION

12Hrs.

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

UNIT2 SOFTWARE TESTING METHODS AND STRATEGIES

12Hrs.

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.

UNIT3 OBJECT ORIENTED TESTING, METRICS AND MEASUREMENTS

12Hrs.

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.

UNIT4 QUALITY CONSIDERATIONS

12Hrs.

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.

UNIT5 OVERVIEW OF STANDARDS

12Hrs.

Levels of standards-Quality assurance standards-Project management standards-Dependability standards-Product standards- Process standards-ISO12000-Reviews, Audits and Certification.

Max.60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Learn software quality factors

CO2-Apply common software testing strategies

CO3-Demonstrate about the project process control and software Metrics

CO4-Implement all the common software testing strategies.

CO5-Understand the SQA standards and software process assessments

CO6-To deploy quality engineering models in projects

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, 112124.
5. Ian Sommerville, "Software Engineering", Addison-Wesley, 5th Edition, 112126.

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

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

SBSB5104	INTRODUCTION TO MATLAB	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	100

COURSE OBJECTIVES

- Enable the students to learn many of MATLAB commands
- To study the fundamentals for image processing
- Use MATLAB and study image enhancement techniques and mathematical transforms.

UNIT1 DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS 12Hrs.

Elements of Visual Perception - Image Sampling and Quantization- Basic Relationships between Pixels-Basic Geometric Transformations-Introduction to Fourier Transform and DFT-Properties of 2D Fourier Transform - FFT - Separable Image Transforms - Walsh - Hadamard - Discrete Cosine Transform.

UNIT2 IMAGE ENHANCEMENT TECHNIQUES 12Hrs.

Spatial Domain Methods- Basic Grey level transformation- Histogram Equalization - Image Subtraction - Image Averaging - Spatial Filtering - Smoothing, Sharpening filters- Laplacian Filters- Frequency Domain Filters- Smoothing, Sharpening Filters- Homomorphic Filtering.

UNIT3 IMAGE RESTORATION 12Hrs.

Model of Image Degradation/ Restoration Process - Noise Models - Blind Image restoration- Pseudo Inverse- Singular Value Decomposition.

UNIT4 IMAGE COMPRESSION 12Hrs.

Lossless compression- Variable Length Coding - LZW coding - Bit Plane Coding - Predictive Coding- DPCM- Lossy Compression- Transform Coding - Wavelet Coding- Basics of Image Compression Standards: JPEG, MPEG.

UNIT5 BOUNDARY REPRESENTATION 12Hrs.

Chain codes- Polygonal Approximation - Boundary Segments - Boundary Descriptors- Simple Descriptors- Fourier Descriptors- Regional Descriptors- Simple Descriptors- Textures.

Max. 60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Analyze general terminology of digital image processing in MATLAB

CO2-Examine various types of images, intensity transformations and spatial filtering.

CO3-Develop Fourier transform for image processing in frequency domain.

CO4-Evaluate the methodologies for image segmentation, restoration etc

CO5-Implement image process and analysis algorithms.

CO6-Apply image processing algorithms in practical applications.

TEXT/REFERENCE BOOKS

1. Rudra Pratap, "Getting Started with MATLAB 6.0", 1st Edition, Oxford University Press, 2004
2. Duane Hanselman, Bruce Littlefield, "Mastering MATLAB 7", Pearson Education Inc, 2005
3. William J. Palm, "Introduction to MATLAB 6.0 for Engineers", McGraw Hill & Co, 2001
4. M. Herniter, "Programming in MATLAB", Thomson Learning, 2001
5. K.K. Sharma, "MATLAB Demystified", K.K. Sharma, Matlab: Demystified Basic Concepts and Applications, Vikas Publishing House Pvt Ltd, 2010
6. Stephen J. Chapman, "MATLAB Programming for Engineers", Thomson, 4th Edition, 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3Hrs.

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)

SBSB5201	NETWORK HACKING AND DIGITAL FORENSICS	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	100

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

UNIT1 ETHICAL HACKING

12Hrs.

Types of DataStolen, 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.

UNIT2 FOOT PRINTING ANDSOCIAL ENGINEERING

12Hrs.

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, DumpsterDiving, Piggybacking.

UNIT3 DATA SECURITY & FIREWALLS

12Hrs.

Physical Security - Attacks and Protection, A study on various attacks- **Input validation attacks - SQL injection attacks** - Buffer overflow attacks - Privacy attacks, Attacks and Measures, WirelessHacking, Windows Hacking, Linux Hacking.

UNIT4 NETWORK PROTECTION SYSTEM & HACKING WEB SERVERS

12Hrs.

Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, **Vulnerability, PenetrationTesting**, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, BufferOverflow, Reverse Engineering, Email Hacking, **Incident Handling& Response**, Bluetooth Hacking, Mobiles Phone Hacking.

UNIT5 ETHICAL HACKING LAWS AND TESTS

12Hrs.

An introduction to the particular legal, professional and ethical issues likely toface **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.

Max.60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Understand the concepts of Cyber forensics

CO2-Apply the Computer Forensics Technology.

CO3-Know How to Investigate Computer Forensic

CO4-Underst and the importance of Business Computer Forensic Technology

CO5-Analyse the Advanced Cyber Forensics -windows, memory, Virtual machine Forensics

CO6-Underst and hacking laws and tests.

TEXT/REFERENC EBOOKS

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, 20012-11-01.
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 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 with internal choice, each carrying 14 marks

70 Marks

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

SBSB5202	MOBILE COMPUTING	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	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.

UNIT1 WIRELESS COMMUNICATION FUNDAMENTALS

12Hrs.

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

UNIT2 TELECOMMUNICATION NETWORKS

12Hrs.

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

UNIT3 MOBILE NETWORK LAYER

12Hrs.

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

UNIT4 MOBILE ADHOC NETWORKS(MANETS)

12Hrs.

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

UNIT5 PROTOCOLS AND TOOLS

12Hrs.

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.60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-To understand concepts of Mobile Communication.

CO2-To analyse next generation Mobile Communication System

CO3-To understand network and transport layers of Mobile Communication.

CO4-Analyze various protocols of all layers from mobile and adhoc wireless communication networks

CO5-To understand IP and TCP layers of Mobile Communication.

CO6-Evaluate the effectiveness of different mobile computing frameworks.

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 04714112028.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML"
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 00714123712, 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 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 with internal choice, each carrying 14 marks

70 Marks

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

SBSB5203	NATURAL LANGUAGE PROCESSING	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	100

COURSE OBJECTIVES

- To understand the use of state automata for language processing.
- To provide the fundamentals of parsing.
- Learn parsing and grammars for natural language

UNIT1 LINGUISTIC BACKGROUND

12Hrs.

An outline of English Syntax-Grammars and Parsing Features and Augmented Grammars.

UNIT2 SYNTACTIC PROCESSING

12Hrs.

Grammars for Natural Language - Toward Efficient Parsing - Bottom-Up Parsing - Top-Down Parsing - Transition Network Grammars.

UNIT3 FEATURES AND AUGMENTED GRAMMARS

12Hrs.

Feature Systems and Augmented Grammars - Some Basic Feature Systems for English - Morphological Analysis and the Lexicon - Grammar using Features - Parsing with Features - Augmented Transition Networks- Generalized Feature Systems and Unification grammars.

UNIT4 GRAMMARS FOR NATURAL LANGUAGE

12Hrs.

Auxiliary Verbs and Verb Phrases- Movement Phenomena in Language- Handling questions in Context - Free Grammars- Relative Clauses - Hold Mechanism in ATN's.

UNIT5 EFFICIENT PARSING

12Hrs.

Human Preferences - Parsing Semantic Interpretation - Semantics and Logical Form Word Senses and Ambiguity - The Basic Logical Form Language - Encoding Ambiguity - Verbs and States in Logical Form - Semantic Interpretation and Compositionality - A Simple Grammar and Lexicon with Semantic Interpretation Prepositional Phrases and Noun Phrases.

Max.60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Understand NLP problems and survey the literature about that problem

CO2-Understand language modeling

CO3-Describe automated natural language generation and machine translation

CO4-Learn the natural language generation.

CO5-Analyze the logic and semantics of world knowledge

CO6-Analyze and compare the use of different statistical approaches for different types of NLP applications.

TEXT/REFERENCE BOOKS

1. James Allan, "Natural Language Understanding", Benjamin/Gumming Publishing Company Inc, 5th edition, 2015.
2. Richard M Reese, "Natural Language Processing with Java", O'Reilly Media, 2015

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration:3Hrs.

PART A: 6 Questions of 5 marks each - No choice

30Marks

PART B: 2 Questions from each unit with internal choice, each carrying 14 marks
(Out of 100 marks, maximum of 10% problems may be asked)

70Marks

SBSB5301	CYBER PHYSICAL SYSTEM	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	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 behavior of CPS based on standard modeling formalisms.

UNIT1 INTRODUCTION TO INDUSTRY 4.0 & CYBER PHYSICAL SYSTEM 12Hrs.

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.

UNIT2 EMBEDDED SYSTEMS MODELING AND DESIGN AND CPS 12Hrs.

