



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 COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In Artificial Intelligence			
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SAIC4004	ENGINEERING IN COMMUNITY SERVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain knowledge to incorporate a multidisciplinary perspective in their research and critical analysis.
- To conceptualize, analyze, articulate, and propose solutions to social issues expressed by the needs of individuals, families and groups.
- To make conceptualize the characteristics and meaning of community.
- To integrate and articulately demonstrate their grasp of the diversity.
- To help the student integrate and demonstrate the values of community service.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to the community, student input into nature of the course, proposed course content, assignments, expectations, evaluation measures, grading, possible community service activities, the meaningful journal, recording volunteer time, sharing in class, the electronic conference, use of the Internet.

UNIT 2 LOCATING RESOURCES IN COMMUNITY SERVICE

9 Hrs.

Orientation to Grade A, course use of e-mail, the electronic conference, accessing library resources, locating community service links on the Internet, locating service learning centers in higher education.

UNIT 3 GETTING STARTED IN COMMUNITY SERVICE

9 Hrs.

Introduction to the history and nature of volunteerism, and the role of volunteerism in Indian value, social, and political systems, thinking about volunteerism, values and value dilemmas, humanism, altruism, building a working relationship, empowering people.

UNIT 4 PREPARING AND DOING COMMUNITY SERVICE

9 Hrs.

Usefulness of the multidisciplinary approach. How theories guide our thinking and understanding. Relating theory to real life situations. Theories: ecological theory, systems theory, symbolic interaction, and discipline specific contributions, compatibility with the perspective.

UNIT 5 REPORTS AND CELEBRATION

9 Hrs.

Celebrating the service learning experience, integrating service learning and the multidisciplinary perspective, synthesizing experience and learning.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 :** Demonstrate all competencies consistent with the objectives of this service learning course in their journal.
- CO2 :** Understand through their journals, discussion groups, and community service activities..
- CO3 :** Demonstrate in a scholarly paper, their ability to research, integrate and analyze their individual volunteer project
- CO4 :** Expected to attend all seminars, complete all assignments, participate in all seminar activities,
- CO5 :** Understand to assume active responsibility for their own learning by independent reading, literature search, and research
- CO6 :** Participation in community service activities.

TEXT/REFERENCE BOOKS

1. Coles, R. (1993). The call of service. New York: Houghton Mifflin Company
2. Albert, G (Ed.). (1994). Service-learning reader: Reflections and perspectives on service .
3. **Corporate Social Responsibility: Doing the Most Good for Your Company and Your Cause** by Philip Kotler and Nancy Lee.
4. **Soul of a Citizen: Living with Conviction in Challenging Times** by Paul Rogat Loeb.
5. **Good Works!: Marketing and Corporate Initiatives that Build a Better World...and the Bottom Line** by Philip Kotler , David Hesekiel and Nancy Lee



Employability

SCSA1404	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of intelligent agents
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems.
- To learn the concepts of learning and communication in AI.
- To know about the various applications of AI.

UNIT 1 INTRODUCTION AND PROBLEM SOLVING

9 Hrs.

Introduction - Foundations of AI - History of AI - Intelligent agent - Types of agents - Structure - Problem solving agents - Uninformed search strategies - Breadth first search - Uniform cost search - Depth first search - Depth limited search - Bidirectional search - Searching with partial Information.

UNIT 2 INFORMED SEARCH AND GAME PLAYING

9 Hrs.

Informed search - Strategies - A* Heuristic function - Hill Climbing - Simulated Annealing - Constraint Specification problem - Local Search in continuous space - Genetic algorithm - Optimal decisions in games - Pruning - Imperfect decisions - Alpha-Beta pruning - Games that include an element of chance.

UNIT 3 KNOWLEDGE AND REASONING

9 Hrs.

Knowledge based agent - The Wumpus world environment - Propositional logic - Inference rules - First-order logic - Syntax and semantics - Situation calculus - Building a knowledge base - Electronic circuit domain - Ontological Engineering - Forward and backward chaining - Resolution - Truth maintenance system-Mental Events and Mental Objects.

UNIT 4 ACTING LOGICALLY

9 Hrs.

Planning - Representation of planning - Partial order planning -Planning and acting in real world - Acting under uncertainty - Bayes's rules - Semantics of Belief networks - Inference in Belief networks - Making simple decisions - Making complex decisions.

UNIT 5 APPLICATIONS

9 Hrs.

AI applications - Language Models - Information Retrieval- Information Extraction -Fields of Natural Language Processing, Chatbots and its types, Artificially Intelligent Chatbots, Introduction to Chatbot Applications (Retrieval based-Conversation based)-Machine Translation - Speech Recognition - Robot - Hardware - Perception - Planning - Moving.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: An ability to identify, analyze the search algorithm for the AI problems.
- CO2: Represent a problem using first order logic.
- CO3: Provide the knowledge-based agent to solve the problem.
- CO4: Understand the Informed search strategies.
- CO5: Apply the baye's rule to solve the problem for societal concern.
- CO6: Design user centric applications that use AI concepts

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rdEdition, Pearson Education, 2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
3. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.
4. Artificial Intelligence: Foundations of Computational Agents, 2nd Edition,David L. Poole and Alan K. Mackworth,2010
5. Introduction to Artificial Intelligence , Ertel, Wolfgang, 1stEdition ,2017

SCSA1504	BIG DATA ANALYTICS FOR AI	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the concepts and phases of big data analytics.
- To study the tools required to manage and analyse big data.
- To explore the concept of knowledge representation
- To learn the ability of planning strategies
- To study the learning techniques and logistic regression

UNIT 1 INTRODUCTION TO BIG DATA

9 Hrs.

Introduction - Challenges of Conventional Systems, What is Business Analytics, Business Analytics lifecycle, Why Big Data Analytics, Defining Big data, Characteristics of Big Data(V's), Business Analytics phases: Data Acquisition- Data Cleaning - Data Manipulation - Data Analysis (Statistical and Analytical methods) to make sense of data - Data Visualization

UNIT 2 HADOOP MAPREDUCE

9 Hrs.

Introduction to HADOOP - Hadoop ecosystem components and uses, Hadoop Storage: HDFS, Concept of Hadoop Distributed file system, Design of HDFS, Configuration of HDFS. Hadoop Data Types, large-scale deep belief nets with map reduce - Functional-Concept of Mappers, Functional-Concept of Reducers, MapReduce Execution Framework, Partitioners and Combiners, Hadoop Clusters component: NameNode, Secondary NameNode, and DataNode, Data flow (Anatomy of File Write and Read) - detecting malicious domain using deep Learning at scale.

UNIT 3 KNOWLEDGE REPRESENTATION

9 Hrs.

Issues, predicate logic, resolution, representing knowledge using rules, forward versus backward reasoning, matching, control knowledge, weak slot and filler structure-semantic nets, frames, strong slot - learning curve analysis by logistic regression.

UNIT 4 GAME PLAYING

9 Hrs.

Mini-max search, alpha-beta cutoffs, planning system, goal stack planning, hierarchical planning, understanding as constraint satisfaction, waltz algorithm, natural language processing, syntactic processing - scalable multi-dimensional prediction model.

UNIT 5 LEARNING

9 Hrs.

Rote learning, learning by taking advice, learning in problem solving, learning from examples, winston's learning program, decision trees, perception, vision, speech recognition, navigation, manipulation, robot architecture - data analytics using scalable logistic regression - sentimental classification of bigdata using logistic regression

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Understand the key issues in big data management
- CO2: Acquire various analysing techniques, software tools in big data analytics
- CO3: Analyse various AI approaches to solve problems.
- CO4: Learn various classification techniques in big data analytics.
- CO5: Design models for real world scenarios.
- CO6: Design a case study and retrieve the patterns from large data to solve complex tasks.

TEXT/ REFERENCE BOOKS

1. Distributed Databases: Principles and Systems Paperback - 1 Jul 2017 by Stefano Ceri , Giuseppe Pelagatti , McGraw Hill Education, ISBN-10: 0070265119, ISBN-13: 978-0070265110, 2017.
2. Tom White "Hadoop: The Definitive Guide" Fourth Edition, O'reilly Media, 2015
3. Prajapati, V. Big data analytics with R and Hadoop. Packt Publishing Ltd, 2013
4. E.RichK.Knight, and B. Nair, Artificial Intelligence, 3rd Edition, TMH, 1 July 2017
5. RusselNorvig, Artificial Intelligence A modern Approach, 3 rd Edition, Pearson Education,2010

SCSA1505	HIGH PERFORMANCE COMPUTING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Parallel Processing.
- To introduce Optimization techniques for serial code.
- To introduce Parallel Computing Paradigms.
- To introduce Parallel Programming using OpenMP and MPI.

UNIT 1 PARALLEL PROCESSING

9 Hrs.

Introduction to Parallel Processing - Levels of Parallelism - SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation - Pipelining.

UNIT 2 OPTIMIZATION TECHNIQUES

9 Hrs.

Introduction to optimization techniques for serial code- scalar profiling-function and line based runtime profiling- hardware performance counters- common sense optimizations- simple measures, large impact- elimination of common sub expressions- avoiding branches- using simd instruction sets- the role of compilers - general optimization options- inlining - aliasing- computational accuracy-register optimizations- using compiler logs- dynamic memory management- loop kernels and iterators data access optimization: balance analysis and light speed estimates- storage order- case study: jacobi algorithm and dense matrix transpose.

UNIT 3 PARALLEL COMPUTERS

9 Hrs.

Introduction Parallel Computers : Taxonomy of parallel computing paradigms-Shared memory computers- Cache coherence- UMA - ccNUMA-Distributed-memory computers- Hierarchical systems- Networks-Basic performance characteristics- Buses- Switched and fat- tree networks- Mesh networks- Hybrids - Basics of parallelization -Why parallelize - Data Parallelism - Function Parallelism- Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws- parallel efficiency - serial performance Vs Strong scalability- Refined performance models-Choosing the right scaling baseline- Case Study: Load balance.

UNIT 4 PARALLEL PROGRAMMING

9 Hrs.

Distributed memory parallel programming with MPI : message passing - introduction to MPI - example - messages and point-to-point communication - collective communication - non blocking point-to-point communication- virtual topologies - Shared memory parallel programming with OpenMp : introduction to OpenMp - parallel execution - data scoping- OpenMp work sharing for loops- synchronization - reductions - loop scheduling -tasking - Any Case study.

UNIT 5 MPI PROGRAMMING

9 Hrs.

MPI programming: MPI performance tools-communication parameters- Synchronization, serialization, contention- Reducing communication overhead- optimal domain decomposition- Aggregating messages - Nonblocking Vs Asynchronous communication- Collective Communication-Understanding intra-node point-to-point communication.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Understand the concepts of Parallel Processing & Pipelining
- CO2:** Analyze Optimization techniques for serial code.
- CO3:** Understand Parallel Computing Paradigms.
- CO4:** Appreciate the concepts of Parallel Programming.
- CO5:** Identify the performance issues in Parallel Programming using OpenMP
- CO6:** Identify the performance issues in Parallel Programming using MPI.

TEXT /REFERENCE BOOKS

- Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall / CRC Computational Science series, 2011.
- Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd Edition, 1998.
- Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984.

SCSA1506	HUMAN COMPUTER INTERACTION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

UNIT 1

9 Hrs.

The Components The Human : Human Memory - Thinking - Emotion - Individual Preferences - Psychology and Design of Interactive Systems. **The Computer :** Text Entry Devices - Pointing Devices - Display Devices - Devices for Virtual Reality and 3D interaction - Physical Controls, Sensors and Special Devices - Memory - Processing and Networks.

UNIT 2

9 Hrs.

HCI in the software process: Interactive Design: Basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in soft

ware process: Software life cycle - usability engineering - Prototyping in practice - design rationale. Design Rules: Introduction - Principles to support usability - Standards - Guidelines - Golden rules and heuristics - HCI patterns

UNIT 3

9 Hrs.

Models and Theories HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements - Communication and collaboration models- Face-toface communication - conversation - text based - group working; Task analysis - difference between other techniques - task decomposition - Knowledge based analysis - ER based techniques -uses

UNIT 4

9 Hrs.

Implementation support: Windowing system elements - using tool kits - user interface management; Evaluation techniques - goals - expert analysis - choosing a method; universal design principles - multimodal interaction; user support - requirements - Approaches - adaptive help systems - designing user support systems.

UNIT 5

9 Hrs.

Web Interface Design: Designing Web Interfaces - Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies. **Max 45 Hrs.**

COURSE OUTCOMES

On completion of the course the student would be able to

- CO1:** Design effective dialog for HCI
- CO2:** Design effective HCI for individuals and persons with disabilities.
- CO3:** Assess the importance of user feedback.
- CO4:** Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- CO5:** Develop meaningful user interface.
- CO6:** Analyze and identify user models and the appropriate tools.

TEXT /REFERENCE BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004 (Unit I, II and III).
2. Human Computer Interaction, Springer publications, 2018.
3. Brian Fling, Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009 (Unit -IV)
4. Bill Scott and Theresa Neil, Designing Web Interfaces, First Edition, O'Reilly, 2009. (Unit-V)

SCSA1406	INTRODUCTION TO ROBOTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The objective of this course is to impart knowledge about industrial robots for their control and design.

UNIT 1 Introduction to Robotics

7 Hrs.

Types and components of a robot, Classification of robots, closed-loop and open-loop control systems. Kinematics systems; Definition of mechanisms and manipulators, Social issues and safety.

UNIT 2 Robot Kinematics and Dynamics

9 Hrs. Kinematic

Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Jacobian, Singularity, and Statics Dynamic Modelling: Equations of motion: Euler-Lagrange formulation

UNIT 3 Sensors and Vision System

9 Hrs.

Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc.

Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations Vision applications in robotics.

UNIT 4 Robot Control

9 Hrs.

Basics of control: Transfer functions, Control laws: P, PD, PID Non-linear and advanced controls

UNIT 5 Robot Actuation Systems

11 Hrs. Actuators:

Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators. Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Perform kinematic and dynamic analyses with simulation.
- CO2: Design control laws for a robot.
- CO3: Integrate mechanical and electrical hardware for a real prototype of robotic device.
- CO4: Select a robotic system for given application.

TEXT/REFERENCE BOOKS

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

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

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCSA3012	KNOWLEDGE MANAGEMENT SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the basic rudiments of knowledge management
- To understand of the knowledge management system life cycle.
- To acquire the Knowledge Capturing Techniques
- To learn the coding tools and procedures
- To explore the faster decision making with knowledge transfer systems.

UNIT 1

9Hrs.

KNOWLEDGE MANAGEMENT: KM Myths - KM Life Cycle - Understanding Knowledge - Knowledge, intelligence - Experience - Common Sense - Cognition and KM - Types of Knowledge - Expert Knowledge - Human Thinking and Learning.

UNIT 2

9Hrs.

KNOWLEDGE MANAGEMENT SYSTEM LIFE CYCLE: Challenges in Building KM Systems - Conventional Vrs KM System Life Cycle (KMSLS) - Knowledge Creation and Knowledge Architecture - Nonaka's Model of Knowledge Creation and Transformation. Knowledge Architecture.

UNIT 3

9Hrs.

CAPTURING KNOWLEDGE: Evaluating the Expert - Developing a Relationship with Experts - Fuzzy Reasoning and the Quality of Knowledge - Knowledge Capturing Techniques, Brain Storming - Protocol Analysis - Consensus Decision Making - Repertory Grid-Concept Mapping-Blackboarding.

UNIT 4

9Hrs.

KNOWLEDGE CODIFICATION: Modes of Knowledge Conversion - Codification Tools and Procedures - Knowledge Developer's Skill Sets - System Testing and Deployment - Knowledge Testing - Approaches to Logical Testing, User Acceptance Testing - KM System Deployment Issues - User Training - Post Implementation.

UNIT 5

9Hrs.

KNOWLEDGE TRANSFER AND SHARING: Transfer Methods - Role of the Internet - Knowledge Transfer in e- world - KM System Tools - Neural Network - Association Rules - Classification Trees - Data Mining and Business Intelligence - Decision Making Architecture - Data Management - Knowledge Management Protocols - Managing Knowledge Workers.

Max 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Understand the concept of knowledge and its types
- CO2:** Analyse the challenges in building Knowledge Management systems
- CO3:** Develop knowledge management capturing techniques
- CO4:** Test the coding tools for knowledge management systems.
- CO5:** Understand the architecture and development of knowledge systems
- CO6:** Develop models with Knowledge management system tools

TEXT /REFERENCE BOOKS

1. Elias.M. Award & Hassan M. Ghaziri - "Knowledge Management" Pearson Education 2000
2. Guus Schreiber, Hans Akkermans, Anjo Anjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2001.
3. C.W. Holsapple, "Handbooks on Knowledge Management", International Handbooks on Information Systems, Vol 1 and 2, 2003
4. Becerra-Fernandez, I.; Sabherwal, R.: Knowledge Management: Systems and Processes. M.E. Sharpe Inc., 2010.

SITA3007	COMPUTATIONAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To know the scope of computational intelligence and the type of agents.
- To study the perceptron and learning techniques
- To explore the concept of fuzzy rules and systems
- To learn the steps in genetic algorithm
- To study the ant colony and swarm optimization algorithm

UNIT 1 ARTIFICIAL INTELLIGENCE 9 Hrs.

Introduction - Foundations of AI - History of AI - Intelligent agent - Types of agents - Structure - Problem solving agents - Uninformed and informed search strategies.

UNIT 2 ARTIFICIAL NEURAL NETWORKS 9 Hrs.

Basic concepts - Single layer Perceptron - Multilayer Perceptron - Supervised and Unsupervised learning -deep learning algorithms - Back propagation Networks - Performance Issues.

UNIT 3 FUZZY SYSTEMS 9 Hrs.

Introduction to fuzzy- Fuzzy sets and Fuzzy reasoning - Fuzzy matrices - Fuzzy Functions - Decomposition - Fuzzy rules and inferences - Fuzzy decision making - deep learning architecture for Fuzzy logic.

UNIT 4 GENETIC ALGORITHMS 9Hrs.

Survival of the fittest - Fitness Computations - Cross over- Mutation - Reproduction - Rank method - Rank Space method.

UNIT 5 SWARM INTELLIGENCE 9 Hrs.

Particle swarm optimization - Global PSO- Local PSO - Ant colony Optimization - Simple Ant Colony - Ant System - feature selection of logistic regression. - Max, Min Ant System.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Understand the search strategies in AI
- CO2:** Analyse the performance issues of learning techniques
- CO3:** Solve a problem with fuzzy logic and rule out the inferences
- CO4:** Optimize continuous and discrete functions and multi objective problems
- CO5:** Design models for real world scenarios.
- CO6:** Design a case study and optimize the results

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, " Artificial Intelligence A Modern Approach ", 3rd Edition, Pearson Education, 2010
 2. Elain Rich & Kevin Knight, Artificial Intelligence, Third edition, Tata McGraw Hill, 2010
- choice, each carrying 16 marks

SITA3010	NATURAL LANGUAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamentals of natural processing
- To understand the way to measure one or more qualities of an algorithm or a system
- To gain knowledge of the linguistics concerned with the interactions between computers and human.
- To get acquainted with the algorithmic description of the main language levels that include morphology, syntax and semantics.

UNIT 1 OVERVIEW AND LANGUAGE MODELLING

9 Hrs.

Overview: Origins and challenges of NLP Language and grammar-Processing Indian Languages- NLP Applications Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

UNIT 2 WORD LEVEL ANALYSIS

9Hrs.

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff - Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging - Hidden Markov and Maximum Entropy models.

UNIT 3 SYNTACTIC ANALYSIS

9 Hrs.

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar - Dependency Grammar - Syntactic Parsing, Ambiguity, Dynamic Programming parsing - Shallow parsing - Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT 4 INFORMATION RETRIEVAL AND LEXICAL RESOURCES

9 Hrs.

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval - valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

UNIT 5 DISCOURSE ANALYSIS AND LEXICAL RESOURCES

9 Hrs.

Discourse segmentation, Coherence - Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm - Coreference Resolution - Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brills Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Max.45 Hours

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 and compare the use of different statistical approaches for different types of NLP applications.
- CO6:** Ability to select a suitable language modelling technique based on the structure of the language.

TEXT / REFERENCE BOOKS

1. Richard M Reese, "Natural Language Processing with Java, O'Reilly Media, 2015.
2. Natural language processing in AI-Brojo Kishore Mishra,Rahavendra kumar, Apple academy press, 1st edition,2020.
3. Nitin Indurkha and Fred J. Damerau, "Handbook of Natural Language Processing, Second Edition,Chapman and Hall/CRC Press, 2010.
4. Daniel Jurafsky, James H. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

Employability

SCSA1605	ROBOTICS AUTOMATION AND SIMULATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamental concepts of Robotics automation process
- To introduce basic concepts of various dynamics processes
- To understand the effect of various power sources and sensors.
- To impart knowledge on the manipulators, grippers and robot dynamics
- To implement a real time Robot with the support of available programming languages

UNIT 1 BASIC CONCEPTS

9 Hrs.

Origin & various generation of Robots - Robot definition - Robotics system components - Robot classification Coordinate frames - Asimov's laws of robotics - degree of freedom - dynamic stabilization of robots.- work volume. Need for Automation - types of automation - fixed, programmable and flexible automation.

UNIT 2 POWER SOURCES AND SENSORS

9 Hrs.

Hydraulic, pneumatic and electric drives - determination of HP of motor and gearing ratio - variable speed arrangements - path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic, fiber optic and tactile sensors.

UNIT 3 MANIPULATORS, ACTUATORS, GRIPPERS and ROBOT DYNAMICS

9 Hrs. Construction

of manipulators - manipulator dynamics and force control - electronic and pneumatic manipulator control circuits - end effectors - various types of grippers - design considerations. Introduction to Robot Dynamics - Lagrange formulation - Newton Euler formulation - Properties of robot dynamic equations.

UNIT 4 KINEMATICS AND PATH PLANNING

9 Hrs.

Forward Kinematics - Denavit Hartenberg Representation. multiple solution jacobian work envelop, Inverse Kinematics - Geometric approach. Hill climbing techniques.

UNIT 5 PROGRAMMING LANGUAGES AND APPLICATIONS

9 Hrs. Robot

programming - Fixed instruction, sequence control, General programming language, Specific programming languages. Robots for welding, painting and assembly - Remote Controlled robots - robots in manufacturing and non-manufacturing applications - Robots for nuclear and chemical plants.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Comprehend the concepts of Robotics automation process
- CO2: Criticize the laws of robotics and identify the types.
- CO3: Integrate different types of sensors for industrial applications
- CO4: Apply the AI techniques in Automation process to make the Robot as intelligent.
- CO5: Simulate Real time Automated Robot for Industrial applications.
- CO6: Create an AI based Robot for any real time applications.

TEXT / REFERENCE BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 2011.
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998. Deb.S.R., "Robotics technology and flexible Automation", John Wiley, USA 2017.
3. Asfahl C.R., "Robots and Manufacturing Automation", John Wiley, USA 2013.
4. Klafter R.D., Chmielewski T.A., Negin M., "Robotic Engineering - An integrated approach", Prentice Hall of India, New Delhi, 1994.
5. McKerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.
6. Bruno Siciliano, Oussama Khatib, Springer Handbook of Robotics, Springer publishing company, 2016 ISBN:9783319325507

A160	Employability	PREDICTIVE AND ADVANCED ANALYTICS			L	T	P	Credits	Total Marks
					3	0	0	3	100

COURSE OBJECTIVES

- To learn the concepts and applications of data mining
- To understand and prepare the data
- To study the model development techniques.
- To explore the Automated Models for Categorical and Continuous targets
- To analyse the performance in different models

UNIT 1 INTRODUCTION TO DATA MINING INTRODUCTION

9 Hrs.

what is Data Mining? Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP - DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

UNIT 2 DATA UNDERSTANDING AND PREPARATION

9 Hrs.

Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.

UNIT 3 MODEL DEVELOPMENT & TECHNIQUES

9 Hrs.

Data Partitioning- Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

UNIT 4 MODEL EVALUATION AND DEPLOYMENT

9 Hrs.

Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling

UNIT 5 DEPLOYING MODEL

9 Hrs.

Assessing Model Performance, Updating a Model, Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error

COURSE OUTCOMES

Upon completion of the course the students will be able to

- CO1: Understand the process of formulating business objectives, data selection/collection
- CO2: Successfully design, build, evaluate models
- CO3: Implement predictive models for various business application.
- CO4: Compare the underlying predictive modeling techniques.
- CO5: Select appropriate predictive modeling approaches to identify cases to progress with.
- CO6: Deploy model and assess the performance

TEXT / REFERENCE BOOKS

1. Predictive & Advanced Analytics (IBM ICE Publication).
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.
3. C.M.Bishop -Pattern Recognition and Machine Learning, Springer, 2006
4. L.Wasserman-All of statistics

SCSA2303	IoT LAB	L	T	P	Credits	Total Marks
		0	0	2	1	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.
3. Interface PIR sensor with ESP8266 WiFi module on NodeMCU platform.
4. Posting temperature and humidity of the environment to Thing speak cloud service using NodeMCU.
5. Implement Raspberry Pi Temperature System with Ubidots cloud service.
6. Implement smart cities Sensor Board v3.0 using Wasp mote platform for measuring temperature, humidity and pressure.
7. Measure light intensity and pollution level using Wasp mote platform.
8. Receiving and storing data in Meslium gateway for Wasp mote platform.
9. Implement barometric pressure monitoring using BMP280 sensor for Zolertia module.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Remember the concept of IoT components for implementing real time applications

CO2: Understand basic concepts about the hardware kits Auduino & Raspberry Pi and supported software.

CO3: Apply and implement various IoT applications like monitoring air quality, soil moisture etc.

CO4: Analyze IoT applications connected with Cloud servers **CO5:**

Design an IoT System for integrating smart city services. **CO6:** Create

an IoT system for real time monitoring applications.

SCSA2404	ROBOTICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To introduce different types of robotics and demonstrate them to identify different parts and components.
- To learn the fundamentals of Robot program to perform various operations
- To model and simulate a Robot with pick and place operations.
- To Map the simulated robot into real world applications
- To Design a simple robot to recognize the individual components to assemble industrial applications.

