Academic Program - UG

Syllabus 2023-24

VII & VIII Semester B.E.

Computer Science and Engineering

ACADEMIC AUTONOMY

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,
DHARWAD – 580 002
(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for VII & VIII semesters of UG program in Computer Science and Engineering is recommended by Board of Studies of Computer Science and Engineering Department and approved by the Academic Council, SDM College of Engineering &Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2023-24 till further revision.

Principal

Chairman BoS & HoD

Department of Computer Science and Engineering

College Vision and Mission

Vision

To develop competent professions with human values

Mission

- To have contextually relevant Curricula.
- To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
- To enhance Research Culture.
- To involve the Industrial Expertise for connecting Classroom contents to real-life situations.
- To inculcate Ethics and soft-skills leading to overall personality development.

QUALITY POLICY:

In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stake holders.

Core Values:

- Competency
- Commitment
- Equity
- Team work and Trust

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION

To develop competent professionals in the field of Computer Science and Engineering with human values.

MISSION

1. To have contextually relevant curricula in line with industry trends and body of knowledge stated by IEEE/ACM.
2. To promote OBE based effective Teaching Learning Practices supported by modern educational tools and techniques.
3. To enhance research.
4. To involve the industrial expertise for connecting classroom contents to real-life situations.
5. To inculcate ethics and soft-skills leading to overall personality development.

Program educational Objectives (PEO)

I. To prepare students for successful careers in Industry, Research and Institutions of higher learning

II. To encourage students to work in teams to address industrial and socially relevant problems / projects.

III. To provide students with a sound mathematical, scientific and engineering fundamentals necessary to formulate, analyse and solve engineering problems.

IV. To promote student awareness and commitment to lifelong learning and professional ethics during the course of professional practice.

PROGRAMME OUTCOMES (POs) and Programme Specific Outcomes (PSOs)

Program Outcomes (POs):

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such

as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes (PSOs):

13. **System Inception and Elaboration:** Conceptualize the software and/or hardware systems, system components and process/procedures through requirement analysis, modeling /design of the system using various architectural / design patterns, standard notations, procedures and algorithms.
14. **System Construction:** Implement the systems, procedures and processes using the state of the art technologies, standards, tools and programming paradigms.
15. **System Testing and Deployment:** Verify and validate the systems, procedures and processes using various testing and verification techniques and tools.
16. **System Quality and Maintenance:** Manage the quality through various product development strategies under revision, transition and operation through maintainability, flexibility, testability, portability, reusability, interoperability, correctness, reliability, efficiency, integrity and usability to adapt the system to the changing structure and behavior of the systems /environments

Scheme of Teaching and Examination

VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)
18UCSC700	PC	Artificial Intelligence and Machine Learning	**4-0-0**	4	50	100	3	-	-
18UCSC701	PC	Advanced Computer Architecture	**4-0-0**	4	50	100	3	-	-
18UCSE70X	PE	Program Elective – 4	**3-0-0**	3	50	100	3	-	-
18UCSO70X	OE	Open Elective	**3-0-0**	3	50	100	3	-	-
18UCSL702	PC	Artificial Intelligence and Machine Learning Lab	**0-0-2**	1	50	--	--	50	3
18UCSL703	PC	Major Project Phase-1	**0-0-4**	2	50	--	--	50	3
18UCSL704	PC	Internship	**4weeks**	2	50	--	--	50	3
Total			**14-0-6**	**19**	**350**	**400**	**-**	**150**	**-**
Electives									
18UCSE705	PE	Computer Graphics	**3-0-0**	3	50	100	3	-	-
18UCSE706	PE	Software Testing	**3-0-0**	3	50	100	3	-	-
18UCSE708	PE	Ad-hoc Networks	**3-0-0**	3	50	100	3	-	-
18UCSE709	PE	Operations Research	**3-0-0**	3	50	100	3	-	-
18UCSE710	PE	Multicore Architecture and Programming	**3-0-0**	3	50	100	3	-	-
18UCSO707	OE	Web Technology	**3-0-0**	3	50	100	3	-	-
18UCSO711	OE	Internet of Things	2-0-2	3	50	100	3	-	-

VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration (Hrs)	Max. Marks	Duration (Hrs)
18UCSC800	PC	Distributed Systems and Applications	**4-0-0**	4	50	100	3	-	-
18UCSE80X	PE	Program Elective – 5	**3-0-0**	3	50	100	3	-	-
18UCSO80X	OE	Open Elective	**3-0-0**	3	50	100	3	-	-
18UCSL801	PC	Independent study	**0-0-**2	1	50	-	-	-	-
18UCSL802	PC	Major Project Phase – 2	**0-0-**12	7	50	-	-	50	3
Total			**10-0-14**	**18**	**250**	**300**		**50**	
Electives									
18UCSE803	PE	Cryptography and Network Security	**3-0-0**	3	50	100	3	-	-
18UCSE805	PE	Network Management	**3-0-0**	3	50	100	3	-	-
18UCSE806	PE	Mobile Applications Development	**3-0-0**	3	50	100	3	-	-
18UCSE807	PE	Ontology and Semantic Web	**3-0-0**	3	50	100	3	-	-
18UCSE808	PE	Data Science	**3-0-0**	3	50	100	3	-	-
18UCSE809	PE	Blockchain Technology	**3-0-0**	3	50	100	3	-	-
18UCSO804	OE	Cloud Computing	**3-0-0**	3	50	100	3	-	-

Note: BS- Basic Science, **PC**- Program Core, **HU**- Humanity Science, **CIE**- Continuous Internal Examination, **SEE**- Semester End Examination, **L**- Lecture, **T**-Tutorials, **P**-Practicals. *SEE for theory is conducted for 100 marks and is reduced to 50 marks.