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 - Wireless HART, CAN, Automotive Ethernet- Software stack -Real-Time Operating system (RTOS) -Scheduling Real Time control tasks.

UNIT3 SENSORS, ACTUATORS AND SENSOR NETWORKS 12Hrs.

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.

UNIT4 SECURITY OF CYBER PHYSICAL SYSTEM 12Hrs.

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.

UNIT5 CYBER-PHYSICAL SYSTEM CASE STUDIES AND PROJECTS 12Hrs.

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.60Hrs.

COURSE OUTCOMES

On completion of the course, 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.

CO4Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.

CO5-Categorize the essential modelling formalisms of Cyber-Physical Systems(CPS).

CO6-Ability to understand cyber modelling system

TEXT/REFERENCE BOOKS

1. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist (Apress)
2. "Industrial Internet of Things: Cybermanufacturing Systems" 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,
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. Princeton University Press, 20012.
6. http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page.

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 with internal choice, each carrying 14 marks
(Out of 100 marks, maximum of 10% problems may be asked)

70 Marks

SBSB5302	WIRELESS SENSOR NETWORKS	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	100

COURSE OBJECTIVES

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

UNIT1 NETWORK ARCHITECTURE

12Hrs.

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.

UNIT2 MAC LAYER

12Hrs.

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.

UNIT3 NODE LOCALIZATION AND DATA GATHERING

12Hrs.

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.

UNIT4 ROUTING AND DISTRIBUTED COMPUTATION

12Hrs.

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.

UNIT5 SENSOR NETWORK TOOLS

12Hrs.

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.60Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-An Ability to understand the concepts of sensors.

CO2-An Ability to analyze modelling and simulation of various communication networks.

CO3-Demonstrate knowledge of MAC protocols developed for WSN. **CO4**-

Demonstrate knowledge of routing protocols developed for WSN. **CO5**-

Understand and explain mobile data-centric networking principles **CO6**-An

Ability to understand the security features in WSN

TEXT/REFERENCE BOOKS

1. FengZhaoandLeonidasJGuibas,“WirelessSensorNetworks”MorganKaufmannPublishers,Elsevier,2004.
2. Raghavendra. C.S., Krishna M. Sivalingam, Taieb F. Znati, “Wireless Sensor Networks”, 2nd edition, Springer,2004.
3. HolgerKarl,AndreasWillig,“ProtocolsandArchitecturesforWirelessSensorNetworks”,JohnWileyand Sons,2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration:3Hrs.

PART A: 6 Questions of 5 marks each - No choice

30Marks

PARTB:2 Questions from each unit with internal choice, each carrying 14marks

70Marks

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

SBSB5303	DATA SCIENCE	L	T	P	EL	Credits	Total Marks
		4	0	0	0	4	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 the iruses, and with the use of empirical distributions

UNIT1 INTRODUCTIONTO DATA SCIENCE

12Hrs.

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).

UNIT2 APPROACHING ANALYTICS PROBLEMS

12Hrs.

Key roles for successful Analyticsproject- Discovery- Businessdomain, Resources, Problem framing, Key stakeholders, Analytics sponsors, Initial hypotheses, Data sources- Data Preparation- Learningabout 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.

UNIT3 INTRODUCTION TOR

12Hrs.

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.

UNIT4 MODELING METHODS

12Hrs.

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.

UNIT5 DELIVERING RESULTS

12Hrs.

Documentationanddeployment-producingeffectivepresentations-Introductiontographicanalysis- plot() function - displaying multivariate data - matrix plots - multiple plotsin one window - exporting graph - using graphics parameters. Case studies.

Max.60Hrs.

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 processingdata from real world problems **CO4**-

Analyse 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, "DataScience and Big Data Analytics", EMCEducation Services, 2015
2. NinaZumel,JohnMount,"PracticalDataSciencewithR",ManningPublications,2014
3. JureLeskovec,andRajaraman,JeffreyD.Ullman,"MiningofMassiveDatasets",Cambridge University Press,2014
4. Glenn J. Myatt, Wayne P.Johnson, Making Sense ofData I: APractical Guide to Exploratory Data Analysis and Data Mining,JohnWiley&SonPublication,SecondEdition,2014.
5. SaltzJeffreyS,AnIntroductiontoDataScience,SagePublicationsInc,SecondEdition,20112
6. W.N.Venables,D.M.SmithandtheRCoreTeam,"AnIntroductiontoR",2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration:3Hrs.

PART A: 6 Questions of 5 marks each - No choice

30Marks

PARTB:2 Questions from each unit with internal choice, each carrying 14 marks

70Marks

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