LIST OF EXPERIMENTS

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Color identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1:** Remember the concept of Robotics programming
- CO2:** Understand basic concepts about Robot operations
- CO3:** Apply and implement various Robot operations through simulation
- CO4:** Analyze Robot programs for industrial applications
- CO5:** Design a Robot to perform machining operations.
- CO6:** Create an AI Robot to perform the task navigation, sense and calculate their reaction.



Skill development

SCSA2503	BIG DATA ANALYTICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To configure Big Data Ecosystem
- To work with No SQL Databases
- To process job scheduling
- To analyze and Interpret Data
- To visualize the data insights

LIST OF EXPERIMENTS

1. Data Pre-Processing: Building Good Training Sets
2. Manipulate the Twitter Data Set.
3. Evaluating the results of machine learning algorithms
4. Implement Regression and Correlation Techniques
5. Implement Classification Algorithms
6. No SQL (using Cassandra/MongoDB/Spark)
7. Hadoop – Map Reduce Programs / Commands / Job Scheduling
8. HDFS
9. YARN
10. Working with Pig and Hive
11. Visualization (using Tableau)

COURSE OUTCOMES

On completion of the course the student would be able to

- CO1:** Able to setup Hadoop in a Cloud / Cluster environment **CO2:** Process and schedule the tasks in the Hadoop platform **CO3:** To configure nosql databases in the big data ecosystem
- CO4:** Selection of right visualization method based on the intended audience
- CO5:** Creates a dashboard and story based on the data analysis

SCSA2603	ROBOTICS AUTOMATION AND SIMULATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To introduce different types of robotics and demonstrate them to identify different parts and components.
- To learn the fundamentals of Robot program to perform various operations
- To model and simulate a Robot with pick and place operations.
- To Map the simulated robot into real world applications
- To Design a simple robot to recognize the individual components to assemble industrial applications.

LIST OF EXPERIMENTS

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Color identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1:** Comprehend the concept of Robotics programming
- CO2:** Criticize basic concepts about Robot operations
- CO3:** Apply and implement various Robot operations through simulation
- CO4:** Analyze Robot programs for industrial applications
- CO5:** Design a Robot to perform machining operations.
- CO6:** Create a AI Robot to perform the task navigation, sense and calculate their reaction.

SCSA2604	NATURAL LANGUAGE PROCESSING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Understanding the morphological of a word by analysing it.
- Learn how to generate words from root
- Tag the different parts of speech.
- Perform sentiment analysis for the data.
- To understand the concept of chunking.

SUGGESTED LIST OF EXPERIMENTS

1. Word Analysis
2. Word Generation
3. Text classification
4. Semantic Analysis
5. Sentiment Analysis
6. Parts of Speech tagging
7. Chunking

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** To use appropriate tools for word and text analysis. **CO2:** Examine and acquire a broad understanding of text data. **CO3:** Analyze the semantics of a text document.
- CO4:** Perform sentiment analyzes on a document.
- CO5:** Tag the different parts of speech.
- CO6:** Implement an NLP project in a business environment

SCSA1306	DESIGN THINKING	L	T	P	Credits	Total Marks
		3	0	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 AGILE

9 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 DEVELOPMENT

9 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 &DevOpsTools- 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. MauricioVianna, 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. Jaokim 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.

SCSA1319	DESIGN THINKING AND INNOVATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the idea of Human-centered design and design thinking.
- To understand the concept of empathy and its technique.
- To understand observation phase and insight concepts in design thinking.
- To leverage the use of prototype in design thinking
- To design business models using the design thinking innovations.

UNIT 1 HUMAN-CENTERED DESIGN**9 Hrs.**

Introduction to Human-centered Design - Applications of Human-centered Design - Design Process - Mindsets of Human-centered designer - Principles and process of Design Thinking - Planning a Design Thinking Project

UNIT 2 INTERVIEWING & EMPATHY-BUILDING TECHNIQUES**9 Hrs.**

Introduction to Empathy - Practicing Empathy - Empathy vs. Sympathy - Methods for Empathetic design - Tips for Interviews - Empathy Interviews - Understanding and defining the problem

UNIT 3 MAKING SENSE OF OBSERVATIONS & INSIGHTS**9 Hrs.**

Observation Phase - Tips for observing - Insights definition - Problems with Insights - Case study: Insight problems in the history of aviation - Creativity process, principles and techniques - Evaluation of ideas

UNIT 4 DEVELOPING AND TESTING PROTOTYPES**9 Hrs.**

Role of Prototype in design thinking - Types of prototyping - Guidelines for prototyping - Lean Startup Method for Prototype Development - Visualization and presentation techniques - Testing prototypes: Feedbacks and Maximize learning

UNIT 5 DEFINING & TESTING BUSINESS MODELS & BUSINESS CASES**9 Hrs.**

Business Model Definition - Design thinking to design business model - Innovation in Business Model - Pursuing innovation in business - Business model innovations cases - Kano Model - Desirability Testing.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course the student will be able to

CO1: Understand and apply human-centered design process and planning of design thinking project

CO2: Use empathetic design in the interview process

CO3: Identify need for observations and insights problems and come up with creative ideas in design thinking

CO4: Understand, build and test the prototypes

CO5: Use design thinking concepts to build successful business models.

CO6: Implement innovation techniques in business models.

TEXT /REFERENCE BOOKS

1. Mueller-Roterberg, Christian. "Handbook of Design Thinking." Hochschule Ruhr West (2018).
2. Design Kit by IDEO.org. "The field guide to human centered design." (2015), ISBN: 978-0-9914063-1-9.
3. <https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy>
4. <https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype>
5. <https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning>
6. <https://uxplanet.org/what-are-insights-aa1f2d1b3b9c>
7. <https://labs.sogeti.com/using-design-thinking-to-design-business-models/>
8. <https://www.northeastern.edu/graduate/blog/implementing-business-model-innovation/>

SCSA2302	CODE OPTIMIZATION AND DEBUGGING - I	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To improve the intermediate code by making it consume fewer resources
- To get the faster running machine code
- To improve the consistency of the code
- To enhance the readability of the code and easier code maintenance
- To improve the work flow of the code

LIST OF EXPERIMENTS

1. Implement Built in Function and Libraries using python
2. Implement Optimizing loop using python
3. Profiling CPU usage using python
4. Profiling memory usage using python
5. Implement query optimization in DBMS
6. Implement heuristics in query optimization in DBMS
7. Implement factorial of given number using memorization in data structure
8. Implement Divide and conquer method in data structure
9. Implement hybrid stable sorting algorithm in data structure
10. Implement linked list with improving the time complexity in data structure

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand importance of code optimization

CO2: Apply time complexity and space complexity of the algorithm for improving optimization. **CO3:** Analyse and appreciate variety of performance measures for various optimization problems **CO4:** Learn efficient computational procedures to solve optimization problems

CO5: Be able to use programming languages to implement optimization algorithms

CO6: Be able reduce the execution time of code by applying proper coding technique.



SBAA1408	ECONOMICS FOR ENGINEERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable students to understand the fundamental micro and macro-economic concepts applicable to engineering;
- To learn the techniques of estimation, planning and policies in economic decision making.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Economics - Concept of Engineering Economics - Law of Demand & Law of Supply - Determinants of Demand & Supply - Elasticity of demand - Concept of Utility - Law of diminishing marginal utility - Equi-Marginal Utility - consumer's Surplus analysis - Indifference Curve Approach - Budget Line - Consumer's Equilibrium

UNIT 2 PRODUCTION, COST ANALYSIS AND PRICING

9 Hrs.

Production function - returns to scale - production optimization - least cost input - Isoquants - Managerial uses of production function. Cost concepts - cost function - Determinants of cost - Short run and long run cost curves - Cost output decisions - Estimation of cost - Pricing under different market structures - price discrimination - pricing methods in practice.

UNIT 3 MONEY, BANKING AND TRADE

9 Hrs.

Money- nature and functions - Inflation and Deflation - Kinds of Banking - commercial banks - Central banking - Credit instrument - Monetary Policy - International trade - Balance of trade and Balance of Payments - taxation - Direct and Indirect taxes - GST- Impact and Incidence of tax- Concept of National Income - Features with reference to developing countries.

UNIT 4 PLAN AND POLICIES FOR ECONOMIC GROWTH IN INDIA

9 Hrs.

Brief overview of post-independence period - plans - Five years plans and its role on Economic growth - Role of Industry in economic development - Industrial Policies in India - New Economic Reforms - New industrial Policy - MSME - concept of unemployment - concept of poverty - concept of urbanization.

UNIT 5 ESTIMATION

9 Hrs.

Estimation of Material - Labor and Overhead Cost - Allocation of Overheads - Estimation for different types of jobs - Use of relevant Indian Standard Specifications - Bar bending Schedules - Mass haul Diagrams - Estimating Earthwork and Foundations - Estimating Concrete and Masonry - Finishes -Interiors -MEP works - BIM and quantity take-offs.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
- CO2: Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
- CO3: Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
- CO4: Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
- CO5: Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
- CO6: Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

TEXT/REFERENCE BOOKS

1. V. Mote, S. Paul, G. Gupta (2004), Managerial Economics, Tata McGraw Hill
2. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
3. Paul A Samuelson and William D Nordhaus, Economics, McGraw Hill International Edition
4. M Chakravarty, Estimating, Costing Specifications & Valuation Relevant Indian Standard Specifications.
5. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016
6. Barthwal R R, Industrial Economics - An Introductory Text Book, New Age International Pvt Ltd, 2000.
7. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
8. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

SAIC4002	SOCIETY 5.0	L	T	P	Credits	Total Marks
		2	0	2	2	100

COURSE OBJECTIVES

- To understand the society 5.0, Cyberspace and Physical Space to solve
- To Provide knowledge and overview about Big data, IoT and Artificial Intelligence for Society 5.0.
- Discuss To understand Augmented Reality and Virtual Reality, Next Generation Sensors
- To discuss about Challenges and Technologies towards Society 5.0, Security of Cyber Physical Systems
- Discuss to apply society 5.0 Innovation with Future Trends with Applications

UNIT 1 INTRODUCTION TO SOCIETY 5.0

9hrs

Introduction -Schema of society 5.0-Characteristics of Society 5.0. Introduction to communication technologies: Artificial Intelligence - robotics - 3D Printing. People: Centric Society -Knowledge Sharing- Physical space- Cyberspace - Humanity VS Society 5.0 -Elements of Society 5.0-Data Driven to Society- Modeling real world Issues.

UNIT 2 EMERGING TECHNOLOGIES WITH SOCIETY 5.0

9hrs

Introduction to Big Data - Issues and Challenges in the traditional systems -Intelligent Data Analysis -Big Data Storage Statistical Concepts: Sampling Distributions - Re-Sampling - Prediction Error - Random Sampling- Artificial Intelligence - Foundations of AI - Intelligent agent - Types of agents - Structure - Problem solving agents -Internet of Things- Introduction to IoT- Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT-Robotics- Robotics system components - Robot classification Coordinate frames - degree of freedom - dynamic stabilization of robots

UNIT III INTRODUCTION TO INDUSTRY 4.0

9hrs

Introduction-Globalization and Emerging Issues, LEAN Production Systems, Smart and Connected Business Perspective, Cyber Physical Systems and Next Generation Sensors, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis- An emerging industrial structure for IoT -Cyber security in Industry 4.0-Basics of Industrial IoT. Common Issues in Industry 4.0 and Society 5.0.

UNIT IV CHALLENGES AND TECHNOLOGIES TOWARDS SOCIETY 5.0

9hrs

Overcome with Economic Development and Solution to Social Problems in Society 5.0- 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- Social Issues in Society 5.0 - human-centered society (Society 5.0)- Sustainable Development Goals-Economic Advancement- Resolution to Social Problems.

UNIT V INNOVATION WITH FUTURE TRENDS WITH APPLICATIONS

9hrs

Mobility - Health Care -Agriculture- Food Products - Disaster Prevention.

MAX.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Understand the Social Problems By A System That Highly Integrates Cyberspace and Physical Space to solve
- CO2:** Get Skills for Economic Development and A Human-Centered Society That Balances Economic Advancement
- CO3:** Achieve a High Degree of Convergence Between Cyberspace (Virtual Space) And Physical Space (Real Space)
- CO4:** Use of Emerging Technologies with Society 5.0 To Achieve More Production / Avoid Loss of Productions
- CO5:** Internet and IoT, Big data for production lines to be adaptive, intelligent, and flexible enough to meet the updated requests.
- CO6:** Design and apply in Health Care, Agriculture, Food Products, Disaster Prevention

TEXT /REFERENCE BOOKS

1. Society 5.0 A People -Centric Super -Smart Society, Hitachi -Utokyo Laboratory, Springer,2020.
2. Society 5.0 Industry of the Future Technologies Methods and Tools By Bruno Salgues,Wiley, 2018
3. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rd Edition, Pearson Education, 2009.
4. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi.,2012.
5. McKerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.



SAIC4003	UNIVERSAL HUMAN VALUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence
- To strengthen self-reflection
- To develop commitment and courage to act

MODULE 1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
 2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
- Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE 2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
 10. Understanding the characteristics and activities of 'I' and harmony in 'I'
 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
 12. Programs to ensure Sanyam and Health.
- Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE 3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
 14. Understanding the meaning of Trust; Difference between intention and competence
 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
 16. Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
- Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

MODULE 4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE 5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up.

Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Total: 28 Lectures And 14 Practice Sessions

COURSE OUTCOMES

On completion of the course, the student are expected

CO1: To become more aware of themselves, and their surroundings (family, society, nature)

CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind

CO3: To have better critical ability

CO4: To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

CO5: To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT /REFERENCE BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj - PanditSunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT:

Assessment by faculty mentor: 10 marks

Self-assessment:: 10 marks

Assessment by peers: 10 marks

Socially relevant project/Group Activities/Assignments: 20 marks

Semester End Examination: 50 marks

SCSA2402	CODE OPTIMIZATION AND DEBUGGING - II	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To analyze the programming logic and apply the appropriate design approach
- To optimize the speed of the program by using proper utilization of available memory
- To make use of performance tools for tracking the application.
- To have a capacity to analyze and design software systems, components to meet desired needs
- To have a working ability and grasping attitude to design and conduct object-oriented analysis

LIST OF EXPERIMENTS

1. Implement minimum heap allocation in java
2. Implement string builder in java
3. Implement concurrency control using java
4. Checking the current log level using java
5. Implement Garbage collection using java
6. Implement grid line in object oriented analysis and design
7. Implement grid with two sets of diagonal lines in object oriented analysis and design
8. Implement concurrency in object oriented analysis and design
9. Implement design optimization for removing non usable associations in object oriented analysis and design
10. Implement sparing and storing derived attributes associations in object oriented analysis and design

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Understand the impact of performance hits during application runtime.
- CO2:** Implement optimal functions for improving the performance
- CO3:** Analyze the proper utilization of memory for code
- CO4:** Design experiments using UML, as well as to analyze and evaluate their models
- CO5:** Discussing and understanding analysis and design heuristics that are involved in the course
- CO6:** Students will learn and understand how to map one style of diagrammatic notations into another



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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In Artificial Intelligence And Machine Learning			
S. No.	Course Code	Course Name	Page No.
Employability			
1	SCSA1209	Foundations of Data Science	2
2	SCSA1210	Artificial Intelligence search methods and reasoning	3
3	SCSA1310	-Intelligent Data Analytics	4
4	SCSA1311	Machine Learning Fundamentals	5
5	SECA1308	-Analog and Digital Electronics	6
6	SCSA1313	-Algorithms for Intelligent Systems	8
7	SCSA3015	-Deep Learning	9
Skill Development			
8	SCSA2204	Application based programming in Python lab	10
9	SCSA2306	-Machine Learning Applications Lab	11
10	SCSA2407	-IoT and Robotics Lab	12
11	SCSA2408	-DL with Tensor flow and Keras Lab	13

SCSA1209	FOUNDATIONS OF DATA SCIENCE	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Learn how to process raw data into formats necessary for analysis
- In-depth knowledge of fundamental data science concepts through motivating real-world case studies
- Understand the methods of data handling and bigdata

UNIT 1 DATA ACQUISITION

9 Hrs.

Data Acquisition-Sources of acquiring the data - Internal systems and External systems- Web APIs, Data preprocessing- Exploratory Data Analysis (EDA)- Basic tools (plots, graphs and summary statistics) of EDA -Open Data Sources, Data APIs, Web Scrapping -Relational Database access (queries) to process/access data.

UNIT 2 DATA PREPROCESSING AND PREPARATION

9 Hrs.

Data Munging, Wrangling - Data Visualization Basics -Plyr packages - Cast/Melt. Tableau: Creating Visualizations in Tableau-Data hierarchies, filters, groups, sets, calculated fields-Map based visualizations-Build interactive dashboards-Data Stories.

UNIT 3 DATA QUALITY AND TRANSFORMATION

9 Hrs.

Data imputation -Data Transformation (minmax, log transform, z-score transform etc.). - Binning, Classing and Standardization. - Outlier/Noise& Anomalies

UNIT 4 HANDLING TEXT DATA

9 Hrs.

Bag-of-words- Regular Expressions - Sentence Splitting and Tokenization - Punctuations and Stop words, Incorrect spellings - Properties of words and Word cloud - Lemmatization and Term-Document TxD computation -Sentiment Analysis (Case Study)

UNIT 5 PRINCIPLES OF BIG DATA

9 Hrs.

Introduction to Big Data - Challenges of processing Big Data (Volume, Velocity and Variety perspective) - Use Cases.

Max.Hours:45 Hrs.

COURSE OUTCOMES

- On completion of the course the student will be able to
- CO1: Explore the fundamental concepts of Data science.
- CO2: Identify and execute the basic data format.
- CO3: Understand basics of Data Preprocessing and Data Visualization
- CO4: Improve the Data quality through various transformations.
- CO5: Implement the methods of handling text data.
- CO6: Analyse and understand the basics of Big Data.

TEXT/REFERENCE BOOKS

1. Data Science at the Command Line, Jeroen Janssens, O'Reilly, 2015, ISBN 978-1-491-94785-2
2. Python for Data Analysis, Wes McKinney, O'Reilly, 2018, ISBN-13: 978-1-491-95766.
3. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
4. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Employability

SCSA1210	ARTIFICIAL INTELLIGENCE SEARCH METHODS AND REASONING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of intelligent agents.
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems.
- To learn the concepts of learning and communication in AI.
- To know about the various applications of AI.

UNIT 1 BASIC SCIENCE BEHIND AI

9 Hrs.

Intelligence - Memory - Computation - Learning - AI's Foundation and History - Intelligent Agents: Features -Behaviour in the environment - Rationality - Nature and its Structure - Case Study: AI Programming Languages History: LISP - Prolog - Python.

UNIT 2 SEARCHING TOWARDS SOLUTION

9 Hrs.

Searching Strategies: Informed Search: BFS - DFS - Depth Bounded DFS - Uninformed Search: Heuristic Functions - Hill Climbing Search - Best First Search - Local Maxima - Solution Space Search - Adversarial Search - Constraint Satisfaction Problem - Case Study: N-Queens Problem

UNIT 3 KNOWLEDGE: ROLE AND REPRESENTATION

9 Hrs.

Knowledge - Definition and Management - Types: Declarative and Procedural Knowledge - Knowledge Engineering behind Logical Agents: Propositional Logic - First Order Logic - Inference: Forward and Backward Chaining - Ontological Engineering - Case Study: Ontology based knowledge representation

UNIT 4 APPROACHES BEHIND PLANNING AND REASONING

9 Hrs.

Algorithm for Planning as State Space Search - Analysis of Planning Approach - Reasoning: Bayes Rule - Bayesian Network and its approximation - Hidden Markov Model - Kalman Filters - Decision Networks - Case Study: Wumpus World Problem

UNIT 5 DECODING AND LEARNING INTELLIGENCE

9 Hrs.

Learning Algorithms: Classification and Regression with Linear Model - Non-Parametric Models - Ensemble Learning - Explanation Based Learning - Learning with Hidden Variables - AI Real Time Applications - Case Study: Nature Inspired Computation

Max.45Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1 : An ability to identify, analyze the search algorithm for the AI problems.
- CO2 : Represent a problem using first order logic.
- CO3 : Provide the knowledge-based agent to solve the problem.
- CO4 : Understand the Informed search strategies.
- CO5 : Apply the bayes rule to solve the problem for societal concern
- CO6 : Design user centric applications that use AI concepts.

TEXT/REFERENCE BOOKS

1. Stuart J. Russel, Peter Norvig, "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education,2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
3. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., 1st Edition, 2008.
4. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, 2nd Edition,2010.
5. Ertel, Wolfgang, Introduction to Artificial Intelligence,1st Edition ,2017

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3Hrs

PART A: 10 questions of 2 marks each -No choice

20 Marks

PART B: 2 questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability

SCSA1310	INTELLIGENT DATA ANALYTICS	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To acquire knowledge on Data science and its Foundations.
- To explore about the various data process and evaluation methods.
- To understand distinct analysis tools and practice ethical decision and actions.
- To implement methods for big data analytics

UNIT 1 INTRODUCTION

9 Hrs.

Business Intelligence vs Data Science vs Big Data Analytics; Data warehouse; Data mining: Introduction, Knowledge discovery from data, Data pre-processing, Classification, Clustering, Prediction, Association, Recent applications of data mining methods; Decision support system (DSS) and its components; Business intelligence

UNIT 2 PREDICTIVE ANALYTICS

9 Hrs.

Predictive Analytics- Simple linear regression- Multiple linear regressions - Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications

UNIT 3 WEB ANALYTICS

9 Hrs.

Web Analytics - Basics - Traditional Ways - Expectations - Data Collection - Clickstream Data - Weblogs - Beacons - JavaScript Tags - Packet Sniffing - Outcome's data - Competitive data - Search Engine Data.

UNIT 4 PRIVACY AND DATA SCIENCE

9 Hrs.

Significance of Privacy and Ethics in Application of Data Science; Reidentification of Anonymous People with Big Data, Privacy-preserving data mining algorithms, Data Partitioning and Privacy; Recent research in privacy-preserving data mining

UNIT 5 ETHICS AND RECENT TRENDS

9 Hrs.

Data and Business Insights- Data Science Engineering: - Need of Data Science - Ethics - Doing good data science - Natural Language Processing - Machine Learning Model- Valuing Data privacy - Getting informed consent - The Five Cs - Diversity -Inclusion - Future Trends.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Analyze the key issues in data science and its associated applications in intelligent business and scientific computing

CO2: Comprehend and apply the methods of big data analytics.

CO3: comprehend the fundamentals of privacy-preservation in data analytics

CO4: Analyze privacy issues on data science applications

CO5: Think through the ethics incorporating privacy, data sharing and decision-making.

CO6: Build interactive dashboards for Business.

TEXTBOOK AND REFERENCES

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016.
2. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018.
3. Introduction to Machine Learning with Python-A Guide for Data Scientists, by Andreas C. Mueller, Sarah Guido, O'Reilly; 1st edition, October 2016.
4. Getting Started with Tableau 2019.2 (Second Edition), Tristan Guillevin, Packt Publishing; 2nd edition June, 2019.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

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

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCSA1311	MACHINE LEARNING FUNDAMENTALS	L	T	P	Credits	Total Marks
		3		0	3	100

COURSE OBJECTIVES

- To understand the need for machine learning and its diverse application.
- To understand the concepts and algorithms of regression and classification models.
- To understand graph models and clustering techniques.
- To understand the ensemble models and its techniques.
- To understand and evaluate the machine learning models built using available techniques.

UNIT 1 INTRODUCTION TO MACHINE LEARNING

9 Hrs.

What is machine learning - Statistics vs. machine learning techniques - Supervised learning - Unsupervised learning - Semi-supervised learning - Reinforcement learning - Basics: Probability Theory-Linear Algebra.

UNIT 2 DECISION THEORY

9 Hrs.

Statistical Decision Theory: Regression - Classification - Linear regression - Multivariate regression - Logistic regression - Classification predictive modeling - Binary classification - multi-class classification - multi-label classification

UNIT 3 DIMENSIONALITY REDUCTION

9 Hrs.

Dimensionality Reduction -Subset Selection -Shrinkage Methods -Linear Discriminant Analysis -Principal Component Analysis- Separating hyper planes.

UNIT 4 PARAMETRIC ESTIMATION

9 Hrs.

Parameter Estimation -Maximum Likelihood Estimation -Bayesian Parameter Estimation-Support vector Machine - Decision Tree -Naïve Bayes' - Clustering methods -Partitional Clustering-Hierarchical clustering.

UNIT 5 ENSEMBLE METHODS

9 Hrs.

Ensemble models -Applications of Ensembling- Types and techniques of Ensembling- Evaluation measures -Hypothesis testing -Cross-validation and Hyper parameter optimization-Bootstrapping and Uncertainties

Max.45 Hrs.

COURSE OUTCOMES

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

- CO1: Understand the concepts and types of models in machine learning
- CO2: Reduce the dimension of the dataset using machine learning techniques
- CO3: Implement a classification model for any real scenario
- CO4: Implement an unsupervised learning application using clustering techniques
- CO5: Implement the ensemble model
- CO6: Implement model evaluations for built machine learning model.

TEXT /REFERENCE BOOKS:

1. Andreas Muller ,Introduction to Machine Learning with Python: A Guide for Data Scientists Paperback - 1 January 2016.
2. Andriy Burkov, The Hundred-Page Machine Learning Book, Publisher: Andriy Burkov, ISBN: 9781999579548, 1999579542, Edition 1,2019
3. Zhi-Hua Zhou, "Ensemble Methods: Foundations and Algorithms", CRC Press, 2012
4. <https://machinelearningmastery.com/stacking-ensemble-machine-learning-with-python/>
5. <https://sebastianraschka.com/blog/2018/model-evaluation-selection-part4.html>

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

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

PART B:2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

Employability

SECA1308	ANALOG AND DIGITAL ELECTRONICS	L	T	P	Credits	Total Marks
		3		0	3	100

COURSE OBJECTIVES

- To understand operational principles and characteristics of semiconductor electronic devices.
- To learn about analog electronic circuits such as rectifiers, regulators and amplifiers.
- To learn about Boolean algebra and basic building blocks of digital systems.
- To learn about optimized implementation of combinational and sequential digital circuits and systems.

Pre requisite: Basic Electrical Science/ Basic Electrical Engineering

UNIT 1 SEMICONDUCTOR DIODES AND THEIR APPLICATIONS

9 Hrs.

Semiconductors - N-Type and P-Type Semiconductors - PN junction diode, VI-Characteristics, Equivalent circuit, DC loadline - PN Diode circuit Analysis, Clippers and Rectifiers - Zener Diode, VI Characteristics, Voltage Regulator design - Varactor diode, LED, LASER diode, Photodiode - Working principle and applications.

UNIT 2 TRANSISTORS AND THEIR APPLICATIONS

9 Hrs.

Bipolar Junction Transistor - VI-Characteristics (CB, CE and CC), BJT as amplifier- DC loadline, Q-point - Fixed and Voltage Divider Biasing circuits - BJT small signal hybrid model, Analysis of CE-BJT amplifier using hybrid model - BJT as a switch - MOSFET- Construction, VI characteristics - Biasing Circuits for MOSFET Amplifier - MOSFET as a Switch - CMOS inverter characteristics

UNIT 3 INTRODUCTION TO DIGITAL SYSTEMS

9 Hrs.

Digital Circuits Characteristics - Logic gates and their truth table - Logic gates realization using complementary MOSFETs (CMOS logic) - Comparison of Digital logic families- TTL and CMOS - Rules and laws of Boolean algebra, Demorgan's Theorems - SOP and POS forms of Boolean Expression - Minterms and Maxterms - Simplification of Boolean Expression using Boolean laws and Karnaugh's Map - Don't care Conditions

UNIT 4 COMBINATIONAL LOGIC CIRCUIT DESIGN

9 Hrs.

Design methodology of combinational logic circuits - Binary to Grey code and Binary to Excess-3 code converters, BCD to Seven Segment Display decoder, Half adder, Full adder and Subtractor, Ripple Carry Adder, BCD adder, Comparator, Encoder and Decoder, Multiplexer and Demultiplexer - Applications of Combinational logic circuits

UNIT 5 SEQUENTIAL LOGIC CIRCUIT DESIGN

9 Hrs.

Introduction to Sequential Circuits, Latches and Flip-Flops - Types of Flip-Flops - RS, T, D, JK, Master-Slave JK- Conversion of Flip-Flops - Design of Shift Registers - Universal Shift Register - Design of asynchronous and synchronous Counters - Applications of sequential logic circuits.

Max 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze circuits involving semiconductor diodes
- CO2 - Design amplifiers and switches for given specifications using BJT
- CO3 - Design biasing circuits for MOSFET amplifiers and switches.
- CO4 - Apply Boolean laws and other techniques for optimized digital system design.
- CO5 - Design combinational logic circuits for given specifications
- CO6 - Design sequential logic circuits for given specifications.

TEXT / REFERENCE BOOKS

1. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" 11th Edition, Pearson Prentice Hall, 2010.

2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2012.
3. Morris Mano, "Digital design-With an Introduction to the Verilog HDL", 5th Edition, Pearson, 2013.
4. R.P. Jain, "Modern Digital Electronics", 4th Edition, TMH, 2010.
5. Thomas L Floyd, "Digital Fundamentals", 11th Edition, Pearson, 2015

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

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

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCSA1313	ALGORITHMS FOR INTELLIGENT SYSTEMS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To introduce the concepts and techniques of building blocks of Artificial Intelligence and Soft Computing techniques and their difference from conventional techniques.
- To conceptualize Fuzzy Logic and its implementation for various real-world applications.
- To provide the understanding of Genetic Algorithms and its applications in developing solutions to real-world problems.
- To introduce the need and concept of hybrid soft computing algorithms.

Prerequisites: Data Structures & Algorithms, Fundamentals of Mathematics

UNIT 1 FUZZY LOGIC

9 Hrs.

Concepts of uncertainty and imprecision; Concepts, properties and operations on classical sets and fuzzy sets; Classical & fuzzy relations; Membership functions and its types; Fuzzification; Fuzzy rule-based systems; Defuzzification; Fuzzy propositions; Fuzzy extension principle; Fuzzy inference system; Recent applications.

UNIT 2 GENETIC ALGORITHMS

9 Hrs.

Difference between traditional algorithms and Genetic Algorithm (GA); Basic concepts of GA; Working principle; Encoding methods; Fitness function; GA Operators: Reproduction, Crossover, Mutation; Convergence of GA; Detailed algorithmic steps; Adjustment of parameters; Multicriteria optimization; Solution of typical problems using genetic algorithm; Recent applications.

UNIT 3 COLLECTIVE SYSTEMS

9 Hrs.

Ant colony optimization: Ant foraging behavior; Theoretical considerations; Convergence proofs; ACO algorithm; ACO and model-based search; Variations of ACO; Artificial bee colony (ABC) Optimization: Behaviour of real bees, ABC algorithm, Variations of ABC.

UNIT 4 EXPERT SYSTEMS

9 Hrs.

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition - Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

UNIT 5 SWARM INTELLIGENCE

9 Hrs.

Particle swarm optimization: Principles of bird flocking and fish schooling; Evolution of PSO; Operating principles, PSO algorithm, Neighborhood topologies, Convergence criteria, Variations of PSO; Overview of other bio-inspired algorithms: Harmony Search, Honey-Bee Optimization, Memetic Algorithms, Co-evolution.

Max.45Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1 :** Apply Fuzzy Logic, the concept of fuzziness and fuzzy set theory in various systems.
- CO2 :** Apply Genetic Algorithms in problems with self-learning situations that seek global optimum.
- CO3 :** Apply evolutionary algorithms to optimize solutions for real-world problems.
- CO4 :** Develop optimized solutions using algorithms like ACO
- CO5 :** Apply swarm intelligence to develop solutions for real-world problems.
- CO6 :** Create solutions to real-world problems using Neural Network, Genetic Algorithms, Fuzzy Logic or their Hybrid systems.

TEXT/REFERENCE BOOKS

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI.
2. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, 2nd ed., Wiley India.
3. J. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House.
4. D. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, AddisonWesley
5. G. Klir, B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Pearson.
6. D. Floreano and C. Mattiussi, Bio-inspired Artificial Intelligence, MIT Press.
7. S. Olariu and A. Zomaya, Handbook of Bioinspired Algorithms and Applications, Chapman and Hall/CRC

SCSA3015	DEEP LEARNING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To present the mathematical, statistical and computational basis of neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Introduction to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT 2 DEEP NETWORK

9 Hrs.

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

UNIT 3 DIMENSIONALITY REDUCTION

9Hrs.

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.

UNIT 4 OPTIMIZATION AND GENERALIZATION

9 Hrs.

Optimization in deep learning- non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT 5 CASE STUDY AND APPLICATIONS

9 Hrs.

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

Max.45 Hours

COURSES OUTCOMES

On completion of the course the student will be able to

- CO1: Understand basics of deep learning
- CO2: Implement various deep learning models
- CO3: Realign high dimensional data using reduction techniques
- CO4: Analyze optimization and generalization in deep learning
- CO5: Explore the deep learning applications
- CO6: Design and creation of data models

TEXT/REFERENCE BOOKS

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

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

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCSA2204	APPLICATION BASED PYTHON PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	50

COURSE OBJECTIVES

- To write application-based programs in python programming.
- To implement web application using Flask
- To implement web framework using Django.
- To implement web scraping and audio processing using python libraries.
- To develop basic and advanced games using python libraries.

SUGGESTED LIST OF EXPERIMENT

1. Rock, Paper & Scissors Game
2. Random Password Generator.
3. Guess The Number Game
4. Email Slicer with Python
5. Python program to check the validity of a Password
6. Python program to check if the website is live or not
7. Writing CSV files in Python
8. make simple calculator in python
9. Weather application using beautiful Soup and Request
10. Detection of face id using OpenCV
11. Game Programming:
 - a. Tic Tac Toe
 - b. Dots and Boxes
 - c. Snake and apple
12. Advanced Game Programming:
 - a. Adding image, scenery
 - b. Making moves
 - c. Turning and shooting
 - d. Badgers, Arrows, Collision
 - e. Adding Health meter, Clock
 - f. Adding music
13. Web Scraping using Beautiful Soup
14. Web Scraping using Mechanical Soup
15. Simple Audio Processing using Pyo

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1 :** Implement and develop application using python.
- CO2 :** Develop program for simple gaming applications
- CO3 :** Design basic and advanced games using python gaming libraries.
- CO4 :** Demonstrate web scraping using python beautiful soup.
- CO5 :** Demonstrate web scraping using python mechanical soup.
- CO6 :** Design and process audio files using pyo python framework.

SCSA2306	MACHINE LEARNING APPLICATIONS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Apply machine learning algorithms to real world problems

SUGGESTED LIST OF EXPERIMENTS:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. Implement Simple Linear Regression
3. Implement Multivariate Linear Regression
4. Implement Logistic Regression
5. Implement Multivariate Logistic Regression
6. Data preprocessing for classification
7. Confusion matrix for a binary classifier.
8. Implement Support Vector Machines.
9. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
10. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
11. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
12. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
13. Implement k-Mean's algorithm to cluster a set of data stored in a .CSV file.
14. Implement Random Forest models for automatic classification
15. Implement Ensemble Model to perform classification.

COURSE OUTCOMES

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

- CO1: Understand the implementation procedures for the machine learning algorithms.
CO2: Design python programs for various learning algorithms.
CO3: Apply appropriate data sets to the machine learning algorithms.
CO4: Identify and apply machine learning algorithms to solve real world problems.
CO5: Apply various clustering algorithms for various applications
CO6: Analyze various machine learning algorithms and their applications

Skill development

SCSA2407	IOT AND ROBOTICS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	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 identify the components used for Robot design
- To understand how to integrate sensors and actuation of a robot.

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. Study components of a real robot and its DH parameters.
7. Forward kinematics and validate using a software (Robo Analyser or any other frees ofware g46tool).
8. Inverse kinematics of the real robot and validation using any software.
9. Use of open-source computer vision programming tool OpenCV.
10. Image Processing using OpenCV.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1 :** Remember the concept of IoT components for implementing real time application
- CO2 :** Understand basic concepts about the hardware kits Arduino& Raspberry Pi and supported software.
- CO3 :** Remember the concept of Robotics design
- CO4 :** Understand programming structure for implement Robot operations
- CO5 :** Apply and implement various Robot enabled image processing applications
- CO6 :** Design simple robots for primitive applications

Skill development

SCSA2408	DL WITH TENSOR FLOW AND KERAS	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objectives

- To understand complexity of Deep Learning algorithms and their limitations.
- Capable of confidently applying common Deep Learning algorithms in practice and implementing their own;
- Capable of performing experiments in Deep Learning using real-world data.

SUGGESTED LIST OF EXPERIMENTS:

1. Install TensorFlow and tf.keras
 1. What Are Keras and tf.keras?
 2. How to Install TensorFlow
 3. How to Confirm TensorFlow Is Installed
2. Deep Learning Model Life-Cycle
 1. The 5-Step Model Life-Cycle
 2. Sequential Model API (Simple)
 3. Functional Model API (Advanced)
3. How to Develop Deep Learning Models
 1. Develop Multilayer Perceptron Models
 2. Develop Convolutional Neural Network Models
 3. Develop Recurrent Neural Network Models
4. How to Use Advanced Model Features
 1. How to Visualize a Deep Learning Model
 2. How to Plot Model Learning Curves
 3. How to Save and Load Your Model
5. How to Get Better Model Performance
 1. How to Reduce Overfitting With Dropout
 2. How to Accelerate Training With Batch Normalization
 3. How to Halt Training at the Right Time With Early Stopping
6. How to classify images using the following Convolutional Neural Networks models pre-trained on the ImageNet dataset with Python and the Keras deep learning library
 1. AlexNet
 2. VGGNet
 3. ResNet
 4. Inception

Course Outcomes

On completion of the course the student will be able to

- CO1: Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline
- CO2: Build deep learning models in TensorFlow and interpret the results
- CO3: Troubleshoot and improve deep learning models
- CO4: Build own deep learning project
- CO5: Differentiate between machine learning, deep learning and artificial intelligence
- CO6: Apply Deep learning concepts and provide solutions for real time problems

Skill development



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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In Artificial Intelligence & Robotics			
S. No.	Course Code	Course Name	Pg. No.
Employability			
1	SCSA1207	Fundamentals of Robotics	2
2	SMRA1301	Introduction to Mechanical Systems	3
3	SCSA1314	Sensors and intelligent Instrumentation	4
4	SMRA1302	Robot Actuators	5
5	SMRA1401	Automation and Programmable Logic Controller	6
6	SMRA1403	Robot Kinematics and Dynamics	7
Skill Development			
7	SCSA2307	Sensors and intelligent Instrumentation lab	8
8	SMRA2301	Robot Actuators Lab	9
9	SMRA2401	PLC & Automation lab	10
10	SMRA2402	Robot Simulation Lab	11
11	SMRA2403	Software Robot Design Lab	12

SCSA1207	FUNDAMENTALS OF ROBOTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of robotics and automation.
- To learn the basic configurations and performance of robot.
- To familiarize with the sensors, drive system, and control systems of a robot
- To design a robot work cell for an industrial application
- To understand the various applications of robots, justification, implementation and safety of robot
- To write programming for various robotic applications

UNIT 1 BASICS OF ROBOTICS

9Hrs.

Introduction - Anatomy of Robot - Laws of robotics - Links and Joints of robot - Robot wrist - Configurations of robot - work volume - Spatial resolution - accuracy resolution - repeatability of robot – speed of motion – load carrying capacity - Drive Systems of Robot - Control system of Robot - Types of robot control - Robot motions Rotary to rotary motion, Rotary to linear motion, Harmonics drives

UNIT 2 ROBOT SENSORS AND END EFFECTORS

9Hrs.

Robotic sensors and actuators - Robot actuation and feedback components - Power transmission system – Robot joint control design - Robot End effectors Types of End effectors - Mechanical gripper- types of gripper mechanism - gripper force analysis - other types of gripper - special purpose grippers - Tools – Degrees of Freedom - Selection and design of Grippers.

UNIT 3 ROBOT MECHANICS

9 Hrs.

Robot kinematics: Introduction - Position representation - 2 DOF Arm in 2D - 3 DOF Arm in 2D - 4 DOF Arm in 3D - rigid motion & homogeneous transformation forward & inverse kinematics - trajectory planning - Wrist Orientation - Manipulator path control - Robot Dynamics: Robot Arm dynamics - configuration of a robot controller.

UNIT 4 WORK CELL DESIGN AND COMPUTER VISION SYSTEM

9 Hrs.

Robot work cell design - Work cell types – Work cell Control - Factors to be considered for work cell design - Interlocks - Machine vision: - Sensing and Digitizing - Imaging Devices - Lighting Techniques - AD Converter - Image Processing - Data reduction - Segmentation - Thres-holding - Region Growing-Edge Detection - Feature extraction - Object recognition - Applications Inspection - Identification - Visual servicing and navigation - Training the vision.

UNIT 5 ROBOT PROGRAMMING

9 Hrs.

Robot programming Methods - Methods of Defining Position - Motion Interpolation - Commands - Branching - Robot Languages Classification of robot language - Computer control and robot software - Val system and Languages - Application of robots - Process Applications - Material Loading and Unloading - Material handling - Robots for Assembly and Inspection

Max. 45 Hrs.

COURSE OUTCOMES

- CO1** - Understand the basics of robotics and to choose the appropriate type of drive and sensor system
- CO2** - To select the appropriate type of tools and grippers for various applications
- CO3** - To design a robotic arm and to bring a controlled movement in the end effectors
- CO4** - Understand the concept of Computer vision system and to develop a machine vision system for inspection
- CO5** - Ability to design robot work cell and develop robots for real life situational problems and think creatively for solutions
- CO6** - Ability to write various robot programs for various applications

TEXT /REFERENCE BOOKS

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel , Nicholas G. Odrey , Ashish Dutta, Industrial Robotics - Technology, Programming and Applications McGraw Hill (SIE) | 2nd Edition 2012
2. John J. Craig, Introduction to Robotics: Mechanics and Control, third edition, Pearson Prentice Hall 2004
3. Harry H. Poole, Fundamentals of Robotics Engineering Van Nostrand Reinhold, Springer 2012
4. Frank L. Lewis, Darren M.Dawson, Chaouki T.Abdallah, Robot Manipulator Control Theory and Practice Second Edition, Revised and Expanded 2004
5. R.D.Klafter, T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
6. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.

Employability

SMRA1301	INTRODUCTION TO MECHANICAL SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To develop the knowledge of mechanisms and mechanical systems.
- To learn about machines and mechanical systems.
- To study mechanical systems and understand what the system does, how it's made, what it's made of.
- To learn about modeling and control of electro mechanical systems.
- To identify systems and subsystems, practice drawing process diagrams

UNIT – 1: Introduction to Mechanical Systems

9 Hrs.

Introduction to Mechanical systems: Basic elements of mechanical system, Types of mechanical systems, symbols used in translational mechanical systems, symbols used in rotational mechanical systems, Newton's second law in translation mechanical systems, Force calculations in mass, springs and dashpot, Transfer function of translation mechanical systems, torque calculation in rotational mechanical systems.

UNIT – 2: Machines and Mechanical Systems

9 Hrs.

Factors affecting mechanical advantage, Combination of basic design, Levers and Inclined planes, three classes of levers, wheel and axle, fixed pulley, movable pulley, gears, screw, difference in mechanical advantage between movable pulley systems

UNIT – 3: Analysis of Mechanical Systems

9 Hrs.

Study of forces, motion and deformation, Application of laws relating the forces to the rotation and deformation, static failure mechanisms in the context of machine design, Finite Element Analysis of Mechanical Components using MAT Lab and ANSYS software, Steady state and transient thermal analysis.

UNIT - 4: Modeling and Control of Electro Mechanical Systems

9 Hrs

Physical System Modeling, Modeling of Mechanical, Electrical and Electro-mechanical Systems. Response of Dynamic Systems, First order, Second Order and Higher Order System Response, Transient and Steady-state system specifications. Frequency Domain Control of Systems

UNIT – 5: Modeling Elements

9 Hrs

Idealized Modeling Elements, Modeling Method and Examples, Lagrange's Equation, Case study: Feasibility Study of a Mobile Robot Design, Mat lab Simulation, process diagrams for the various systems and subsystems

Max. 45 Hrs.

COURSE OUTCOMES

CO1- Understand the elements of mechanical systems and apply the laws to calculate force, torque on mechanical systems

CO2- Understand the factors that affects mechanical systems

CO3- Analyse the mechanical systems using Mat lab and Ansys

CO4- Apply the knowledge of mathematics to control the electro mechanical systems

CO5- Build a mechanical system using kits, components and resistant materials.

CO6- Apply knowledge to identify systems and subsystems and illustrates the mechanical systems

TEXT /REFERENCE BOOKS

1. System Dynamics for Engineering Students – Nicolae Lobontiu, Academic Press
2. Fundamentals of Mechanical Vibrations – S Graham Kelly, McGraw-Hill
3. Feedback Control of Dynamic Systems – Franklin, Powell and Naeini, Pearson Education Asia
4. Advanced Control Systems – Dorf and Bishop, Pearson Education Asia
5. Control Systems Engineering – Norman S Nise, John Wiley & Sons
6. Identification and Control of Mechanical Systems, Juang and Phan, Cambridge University Press
7. Feedback Control of Dynamic Systems, Franklin, Powell and Naeini, Pearson Education
8. Dynamic Systems Control, Skelton, John Wiley and Sons

SCSA1314	SENSORS AND INTELLIGENT INSTRUMENTATION	L	T	P	Credits	Total Marks
		2	0	0	2	100

COURSE OBJECTIVES

- To learn the basic knowledge about sensors and instrumentation.
- To understand the different sensors used to measure various physical parameters.
- To understand the concepts of measurement technology.
- To learn the construction and working principles of different types of sensors.
- To analyze the sensor, instrument and measurement situation.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT 1 INTRODUCTION

9 Hrs.

Sensors: Definition, Classification of Sensors, Selection of Sensors, Performance Measures of Sensors, Sensor Calibration Techniques, Sensor Output Signal Types, Static and Dynamic Characteristics of Transducers.

UNIT 2 MOTION, PROXIMITY, RANGING, FORCE, MAGNETIC SENSORS

9 Hrs.

Motion Sensors, Potentiometers, Resolver, Encoders, Optical, Magnetic, Inductive, Capacitive, LVDT, RVDT, Accelerometer, GPS, Bluetooth, Range sensors, RF, Ultrasonic, Laser Range Sensor, Strain-Gage, Load Cell, Magnetic Sensors, Magneto Resistive, Hall Effect, Current Sensor.

UNIT 3 OPTICAL, PRESSURE, TEMPERATURE SENSORS, HEADING SENSORS

9 Hrs.

Photo Conductive Cell, Photo Voltaic, Photo Resistive, LDR, Fiber Optic Sensors, Pressure Sensors, Diaphragm, Piezoelectric, Tactile Sensors, Temperature – IC, Thermistor, Acoustic Sensors, Flow and Level Measurement, Radiation Sensors, Nano Sensors, Laser Sensors, Heading Sensor, Compass, Gyroscope, Inclometers.

UNIT 4 VIRTUAL INSTRUMENTATION

9 Hrs.

Graphical Programming Techniques, Data Types, Advantage of Virtual Instrumentation Techniques, Concept of while, for Loops, Arrays, Clusters and Graphs, Structures, Need of Software-Based Instruments for Industrial Automation.

UNIT 5 INTELLIGENT SENSORS

9 Hrs.

Structure of smart sensors, Application of smart sensors, Components of smart sensors, Characteristics of smart sensors, Self-testing, self-communicating, Self-calibration, Automatic robot control and automobile engine control.

Max. 45 Hrs.

COURSE OUTCOMES

- CO1** - Identify the different types of sensors used in real-life applications.
- CO2** - Evaluate the performance characteristics of different types of sensors.
- CO3** - Use the sensors for converting a physical parameter into an electrical quantity.
- CO4** - Comprehend intelligent instrumentation in industrial automation.
- CO5** - Apply the various sensors for measurement of pressure, force and displacement.
- CO6** - Deploy sensors in the industry for the measurement of temperature, flow level, vibration and accelerometer.

TEXT / REFERENCE BOOKS

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009
2. Ian Sinclair, "Sensors and Transducers", Newnes, 2001.
3. Gary Johnson, "Lab VIEW Graphical Programming", II Edition, McGraw Hill 1997.
4. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
5. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration:3Hrs.

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

20Marks

SMRA1302	ROBOT ACTUATORS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand functions of the fluid power systems and its applications.
- To learn how the hydraulic actuators works and its types with its applications.
- To learn how the Pneumatic actuators works and its types with its applications.
- To learn how the Electric actuators works and its types with its applications.
- To learn how to use exception handling in Python applications for error handling.
- To design and program Python applications.

UNIT1 INTRODUCTION TO FLUID POWER SYSTEMS

9Hrs.

Introduction to Fluid power, types of Fluid power systems, components, advantages and applications of Fluid power systems. Transmission of power at static and dynamic states. Pascal's law and its applications.

UNIT2 HYDRAULIC ACTUATORS

9Hrs.

Introduction to Hydraulic systems, working principle and types of Linear and Rotary hydraulic actuators, Hydraulic Control valves, its components, advantages and applications, Design of hydraulic circuit.

UNIT3 PNEUMATIC ACTUATORS

9Hrs.

Introduction to Pneumatic systems, working principle and types of Pneumatic actuators, Pneumatic Control Valves, its components, advantages and applications; Design of Pneumatic circuit Circuits.

UNIT4 ELECTRIC ACTUATORS

9Hrs.

Introduction, Types of electrical drives; Working principle and types of DC electric motor, AC electric motor, stepper motors, Servo motors.

UNIT5 ACTUATOR MECHANISMS

9Hrs.

Objectives, motivation, open loop control, closed loop control, Types and Functions of drive; Lead Screws, Ball Screws, Chain & linkage drives, Belt drives, Gear drives.

Max. 45 Hrs.

COURSE OUTCOMES

CO1- Identify and analyse the functional requirements of a fluid power transmission system for a given application.

CO2- Design an appropriate hydraulic actuator for a given application.

CO3- Design an appropriate pneumatic actuator for a given application.

CO4- Design an appropriate pneumatic actuator for a given application.

CO5- Summarize the Open loop and Closed loop for actuator Controls.

CO6- Summarize the types and functions of the actuator Mechanism.

TEXT /REFERENCE BOOKS

1. Francis N-Nagy Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987
2. Richard D. Klafter, Thomas. A, Chmielewski, Michael Negin, Robotics Engineering an Integrated Approach, Prentice Hall of India Pvt. Ltd., 1989
3. Bernard Hodges, Industrial Robotics, Second Edition, Jaico Publishing house, 1993
4. Robert J. Schilling, Fundamentals of Robotics Analysis and Control, Prentice Hall of India Pvt. Ltd., 2000
5. Tsuneo Yohikwa, Foundations of Robotics Analysis and Control, Prentice Hall of India Pvt. Ltd., 2001
6. John J. Craig, Introduction to Robotics Mechanics and Control, Second Edition, Addison Wesley Longman Inc. International Student edition, 1999

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration 3Hrs.

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

20 Marks

SMRA1401	AUTOMATION AND PROGRAMMABLE LOGIC CONTROLLER	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To familiarise with the actuators, control valves and different types of controllers.
- To learn about the architecture of PLC and its working.
- To write programs using ladder logic.
- To design a PLC based control system.

UNIT 1 ACTUATORS AND CONTROL VALVES

8 Hrs.

Control valve: Control valve Characteristics (Inherent & Installed) Control valve terminology: Range ability, Turndown, valve capacity, viscosity index, AO, AC (Fail Safe Action) etc. Classification of control valve based on: valve body, Construction, type of actuation and application. Construction & applications of Globe: Single, double, 3way, angle, Gate, Needle, Diaphragm, Rotary valves, Ball, Butterfly. Types of actuators: Construction, Advantages, Disadvantages & applications: Spring Diaphragm & Smart actuators. Positioners, Volume boosters, Pressure boosters, reversing relay, Solenoid valves, Air lock, Position indicating switches, Electro pneumatic converter, Hand wheel, Motors.

UNIT 2 CONTROLLERS

9 Hrs.

Controllers: Discontinuous: ON/OFF, Multi-position Control, Floating Control, Continuous Controller: PID controllers, Composite controllers, Anti-reset windup, Rate before Reset, Concept of Bump less transfers in PID controller, Effect of process characteristics on PID combination, Selection & application of controller actions.

UNIT 3 BASICS OF PROGRAMMABLE LOGIC CONTROLLER (PLC)

9 Hrs.

PLC Architecture and specifications – PLC hardware components Analog & digital Input/ Output modules - Power supplies – I/O slots, CPU & memory module – Programming devices –General PLC programming procedures - programming on-off outputs, Auxiliary commands and functions - creating ladder diagrams from process control descriptions – PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays.

UNIT 4 PLC INTERMEDIATE FUNCTIONS

11 Hrs.

Arithmetic functions - number comparison functions - skip and MCR functions - data move systems. PLC Advanced intermediate functions- utilizing digital bits - sequencer functions - PLC Advanced functions: alternate-programming languages - operation. PLC basic programming – digital logic Gates – Boolean algebra. Basic PLC functions-register basics-timers-counters.

UNIT 5 APPLICATIONS OF PLC

8 Hrs.

Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application - Case Study of Bottle Filling System, Field Bus and HART Protocol.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the working of actuators, control valves, controllers, PLC.
- CO2 - Explain the use of actuators, control valves, controllers.
- CO3 - Select an appropriate controller for a process.
- CO4 - Apply the knowledge of PLC in control.
- CO5 - Develop a program using ladder logic.
- CO6 - Design a control system using PLC.

TEXT/ REFERENCE BOOKS

1. Process control and Instrument technology, C.D. Johnson, TMH.
2. Instrumentation for Process measurement and control, N.A. Anderson, CRC Press.
3. Introduction to Programmable Logic Controller, Gary Dunning, DELMAR Cengage Learning.
4. Programmable Logic Controller, Webb, PHI Reference Books.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

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

20 Marks

PART B :2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SMRA1403	ROBOT KINEMATICS AND DYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamentals of robot kinematics and dynamics.
- To understand the robot kinematics with velocity and force domain.
- To understand the trajectory planning of robot manipulators.
- To understand the control systems used in robot kinematics and dynamics.

UNIT 1 ROBOT KINEMATICS

9 Hrs.

Representing Position and orientation – Homogeneous matrices – Denavit Hardenberg representation - Describing a Robot Arm - Forward Kinematics - Inverse Kinematics, Case studies on describing the real life robot manipulators using D-H representation.

UNIT 2 VELOCITY AND FORCE RELATIONSHIPS

9Hrs.

Velocities in manipulators, Forward and inverse velocity kinematics - Manipulator Jacobian and Transforming Velocities between Coordinate Frames - Static forces in manipulators - Jacobians in the force domain - Cartesian transformation of velocities and static forces.

UNIT 3 ROBOT DYNAMICS

9Hrs.

Acceleration of a rigid body - Equations of Motion – Forward and inverse dynamics - Iterative Newton-Euler dynamic formulation – Closed form dynamic equations – Lagrangian formulation of manipulator dynamics - Formulating manipulator dynamics in Cartesian coordinates.

UNIT 4 TRAJECTORY PLANNING

9Hrs.

Joint space schemes – Cartesian space schemes – Path generation in run time – Description of paths in a robot programming language – Planning path when using the dynamic model – Collision-free path planning.

UNIT5 KINEMATICS AND DYNAMICS CONTROL

9Hrs.

Open and closed loop control systems – Computer torque control – Linear control techniques – Nonlinear control techniques – Force control of manipulators. Case studies to conduct the kinematic and dynamic analyses required for the development of real robot manipulators.

Max. 45 Hrs.

COURSE OUTCOMES

- CO1** – Develop the kinematic equations for any given robot manipulator using Denavit Hartenberg representation.
CO2 – Analyze the robot kinematic equations for the given force and/ or velocity domains.
CO3 – Formulate the robot dynamic equations for the given manipulator.
CO4 – Predict the trajectory of the given robot manipulator using the joint space or Cartesian space schemes.
CO5 – Propose the control technique for the control of robot kinematics and dynamics.
CO6 – Conduct the kinematic and dynamic analysis required for the development of the given robot manipulator.

TEXT /REFERENCE BOOKS

1. John J. Craig, Introduction to Robotics Mechanics and Control, Third Edition, Pearson Education International, 2005.
2. Kevin Russell, Qiong Shen, Raj S. Sodhi, Kinematics and Dynamics of Mechanical Systems, Second Edition, CRC Press, 2019.
3. Reza N. Jazar, Theory of Applied Robotics: Kinematics, Dynamics, and Control, Second Edition, Springer, 2010.
4. S. R. Deb, Sankha Deb, Robotics Technology and Flexible Automation, Second Edition, McGraw Hill Education (India) Private Limited, 2010.
5. Ghosal, A., Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2nd reprint, 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration:3Hrs.

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

20Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80Marks

SCSA2307	SENSORS AND INTELLIGENT INSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To Understand the fundamentals and use of various Sensors.
- To understand the working principles of different types of sensors.
- To understand the circuits and Arduino.
- To Deploy various Sensors to measure certain physical parameters.
- To implement the various application using Arduino Software.

LIST OF EXPERIMENTS

1. Voltage and Current detection circuit.
2. Temperature and Pressure detection circuit.
3. Water Level detection circuit.
4. Detect Position using LVDT (Linear Variable Differential Transformers).
5. Detection of Wind Speed using Proximity sensors.
6. Calculating the distance using Distance Sensor (Ultrasonic).
7. Measuring Light Intensity.
8. To Sense the Humidity.
9. To detect the Rainfall using a Rain drop sensor.
10. Detection of Soil Moisture content.
11. Detection of Motion using the motion sensor.
12. Accelerometer sensor.

COURSE OUTCOMES

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

- C01:** Remembering the concept of sensors, Arduino and Circuits.
- C02:** Able to Identify the different types of sensors used in real-life applications.
- C03:** Able to select various hardware devices used for every application.
- C04:** Able to Implement various applications using Arduino software.
- C05:** Ability to deploy sensors according to the application for the measurement of various parameters.
- C06:** To implement various control mechanisms based on the output received from the sensors.

SMRA2301	ROBOT ACTUATORS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To implement actuators for robotic drive system
- To understand the concept of robot actuators
- To implement basic concepts of Hydraulics and Pneumatics.
- To get familiarized in Operating Hydraulic and Pneumatic drives.
- To implement sensors with actuators.

LIST OF EXPERIMENTS

1. Actuation of Double acting single cylinder using pneumatic source by simulation software
2. Actuation of Two Cylinders of Sequence A+B+A-B- using pneumatic source by Simulation software.
3. Actuation of Double acting single cylinder using Hydraulic source by simulation software
4. Actuation of Double acting Cylinder using Electro-Pneumatic Trainer Kit.
5. Actuation of Double acting cylinder in Hydraulic trainer kit.
6. Determination of Pressure, velocity in Hydraulic Trainer kit.
7. Speed control of DC Motor using PID Control
8. Speed control of Stepper motor with Microprocessor.
9. Interfacing of Sensors for Actuator control
10. A/D Convertor

COURSE OUTCOMES

On completion of the course, student will be able to

- C01:** Remembering the concept of Actuators for Robotics.
- C02:** Understand basic concepts Pneumatic, Hydraulic and Electric actuators.
- C03:** Able to apply and implement various types of actuators in a robotic system.
- C04:** Ability to analyze different types of actuators which is suitable of robotic system..
- C05:** Understanding the interfacing concept of sensors with actuators.
- C06:** Designing suitable actuators for a robot manipulator.

SMRA2401	PLC AND AUTOMATION LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To implement programmable logic controllers with robots.
- To understand the different operations of programmable logic controllers
- To implement programmable logic controllers with input and output devices
- To interface programmable logic controllers with sensors and actuators
- To develop a automation system using programmable logic controllers.

LIST OF EXPERIMENTS

1. Study of Programmable logic controllers and its components
2. Interfacing of PLC with Timers
3. Interfacing of PLC with Counters
4. Interfacing of PLC with AND , OR Logic Gates
5. Interfacing of PLC with NAND , NOR Logic gates
6. Interfacing of PLC with Stepper motor
7. Interfacing of PLC with Servo motor
8. Interfacing of PLC in Traffic light signal arrangements
9. Interfacing of PLC with MCR
10. Interfacing of PLC with Sensors
11. Introduction to PLC simulation software
12. Simple ladder program using PLC simulation software

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1:** Remembering the concept of programmable logic controllers
- CO2:** Understand basic concepts of PLC and interfacing with inputs and outputs.
- CO3:** Able to apply and implement ladder logic programs
- CO4:** Ability to perform PLC programming
- CO5:** Ability to interface PLC with Sensors and Actuators
- CO6:** Design a PLC ladder program in simulation software

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks:50

Exam Duration:2 Hrs

CAE	Evaluation of Regular Lab class	15 Marks	25 Marks
	Model practical exam	10 Marks	
ESE	End Semester Practical exam		25 Marks

SMRA2402	ROBOT SIMULATION LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To introduce different types of robotics and demonstrate them to identify different parts and components.
- To write programming for various operations.
- To write programming for Colour Identification.
- To write programming for Shape Identification.
- To write programming for Multi Process.
- To write programming for industrial process like Packaging and Assembly.

LIST OF EXPERIMENTS

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Colour identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1:** To model the different types of robots and calculate work volume for different robots by any robotic simulation software.
- CO2:** To program and simulate for Pick and Place Operations.
- CO3:** To program and simulate for Colour identification.
- CO4:** To program and simulate for Shape Identification.
- CO5:** To program and simulate for Multi Process.
- CO6:** To program and simulate for industrial process like Packaging and Assembly.

SMRA2403	SOFTWARE ROBOT DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To provide knowledge of Arduino boards and basic components
- To get familiarized with Arduino installation and programming language
- To develop skills to design and implement various smart system application
- To provide knowledge of different smart application systems
- To do coding for various applications using Arduino programming
- To apply these smart application systems in day-to-day life

LIST OF EXPERIMENTS

1. Study of Arduino Uno R3 microcontroller, breadboard, components and cables and applications
2. Study of Arduino Installation, Programming and Coding
3. Coding to blink an LED
4. Coding to turn on and off an LED
5. Coding to increase and decrease the intensity of brightness the LED blinks
6. Coding to blink multiple LEDs at the same time
7. Coding for RGB LED to scroll through a variety of colors
8. Coding for piezo buzzer/speaker
9. Coding of a temperature/ fire sensor
10. Coding of a Infra-red obstacle sensor
11. Coding of a heart beat sensor
12. Coding for servo back and forth range of motion
13. Coding for DC stepper / servo motor control
14. Coding for Blue tooth and Wi-Fi
15. Coding for display text / names / number / time on the LCD screen

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1:** Familiarize with the basic concepts Arduino components
- CO2:** Assembly and install the Arduino components and programme for various applications
- CO3:** Able to apply and implement these concepts for design a smart application system
- CO4:** To Familiarize with Arduino programming with C++
- CO5:** Ability to analyze and develop coding through step-by-step approach for various applications
- CO6:** To apply Arduino programming with C++ and develop smart application systems





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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In Blockchain Technology			
S. No.	Course Code	Course Name	Page No.
Employability			
1	SCSA1315	Introduction to Cryptography	2
2	SCSA1316	Bitcoin	3
3	SCSA1411	Blockchain Architecture Design and use cases	4
4	SCSA1412	Introduction to Ethereum and Solidity Programming Language	5
Skill Development			
5	SCSA2410	Ethereum and Solidity Programming Language Lab	6

SCSA1315	INTRODUCTION TO CRYPTOGRAPHY	L	T	P	Credits	Total Marks
		2	0	0	2	100

COURSE OBJECTIVES

- To Learn about modern Cryptography.
- To focuses on how cryptographic algorithms and protocols work and how to use them
- To build a Pseudorandom permutation
- To Construct Basic cryptanalytic techniques
- To provide instruction on how to use the concepts of block ciphers and message authentication codes

UNIT 1 INTRODUCTION

9Hrs.

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT 2 FORMAL NOTIONS OF ATTACKS

9Hrs.

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Inter-relations among the attack model

UNIT 3 RANDOM ORACLES

9Hrs.

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo-random Functions (PRF)

UNIT 4 BUILDING A PSEUDORANDOM PERMUTATION

9Hrs.

The Luby Rackoff Construction: Formal Definition, Application of the Luby Rackoff Construction to the construction of Block Ciphers, The DES in the light of Luby Rackoff Construction.

UNIT 5 MESSAGE AUTHENTICATION CODES

9Hrs.

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analysing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Understand basic principles of cryptography and general cryptanalysis
- CO2: Be acquainted with the concepts of symmetric encryption and authentication
- CO3: Use the concept of public key encryption, digital signatures, and key establishment.
- CO4: Be able to compose, build and analyse simple cryptographic solutions.
- CO5: Implement cryptographic schemes
- CO6: Be able to use Message Authentication Codes

TEXT /REFERENCE BOOKS

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)
3. Shaffi Goldwasser and Mihir Bellare, Lecture Notes on Cryptography, Available at <http://citeseerx.ist.psu.edu/>.
4. Oded Goldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23

SCSA1316	BITCOIN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand Bitcoin, their needed and why
- Explore the Security and Stability of Bitcoin and Cryptocurrencies
- Learn Bitcoin's Consensus Mechanism and reason about its Security
- Gain a detailed understanding of the World of Blockchain and Virtual Currencies

UNIT 1 Core of Bitcoin

9Hrs.

Introduction - History & Philosophy of Bitcoin - Bitcoin & Ethereum - Bitcoin Core Architecture - Cryptocurrencies - Transactions (Inputs & Outputs & Constraints) - Blockchain - Soft Fork and Hard Fork- Fork categorization - Signalling, & Protocol Overview - Bitcoin Scripting System -Economic Limits of Bitcoin and the Blockchain

UNIT 2 Security Models

9Hrs.

Security Models : Overview of Security Concerns - Bitcoin Threat Models, Bitcoin's Security Mode - Weakness , Speed - Security Trade-offs in Blockchain Protocols - Checkpoints, assume valid, minimum chain work - SPV and Light clients - Committed bloom filters - UTXO - The Onion Model of Blockchain Security- Byzantine Generals Problem - Consensus Algorithms

UNIT 3 Mining

9Hrs.

Block arrivals in the Bitcoin Blockchain - Fee Sniping - Selfish Mining - Poisson Distribution - Poisson Process - Bitcoin's Attack Vectors - Better Hash - No Reward Mining Overview - Pool overview - Pool Hopping - PPS As a Real-World Business Solution - Trustless Pools - Payment Channel Pay-outs - ASIC Boost - BCH Mining / Difficulty Adjustment - Tumble bit - Dust attack

UNIT 4 Consensus Approaches and Cryptography

9Hrs.

Overview - GHOST - Braiding - Bitcoin-NG: A Scalable Blockchain Protocol - Sidechains - Extension Blocks - Replay Protection - Wipeout Protection - 3 Seminal Events In Cryptography - Public Key Cryptography - Finite fields, Elliptic Curves, ECDSA, Schnorr - Bitcoin, Chance and Randomness - Broken Crypto Primitives - State of Cryptography - SNARKs - Bullet proofs - Commitment schemes -Diffie-Hellman Key Exchange - Ring Signatures - RSA

UNIT 5 Transactions

9Hrs.

Raw Bitcoin Protocol - Working with Transactions - Transaction Life Cycle - Transaction Format - Bitcoin Scripting: Transactions & Multisig - Signing transactions - Standardness - Zero-confirmation transactions - Compacted Transactions - Transaction Pools, Bitcoin Peer-to-Peer Network - Mempool - Wallet Development - Hierarchical Deterministic Wallets - Native Descriptor Wallets - Wallet key management

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Learn how the individual components of the Bitcoin protocol make the whole system works: transactions, script, blocks, and the peer-to-peer network
- CO2: Understand How using Bitcoin works and different ways of storing Bitcoin keys.
- CO3: Define how mining can be re-designed in alternative Cryptocurrencies.
- CO4: Explain cryptographic building blocks and reason about their security.
- CO5: Ability to Understand Bitcoin Transactions in Real World.
- CO6: Exploit applications of Blockchain in Real World Scenario

TEXT / REFERENCE BOOKS

1. Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain" (2nd edition, 2017),Oreilly & Associates Inc, 978-1491954386 . <https://github.com/bitcoinbook/bitcoinbook>
2. Narayanan, et al., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" (2016), Princeton University Press, 978-0691171692 . https://www.lopp.net/pdf/princeton_bitcoin_book.pdf
3. Jimmy Song, "Programming Bitcoin: Learn How to Program Bitcoin from Scratch" (2020), Oreilly & Associates Inc, 978-1492031499. <https://github.com/jimmysong/programmingbitcoin>

SCSA1411	BLOCKCHAIN ARCHITECTURE DESIGN AND USE CASES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn blockchain basics and primitives along with architecture
- To understand how to consensus, work along with design goals.
- To build Hyperledger fabric A & B.
- To apply use cases like KYC, Financial blockchains.
- To create privacy and security policy and cryptography schemes

UNIT 1 Introduction to Blockchain

9Hrs.

Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms.

UNIT 2 Consensus

9Hrs.

Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains.

UNIT 3 Hyperledger Fabric

9Hrs.

Hyperledger Fabric (A):

Decomposing the consensus process, Hyperledger fabric components, Chaincode Design and Implementation

Hyperledger Fabric (B):

Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool

UNIT 4 Use Cases 1 & 2

9Hrs.

Use case 1: Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance

Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc

UNIT 5 Use Case 3

9Hrs.

Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Describe basics of blockchain and hash functions.
- CO2: Able to know about consensus along with protocols.
- CO3: Define Hyperledger fabric components and design policies.
- CO4: Design use cases related to trade/supply chain finance
- CO5: Ability to design real life situational problems like insurance, KYC, etc.
- CO6: Apply privacy and security policies and cryptography systems.

TEXT /REFERENCE BOOKS

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>
4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits
<https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>

SCSA1412	INTRODUCTION TO ETHEREUM AND SOLIDITY PROGRAMMING LANGUAGE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart strong understanding about the Ethereum technologies
- To understand how Block chain and Ethereum works
- To gain the knowledge on basics and advanced level of solidity programming language
- To design and develop a smart contract and distributed application using solidity programming language

UNIT1 INTRODUCTION TO ETHEREUM

9Hrs.

Blockchain Basics and its Components -Birth of Ethereum-Block chain and Ethereum Architecture-Ethereum for Newbies -Ethereum Ecosystem- Ethereum Clients - Working of Ethereum: Bitcoin - Ether-Ethereum Mining-Ethereum Storage: Hardware Wallets, Desktop Wallets, Mobile Wallets, Web Wallets, Paper Wallets.

UNIT2 FEATURES AND APPLICATIONS OF ETHEREUM

9Hrs.

Ethereum Features: Cryptocurrency - Smart Contracts - Ethereum Virtual Machine - Decentralized Application - Autonomous Organization - Application of Ethereum.

UNIT3 INTRODUCTION TO SOLIDITY PROGRAMMING LANGUAGE

9Hrs.

Solidity-Setup of Environment-Syntax: Pragma, Contract, Importing Files, Reserve Keywords, Comments, Types, Variables, Variable Scope, Operators, Loops, Decision Making, String, Arrays, Enums, Structs, Mapping, Conversion, Ether units, Special Variables, Style Guide-Solidity Function: Functions, Function Modifiers, View function, Pure function, Fallback function, Function Overloading, Mathematical Functions, Cryptographic Functions.

UNIT4 ADVANCED SOLIDITY PROGRAMMING LANGUAGE

9Hrs.

Contracts-Inheritance-Constructors-Abstract Contracts-Interfaces-Libraries-Assemble-Events-Error Handling-A Simple Smart Contract using solidity programming language: Storage and Sub-currency example.

UNIT5 CASESTUDY

9Hrs.

Smart Contract-Simple Bank Smart Contract Development-Voting Exercise-Token Exercise.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1: Gain strong knowledge about the architecture of Ethereum and their features
- CO2: Build compelling blockchain applications using the Ethereum Blockchain
- CO3: Explain the performance of Ethereum virtual machine
- CO4: Ability to develop a small application using solidity programming language
- CO5: Strong knowledge in advanced level of solidity programming language
- CO6: Ability to develop and design the smart contract application using solidity programming language

TEXT /REFERENCE BOOKS

1. Mayukh Mukhopadhyay, "Ethereum Smart Contract Development: Build blockchain based decentralized application using solidity", Packt> (Mumbai) 2018.
2. Andreas M. Antonopoulos, Gavin Wood Ph.D., "Mastering Ethereum: Building Smart Contracts DApps", O'REILLY 2019.
3. Ritesh Modi, "Solidity Programming Essentials: A Beginners Guide to build smart contracts for Ethereum and Blockchain", Packt>(Mumbai) 2018.
4. Chris Dannen, "Introducing Ethereum and Solidity: Foundation of Cryptocurrency and Blockchain Programming for Beginners", Apress 2017.
5. Solidity – Official Website of Solidity and Documentation: <https://docs.soliditylang.org/en/v0.8.4/>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration:3 Hrs.

PART A: 10 Questions carrying 2 marks each - No choice

20 Marks

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

80 Marks

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SCSA2410	ETHEREUM AND SOLIDITY PROGRAMMING LANGUAGE LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand the basic knowledge of solidity programming language
- To get familiarized with smart contract
- To gain the knowledge of secure payment
- To know how to work in Ethereum platform
- To implement the smart contract for various application

LIST OF EXPERIMENTS

1. Program to implement simple counter smart contract using solidity programming language
2. Program to implement variables, datatypes and structs in smart contract
3. Program to implement data structures inside smart contract using solidity programming language (Array and Mapping)
4. Program to check the given number is even or not using conditionals and looping inside smart contract using Solidity Programming Language
5. Program to implement smart contract for simple marketplace
6. Program to build a code cryptocurrency payment in smart contract for hotel rooms
7. Program to perform the operation in multiple smart contracts inside solidity using inheritance and factories
8. Program to create a shipping contract by using the blockchain development kit for Ethereum

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Understand the basics & advanced features of Solidity & Ethereum Virtual Machine
- CO2: Ability to analyse and develop algorithms for smart contract
- CO3: Able to do the secure payment between the owner and the customer
- CO4: Able to work with multiple smart contracts for various real time applications
- CO5: Familiar to Develop their own decentralized blockchain applications
- CO6: Develop Ethereum smart contract using Solidity

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration:3 Hrs.

CAE: Evaluation of Regular Lab class

15 Marks

Model practical exam

10 Marks

25 Marks

ESE: End Semester Practical Exam

25 Marks

Skill development



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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In Cyber Security			
S. No.	Course Code	Course Name	Pg.No
Employability			
1	SCSA1208	Fundamentals of Cyber security	2
2	SITA1401	Data communication and Computer Networks	3
3	SCSA1317	Privacy and Security in Online social media	4
4	SCSA1318	Forensics and incident Response	5
5	SCSA1410	Cyber threats for IOT and Cloud	6
6	SCSA1413	Secured network protocols and standards	7
7	SCSA1414	Cyber Forensics	8
Skill Development			
8	SCSA2205	Cybersecurity Lab	9
9	SCSA2308	Cryptography and Network Security Lab	10
10	SCSA2409	IOT and Cloud Security lab	11
11	SCSA2411	Cyber Forensics Lab	12

SCSA1208	FUNDAMENTALS OF CYBERSECURITY	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the basic concepts of cybersecurity
- To acquire knowledge on cyber threats and attacks
- To become aware of significant security technologies and tools
- To impart knowledge on cipher methods and cryptographic algorithms
- To explore various protocols for establishing secured communication

UNIT1 INTRODUCTION TO CYBERSECURITY

9Hrs.

Introduction–Need for Security–Security Approaches–Principles of Security–Components–Balancing Security & Access–Software Development Life Cycle–Security Systems Development Life Cycle–Security Professionals and the organization

UNIT2 CYBERSECURITY-THREATS&ATTACKS

9Hrs.

Threats: Intellectual Property–Software Attacks–Deviations in QoS–Espionage–Forces of Nature–Human Error–Information Extortion–Missing, inadequate or incomplete organization policy–Missing, inadequate or incomplete controls–sabotage–Theft–Hardware Failures–Software Failures Attacks: Malicious Code–Hoaxes–Back Doors–Password Crack–Brute Force–Dictionary–DoS and DDoS–Spoofing–Man-in-the-Middle–Spam–Email Bombing–Sniffers–Social Engineering–Pharming–Timing Attack

UNIT3 SECURITY TOOLS & TECHNOLOGIES

9Hrs.

Firewall and VPNs–Intrusion Detection and Prevention Systems–Other Security Tools–Access Control–Firewalls–Protecting Remote Connections–Intrusion Detection and Prevention Systems–Honeypots, Honeynets and Padded Cell Systems

UNIT4 CRYPTOGRAPHY

9Hrs.

Cryptology Terminology–Cipher methods–Cryptographic Algorithms–Cryptographic tools–Attacks on cryptosystems–Physical Security.

UNIT5 PROTOCOLS FOR SECURE COMMUNICATION

9Hrs.

Basic Concepts–S/HTTP, SSL & SET–S/MIME, PEM & PGP–WEP, WPA & WPA2–IPSEC & PGP

Max. 45Hrs.

COURSE OUTCOME

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

- CO1: Understand the basic concepts, need, approaches, principles and components of security. CO2: Explain the various cyber threats and attacks.
- CO3: Describe the various Security Technologies and Tools.
- CO4: Explain the basic principles of cryptography and algorithms. CO5: Examine the various protocols for secure communication. CO6: Explore the significant aspects of cybersecurity.

TEXT/REFERENCE BOOKS

1. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", CENGAGE Learning, 4th Edition.
2. William Stallings, "Cryptography and Network Security–Principles and Practice", Pearson Education, 7th Edition.
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 4th Edition.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3Hrs.

PART A: 10 Questions carrying 2 marks each–No choice

20 Marks

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

80 Marks

Employability

SITA1401	DATACOMMUNICATIONANDCOMPUTER NETWORKS	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSEOBJECTIVES

- To understand the network architecture and protocols supported for connecting devices in a network.
- To gain the knowledge of framing in data link layer.
- To learn the functions of network layer and the routing strategies with their associated protocols.
- To introduce the protocols used for end-to-end packet delivery in transport layer.
- To understand the application layer protocols.

UNIT1 DATACOMMUNICATION

9Hrs.

Introduction to data communication- Network protocols & standards- Line configuration- Topology- Transmission mode- Categories of networks- OSI model- Layers of OSI model- TCP/IP Model- Transmission media- Guided media- Unguided media- Switching- Circuit Switching- Packet Switching.

UNIT2 DATALINK LAYER

9Hrs.

Error detection and correction- Line Discipline- Flow Control- Error control- Medium Access Control- Ethernet- CSMA/CD- Wireless LAN- CSMA/CA- IEEE 802.11, Bluetooth.

UNIT3 NETWORK LAYER

9Hrs.

Routing- Distance Vector Routing- Link State Routing- Addressing- Subnetting- IPv4- IPv6- ARP- RARP- ICMP- IGMP- DHCP- Networking Devices- Repeaters- Switches- Bridges- Routers- Gateways.

UNIT4 TRANSPORT LAYER

9Hrs.

TCP- UDP- Connection Management- Flow Control- Retransmission- Congestion Control- Leaky bucket algorithm- Detection and Avoidance.

UNIT5 APPLICATION LAYER

9Hrs.

Message Handling System (MHS)- FTAM- Virtual Terminal (VT)- Domain Name System- FTP- WWW and HTTP- SNMP- SMTP- POP3- IMAP- MIME- TELNET

Max. 45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Describe the architecture of a computer network and explain how each device in a network communicates with each other. CO2: Explain packet collision in the link layer and how they are corrected.
- CO3: Design a routing protocol in a network and demonstrate how a data packet will reach to the intended destination. CO4: Implementation of flow control mechanisms to regulate the traffic in a network.
- CO5: Describe IP addressing and explain its functions.
- CO6: Recognize various application layer protocols and its functions.

TEXT/REFERENCE BOOKS

1. Behrouz A. Fourouzan, "Data Communication and Networking", Fifth Edition, McGraw-Hill Education India Pvt. Ltd.- New Delhi., 2013.
2. William Stallings, "Data and Computer Communications", Pearson Education, 8th ed., 2007.
3. P.C. Gupta, "Data Communications and Computer Networks", Prentice-Hall of India, 2006.
4. Andrew S. Tanenbaum, "Computer Networks", Fifth Edition, Pearson, 2011.
5. L.L. Peterson and B.S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann, 3rd ed., 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions carrying 2 marks each- No choice

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

Exam Duration: 3Hrs.

20 Marks

80 Marks

.SCSA1317	PRIVACYANDSECURITYINONLINESOCIAL MEDIA	L	T	P	Credits	Totalmarks
		3	0	0	3	100

COURSEOBJECTIVES

- To discuss about privacy in social networks
- To study the different encryption systems in social network
- To know the importance of K-Anonymity
- To understand the types of attacks against individuals' privacy.
- To discuss the privacy preserving for users.

UNIT1 ANALYSIS OF PRIVACY IN SOCIAL NETWORKS 9Hrs.

Three-Layered Framework- Characteristics Used to Analyze Social Web Privacy- Privacy Issues Related to Social Web Users- Privacy Issues Related to Service Providers- Security and Privacy for Digital Facets- Identifiable Facets- Private Facets.

UNIT2 ENCRYPTION FOR PEER-TO-PEER SOCIAL NETWORKS 9Hrs.

Essential Criteria for the P2P Encryption Systems- Existing P2P OSN Architectures- Evaluation of Existing Encryption Schemes Based on Our Criteria- Broadcast Encryption- Predicate Encryption- Survey of Unethical Behaviour- Influencing factors.

UNIT3 STEALING REALITY AND K-ANONYMITY 9Hrs.

Stealing Reality- Social Attack Model- Social Learnability- k-Anonymity- k-Degree Anonymity- k-Neighbourhood Anonymity- k-Automorphism- k-Isomorphism- L-diversity- Attack Model and Privacy Guarantee- Insights from an L-Diversified Graph- Anonymization Techniques.

UNIT4 LINKS RECONSTRUCTION ATTACK AND BITCOIN SYSTEM 9Hrs.

Privacy in Social Networks- Link Prediction- Feature Extraction- Communities Datasets- Electronic Currencies- Anonymity- The Bitcoin System- The Transaction Network- The User Network- Anonymity Analysis- Integrating Off-Network Information- The Bitcoin Faucet- Voluntary Disclosures- TCP/IP Layer Information- Context Discovery- Flow and Temporal Analyses.

UNIT5 PRIVACY-PRESERVING DATA INTEGRATION USING DECOUPLED DATA 9Hrs.

Use Case and the Threat Model- Use Case for Private Record Linkage- Use Case for Privacy-Preserving Record Linkage- Threat Model for Privacy-Preserving Record Linkage- Record Linkage- Privacy-Preserving Computation- Information and Privacy- Sensitivity and Identifiability- A Model for Privacy-Preserving Record Linkage- Decoupled Data Access Model- Social Security Numbers- Need for Chaffing.

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Understand the concepts of privacy in social network. CO2: Apply the Different encryption techniques.
- CO3: Know How to Steal and Attack social model CO4: Understand the importance of Bitcoin System.
- CO5: Analyze the privacy preserving for decoupled data. CO6: Develop the use case model for privacy preserving.

TEXT/REFERENCE BOOKS

1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers, Nadav Aharoni, Alex Pentland, "Security and Privacy in Social Networks".
2. Privacy and Security in Online Social Media course in NPTEL.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

PART A:10 Questions carrying 2 marks each- No choice

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

Exam Duration:3Hrs.

20Marks

80Marks

SCSA1318	FORENSICS AND INCIDENT RESPONSE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To define an incident relating to Cyber Security.
- To recognize an Incident
- To analyze protocol on Crime Scene Investigations.
- To understand Computer Crime Scenarios.

UNIT1 INCIDENT RESPONSE DEFINITIONS

9Hrs.

Definition of incident response and forensic analysis, relation of incident response to the rest of cybersecurity operations, incident response phases- preparation, identification, containment, eradication, recovery, follow-up, indicators of compromise (IOC)

UNIT2 INCIDENT WORKFLOWS

9Hrs.

Incident workflows, guidelines, incident handling forms, principles of malware analysis, log analysis, threat intelligence, vulnerability management, penetration testing, digital forensics, incident ticketing systems, incident documentation templates. Identification: Detection, incident triage, information gathering and reporting, incident classification, indicators of compromise (IOC)s.

UNIT3 INCIDENT RESPONSE AND HANDLING PROCESS

9Hrs.

Incident Response and Handling Process, Identification, Incident Recording, Initial Response, Communicating the Incident, Containment, formulating a Response Strategy, Incident Classification, Incident Investigation, Data Collection, Forensic Analysis, Evidence Protection, Notify External Agencies, Eradication, System Recovery, Incident Documentation, Incident Damage and Cause assessment, Review and Update the Response Policies

UNIT4 TECHNICAL FORENSIC TOOLS AND TECHNIQUES

9Hrs.

Hard disks, removable media and file systems, Windows forensics, duplication/imaging of forensic data, recovering deleted files and hidden or deleted partitions, steganography and image forensics, log analysis, password crackers, network device forensics, packet capture analysis, email tracking, mobile forensics, investigation of attacks, common tools (Encase, FTK, etc.)

UNIT5 BUSINESS CASE STUDY AND LECTURE:

9Hrs.

Lecture by invited experts from the cybersecurity industry, including law enforcement. Discussion normally focuses on the practicalities and challenges of incident response and the ways in which forensic analysis contributes to successful cybercrime prosecutions.

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Acquire and analyze live response data from compromised systems. CO2: Analyze memory for evidence of a compromise.
- CO3: Analyze file system and operating system artifacts CO4: Understand evidence tools of a compromise.
- CO5: Evaluate and apply tools and common processes. CO6: Performing analysis of compromised systems

TEXT/REFERENCE BOOKS

1. Jason T. Luttgens and Matthew Pepe, "Incident Response & Computer Forensics, O'reilly, Third Edition" 2014
2. Eighton Johnson, "Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response", 2014.
3. John Sammons, "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics", Elsevier, August 2011.
4. Cory Altheide and Harlan Carvey, "Digital Forensics with Open-Source Tools", Imprint Press, 2011.
5. David Lilburn Watson and Andrew Jones, "Digital Forensics Processing and Procedures", 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

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

PART B:2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration:3Hrs.

20 Marks

80 Marks

SCSA1410	CYBERTHREATSFOR IOT AND CLOUD	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of IoT and its applications.
- To identify the various security issues in IoT platforms
- To learn about the role of cloud computing in IoT.
- To provide knowledge and overview about security in cloud.
- To make students aware of various security techniques in cloud.

UNIT 1 IOT AND APPLICATIONS

9Hrs.

Introduction & Application to Internet of Things: The Internet of Things, Importance of IoT, Towards the IoT Universe IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, IoT SmartX Application: Smart Cities, Smart Energy & Smart Grid, Smart Mobility & transport, Smart Home, Smart Building & Infrastructure, Smart Factory & Manufacturing.

UNIT 2 PRIVACY, SECURITY & GOVERNANCE

9Hrs.

IoT Security Requirements-Data Confidentiality-Data Encryption-Data Authentication-Secured Access Control-IoT-Vulnerabilities-Secret-Key, Authentication/Authorization for Smart Devices-Constrained System Resources-Device Heterogeneity-Fixed Firmware.IoT Attacks-Side-channel Attacks-Reconnaissance-Spoofing-Sniffing-Neighbour-Discovery-Rogue Devices-Man-in-Middle attack.

UNIT 3 IOT AND CLOUD

9Hrs.

Connecting IoT to Cloud: Introduction to cloud computing, Difference between Cloud Computing and IoT, Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT, Living on the Edge, Connecting IoT to cloud, Cloud Storage for IoT. Cloud-to-Device Connectivity, Challenge in integration of IoT with Cloud.

UNIT 4 CLOUD SECURITY

9Hrs.

Cloud Computing Software Security Fundamentals: Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements. Cloud Computing Risk Issues: Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks.

UNIT 5 SECURITY TECHNIQUES

9Hrs.

Cloud Computing Security Challenges: Security Policy Implementation, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques. Cloud Computing Security Architecture: Architectural Considerations, Identity Management and Access Control, Autonomic Security.

Max. 45Hrs.

COURSE OUTCOMES

On completion of the course, the student can able to, CO1:

Analyse the IoT model and different platforms.

CO2: Recognize the IoT security and vulnerability threats. CO3:

Understand the next evolution of cloud computing. CO4:

Analyse the connectivity of IoT to cloud computing. CO5:

Evaluate the risk issues and threats in cloud computing.

CO6: Analyse these security techniques and access control methods.

TEXT/REFERENCE BOOKS

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things", Global paper back edition, 2016.
2. Kris Jamsa, "Cloud Computing", Jones & Bartlett, 2012.
3. Wiem Tounsi, "Cyber-Vigilance and Digital Trust: Cyber Security in the Era of Cloud Computing and IoT", Wiley, 2019.
4. Russell Dean Vines and Ronald L. Krutz, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley India Pvt Ltd, 2010.
5. Barrie Sosinsky, "Cloud Computing Bible", Wiley India, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

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

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3Hrs.

20 Marks

80 Marks

SCSA1413	SECURED NETWORK PROTOCOLS AND STANDARDS	L	T	P	Credits	Total marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of different layers of protocols.
- To identify the various protocols in cyber security.
- To understand the various attacks and intrusion detection system.
- To provide knowledge and overview about cyber physical system and IoT.
- To make students aware of various cyber risk assessment and threats.

UNIT1 INTRODUCTION

9Hrs.

Introduction (overview of network security issues, cryptographic algorithms, authentication techniques) - Layer 2/3 security - Authentication systems, Key establishment protocols, Kerberos - Secure communication at the data link and network layers (IPsec and IKE) - Secure communication at the transport and application layers (SSL/TLS, email security, PGP) - Vulnerabilities of Internet protocols

UNIT2 PROTOCOLS

9Hrs.

Secure Sockets Layer (SSL) - SSL Protocol Stack - SSL Record Protocol Operation IP Security (IPsec) - IP Security (IPsec) architecture - Benefit of IPsec Hypertext Transfer Protocol Secure (HTTPS) Kerberos - Drawbacks and limitations - Kerberos Vulnerabilities Transport Layer Security (TLS).

UNIT3 ATTACKS AND THREATS

9Hrs.

Denial of Service (DoS) attacks and defences - Firewalls, IP spoofing prevention - Routing protocols security and router security - Domain Name System (DNS) security - Traffic monitoring, Intrusion detection, Honey pots - Wireless network security - Spam, Phishing, and Pharming - Malware propagation and containment, Botnets - Anonymity and privacy on the Web.

UNIT4 SECURITY IN NEXT GENERATION SYSTEM

9Hrs.

Internet Security Protocols and Standards - TCP Attacks, DNS Vulnerabilities, SSL/TLS, DDoS - Next Generation System Designs and Challenges - Cyber - Physical System Overview and Security - Internet of Things and Smart Grid Security - Data & Infrastructure Security in Cloud/Edge Computing.

UNIT5 CYBER RISK ASSESSMENT

9Hrs.

Blockchain and Decentralized Applications - Hashcash and other Consensus Protocols Blockchain Security - Smart Contracts - Scalability and Privacy challenges, Security Economics and Risk Modelling - Cyber - Risk Assessment - Threat Information Sharing - Cyber - insurance

Max. 45Hrs.

COURSE OUTCOMES:

On completion of the course, the student can able to

- CO1: Analyse the security issues and authentication algorithms. CO2: Express the various protocols in different layers.
- CO3: Explain the use of different attacks and security mechanisms in current network scenario. CO4: Analyse the security issues in IoT and smart grid applications.
- CO5: Evaluate the security methods using blockchain. CO6: An Ability to analyse the cyber risk assessment.

TEXT/REFERENCE BOOKS

1. Uyles D. Black, "Computer Networks: Protocols, Standards and Interface 2nd Edition", 2nd Edition, 2015
2. James F. Kurose and Keith W. Ross, "Computer Networking - A Top-Down Approach", Addison-Wesley, Fifth Edition, 2010.
3. L. Peterson and B. Davie, "Computer Networks: A Systems Approach", Elsevier Inc., Fifth Edition, 2011.
4. William Stallins, "Network Security Essentials: Applications and Standards", Pearson Publication, 2016.
5. Yassine Maleh, "Security and Privacy Management, Techniques, and Protocols", Morocco, 2018

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

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

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3Hrs.

20 Marks

80 Marks

SCSA1414	CYBERFORENSICS	L	T	P	Credits	Totalmarks
		3	0	0	2	100

COURSE OBJECTIVES

To discuss about Cyberforensics, Information Security Investigations To
 Understanding information and Methods of storing data
 To know the importance of Computer Forensics and Fundamentals
 To understand the Types of Computer Forensics Tools and Technology. To discuss the
 Types of Computer Forensics Systems.

UNIT1 DIGITAL INVESTIGATION

9Hrs.

Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process - Investigative Reconstruction -
 Modus Operandi, Motive and Technology - Digital Evidence in the Courtroom.

UNIT2 UNDERSTANDING INFORMATION

9Hrs.

Methods of storing data: numbers systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats -
 Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers -
 Extraction of forensic artifacts understanding the dimensions of other latest storage devices SSD Devices

UNIT3 COMPUTER BASICS FOR DIGITAL INVESTIGATORS

9Hrs.

Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology - Steps
 taken by computer forensic specialists.

UNIT4 TYPES OF COMPUTER FORENSICS

9Hrs.

Tools and Technology - Tools and Types of Military Computer Forensics Technology - Tools and Types of Law Enforcement Computer Forensic Technology - Tools and
 Types of Business Computer Forensic Technology

UNIT5 ADVANCED CYBERFORENSICS

9Hrs.

Windows Forensics: Registry Analysis - Browser Usage - Hibernation File Analysis - Crash Dump Analysis - File System Analysis - Network Forensics -
 Understanding Protocols with Wireshark. Memory Forensics: Filesystem artifacts including \$MFT, shellbags, paged memory and advanced registry artifacts -
 Related tools Bulk Extractor and YARA. Virtual Machine Forensics, Cloud Forensics: Cloud Storage Forensic Analysis -
 Evidence Source Identification and Preservation Collection of evidence from cloud storage devices - Examination and analysis of collected data

Max. 45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to CO1:

Understand the concepts of Cyberforensics CO2:

Apply the Computer Forensics Technology. CO3:

Know How to Investigate Computer Forensic

CO4: Understand the importance of Business Computer Forensic Technology

CO5: Analyse the Advanced Cyber Forensics windows, memory, Virtual machine Forensics CO6: Develop the
 use case model for Cloud Storage Forensic Analysis.

TEXT/REFERENCE BOOKS1.

- John R. Voca, "Computer Forensics: Computer Crime Scene Investigation", Charles River Media, 2nd Edition, 2005.
- Ravi Kumar & Dhanu, "Computer Forensics", Pearson Education, 2006.
- Christof Paar, Jan "Cyber Concepts and Approaches", Wiley, 2006.
- Ali, "Understanding Cryptography: A Textbook for Students and Practitioners" Springer's, Second Edition, 2010.
- Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers, 2009
- Jahangiri, "Live Computer Forensics: Investigating Network Intrusions and Cyber Crime", ELP Press, 2010.
- C. Altheide & H. Carvey, "Digital Forensics with Open Source Tools", Synpress, ISBN: 781597495868, <https://esu.desire2learn.com>

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Employability

CSA2205	CYBERSECURITY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand various reconnaissance tools.
- To Explore Wireshark tool for packet capturing.
- To Explore Security aspect of Windows Operating System.
- To demonstrate ciphers and SHA1 hash algorithm.
- To understand cyberattacks.

SUGGESTED EXPERIMENTS

1. Working with Network Reconnaissance tools such as nslookup, traceroute, dig and Whois
2. Capturing and Exploring packets with Wireshark packet sniffer
3. Exploring Windows Firewall Security
4. Configuring security for Web Browsers
5. Hardening Windows Operating System
6. Exploring Windows Group Policy
7. Working with Ciphers
8. Working with SHA-1 algorithm
9. Perform encryption and decryption using following transposition techniques
 - a. Rail fence - Row & Column Transformation
10. Prevent Eavesdropping attack using SSH

COURSE OUTCOMES

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

- CO1: Demonstrate and exhibits skills with reconnaissance tools such as nslookup, traceroute, dig and who is.
- CO2: To Capture and Analyze the packets using Wireshark Tool
- CO3: Configure and Secure the Windows Firewall and Group Policy in Windows OS
- CO4: Configure and Secure the Web Browsers and harden the Windows OS.
- CO5: Explore and demonstrate the cryptographic skills on various ciphers.
- CO6: Identify and Prevent Eavesdropping attack using SSH.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration:3 Hrs.

CAE: Evaluation of Regular Lab class

15 Marks

Model practical exam

10 Marks

25 Marks

ESE: End Semester Practical Exam

25 Marks

SCSA2308	CRYPTOGRAPHY AND NETWORK SECURITY LAB	L	T	P	Credits	Total marks
		0	0	4	2	100

COURSE OBJECTIVES

- To Implement basic encryption and decryption Techniques.
- To Implement discrete logarithm problems.
- To understand the concepts of public key Encryption.
- To Implement various Identification Protocol.
- To Implement different Signature Scheme.

SUGGESTED LIST OF EXPERIMENTS

1. Perform the encryption and decryption using following techniques: i) shift cipher, ii) affine cipher and iii) vignere cipher
2. Implement the Euclidean algorithm for polynomials
3. Implement the following discrete logarithm problem: i) Baby-step giant-step algorithm and ii) Pohlig-Hellman algorithm
4. Implement the following modes of operations of block cipher: i) Electronic Code Book (ECB) Mode, ii) Cipher Block Chaining (CBC) Mode and iii) Cipher Feedback (CFB) Mode
5. Implement the following Public-key Encryption:
 - i) RSA, ii) ElGamal public-key encryption and iii) Merkle-Hellman knapsack encryption
6. Implement the unkeyed hash function based on MD4
7. Implement the following Advanced attacks on hash functions:
 - i) Birthday attacks, ii) Pseudo-collisions and compression function attacks and iii) Chaining attacks
8. Implement Feige-Fiat-Shamir identification protocol
9. Implement GQ identification protocol
10. Implement Schnorr identification protocol
11. Implement Rabin one-time signature scheme
12. Implement Merkle one-time signature scheme
13. Implement Authentication trees and one-time signatures
14. Implement GMR one-time signature scheme

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Understand the basic concepts of Encryption and Decryption Techniques.
- CO2: Remembering the concepts of Polynomial.
- CO3: Able to implement the public key encryption
- CO4: Understand the concepts of attacks using hash methods
- CO5: Apply the concepts of identification protocol
- CO6: Able to apply and implement various signature scheme

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

CAE: Evaluation of Regular Lab class

15 Marks

Model practical exam

10 Marks

25 Marks

ESE: End Semester Practical Exam

25 Marks

SCSA2409	IOT AND CLOUD SECURITY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To provide the knowledge of simulation tools for security in IoT.
- To familiarize students with different tools for cyber security.
- To provide knowledge of deployment of tools for secure data storage.
- To capable of using different access control techniques for security in cloud.
- To implement the intrusion detection techniques for security in cloud.

LIST OF EXPERIMENTS

1. Make a study of anyone simulation tool based on parameters of data security.
2. Implement the formation of virtual modes using OMNET++.
3. Implement the networking attack using OMNET++.
4. Implement WEP and EAP security protocol using OMNET++.
5. Implement secure efficient data routing in IoT using OMNET++.
6. Demonstrate the web application firewall to stop attacks.
7. Implement access management in cloud environment.
8. Implement secure user management in cloud.
9. Implement identity management in cloud environment.
10. Demonstrate the intrusion detection system using any tool

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Learn the simulation tool for implementing security in IoT and cloud.
- CO2: Learn the implementation of security protocols using OMNET++.
- CO3: Learn the different types of attacks in IoT environment.
- CO4: Learn the tool for secure data storage and management.
- CO5: Learn about secure data access in cloud environment.
- CO6: Use different open-source tools for cloud security and analysis.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

CAE: Evaluation of Regular Lab class

Model practical exam

ESE: End Semester Practical Exam

15 Marks

10 Marks

Exam Duration:3 Hrs.

25 Marks

25 Marks

SCSA2411	CYBER FORENSICS LAB	L	T	P	Credits	Total marks
		0	0	4	2	100

COURSE OBJECTIVES

- Understand the concepts of open source tools
- Identify and report the forensic on disk level
- Implement forensic concepts in network level
- Analyze Virtual machine forensic
- Analyze various cloud forensic

SUGGESTED LIST OF EXPERIMENTS

1. Case Studies of Open source Forensic Tools
2. Disk Forensics
 - a. Identify digital evidences
 - b. Acquire the evidence
 - c. Authenticate the evidence
 - d. Preserve the evidence
 - e. Analyze the evidence
 - f. Report the findings
3. Network Forensics:
 - a. Intrusion detection
 - b. Logging
 - c. Correlating intrusion detection and logging
4. Device Forensics
 - a. Mobile phone
 - b. Digital Music
 - c. Printer Forensics
 - d. Scanner Forensics
5. Credit Card Forensics
6. Telecommunications Forensics
7. Forensic Analysis of a Virtual Machine
8. Forensic analysis of Cloud storage and data remnants

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Understand the concepts of various levels of forensics.
 CO2: Remembering the concepts of disk forensics.
 CO3: Implement the concepts of forensics in network.
 CO4: Understand the concepts of forensics in devices.
 CO5: Apply the concepts for finding virtual machine forensics.
 CO6: Implement cloud data forensics.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Duration: 3 Hrs.

CAE: Evaluation of Regular Lab class

Model practical exam

Marks

ESE: End Semester Practical Exam

Marks

Exam

15 Marks

10 Marks

25

25



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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In Data Science			
S. No.	Course code	Course Name	Page No.
Employability			
1	SCSA1305	Computer Communication	3
2	SCSA1303	Software Engineering (Only for 2019 and 2020 Batches)	5
3	SCSA1309	Data Foundation	7
4	SITA3008	Internet of Things	9
5	SCSA1405	Machine Learning Essentials	11
6	SCSA4001	R Programming	13
7	SCSA1508	Cryptography and Network Security	15
8	SCSA1603	Big Data Analytics	17
9	SCSA1513	Time Series Analysis	19
10	SCSA1610	Business Intelligence (Only for 2019 and 2020 Batches)	21
11	SITA3005	Social Network Analysis	23

12	SCSA1611	Data Visualization	25
Skill Development			
13	SCSA2305	Data Foundation lab	27
14	SCSA2403	Machine Learning Lab	28
15	SCSA2406	R Programming Lab	29
16	SCSA2506	Big Data Lab	30
17	SCSA2607	Data Visualization Lab	31
18	SCSA2604	Natural Language Processing Lab	32

SCSA1305	COMPUTER COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basics of communication
- To impart knowledge on basics of analog and digital communication.
- To understand the basics of data communication models
- To explore the various layers and its functionalities in data communication model

UNIT 1 BASICS OF COMMUNICATION

9 Hrs.

Introduction to Communication systems – basic model, point to point, broadcast communication; modulation-need for modulation, types of modulation, Base band and Pass band transmission; Demodulation (detection) - Coherent and Non-coherent detection; Noise – types of noise; Analog to Digital Conversion (ADC) process– Sampling, Quantization and Coding; Sampling theorem, types of sampling – ideal, natural and flat –top sampling; nyquist rate, Signal reconstruction, types of quantization, Quantization noise, Aliasing.

UNIT 2 ANALOG AND DIGITAL COMMUNICATION

9 Hrs.

Amplitude modulation – types of amplitude modulation- Standard AM with Full Carrier, Comparison of different amplitude modulations; Angle modulation (FM and PM), FM generation using PM, PM generation using FM, Comparison of Narrowband and Wideband FM, Comparison of AM, FM and PM. Analog pulse modulation – PAM, PWM, PPM; Digital pulse modulation – Pulse Code Modulation (PCM), Delta modulation (DM), Adaptive Delta modulation (ADM), Multiplexing – Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM).

UNIT 3 INTRODUCTION TO DATA COMMUNICATION AND OSI MODEL

9 Hrs.

Introduction to computer communication: Transmission modes - Switching: circuit switching and packet switching, OSI model, Layers in OSI model, TCP/IP protocol suite. Physical Layer: Guided and unguided transmission media (Co-axial cable, UTP, STP, Fiber optic cable), Data Link Layer: Framing, Flow control (stop and wait, sliding window flow control), Error control, HDLC, Media access control: Ethernet (802.3), CSMA/CD, Logical link control, Wireless LAN (802.11), CSMA/CA.

UNIT 4 NETWORK LAYER COMPONENTS AND FUNCTIONS

9 Hrs.

Network Layer Logical addressing: IPv4 & IPV6, Subnetting, DHCP, Virtual LAN, Networking devices (Hubs, Bridges & Switches), Network topologies. Routing: Routing and Forwarding, Static routing and Dynamic routing, Routing Algorithms: Distance vector routing algorithm, Link state routing (Dijkstra's algorithm), Routing Protocols: Routing Information protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), MPLS.

UNIT 5 TRANSPORT, SESSION AND APPLICATION LAYER

9 Hrs.

Transport Layer –UDP, TCP, Congestion Control & Quality of Service – Data traffic, Congestion, Congestion Control, QoS and Flow Characteristics, Application Layer – DNS, Remote Logging (Telnet), SMTP, FTP, WWW, HTTP, POP3, MIME, SNMP.

Max.45

Hours.

COURSE OUTCOMES

On completion of the course the student will be able to

1. Describe the essential basics of communication
2. Classify different types of analog digital modulation schemes
3. Comprehend the need of data communication models
4. Identify the required network layer components and functions
5. Analyze the various protocols required in various layers
6. Acquire the needs for building a communication model

TEXT / REFERENCE BOOKS

1. Wayne Thomasi, "Advanced Electronic Communication Systems", 6th Edition, PHI Publishers, 2003.
2. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, March 2009.
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill 5th edition November 6, 2007.
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, Jan. 21, 2001.
5. Behrouz A. Forouzen, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.
6. Andrew S.Tanenbaum, "Computer Networks", 5th Edition, Pearson, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Duration : 3 Hrs.

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

Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

Exam

20

SCSA1303	SOFTWARE ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Software process models and compare their applicability
- Identify the key activities in managing a software project
- Concepts of requirements engineering and Analysis Modelling
- Apply systematic procedure for software design and deployment
- Compare and contrast the various testing and maintenance

UNIT 1 SOFTWARE PROCESS AND PROJECT MANAGEMENT

9 Hrs.

The evolving role of software – the changing nature of software- Life cycle models - Water fall - Incremental - Spiral - Evolutionary - Prototyping – Concurrent development – Specialised process models - Verification - Validation - Life cycle process - Development process - System engineering hierarchy - Introduction to CMM - Levels of CMM

UNIT 2 REQUIREMENT ANALYSIS AND SPECIFICATIONS

9 Hrs.

Functional And Non-Functional - User - System - Requirement Engineering Process - Feasibility Studies – communication practices- Requirements - Elicitation - Validation and management - Fundamental of requirement analysis – Analysis principles – Structured System Analysis - Software prototyping - Prototyping in the Software Process - Data - Functional and Behavioral Models - Structured Analysis and Data Dictionary

UNIT 3 SOFTWARE DESIGN

9 Hrs.

Design process - Modular design - Design heuristic - Design model and document - Architectural design - Software architecture - Data design - Architecture data - Transform and transaction mapping - User interface design - User interface design principles.

UNIT 4 TESTING AND IMPLEMENTATION

9 Hrs.

Levels - Software Testing Fundamentals - Types of s/w test - White box testing- Basis path testing - Black box testing - Control Structure testing- Regression testing strategies - Strategic approach and issues - UNIT testing - Integration testing - Validation testing - System testing and debugging. Case studies - Writing black box and white box testing-Coding Practices-Refactoring.

UNIT 5 PROJECT MANAGEMENT AND ESTIMATION

9 Hrs.

Software cost estimation - COCOMO model - Quality management - Quality concepts- SQA - Software reviews - Formal technical reviews - Formal approaches of SQA and software reliability - Software maintenance - SCM - Need for SCM - Version control - Introduction to SCM process - Software configuration items. Re-Engineering - Software reengineering - Reverse engineering - Restructuring - Forward engineering.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

1. Identify and apply software lifecycle model for a given problem and will know the criteria for each level of CMM.
2. Comprehend types of requirements and summarize Requirement Engineering Process
3. Design data, functional and behavioral model for any given software requirement.
4. Identify and analyze levels of testing and perform white box testing and black box testing for a given problem.
5. Describe concepts of software quality assurance and software configuration management.
6. Compare and contrast forward engineering, reverse engineering and reengineering.

TEXT / REFERENCE BOOKS

1. Pressman, "Software Engineering and Application", 7th Edition, McGraw International Edition, 2009.
2. Ian Sommerville, "Software Engineering", 8th Edition, Pearson Education, 2008
3. Stephan Schach, "Software Engineering", Tata McGraw Hill, 2007
4. Pfleeger and Lawrance, "Software Engineering: Theory and Practice" Pearson Education, Second Edition, 2001
5. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
6. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
7. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Duration : 3 Hrs.

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

Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

Exam

20



Employability

SCSA1309	DATA	L	T	P	Credits	Total Marks
	FOUNDATION	3	0	0	3	100

COURSE OBJECTIVES

- To acquire knowledge on Data science and its Foundations.
- To explore about the various data process and evaluation methods.
- To understand distinct analysis tools and practice ethical decision and actions.

UNIT

1 INTRODUCTION

9 Hrs.

Overview of Data: Definition - Types of data – Quantitative and Qualitative (Nominal, Ordinal, Discrete and Continuous) Big Data: Structured, Unstructured and semi-structured - Metadata: Concepts of metadata – Types of metadata – Uses Data Source: Enterprise Data Source, Social Media Data Source, Public Data Source – Web Scrapping- Basic Concepts of Data Warehouse and Data Mining – Distributed File System.

UNIT 2 DATA PROCESS

OVERVIEW

9 Hrs.

Defining Goals- Data Acquisition – Sources of acquiring the data - Data preprocessing- Imputation of Missing values - Data cleaning - Data Reduction, Data Transformation and Data Discretization. Exploratory Data Analysis (EDA) – Philosophy of EDA - The Data Science Process. Significance of EDA in data science - Basic tools (plots, graphs and summary statistics) of EDA.

UNIT 3 DATA ORGANIZATION

9 Hrs.

Data Structures: Basics – stack, Queue, Linked List, Tree, Graph - Data Organizational Models-Centralized Model-Embedded Model- Hybrid Model-The Three-Layered structure-Centre of Excellence Model – Roles and Responsibilities- Data Governance- Data Privacy-Data Quality- Data Extraction-Extraction and ETL(Extract,Load,Transform)-Types- Physical -Logical-Data extraction with SQL.

UNIT 4 DATA ANALYSIS & VISUALIZATION

9 Hrs.

Spreadsheets: Data Manipulations- Sort, filter, remove duplicates-text and math functions-pivot table-lookup functions-Data visualizations for quantitative and qualitative data- charts-Excel Modelling- forecast models using advanced lookup and data validation tools.

Tableau: Creating Visualizations in Tableau-Data hierarchies, filters, groups, sets, calculated fields-Map based visualizations-Build interactive dashboards-Data Stories.

UNIT 5 ETHICS AND RECENT TRENDS

9 Hrs.

Data and Business Insights- Data Science Engineering: - Need of Data Science - Ethics – Doing good data science – Natural Language Processing – Machine Learning Model- Valuing Data privacy – Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

Max.45 Hours.

COURSE OUTCOMES

On completion of the course, student will be able to

1. Explore the fundamental concepts of Data science.
2. Understand Data Science Process and Tools of EDA.
3. Address how Organizational structure's influence efficiency and effectiveness.
4. Analyse and Validate data using Spreadsheets and Tableau.
5. Think through the ethics incorporating privacy, data sharing and decision-making.
6. Build interactive dashboards for Business.

TEXT / REFERENCE BOOKS

1. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016.
2. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018.
3. Introduction to Machine Learning with Python-A Guide for Data Scientists,by Andreas C. Mueller, Sarah Guido, O'Reilly; 1st edition, October 2016.
4. Getting Started with Tableau 2019.2 (Second Edition),Tristan Guillevin, Packt Publishing; 2nd edition June, 2019.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3

Hrs.

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

20

Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks



Employability

SITA3008	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 TECHNOLOGIES

AND

CONNECTIVE

9Hrs.

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

1. To learn and understand the technology and current trends in Internet of things.
2. To understand the various elements of IoT system and hardware devices.

3. To learn the programming languages and platforms for building IoT applications.
4. To understand the cloud computing and its relevance for developing IoT applications.
5. To design and implement IoT applications that manages big data with data analytics and visualization tools.
6. 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

Exam Duration : 3

Hrs.

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

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80

Marks



Employability

SCSA1405	MACHINE LEARNING ESSENTIALS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To introduce Machine Learning concepts in Java
- To understand Linear regression and predictive models.
- To understand classification and clustering techniques
- To understand the ensembling models and its techniques.
- To evaluate the model and compare the algorithms.

UNIT 1 INTRODUCTION TO MACHINE LEARNING

9 Hrs.

What is machine learning – Types of Machine learning Techniques-security with deep learning - - Reinforcement learning- Logistic Regression-hypothesis- Logistic regression models- Decision boundary- Cost function-Dimensionality Reduction-Principal Component Analysis

UNIT 2 PREDICTIVE ANALYTICS

9 Hrs.

Linear regression-with one variable-with multiple variable--Multiple Linear regression-Non linear regression-Regression analysis-Predictive models - prediction using logistics regression.

UNIT 3 CLASSIFICATION AND CLUSTERING TECHNIQUES

9 Hrs.

Support vector Machine- Decision Tree-Naïve Bayes-Random Forest- Density-Based Clustering Methods- Hierarchical Based clustering methods-Partitioning methods- Grid based methods-K means clustering - pattern based with deep learning

UNIT 4 ENSEMBLING MODELS

9 Hrs.

Need of Ensembling- Applications of Ensembling - Types of Ensembling- Techniques of Ensembling- Bagging-Boosting –Stacking-Blending-AdaBoost -informatics with deep learning

UNIT 5 MODEL EVALUATION, MODEL SELECTION, AND ALGORITHM SELECTION

9 Hrs.

Statistical tests - validation Techniques-Cross validation -Nested Cross validation- Essential Model Evaluation Terms and Techniques - Bootstrapping and Uncertainties -Cross-validation and Hyperparameter Optimization - Algorithm Comparison - Testing the Difference of Proportions - Comparing Two Models with the McNemar Test - The F-test for Comparing Multiple Classifiers - Comparing Algorithms - optimizing deep learning hyper parameters by evolutionary algorithm.

Max.45 Hours.

COURSE OUTCOMES

On completion of the course the student will be able to

1. Reduce the dimension of the dataset with machine learning techniques
2. Implement the predictive analytics for any real scenario
3. Implement applications with clustering and classification techniques
4. Implement the ensembling model .

5. Implement model evaluations and model comparisons.

CO6: Design a case study on the business data and compare the performance of the classifiers and algorithms.

TEXT /REFERENCE BOOKS

1. Introduction to Machine Learning with Python: A Guide for Data Scientists Paperback – 1 January 2016 by Andreas Muller
2. Zhi-Hua Zhou, “Ensemble Methods: Foundations and Algorithms”, CRC Press, 2012
3. <https://machinelearningmastery.com/stacking-ensemble-machine-learning-with-python/>
4. <https://sebastianraschka.com/blog/2018/model-evaluation-selection-part4.html>

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam

Duration : 3 Hrs.

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

20

Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks



Employability

SCSA4001	R PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand how to link data, statistical methods, and actionable questions
- Use R for statistical programming, computation, graphics, and modeling.
- Fit some basic types of statistical models.
- Be able to expand their knowledge of R on their own.
- To identify types of data analytics and data visualization tools.

UNIT 1 INTRODUCTION TO R

9 Hrs.

History and fundamentals of R, Installation and use of R / R Studio / R Shiny, Installing R packages, R – Nuts and Bolts -Getting Data In and Out –Objects in R -Arrays, DataFrame and List -Control Structures and Functions- Loop Functions-Data Manipulation- String Operations- Matrix Operations.

UNIT 2 R DATA INTERFACES

9 Hrs.

R Data interfaces - CSV Files, XSL files, XML files, Web Data- Data Preprocessing: Missing Values, Outliers ,Principle Component Analysis - Data Visualization – Charts & Graphs-Pie Chart, Bar Chart, Box plot, Histogram, Line graph, Scatter Plot.

UNIT 3 STATISTICAL MODELING IN R

9 Hrs.

Statistical Modeling in R - Descriptive statistics-R Packages: Regression (MASS package) - Distribution (STATS package) - ANOVA - Time Series Analysis.

UNIT 4 MACHINE LEARNING IN R

9 Hrs.

Machine Learning in R - Classification: Decision Trees, Random Forest, SVM – Clustering: K-Means, Fuzzy - Association Rule Mining - Outlier Detection.

UNIT 5 BUILDING R SHINY APPLICATION

9 Hrs.

Building R shiny Application: User Interface, Control Widgets, Dynamic Output - R Hadoop :Installation of R Hadoop -rhdfs –rmr2-Data Analysis with RHadoop- Case Study .

Max. 45 Hours.

COURSE OUTCOMES

- CO 1:** List motivation for learning R programming language
- CO2:** Access online resources for R and import new function packages into the R workspace
- CO3:** Import, review, manipulate and summarize data-sets in R
- CO4:** Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- CO5:** Perform appropriate statistical tests using R
- CO6:** Create and edit visualizations with R

TEXT / REFERENCE BOOKS

1. Hands-On Programming with R: Write Your Own Functions and Simulations By Garrett Grolmund, O'Reilly Media, Inc., 2014.
2. R for Data Science, Hadley Wickham, Garrett Grolmund, "O'Reilly Media, Inc. 2016.
3. Introduction to Statistics and Data Analysis - With Exercises, Solutions and Applications in R By Christian Heumann, Michael Schomaker and Shalabh, Springer, 2016
4. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet, Springer 2013
5. A Beginner's Guide to R (Use R) By Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Springer 2009

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam

Duration: 3 Hrs.

Part A: 10 question of 2 marks each – No choice

20 Marks

Part B: 2 questions from each unit of internal choice, each carrying 16 marks

80 Marks



Employability

SCSA1508	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	Credit	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand basics of Cryptography and Network Security.
- To understand the concept of Public key cryptography.
- Apply methods for authentication, access control, intrusion detection and prevention.
- Identify and mitigate software security vulnerabilities in existing systems.

UNIT 1 INTRODUCTION AND MATHEMATICAL FOUNDATIONS

9Hrs.

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques.

FINITE FIELDS AND NUMBER THEORY: - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm - Chinese Remainder theorem - discrete algorithms.

UNIT 2 BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

9 Hrs.

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT 3 HASH FUNCTIONS, MACS AND DIGITAL SIGNATURE

9 Hrs.

Message Authentication and Hash Function: Authentication requirements - authentication functions message authentication code - hash functions - birthday attacks – security of hash functions and MACS.– MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS –EIGamal – Schnorr.

UNIT 4 SECURITY PRACTICE & SYSTEM SECURITY

9 Hrs.

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT 5 E-MAIL, IP & WEB SECURITY

9 Hrs.

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME.IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management.Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

Max. 45 Hours.

COURSE OUTCOMES

- CO1:** Understand various Cryptographic Techniques.
CO2: Apply various public key cryptography techniques.
CO3: Implement Hashing and Digital Signature techniques.
CO4: Understand the various Security Applications.
CO5: Implement system level security applications.
CO6: Describe the principles of the most widely used Internet security solutions.

TEXT / REFERENCE BOOKS

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006. REFERENCES:
2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
3. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw Hill 2007.
4. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2
5. Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 100	Exam
Duration : 3 Hrs.	
PART A : 10 questions of 2 marks each - No choice	20
Marks	
PART B : 2 questions from each unit of internal choice; each carrying 16 marks	80
Marks	



Employability

SCSA1603	BIG DATA ANALYTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To become familiar with the fundamental concepts of BigData
- To be competent in identifying the challenges in handling large volumes of data
- To propose scalable solutions
- To understand the impact of Big Data in business intelligence, scientific discovery, and in day-to-day life
- To learn the tools and techniques for handling large datasets

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Big Data – Issues and Challenges in the traditional systems - Evolution of Big Data – Four V's of Big Data – Big Data Use Cases and characteristics – Intelligent Data Analysis – Data Analytic Tools – Big Data Storage Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error – Random Sampling.

UNIT 2 BIG DATA TOOLS I

9

Hrs.

Big Data Applications using Pig and Hive – Fundamentals of HBase and ZooKeeper – IBM InfoSphere Big Insights – Introduction to FLUME – KAFKA.

UNIT 3 BIG DATA TOOLS II

9

Hrs.

Introduction to NoSQL - MongoDB – Spark – Cassandra - Cassandra Data Model – Data Design – Cassandra Architecture – Read and Write Data – Clients – Integrate with Hadoop. Introduction - Importance of Effective Data Visualization - Introduction to Tableau - Choosing the Right Chart Type - Using the Color Effectively Reducing Clutter - Dashboard Creation and Formatting.

UNIT 4 HADOOP

9

Hrs.

Introduction to Hadoop – Hadoop Distributed File System – Analysing data with Hadoop – Scaling – Streaming – Clustering: Single Node and Multi Node – Working with Hadoop Commands – Working with Apache Oozie.

UNIT 5 MAP REDUCE

9 Hrs.

Algorithms using map reduce - Matrix-Vector – Multiplication – Word Count - Understanding inputs and outputs of MapReduce, Data Serialization – Introduction to YARN – MapReduce Vs YARN – YARN Architecture – Scheduling in YARN – Fair Scheduler – Capacity Scheduler.

Max.45 Hours.

COURSE OUTCOMES

On completion of the course the student will be able to

1. Configure the tools required for setting up Big Data Ecosystem.
2. Understand conceptually how Big Data is stored and organized.
3. Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.
4. Interpret data findings effectively in visual formats.
5. Explore the fundamentals of various big data applications.
6. Implement the Algorithms for data analytics.

TEXT /REFERENCE BOOKS

1. Joshua N. Milligan, “Learning Tableau”, Packt Publishing,2015.
2. Chuck Lam, “Hadoop in Action”, Manning Publications Co.,2018.
3. Tom White, “Hadoop the Definitive Guide”, Oreilly, 4th Edition,2015.
4. Eben Hewitt, “Cassandra: The Definitive Guide”, O’Reilly,2010.
5. AnandRajaramanandJeffreyDavidUllman, “MiningofMassiveDatasets”, CambridgeUniversityPress, EditionI, ISBN-10: 1107015359 | ISBN-13: 978-1107015357, 2011.
6. JimmyLinandChrisDyer, “Data-IntensiveTextProcessingwithMapReduce”, MorganandClaypoolPublishers,2010.
7. Jonathan R. Owens, Brian Femiano, and Jon Lentz, “Hadoop Real World Solutions Cookbook”, Packt Publishing, ISBN-10: 1849519129 | ISBN-13: 978-1849519120,2013

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam

Duration : 3 Hrs.

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

20

Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks



Employability

SCSA1513	TIME SERIES ANALYSIS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Understand the basic concepts in time series analysis
- Attain knowledge of time series regression
- Gain knowledge of frequently used volatility models
- Understanding the problems arising when analyzing unit root processes
- Gain knowledge of ARIMA modelling of stationary and non stationary time series

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Time Series -Components of a Time Series-Understanding Problem Statements and Data Sets-Exploration and Preprocessing-Modelling Techniques and Evaluation

UNIT 2 STATISTICS BACKGROUND

9 Hrs.

Introduction- Graphical Displays-Numerical Description of Time Series Data (stationarity, auto covariance, autocorrelation)-Use of Data Transformations and Adjustments-General Approach to Time Series Modeling and Forecasting- Evaluation and Monitoring Forecasting Model Performance

UNIT 3 REGRESSION ANALYSIS

9 Hrs.

Introduction-Least Squares Estimation in Linear Regression-Prediction of New Observations-Model Adequacy Checking-Variable Selection Methods in Regression-Generalized and Weighted Least Squares-Regression Models for General Time Series Data

UNIT 4 EXPONENTIAL SMOOTHING METHODS

9 Hrs.

Introduction-First-Order Smoothing-Modeling Time Series Data-Second-Order Exponential Smoothing-Higher-Order Exponential Smoothing-Forecasting-Exponential Smoothing for Seasonal Data-Exponential Smoothers and ARIMA Mode

UNIT 5 AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS

9 Hrs.

Introduction-Linear Models for Stationary Time Series-Finite Order Moving Average Processes-Finite Order Autoregressive Processes-Mixed Autoregressive – Moving Average (ARMA)-Nonstationary Processes-Time Series Model Building-Forecasting ARIMA Processes-Seasonal Processes-Final Comments

Max. 45

Hours.

COURSE OUTCOMES

On completion of the course the student will be able to

CO 1: Apply the knowledge on real world time series and forecast problems

CO 2: Think critically and analyse problems

CO 3: Information and technology literacy

CO 4: Choose and apply the right smoothing method for the data.

CO 5: Apply of knowledge, skills, and responsibilities to new settings and progressively more complex problems

CO 6: Critically review and evaluate time series models and choose the best modelling approach

TEXT/REFERENCE BOOKS

1. Time Series Analysis Univariate and Multivariate Methods, 2nd Edition, W. W. Wei, 2006, Addison Wesley.
2. Time Series Analysis, J. Hamilton, 1994, Princeton University Press.
3. Time Series Analysis: Theory and Methods, P. Brockwell and R. Davis, 1991, Springer-Verlag.
4. Time Series Analysis and Its Applications with R Examples, Shumway, R. and Stoer, D., 2006, Springer.
5. Introductory Time Series with R (Use R!) 2009th Edition
6. Time Series Analysis and Its Applications: With R Examples (Springer Texts in Statistics) 3rd ed. 2011 Edition
7. Practical Time Series Forecasting with R: A Hands-On Guide [2nd Edition] (Practical Analytics) 2nd Edition by Galit Shmueli (Author), Kenneth C. Lichtendahl Jr (Author)

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam

Duration : 3 Hrs.

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

20

Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks



Employability

SCSA1610	BUSINESS INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquire knowledge on Business Intelligence and its Applications.
- To explore about the issues and challenges in Business Intelligence.
- To understand the various issues and challenges in Business Intelligence.

UNIT 1 BUSINESS INTELLIGENCE

INTRODUCTION

9 Hrs.

Introduction-Data, Information Vs Intelligence- Components of Business Intelligence Architecture-Business Query and Reporting-A Business view of the Data-Production Reporting-Online Analytical Processing (OLAP)-Microsoft Office-dashboards-Scorecards-Analytic Applications-Measures of BI Success -Emerging BI Modules.

UNIT 2 BUSINESS INTELLIGENCE LIFE

CYCLE

9 Hrs.

Introduction, Business Intelligence Lifecycle, Enterprise Performance Life Cycle (EPLC)Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Strategy, Objectives and Deliverables, Transformation Roadmap, Building a transformation roadmap, BI Development Stages and Steps, Parallel Development Tracks, BI Framework

UNIT 3 BUSINESS INTELLIGENCE USER MODEL

9 Hrs.

Introduction, Evolution of Business Intelligence, Business Intelligence Opportunity Analysis Overview, Content Management System, End User Segmentation, Basic Reporting and Querying, Online Analytical Processing, OLAP Techniques, OLAP Applications, Applying the OLAP to Data Warehousing, Benefits of using OLAP, Dashboard, Advanced/Emerging BI Technologies, Future of Business Intelligence.

UNIT 4 BUSINESS INTELLIGENCE ISSUES AND

CHALLENGES

9 Hrs.

Critical Challenges for Business Intelligence success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, Availability of Skilled Team Members, Business Intelligence Application Development methodology, Planning the BI Projects, Business Analysis and Data Standardization, Affect of Dirty Data on Business profitability, Importance of Meta-Data, Silver Bullet Syndrome, Customer Pain Points, Creating Cost Effective Enterprise friendly BI solution

UNIT 5 BUSINESS INTELLIGENCE STRATEGY AND ROAD MAP

9 Hrs.

Planning to implement a Business Intelligence Solution, Understand Limitations of Business Intelligence, Business Intelligence Usage, Best use of Business Intelligence, The Advantages of BI with Sales- BI used for the rescue, Organization Culture, Managing Total Cost of Ownership for Business Intelligence, Total Cost of Ownership and Business Intelligence, Managing the TCO of the Business Intelligence, Factors that Affect Total Cost of Ownership.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

1. Understand the foundations, definitions and capabilities of Data Analytics and Business Intelligence.
2. Demonstrate stages and steps in the Life Cycle of Business Intelligence.
3. Analyse the intelligent issues and critical challenges in Business Intelligence.
4. Apply distinct methodologies to create Cost effective and Enterprise friendly Solutions on BI Projects.
5. Design and Deploy BI solutions to real world problems.

6. Compare and identify the factors that influence Total Cost of Ownership for Business Intelligence.

TEXT / REFERENCE BOOKS

1. Grossmann W, Rinderle-Ma,” Fundamental of Business Intelligence”, Springer, 2015.
2. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision support and Business Intelligence Systems”, Pearson-9th Edition, 2011.
3. Cindi Howson, “Successful Business Intelligence”, Tata McGraw-Hill Edition,2008.
4. Foster Provost and Tom Fawcett, “Data Science for Business: What you need to know about data mining and data-
analytic thinking”,2013.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam

Duration : 3 Hrs.

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

20

Marks

PART B :2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

 Employability

SITA3005	SOCIAL NETWORK ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behavior in social web and related communities.
- To learn mining in social network communities.
- To learn visualization of social networks.

UNIT 1 INTRODUCTION

9Hrs.

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web Social Network Analysis: Social Networks Perspective - Analysis of Network Data – Key concepts and measurements in network analysis-Interpretation of Network Data - Social Network Analysis in the Social and Behavioral Sciences - Metrics in social network analysis.

UNIT 2 SOCIAL NETWORK ANALYSIS SOFTWARE, TOOLS AND LIBRARIES

9Hrs.

Modelling and aggregating social network data: Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data – (Advanced representations) Multi-Relational characterization of dynamic social network communities - Social network analysis software - Tools - Libraries.

UNIT 3 CLIQUES, CLUSTERS AND COMPONENTS

9Hrs.

Components and Sub graphs: Sub graphs - Ego Networks, Triads, and Cliques, Hierarchical Clustering, Triads, Network Density and conflict. Density: Egocentric and Sociocentric - Digression on Absolute Density - Community structure and Density, Centrality : Local and Global - Centralization and Graph Centres, Cliques and their intersections, Components and Citation Circles - Positions, Sets and Clusters.

UNIT 4 PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES

9Hrs.

Development of Social Network Analysis - Understanding and predicting human behavior for social communities - User data management - policy, legal, and technical challenges. Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT 5 VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

9Hrs.

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 – Modeling and aggregating social network data -Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

Max. 45 Hours.

COURSE OUTCOMES

On completion of the course the student will be able to

1. An ability to identify metrics used in network analysis.
2. An ability to classify the network related data's.
3. Identify the aim of graph in computational models.
4. Apply the knowledge in predicting the user behaviors.
5. Visualization of a social network using tools.
6. Ability to analyze metrics in social network analysis.

TEXT/REFERENCE BOOKS

1. Jeffrey C Johnson, Martin G Everett, Stephen P Borgatti - Analyzing Social Networks –sage publication-2013.
2. Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
3. Dion Goh and Schubert Foo,-Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
4. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publications Ltd 2013.
6. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.
7. Maksim Tsvetovat, Alexander Kouznetsov, “ Social Network Analysis for Startups”, First Edition, O'Reilly Media, 2011.
8. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks:100

Exam

Duration:3 Hrs.

PART A:10 question of 2 marks each – No choice

20 Marks

PART B:2 questions from each unit of internal choice, each carrying 16 marks

80 Marks



Employability

SCSA1611	DATA VISUALIZATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

C

COURSE OBJECTIVES

- To understand the basic concepts of Data visualization.
- To develop skills for data visualization and analysis.
- To learn the various clustering techniques and predictive modeling techniques for data visualization.
- To understand the concepts of visualization of volumetric data.
- To learn the various tools used in effective visualization of data.

UNIT 1 INTRODUCTION TO DATA VISUALIZATION 9 Hrs.

Data Visualization: Basic Concepts- Data preparation- Stages in data mining - Principles of Perception, Color, Design, And Evaluation, Text Data Visualization, Interactivity and Animation, Temporal Data Visualization-Exploratory Data Analysis.

UNIT 2 DATA VISUALIZATION METHODS 9 Hrs.

Univariate Data Visualization: Bar Chart, Histograms, Frequency Polygram, Box Plots, Dot Plots - Bivariate Data Visualization - Multivariate Data Visualization: Histogram Matrix, Scatter plots Matrix, Multiple Box Plot and Trellis Plot -Visualizing Groups - Dynamic Techniques-Text and narrative Visualization.

UNIT 3 CLUSTERING AND PREDICTIVE MODELING 9 Hrs.

Distance Measures - Agglomerative Hierarchical Clustering - Partition Based Clustering - Fuzzy Clustering. Predictive Modeling- Scatter Plots - ROC Charts - Lift Charts.

UNIT 4 VISUALIZATION OF VOLUMETRIC DATA 9 Hrs.

Vector Fields – Processes and Simulations – Visualizations of Maps – Geographic Information –GIS Systems – Collaborative Visualizations – Evaluating Visualizations.

UNIT 5 VISUALIZATION TOOLS AND APPLICATIONS 9 Hrs.

Visualization Tools: Google Chart, Google Map API, MS Excel, Power Bi and D3(Data Driven Documents)- Designing Information Dashboards -Applications: Science, Medicine and Bioinformatics.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO 1: Explain the data visualization concepts.

CO 2:Plot various data visualization graphs.

CO 3:Apply the appropriate clustering technique to the given data.

CO 4: Apply visualization techniques for various data analysis tasks.

CO 5: Use the different tools for effective data visualization.

CO 6:Designing information dashboards.

TEXT/REFERENCE BOOKS

1. Glenn J Myatt, Wayne P. Johnson, “Making sense of Data - A practical guide to data visualization, advanced mining methods and applications”, 1st Edition, Wiley, 2009.
2. Tom Soukup and Ian Davidson, “Visual Data Mining: Techniques and Tools for Data Visualization and Mining”, 1st Edition, John Wiley & Sons, 2002.
3. George and Roger L. Berger (2002), Statistical Inference, 2nd edition. Interactive Data Visualization for the Web, Scott Murray, O’Reilly (2013)
4. R for Data Science: Visualize, Model, Transform, Tidy, and Import Data Hadley Wickham (Author), Garrett Grolemond (Author) O’Reilly Media; 1 edition
5. The R Book, 2nd Edition Michael J. Crawley.
6. Beautiful Visualization By Julie Steele, Noah Iliinsky Publisher: O’Reilly Media.
7. Beginning Google Maps API 3 by Gabriel Svennerberg.

.END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam

Duration: 3 Hrs.

PART A: 10 question of 2 marks each – No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 16 marks

80 Marks

SCSA2305	DATA FOUNDATION LAB	L	T	P	Credits	Total Marks
		0	0	2	1	100

COURSE OBJECTIVES

- To import and create metadata for the given data.
- To identify missing values and clean the data.
- To perform data manipulation.
- To create different views

LIST OF EXPERIMENTS

MS-Excel: Spreadsheet

1. Load the data in excel file and apply the following operations:
 - a. Find Number of rows and columns
 - b. Add and Delete a new column
 - c. Hiding the column
 - d. Filtering the column
 - e. Find Quantitative and Qualitative values
 - f. Create new sheets and categorize the data

Load the data in Excel sheet and apply Pivot operation and understand the data set.

Apply different Arithmetic operations (sum, aggregate, average etc.) in the data and report the result.

Apply statistics operations and find the central tendency (Mean, Mode, Median, Standard Deviation, and Variance) of the data set.

Apply different data formatting commands. (Ex. Changing date format)

Perform sorting and Replace operations based on selected columns (Practice Ascending and Descending order)

Perform different ANOVA test to find the relationship between the features (Column).

Perform operations to find the missing value and impute the NULL values using different imputation methods such as mean, mode, median etc.,

Load the file which has categorical data and encode it.

Perform normalization in the data.

Create data joins.

Tableau

12. Learn Sheet, Dashboard and story board in tableau and observe its purposes.
13. Load the data set (excel and .csv) into the tableau software and find the central tendency of the different columns.
14. Sort Top N, Bottom N
15. Apply filters

COURSE OUTCOMES

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

1. Handle data from various sources
2. Clean the data and make it suitable for processing.
3. Scale the data
4. Normalize the data and implement joins.
5. Find anomalies in the data.
6. Visualize the data by creating different views.

SCSA2403	MACHINE LEARNING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand the fundamental concepts of Machine Learning.
- To develop logics and employ statistics for various Machine Learning algorithms.
- To gain practical knowledge of machine learning algorithms and methods
- Identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
- To recognize the characteristics of ML and employ them to cater real-world problems.

SUGGESTED LIST OF EXPERIMENTS

1. Analysis and implementation using Python /Jupyter Notebook/Colab
 - i. Compute the distance travelled by the robot from current position after a sequence of movement and original point.
 - ii. Creation of scatter plot using sepal length and petal width to separate the Species classes
2. Computation of Statistical details and Complexity
 - i. Calculate the Five Number Summary(Quartiles, IQR) for the attribute(age) of each employee at a Tea Factory.
 - ii. Analyze the complexity of Heap sort, applied over different sized random lists.
3. Preprocessing and construction of a quality dataset
 - i. Preprocess the given data to build good training sets (80%) and test sets (20%) by removing the missing values and imputing them with the mean value.
 - ii. Examine the interrelations among the set of variables using Principal Component Analysis, display the PCA Components and generate Heatmap.
4. Analysis and Interpretation of data
 - i. Manipulate the Twitter Data Set by removing the Punctuation, Numbers, Special Characters and word length<=3. Tokenize the Words and Stem.
 - ii. Generate a word cloud for the Twitter dataset and retrieve the top 15 positive and negative tags.
5. Build new models (Classification and Clustering)
 - i. Find core samples of high density and expand clusters from them using DBSCAN Clustering.
 - ii. Split the iris dataset into train and test data(80%-20%) and train or fit the data into the model using K Nearest Neighbor Algorithm.
6. Evaluate the Performance of Machine Learning algorithms
 - i. Evaluate the performance of Machine Learning algorithms using Confusion Matrix, Accuracy, Sensitivity, Specificity, Precision and Recall.
 - ii. Employ Linear Regression to check the linearity between the a) stock price and interest rate, b)stock price and unemployment rate.

COURSE OUTCOMES

- CO1:** Design and develop Python Program for simple Machine Learning tasks.
- CO2:** Explain Complexity, Implementation and limitations of Machine Learning.
- CO3:** Formulate the model for various Use cases by employing Supervised, Semi- supervised and Unsupervised Machine learning algorithms.
- CO4:** Interpretation of data by analyzing the Data set.
- CO5:** Construct new models with efficient visualization techniques for real world problems.
- CO6:** Evaluate and assess the performance of Machine Learning systems.

SCSA2406	R PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	2	1	100

COURSE OBJECTIVES

- To understand the basic R programming constructs.
- To learn the R data structures namely vectors, frames and lists.
- To plot different types of graphs for effective data visualization.
- To implement machine learning algorithms in R
- To develop R shiny applications.

SUGGESTED LIST OF EXPERIMENTS

1. Implement the built-in functions in R
2. Using vectors and matrices
3. Using data frames
4. Using lists
5. Using looping constructs.
6. Creating custom functions.
7. Plotting Data (Dot plots, Histogram, Box plots, 3D plots, Scatter plots)
8. Fit Statistical Models using R
9. Implementing machine learning algorithms in R
10. Building R shiny applications.

COURSE OUTCOMES

On completion of the course the student will be able to

1. Design and develop simple R programs.
2. Create custom functions in R.
3. Create visualizations using R.
4. Compute basic summary statistics
5. Implement machine learning algorithms in R
6. Build applications in R



Skill development

SCSA2506	BIG DATA LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To learn to build and maintain reliable, scalable, distributed systems with Apache
- To apply Hadoop ecosystem components.
- To set up single and multi-node Hadoop Clusters.
- To solve Big Data problems using Map Reduce Technique.
- To design algorithms that uses Map Reduce Technique to apply on Unstructured and structured data.
- To learn NoSQL query.

LIST OF EXPERIMENTS

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. MapReduce application for word counting on Hadoop cluster
3. Lab on Manipulating files in HDFS pragmatically using the FileSystem API. Alternative Hadoop File Systems: IBM GPFS, MapR-FS, Lustre, Amazon S3 etc
4. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
5. K-means clustering using map reduce
6. Page Rank Computation
7. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
8. Application of Recommendation Systems using Hadoop/mahout libraries

COURSE OUTCOMES

On completion of the course, student will be able to

1. Install and configure a Hadoop cluster.
2. Apply the MapReduce technique to solve many problems.
3. Manipulate files in HDFS.
4. Query a NoSQL database.
5. Apply the machine learning libraries for big data analysis.
6. Build Recommendation systems using Hadoop and Mahout libraries.



Skill development

SCSA2607	DATA VISUALIZATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Learn to use Open Source data visualization tools
- Understand the techniques used in visualization.
- To create data visualizations with the available data.
- To think critically about each design decision
- To build and evaluate visual systems.

LIST OF EXPERIMENTS

Creating Visual Representations using MS Excel , Power BI, D3 (Data Driven Documents)

1. Study various charts and usages. Prepare the report for the same.
2. Plotting the Graph: Bar chart, Pie Chart, Histogram etc.,.
3. Load the data set (excel and .csv) into the software and find the central tendency of the different columns.
4. Draw line chart for the selected columns and report the understanding of the data.
5. Draw Box plot and report the Q1, Q2, Q3 ranges and identify the outliers.
6. Plot different charts and format the chart using colours, mentioning legends etc.,
7. Load data set and choose any one of the numeric column. Apply forecasting technique.
8. Create dynamic charts.
9. Implement filters.
10. Create an interactive dashboard for the given data set.
11. Create the dashboard and collate the different sheets.
12. Create story board and collate the dashboards.
13. Prepare, analyse and present geographic data.
14. Develop reactive webpages for narrative data storytelling.

Case Study:

- Students performance dashboards
- Creating sales dashboard
- Social media usage dashboards

COURSE OUTCOMES

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

1. Transform data into visually appealing graphics
2. Using visualisation, perform exploratory data analysis.
3. Create effective visual systems for efficient communication.
4. Evaluate the effectiveness of visualization designs
5. Model and test color palettes based on perception theories for visualisation.
6. Use vision and awareness information to determine alternatives to visualization design.



Skill development

SCSA2604	NATURAL LANGUAGE PROCESSING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Understanding the morphological of a word by analysing it.
- Learn how to generate words from root
- Tag the different parts of speech.
- Perform sentiment analysis for the data.
- To understand the concept of chunking.

LIST OF EXPERIMENTS

1. Word Analysis
2. Word Generation
3. Text classification
4. Semantic Analysis
5. Sentiment Analysis
6. Parts of Speech tagging
7. Chunking

COURSE OUTCOMES

On completion of the course the student will be able to

1. To use appropriate tools for word and text analysis.
2. Examine and acquire a broad understanding of text data.
3. Analyze the semantics of a text document.
4. Perform sentiment analyzes on a document.
5. Tag the different parts of speech.
6. Implement an NLP project in a business environment



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SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

1.1.3 Courses having focus on employability/ entrepreneurship/ skill development

B.E Computer Science and Engineering With Specialization In IoT			
S. No.	Course Code	Course Name	Page No.
Employability			
1	SCSA1307	Embedded System	2
2	SCSA1308	Introduction to IoT	3
3	SCSA1407	Arduino Programming for IoT Boards	5
4	SCSA1408	IoT Architecture and its Protocols	6
5	SCSA3003	Software Defined Networks (Only for 2019 and 2020 Batches)	8
6	SCSA1507	Wearable Computing (Only for 2019 and 2020 Batches)	9
7	SCSA1509	Image Processing	10
8	SCSA1510	Mobile Application Development for IoT	11
9	SCSA1607	IoT and Multimedia Technology	12
10	SCSA1608	IoT in Big Data Analytics	13
11	SITA1503	Fog and Cloud Computing (Only for 2019 and 2020 Batches)	14
12	SCSA1609	Java Programming for IoT	16
Skill Development			
13	SCSA2304	Embedded Programming Lab	17
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15	SCSA2504	Image Processing Lab	19
16	SCSA2505	Mobile Application Development for IoT lab	20
17	SCSA2605	Java Programming for IoT Lab	21
18	SCSA2606	IoT in Big Data Analytics Lab	22

SCSA1307	EMBEDDED SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the technologies behind the embedded computing systems.
- To acquire knowledge about microcontrollers embedded processors and their applications.
- To analyze and develop software programs for embedded systems
- To have knowledge about the working of a microcontroller system and its programming in assembly language.
- To provide experience to integrate hardware and software for microcontroller applications systems.

UNIT 1 INTRODUCTION AND REVIEW OF EMBEDDED HARDWARE

9 Hrs.

Terminology – Gates – Timing diagram – Memory – Microprocessor buses – Direct memory access – Interrupts – Built interrupts – Interrupts basis Shared data problems Interrupt latency - Embedded system evolution trends Round-Robin – Round Robin with interrupt function – Rescheduling architecture – algorithm.

UNIT 2 REAL TIME OPERATING SYSTEM

9 Hrs.

Task and Task states Task and data Semaphore and shared data operating system services Message queues timing functions Events Memory management Interrupt routines in an RTOS environment Basic design using RTOS.

UNIT 3 EMBEDDED HARDWARE, SOFTWARE AND PERIPHERAL

9 Hrs.

Custom single purpose processors: Hardware Combination Sequence Processor design RT level design optimizing software: Basic Architecture Operation Programmers view Development Environment ASIP Processor Design Peripherals Timers, counters and watch dog timers UART Pulse width modulator LCD controllers Key pad controllers – Stepper motor controllers A/D converters Real time clock.

UNIT 4 MEMORY AND INTERFACING

9 Hrs.

Memory write ability and storage performance Memory types – composing memory – Advance RAM interfacing communication basic – Microprocessor interfacing I/O addressing Interrupts Direct memory access Arbitration multilevel bus architecture Serial protocol Parallel protocols Wireless protocols Digital camera example.

UNIT 5 PROCESS MODELS AND HARDWARE SOFTWARE CO-DESIGN

9 Hrs.

Modes of operation Finite state machine HCFSL and state charts language state machine models Concurrent process model Concurrent process Communication among process Synchronization among process Implementation - Data Flow model - Design technology- Automation synthesis Hardware & software co-simulation IP cores Design Process Model.

MAX. 45 Hrs.

Course Outcomes:

On completion of the course, student will be able to

- CO1: Understand basic concepts of embedded systems hardware.
- CO2: Implement the RTOS development tools in building real time embedded systems.
- CO3: Develop the hardware for embedded system applications based on the processors.
- CO4: Develop prototype circuit on breadboard including micro processor interfacing.
- CO5: Design Hardware and Software using process models.
- CO6: Develop and implement embedded based applications.

TEXT / REFERENCE BOOKS

1. David. E. Simon, "An Embedded Software Primer", Pearson Education, 2001.
2. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.
3. Steve Heath, "Embedded System Design", Elsevier, Second Edition, 2004.
4. Shibu K.V, "Introduction to Embedded Systems", Mc Graw Hill.
5. Raj Kamal, "Embedded Systems", TMH.
6. Lyla, "Embedded Systems", Pearson, 2013.
7. Peter Marwadel, "Embedded System Design: Embedded Systems, Foundations of Cyber-Physical Systems, and the Internet of Things", Springer, Third Edition, 2018.
8. Perry Xiao, "Designing Embedded Systems and the Internet of Things (IoT) with the ARM® Mbed™", John Wiley & Sons, 2018.
9. Rob Toulson & Tim Wilmshurst, "Fast and Effective Embedded Systems Design, Second Edition: Applying the ARM mbed", Newnes, 2018.

SCSA1308	INTRODUCTION TO IoT	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 transfer data from IoT devices to various cloud providers.
- To make students aware of various domain specific applications 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 - IoT Devices - IoT Devices vs. Computers - Trends in the Adoption of IoT - Societal Benefits of IoT -, Business Scope, Relation with embedded system - IoT Reference Architecture physical-logical design of IOT-From M2M to IoT, Software define Network

UNIT 2 ELEMENTS OF IoT 9 Hrs.

Application Sensors & Actuators - Edge Networking (WSN) Gateways - IoT Communication Mode- 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 - Wireless medium access issues - MAC protocol survey -Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination. Communication technologies, Long-range Wireless Protocols : LoRa WAN, Ingenu, Satellite Communications, Short-range Wireless Protocols : ANT+, WiFi, ZigBee, WHART, EnOcean, Z-Wave, NFC communication technologies : Zigbee Wifi - Zwave.

UNIT -IV IoT AND CLOUD

9Hrs Interoperability in IoT - Introduction to Arduino Programming - Integration of Sensors and Actuators with Arduino - Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud,- cloud based IoT platforms - IBM Watson, Google cloud.

UNIT – V DOMAIN SPECIFIC APPLICATIONS OF IoT 9 Hrs

Home automation, Industry applications, Surveillance applications, Other IoT applications - Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform- case studies : Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

Max. 45 Hrs.

COURSE OUTCOMES

On Completion of the course, student will be able to

- CO1** - Understand general concepts of Internet of Things (IoT)
- CO2** - Recognize various devices, sensors and applications
- CO3** - Apply design concept to IoT solutions
- CO4** - Analyze various M2M and IoT architectures
- CO5** - Evaluate design issues in IoT applications
- CO6** - Create IoT solutions using sensors, actuators and Devices

TEXT / REFERENCE BOOKS

1. Boswarthick, Omar Elloumi., The Internet of Things: Applications and Protocols, Wiley publications., 2012
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles., Architecting the Internet of Things, Springer publications.2011
3. Marco Schwatz Internet of Things with Arduino Cookbook, Packt Publications.2016 .
4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
5. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" published by Vijay Madiseti 2014

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

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

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SCSA1407	ARDUINO PROGRAMMING FOR IoT BOARDS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To program Arduino to control lights, motors, and other devices.
- To learn Arduino's architecture, including inputs and connectors for add-on devices.
- To add third-party components such as LCDs, accelerometers, gyroscopes, and GPS trackers to extend Arduino's functionality.
- To understand various options in programming languages, from C to drag-and-drop languages.
- To test, debug, and deploy the Arduino to solve real world problems.

UNIT 1: Introduction to sensors hours

9

Transducers, Classification, Roles of sensors in IOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IOT sensors, Role of actuators, types of actuators.

UNIT 2: Hardware hours

9

Physical device Arduino Interfaces, Hardware requirement for Arduino, Connecting remotely over the network using VNC, GPIO Basics, Controlling GPIO Outputs Using a Web Interface, Programming, APIs / Packages- Quark SOC processor, programming, Arduino Boards using GPIO (LED, LCD, Keypad, Motor control and sensor)

UNIT 3: Platforms hours

9

History - Creative Coding Platforms - Open Source Platforms PIC - Arduino, Sketch, Iterative coding methodology Python Programming - Mobile phones and similar devices - Arm Devices - Basic Electronics (circuit theory, measurements, parts identification) Sensors and Software: Understanding Processing Code Structure, variables and flow control, Interfacing to the Real World

Unit 4 Programming an Arduino IoT Device

9 hours

Preparing the development environment (Arduino IDE), Exploring the Arduino language (C/C++) syntax, Coding, compiling, and uploading to the microcontroller, Working with Arduino Communication Modules: Bluetooth Modules, WiFi Modules and I2C and SPI, Interfacing arduino and Blynk via USB : LED Blinking, Controlling a Servomotor.

Unit 5 Programming ESP 8266 Module

9 hours

ESP8266 WiFi Serial Module: Overview, Setting Up the Hardware, Interfacing with Arduino, Creating an IoT Temperature and Humidity Sensor System, Overview of DHT-22 Sensor, Interfacing the Hardware: Arduino, ESP8266 WiFi Module, and DHT-22 Sensor, Checking Your Data via ThingSpeak, Connecting Your Arduino Set-up to Blynk via WiFi

Max 45 hours

COURSE OUTCOMES:

- CO1: Recall the basics of sensors, its functioning.
- CO2: Execute basic and advanced assembly language programs.
- CO3: Learn the ways to interface I/O devices with processor for task sharing.
- CO4: Recall the basics of co-processor and its ways to handle float values by its instruction set.
- CO5: Recognize the functionality of micro controller, latest version processors and its applications.
- CO6: Acquire design thinking capability, ability to design a component with realistic constraints, to solve real world engineering problems and analyze the results.

TEXT / REFERENCES BOOKS

1. "Practical Electronics for Inventors, Third Edition," by Paul Scherz and Simon Monk. 2016
2. Intel Galileo and Intel Galileo Gen 2 API Features and Arduino Projects for Linux Programmers, Ramon, Manoel 2014 (Open Access)
3. Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design By Omesh Tickoo, Ravi Iyer 2016
4. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
5. Programming Interactivity, Second Edition By Josha Noble, 2012
6. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

SCSA1408	IoT ARCHITECTURE AND ITS PROTOCOLS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To learn the fundamentals of IoT
- To understand the various models and architecture of IoT
- To understand the protocols in data link and network layers
- To analyze the different transport and session layer protocols
- To analyze various service layer protocols and security

UNIT 1 INTRODUCTION TO IoT

9

Hrs.

Introduction - IoT and digitization – IoT impact – Convergence of Information Technology and Operational Technology – Ancestors without IP IoT enabled applications - IoT challenges

UNIT 2 IoT REFERENCE ARCHITECTURE

9

Hrs.

IoT Architecture-State of the Art Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT 3 IoT DATA LINK LAYER & NETWORK LAYER PROTOCOLS

9

Hrs.

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART,ZWave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT 4 TRANSPORT & SESSION LAYER PROTOCOLS

9

Hrs.

Transport Layer: TCP, MPTCP, UDP, DCCP, SCTP-TLS, DTLS – Session Layer: HTTP, CoAP, XMPP, AMQP, MQTT

UNIT 5 SERVICE LAYER PROTOCOLS & SECURITY

9

Hrs.

Service Layer one M2M, ETSI M2M, OMA, BBF Security in IoT Protocols MAG-802.15.4 , 6LoWPAN, RPL, Application Layer

MAX. 45

Hrs.

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1: Understand the need of digitization and IoT challenges
- CO2: Describe the various IoT reference models and architecture
- CO3: Analyze the data link and network layer protocols
- CO4: Recognize the transport and session layer protocols required for IoT.
- CO5: Describe the service layer protocols and security
- CO6: Implement an application based on understanding of architecture and protocols

TEXT / REFERENCE BOOKS

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Cirani, Simone, Gianluigi Ferrari, Marco Picone, and Luca Veltri. Internet of Things: Architectures, Protocols and Standards. John Wiley & Sons, 2018.
3. Hassan, Qusay F., ed. Internet of Things A to Z: technologies and applications. John Wiley & Sons, 2018.
4. Holler, Jan, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, and David Boyle. Internet of Things. Academic Press, 2014.
5. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.
6. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3

Hrs.

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

20

Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80

Marks



SCSA3003	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 & 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 Hrs.

COURSE OUTCOMES:

On completion of the course, the student can 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 BeginnersII, 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 : 10 Questions of 2 marks each-No choice

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SCSA1507	WEARABLE COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- Describe and discuss constraints unique to wearable and ubiquitous computing platforms and applications,
- Design, develop and evaluate a wearable computing application,
- Apply state-of-the-art hardware and software development tools to computer system design, and
- Communicate both orally and in writing with other members of a team.

UNIT 1 INTRODUCTION TO WEARABLE TECHNOLOGIES

9Hrs.

Fundamentals of Wearable Technologies - History of wearable Technologies -User Experience Design for Internet of Things - Social Aspects of Wearability - Internet of Things – Applications - Wearable Chemical and Biochemical Sensors - Technology of Connected Devices – Device Types, Sensors, Actuators.

UNIT 2 WEARABLE COMPUTING APPLICATIONS

9Hrs.

Medical Applications of Wearable Technologies - Wearable Technologies - Energy Expenditure and Energy Harvesting - Technology of Connected Devices – Energy Considerations - Flexible Electronics and Textiles for Wearable Technologies.

UNIT 3 WEARABLE COMPUTING ARCHITECTURE

9Hrs.

Wearable Algorithms - Web of Things – Architecture Standardization- Data Mining for Body Sensor Network - Internet of Things – Embedded Device UX Design

UNIT 4 COMMUNICATION TECHNOLOGIES

9Hrs.

Physical Activity Modeling and Behavior Change - Internet of Things – Interface and Interaction Design - Human Body Communication for a Data Rate Sensor Network. Internet of Things – Networking. - Wireless Body Area Networks - Wearable Computing as a form of urban design

UNIT 5 WEARABLE COMPUTING CASE STUDIES

9Hrs.

Wearable Sensors for Monitoring of Physical and Physiological Changes and for Early Detection of Diseases - Wearable and Non-Invasive Assistive Technologies.

Max. 45 Hrs.

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1** :Understand advanced and emerging technologies
- CO2** :Extend the knowledge achieved and apply it to solve real world problems.
- CO3** :Understanding of different methodologies for research on wearable technology.
- CO4** : Ability to analyse ethical issues related to the Wearable devices.
- CO5** : To contribute innovative thinking and innovation processes
- CO6** : Ability to integrate several domain through wearable technology.

REFERENCES:

1. "Practical Electronics for Inventors, Third Edition," by Paul Scherz and Simon Monk. 2016
2. Intel Galileo and Intel Galileo Gen 2 API Features and Arduino Projects for Linux Programmers, Ramon, Manoel 2014 (Open Access)
3. Fundamentals of Wearable Computers and Augmented Reality, Second Edition by Woodrow Barfield 2015
4. Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design By Omesh Tickoo, Ravi Iyer 2016
5. Programming Interactivity, Second Edition By Joshua Noble, 2012
6. Programming the Raspberry Pi: Getting Started with Python 2E, 2016

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

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

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

Employability

SCSA1509	IMAGE PROCESSING	L	T	P	Credit	Total Marks
		3	0	0	3	100

Course Outcomes:

- To have the ability to describe the basic principles and fundamental concept of Image processing
- To understand and analyze image processing problems and images in frequency domain using various transformation techniques
- To solve image processing problems and meet design specifications by designing algorithms
- To evaluate image enhancement, restoration, segmentation and representation techniques
- To categories and interpret various image compression standards and techniques

UNIT 1 INTRODUCTION AND FUNDAMENTALS OF IMAGE PROCESSING 9 Hrs.

Digital Image processing and its origin, Applications of Image Processing, Steps implied in Image processing, Image processing Components. Visual perspective elements, Light and Electromagnetic spectrum, Image Sensing, Image Acquisition, Image Sampling and Image Quantization, Pixels, Introduction to Tools used in Image processing.

UNIT 2 TRANSFORMATION AND FILTERING IN SPATIAL AND FREQUENCY DOMAIN 9 Hrs.

History, Basics of Transformation intensity function, Histogram Processing, Spatial Filtering and its types, Combining enhancement methods, Fuzzy Techniques. Concepts, Sampling and the Fourier Transform of Sampled Function, DFT of one variable, DFT of two variables and its properties, Introduction to Filtering in the Frequency Domain, Image Smoothing and Image Sharpening in Frequency Domain, Selective Filtering.

UNIT 3 IMAGE RESTORATION, RECONSTRUCTION AND COLOR IMAGE PROCESSING 9 Hrs.

Image Degradation/Restoration Process model, Noise models, its restoration and periodic Noise reduction, Linear, Position-Invariant Degradation, Filtering and its types, Image Reconstruction. Fundamentals and Models of Colors, Pseudo Colors, Transformation of Colors, Color Smoothing and Sharpening, Color based image segmentation, Colored Image Noise and Compressing.

UNIT 4 WAVELETS, MULTIREOLUTION PROCESSING AND IMAGE COMPRESSION 9 Hrs.

Multiresolution Expansions, Wavelet Transforms in One Dimension and Two Dimension, Wavelet Packets. Image Compression Fundamentals, Basics of Compression Method, Image Watermarking.

UNIT 5 MORPHOLOGICAL IMAGE PROCESSING AND SEGMENTATION 9 Hrs.

Erosion and Dilation, Opening and Closing, Transformation, Morphological Algorithms, Morphology of Grey Scale Images. Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds, Uses of Motion in Segmentation

MaX. 45 Hrs.

Course Outcomes:

On completion of the course, student will be able to

CO1: Understanding of fundamental concepts & general terminologies in image processing

CO2: Analysing the various types of images, intensity transformations and spatial filtering.

CO3: Image reconstruction and modelling using various filtering techniques

CO4: Transformation of Image in various dimensions and signature storage

CO5: Evaluation of methodologies for image segmentation, restoration etc.

CO6: Apply image processing algorithms in practical applications.

TEXT / REFERENCE BOOKS

1. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Fifth Edition, Tata McGraw Hill Publication, 2015.
2. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Third Edition, Pearson Education, 2008.
3. Digital Image Processing, S Sridhar, Oxford University Press, 2016.
4. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ, 1998.
5. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY, 1992.

SCSA1510	Mobile Application Development for IoT	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives:

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and RealWorld Design Constraints
- To Understand the various IoT Protocols

UNIT I – OVERVIEW

9 Hrs.

IoT-An Architectural Overview-Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT II BASIC DESIGN

9 Hrs.

Introduction-Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related-Architecting mobile applications-user interfaces for mobile applications-touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.

Unit III IoT MOBILE APPS

9 Hrs

IoT Mobile App Development Trends In 2020 - Role of Mobile Apps in revolutionizing the world of IoT - UX / UI design for IoT Mobile apps - challenges of UX/UI design for IoT applications - practice tips on design for IoT mobile apps IoT App Design Solutions

UNIT IV TECHNOLOGY I – ANDROID

9 Hrs.

Introduction Establishing the development environment Android architecture Activities and views Interacting with UI - Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi- Integration with social media applications.

UNIT V TECHNOLOGY II – ANDROID THINGS

9 Hrs.

Android things -Installation of Android things -Verification of Android things installation -API in Android IoT Setting up the Android things - Building your first IOT-Android application with Android Things

MAX:45Hrs

COURSE OUTCOMES

- CO1: Able to understand the application areas of IOT
- CO2: Able to realize the revolution of Internet in Mobile Devices, Cloud & SensorNetworks
- CO3: Able to understand building blocks of Internet of Things and characteristics.
- CO4: Understand the concepts of mobile apps used in internet of things
- CO5: Learn about android application development
- CO6: Implement mobile application using Android things

TEXT REFERENCES BOOKS

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
- 3.Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
- 4.Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

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

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SCSA1607	IoT AND MULTIMEDIA TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand IoT and Multimedia communication
- To learn guaranteed service model.
- To learn communication protocols that is frequently used in IoT ecosystems.
- To explore the study of Embedded internet
- To study about application of real time multimedia network applications.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Multimedia Big Data Computing for IoT-Energy Conservation in Multimedia Big Data Computing and the Internet of Things-A Challenge- An Architecture for the Real time Data Stream Monitoring in IoT-Deep Learning for Multimedia Data in IoT.

UNIT 2 GUARANTEED SERVICE MODEL

9 Hrs.

Switched Networks and Shared media Networks-Circuit Switching, Packet Switching and Virtual Circuits-Flow Control and Congestion Control-Best Effort Service Model and Its Limitations Qos Metrics- Diffserv and Intserv Networks- Queuing Techniques-WFQ and Its Variants RED Qos-Aware Routing Call Admission Control RSVP- Policing and Traffic Shaping Algorithms Multicast-Routing IGMP, Protocol Independent Multicast PIM SM and PIM DM Variants.

UNIT 3 MULTIMEDIA TRANSPORT

9 Hrs.

End To End Solutions Laissez Faire Approach Multimedia over TCP Significance of UDP Multimedia Streaming Audio and Video Streaming Accessing Audio And Video from a Web Server And Media Server Removing Jitter at the Receiver Recovering from Packet Loss Forward Error Correction and Interleaving Interactive And Non-Interactive Multimedia Transcoding RTSP RTP/RTCP.

UNIT 4 EVOLUTION OF EMBEDDED INTERNET

9 Hrs.

Introduction-Mobile Crowdsensing-Perspective Protocol stack for wireless-WSNs and IoT-M2M Communications and Embedded Internet-Nano networks and IoT-Principles for FI Architecture-Physical Layer-Aware Network Architecture-Information-Centric Networking-Streaming of Scalable video for FI Media Search and Retrieval in FI-FI Self-Management Scenarios

UNIT 5 APPLICATION ENVIRONMENT

9 Hrs.

Recent advancements in multimedia big data computing for IoT applications in Precision Agriculture-Network based applications of multimedia big data computing in IoT Environment- H.322 Standard Protocol Stack And Call Setup Session Initiation Protocol Components, Messages And Operation Supporting Protocols For SIP Media Gateway Access Protocol, Resource Reservation Protocol, Session Description Protocol – Hardware Standards – Scibus and S.100 – Case Study – Video Conferencing-Military Surveillance-Interactive TV Video On Demand Smart Phone.

MAX. 45 Hrs.

COURSE OUTCOMES:

- CO1: Understand the IoT technique
- CO2: Deploy the right multimedia communication models.
- CO3: Apply QoS to multimedia network applications at the end system level with efficient scheduling and routing techniques.
- CO4: Understand Embedded Internet
- CO5: Learn about different protocols used in multimedia in IoT
- CO6: Develop the real-time multimedia network applications.

TEXT / REFERENCES BOOKS:

1. Sudeep Tanwar, Tyagi, Neeraj Kumar, "Multimedia Big Data Computing for IoT Applications".
2. Mario Marques da Silva, "Multimedia Communications and Networking", CRC Press, 2012.
3. K. R. Rao, Zoran S. Bojkovic, Bojan M. Bakmaz, "Wireless Multimedia Communication Systems: Design, Analysis and Implementation", CRC Press, 2017.
4. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", Pearson Education, 2017.
5. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Introduction to Multimedia Communications Applications, Middleware, Networking", John Wiley and Sons, 2009
6. Fred Halsal, "Multimedia Communications: Applications, Protocols and Standards", Pearson Education, 2002.
7. William Stallings, "High speed networks and Internets: Performance and Quality of Service", Pearson Education, 2002.

SCSA1608	IoT IN BIG DATA ANALYTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives:

- To understand data analytics for IoT applications
- To discuss the classification algorithms for big data analytics
- To elaborate various prediction and clustering algorithms
- To analyse real time IoT applications

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to data analytics for IoT, IoT Applications, Type of sensor, Attributes and Data types, Data pre-processing, Statistical descriptions of Data, Handling missing Data, Data sampling

UNIT 2 INTRODUCTION TO BIG DATA

9 Hrs.

Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Big Data Technologies Hadoop's Parallel World – Data discovery–Open source technology for Big Data Analytics– cloud and Big Data– Predictive Analytics–Mobile Business Intelligence and Big Data Crowd Sourcing Analytics Inter- and TransFirewall Analytics - Information Management.

UNIT 3 CLASSIFICATION

9 Hrs.

Definition of Classification, Decision tree Induction, Attribute Selection measures, Issues: Over-fitting, tree pruning methods, missing values, continuous classes, Classification and Regression Trees (CART), Bayesian Classification: Bayes Theorem, Naïve Bayes classifier, Bayesian Networks, Linear classifiers, Least squares, SVM classifiers, Lazy Learners (or Learning from Your Neighbors)

UNIT 4 PREDICTION AND CLUSTERING

9 Hrs.

Prediction: Definition of Prediction Linear regression, Non-linear regression, Logistic regression
Clustering: Clustering types: Partitioning Methods, Hierarchical Methods, Distance Measures in Algorithmic Methods, Density Based Clustering.

UNIT 5 PERFORMANCE EVALUATION

9 Hrs.

Performance Measures: Precision, recall, F-measure, confusion matrix, cross-validation, bootstrap.
Case Studies: Health Care Analytics, Tele medicine, Smart Campus, Intelligent Gym, Weather Prediction, time series modeling

MAX. 45 Hrs.

COURSE OUTCOMES:

- CO1:** Analyse various data produced by IoT Applications
- CO2:** Describe big data technologies
- CO3:** Develop classification algorithms for data analysis
- CO4:** Implement prediction and classification algorithms
- CO5:** Evaluate algorithms using measures
- CO6:** Design solutions for the real time problems

TEXT / REFERENCE BOOKS

1. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
2. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012
3. Ian H.Witten, Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques, Elsevier/(Morgan Kauffman), ISBN:9789380501864
4. Introduction to Data Mining (2005) By Pang-Ning Tan, Michael Steinbach, Vipin Kumar Addison Wesley ISBN: 0-321-32136-7
5. [Research-Papers]: Some of the relevant research papers that contain recent results and developments in data analytics field

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

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

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SITA1503	FOG AND CLOUD COMPUTING	L	T	P	Credit		Total Mar
		3	0	0	3		100

COURSE OBJECTIVES

- To understand the basic concepts of cloud computing and cloud enables.
- To understand cloud services and Multi-tenancy computing.
- To study about various models of cloud environments and virtualization.
- To manage the cloud computing infrastructure with security.
- To gain knowledge of cloud and to understand about Fog, edge computing.

UNIT 1 UNDERSTANDING CLOUD COMPUTING

9

Hrs.

Basic Concepts and Terminology - Cloud Computing Architectural Framework - Types of Clouds - pros and cons of cloud computing Cloud Characteristics - difference between web 2.0 and cloud - key challenges in cloud computing - Major Cloud players - Virtualization in Cloud Computing - Parallelization in Cloud Computing - cloud resource management Cloud Enabling Technology.

UNIT 2 CLOUD SERVICE MODELS

9

Hrs.

Software as a Service (SaaS) - Infrastructure as a Service (IaaS)- Platform as a Service (PaaS)- Web services - Service Oriented Architecture (SoA) - Elastic Computing - On Demand Computing- Service Management in Cloud Computing - Multi-tenancy computing , architecture.

UNIT 3 CLOUD DEPLOYMENT MODELS AND VIRTUALIZATION

9

Hrs.

Deployment models: Public cloud Private Cloud Hybrid cloud Community cloud - Need for virtualization Types of Virtualization Virtualization OS VMware, KVM System VM Process VM - Virtual Machine Monitor Properties - Xen, Hyper V, Virtual Box, Eucalyptus .

UNIT 4 MANAGEMENT IN CLOUD COMPUTING & SECURITY

9

Hrs.

Cloud data centres - Energy efficiency in data centre - Data Management in Cloud Computing - Mobile cloud computing service models-Open Source and Commercial Clouds, Cloud Simulator-sensor cloud- Fundamental Cloud security- Cloud security Threads Additional considerations Security solutions a case study.

UNIT 5 FOG COMPUTING

9

Hrs.

From Cloud to Fog - Fog Computing architecture - fog networks - Principles of Edge/P2P networking - Security and privacy in Fog.

COURSE OUTCOMES

Max. 45Hrs.

CO1 - Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.

CO2 - Implement and install the cloud tools to make enable the cloud computing infrastructures.

CO3 - Apply and design suitable Virtualization concept, Cloud Resource Management and collaboration services.

CO4 - Create combinatorial auctions for cloud resources and services for computing clouds Develop and make cloud services as commercial.

CO5 - Assess cloud and cloud to Fog with IoT.

CO6 - Ability to, understand fog computing architecture.

TEXT / REFERENCE BOOKS

1. Cloud computing concepts, technology and Architecture Thomas Erl, Zaigham Mahmood, Ricardo Puttini , Pearson , 2017.

2. Instant Guide to Cloud Computing, Anand Nayar (Ed), Ashokkumar, sudeep Tanwar, BPB, 2019.

3.Cloud computing a practical approach - Anthony T.Velte, Toby J. Velte Robert Elsenpeter TATA McGraw - Hill, New Delhi – 2010.

4. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, WileyIndia, 2010.
6. Fog Computing Concepts, Frameworks and Technologies ,Mahmood, Zaigham (Ed.), Springer , 2018.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

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

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks



Employability

SCSA1609	Java Programming for IoT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of structure of Java language
- To identify the various OOPs properties with Java.
- To understand the various exceptions and multithreading used in Java.
- To analyse various events handling methods and layout models.
- To make students aware of various socket programming methods to communicate with IoT devices.

UNIT 1 JAVA BASICS & IoT

9 Hrs.

Concepts of OOP, Features of Java, How Java is different from C++, Environmental setup, Basic syntax, Objects and classes, Basic Data Types, Variable Types, Modifier Types, Basic operators, Loop Control, Decision Making, Strings and Arrays, Methods, I/O. Java support with IoT.

UNIT 2 JAVA OBJECT ORIENTED

9 Hrs.

Inheritance, Overriding, Polymorphism, Abstraction, Encapsulation, Interfaces, Packages, Exploring java.util package.

UNIT – 3 EXCEPTIONS HANDLING AND THREADING

9 Hrs.

Exception Hierarchy, Exception Methods, Catching Exceptions, Multiple catch Clauses, Uncaught Exceptions Java's Built-in Exception. Creating, Implementing and Extending thread, thread priorities, synchronization suspending, resuming and stopping Threads, Multi-threading.

UNIT- 4 JAVA DEVELOPMENT ENVIRONMENT FOR IOT

9 Hrs.

Introduction to Java SE 8 - NetBeans IDE and Raspberry Pi- -Embedded Applications- Java ME 8 Platform Overview- Java ME Configurations- CDC and CLDC- . Building Java ME IMlets Programs- IMlet- IMlets Components-Creating and Deploying IMlets-Java ME 8 Security-MIDP Architecture-Embedded Permissions Overview-QTA Installation Status. CLDC Overview : CLDC 8 Architecture:CLDC Library Updates-Vector Casting-Hashtable-Stack-Streams-InputStream-OutputStream-ByteArrayStream-Data Streams-Character Streams-CLDC Thread Management-Controlling Timers

UNIT- V APPLICATION MANAGEMENT WITH IOT

9 Hrs.

Application Management System - Different ways of Using Java Runtime on Raspberry Pi Board- Command Line Interface to Raspberry Pi- AMS-CLI Commands- Creating notifications with PushRegistry: PushRegistry-Registering a Connection- Listing and Receiving Connections-Push registry Permissions-SMS-Based Activation-Alarm Registration

Max.

45 Hrs.

COURSE OUTCOMES

On Completion of the course, student will be able to

- CO1 - Understand the fundamentals of Java programs and its structure
- CO2 - Recognize the support of object oriented programming with Java language
- CO3 - Apply the concepts of Exceptions and multithreading for different applications
- CO4 - Analyze various IoT application using Java Development Environment
- CO5 - Evaluate the working models of IoT application using Java ME
- CO6 - Create IoT solutions using Java

TEXT / REFERENCE BOOKS

1. Herbert Schildt, "The Complete Reference JAVA2", 5 th Edition, Tata McGraw Hill, 2017.
2. Bruce Eckel, "Thinking in Java", Pearson Education, 4 th Edition 2006.
3. Core Java Volume-I Fundamentals, 9th Edition, Cay Horstman and Grazy Cornell, Prentice Hall, 2013.
4. <https://docs.oracle.com/javase/tutorial/>. 5. <https://www.tutorialspoint.com/java/>.
5. Stephen Chin, Raspberry Pi with Java: Programming the Internet of Things (IoT) (Oracle Press) 1st Edition, McGraw-Hill Education 2015

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

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

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

Employability

SCSA2304	EMBEDDED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Design complex electronic systems interfacing multiple integrated circuits.
- Design and conduct experiments, as well as analyze and interpret data.
- Design a system, component, or process to meet desired needs. .
- Identify, formulate, and solve engineering problems. .
- Use the techniques, skills, and modern engineering tools necessary for engineering practice

LIST OF EXPERIMENTS

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Write programs in ARM for a specific Application
CO2: Interface memory and Write programs related to memory operations
CO3: Interface A/D and D/A converters with ARM system
CO4: Analyse the performance of interrupt
CO5: Write programmes for interfacing keyboard, display, motor and sensor.
CO6: Formulate a mini project using embedded system

SCSA2405	Programming for IoT Boards Lab	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To provide knowledge of Arduino board and its applications.
- To familiarize students with Arduino as IDE, programming language & platform.
- To provide knowledge of Arduino boards and basic components.
- To capable of developing various applications using raspberry pi projects.
- To provide the knowledge of developing application in waspmote boards.

LIST OF EXPERIMENTS:

1. Make your Arduino board blink an LED.
2. Create an application to find Motion detection using arduino board.
3. Create an application to measure Temperature and Humidity using arduino board.
4. Demonstrate Ultrasonic distance sensor in arduino board.
5. Create an application to learn to test the output & input of GPIO pins on Raspberry pi.
6. Develop an application to set up a Apache Tomcat web server on a Raspberry Pi.
7. Design an prototype which measures the amount the gas present inside the working environment using gas sensor in Raspberry pi.
8. Build the application to monitor the environment using temperature sensor in Raspberry pi board.
9. Implement smart cities Sensor Board v3.0 using Wasp mote platform for measuring temperature, humidity and pressure.
10. Measure the light intensity and pollution level using Wasp mote platform.

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1:** Learn the basics of electronics and sensors.
- CO2:** Learn how to prototype circuits with a breadboard
- CO3:** Learn the Arduino programming language and IDE
- CO4:** Learn the Raspberry pi pins and Raspbian OS
- CO5:** Build the prototype in washmote platform.
- CO6:** Build the projects for real world applications.

SCSA2504	IMAGE PROCESSING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To perform implementation and design for building basic algorithms in image processing
- To enhance the understanding ability in design and implementation of advance analysis of image processing
- To understand image wavering and transformation techniques imposing on original image
- To acquire the ability to morph images using various techniques on the original image

SUGGESTED LIST OF EXPERIMENTS

1. Program to read, show, write, convert rgb to gray / black and white scale convert, histogram generate using, imread(), imshow(), imwrite(), rgb2gray(), imhist(), imadjust() and im2bw()) functions
2. Program on flow control constructs using if statement, switch statement and break statement
3. Program on Loops using for loop, while loop and Vectorize Loops over images
4. Program to perform Point Processing and Pixel Operations
5. Program to perform Image Arithmetic
6. Program to perform Logical operations on Digital Image
7. Program to perform Histogram Calculation and Equalization
8. Program to perform Geometric Transformation
9. Program to perform Image Restoration
10. Program to perform Spatial filters
11. Program to perform Frequency Domain Filtering
12. Program to perform Morphological operations
13. Program to perform Wavelet transform

COURSE OUTCOMES:

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

- C01:** The process of obtain compliment image from original image
C02: Implementation of smoothing and averaging filter operation on original image
C03: Programming controls on image handling
C04: Understanding on Image wavering and transformation technique
C05: Advance analysis and basic algorithms handling on Image processing
C06: Various image morphing techniques on the original image

Skill development

SCSA2505	Mobile Application Development for IoT Lab	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objectives:

- To learn how to develop Applications in android environment.
- To learn how to develop mobile app for IoT applications.
- To learn about interfacing with sensor in IoT devices

List of Experiments

1. Create a mobile application for (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.
2. Develop an application to perform arithmetic operations.
3. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
4. Build an android app for measuring temperature, pressure and humidity using Raspberry pi.
5. Create an android for Temperature and Humidity Logger Using Raspberry Pi with MySQL.
6. Build an app for simple Led Control With Blynk and NodeMCU Esp8266 12E
7. Create an app for home Automation using ESP8266 & Blynk App – IoT
8. Build an app using NodeMCU for GPS Tracker Blynk App In IOT Platform
9. Build an app using NodeMCU to DHT Interface in Blynk app.
10. Create an app for finding movement detection in Blynk app.

Course Outcomes

- CO1:** To learn about different user interface components in android app development
- CO2:** To know about notification in android app
- CO3:** To learn interfacing with sensor in different IoT boards
- CO4:** To build a mobile app for IoT devices using android
- CO5:** To learn about different types of mobile apps platform for IoT application
- CO6:** To build an application for solving real world problem using different IoT platforms

SCSA2605	Java programming for IoT Lab	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To implement Object Oriented concepts in Java.
- To implement Packages, Interfaces and Multithreading Concepts.
- To develop applications using lang and io packages.
- To design web based application.
- To design IoT based applications using Java

List Of Experiments:

1. Using Classes and Objects.
2. Inheritance
 - Single Inheritance.
 - Multilevel Inheritance.
 - Hierarchical Inheritance.
3. Packages and Interfaces
 - Import package.*;
 - Import package.classname;
 - Fully Qualified name.
4. Input and Output
 - Input Stream and Output Stream classes
 - Reader and Writer Classes
 - Data Output Stream and Data Input Stream classes.
5. Design a Calculator using J2ME
6. Configure GPIO input and Output pin.
7. Develop the application to read environment temperature using Temperature sensor and display it.
8. Write a program for reading sensor values from a Light sensor which is wired to Arduino board, and Arduino board connected via USB cable to Raspberry Pi
9. Build an application to measure the distance between objects using the Ultrasonic sensor.
10. Building a Raspberry Pi Project Using Motion sensor or PIR sensor to identify the presence of object.

COURSE OUTCOMES:

On completion of the course the student will be able to

- CO1:** Ability to implement application programs using java object oriented concepts
- CO2:** Able to implement interface, package and multithread concepts
- CO3:** Understand various built in packages and its applications
- CO4:** Knowledge on designing IoT applications using java programming
- CO5:** Learn about Interfacing of sensor in IoT boards.
- CO6:** Create real time IoT applications.

SCSA2606	IoT IN BIG DATA ANALYTICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES:

- To implement various big data tools
- To analyse different classification algorithms
- To use the visualization tools
- To experiment with the real time applications

LIST OF EXPERIMENTS:

1. Install, configure and run Hadoop and HDFS
2. Implement word count/ frequency programs using MapReduce
3. Implement MapReduce program that processes a weather dataset
4. Collect sensor data from any real time application and apply preprocessing techniques
5. Collect sensor data and do Prediction using linear regression
6. Collect sensor data and Implement Support Vector Machine
7. Collect sensor data and Implement Decision tree classification technique
8. Collect sensor data and Implement clustering algorithm
9. Visualize data using visualization techniques
10. Model Time series data
11. Implement an application that stores big data in Hbase/ MongoDB/ Pig
12. Implement an application for predicting air pollution level using gas sensors.

COURSE OUTCOMES:

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

- C01:** Process big data using Hadoop framework
- C02:** Apply pre-processing techniques
- C03:** Perform data analysis using machine learning methods
- C04:** Visualize data using visualization techniques
- C05:** Use Hbase/ MongoDB/Pig for big data processing
- C06:** Build a Prediction model for different dataset.