VII SEMESTER

18UCSC700 Artificial Intelligence and Machine Learning (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- To introduce the basic concepts, theories and state-of-the-art techniques of artificial intelligence and machine learning.
- Enable student with knowledge enough to be a self-learner in exploring the application of machine learning /AI algorithms in the different fields of science, medicine, finance etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the world, behavior of agents and problem-solving aspects of agents.	-	3,4	1,2
CO-2	**Demonstrate** the representation and usage of knowledge using First order logic.	-	3,4	1,2
CO-3	**Explain** the decision-making process with incomplete, inconsistent and everchanging facts.	-	3,4	-
CO-4	**Explain** machine learning concepts and range of problems that can be handled by machine learning.	-	3,4	-
CO-5	**Apply** the concepts of and the machine learning to the real-world problems.	-	-	3,4,5

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	1.0	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

1. Logic
2. Discrete Mathematics
3. Programming Fundamentals

Contents:

Unit-I

Introduction: AI Problems Underlying Assumption, AI Techniques, Criteria for Success

State Space Search & Heuristic Search Techniques: Defining the Problems as A State Space Search, Production Systems, Production Characteristics, Issues in The Design Of Search Programs.

Generate And-Test: Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, and Means-ends Analysis. **11 Hrs**

Unit-II

Knowledge Representation: Issues, Representations and Mappings, Approaches to Knowledge Representation.

Using Predicate Logic: Representation Simple Facts in Logic, Representing, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules, Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. **11 Hrs**

Unit-III

Statistical Reasoning, Probability and Uncertainty: Bayes' Theorem, Full joint probabilistic distribution, Bayesian Networks and Probabilistic inferences, Dumpster Shafer Theory.

Forms of learning: Issues in designing a learning system. Assumptions of Common Machine Learning Models. **10 Hrs**

Unit-IV

Linear Regression: Multivariate Regression, Logistic regression, Polynomial Regression.

Linear Models for Classification: Decision Trees, Regression Trees, K-nearest neighbors (KNN) algorithm. Bias Variance Trade off. **10 Hrs**

Unit-V

Perceptron: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Support Vector Machines, Introduction, Early Models, Unsupervised learning and clustering – k-means clustering, hierarchical clustering. **10 Hrs**

Reference Books:

1) Elaine Rich and Kevin Knight "Artificial Intelligence", 2/E, Tata Mcgraw-Hill, 2005.
2) Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3/E, Prentice Hall, 2009.
3) Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman "The Elements of Statistical Learning".
4) Christopher Bishop, "Pattern Recognition and Machine Learning"
5) Mitchell Tom "Machine Learning", McGraw Hill, 1997.

18UCSC701 Advanced Computer Architecture (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the different computer architecture designs in the present scenario by considering performance parameters. Further, the concept of parallel processing and the relationship between parallelism and performance of different parallel architectures and software tools are emphasized. The concepts in memory hierarchy design and storage systems are also discussed.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the various performance characteristics of computer architectures with respect to theory of parallelism.	**4**	**1**	**-**
CO-2	**Explain** the working principles of processors, Memory hierarchy, Memory Consistency models.	**-**	**3**	**2**
CO-3	**Analyze** various cache memory organizations, **identify** the characteristics of shared memory organization and **illustrate** sequential and weak consistency models.	**5**	**1**	**13,16**
CO-4	**Identify** the generations of multi-computer architectures and **Analyze** the concept of message passing mechanisms.	**3**	**2**	**13,16**
CO-5	**Detect** the instruction level parallelism and **explain** the role of compiler in exploitation of ILP.	**2**	**3**	**1**

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.6	2.0	2.5	3.0	3.0	-	-	-	-	-	-	-	1.0	-	-	1.0

Pre-requisites: Knowledge of

- Computer Organization
- High level Programming
- Assembly Language Programming

Contents:

Unit-I

Theory of Parallelism: Parallel Computer Models,The State of Computing, Multiprocessors and Multicomputer, Multi-vector and SIMD Computers, Program and Network Properties,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. **12 Hrs**

Unit-II

Hardware Technologies: Processors and Memory Hierarchy: Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology **9 Hrs**

Unit-III

Bus, Cache, and Shared Memory: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models.
Pipelining and Superscalar Techniques: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design **9 Hrs**

Unit-IV

Parallel and Scalable Architectures: Multiprocessors and Multi computers - Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multi computers, Message-Passing Mechanisms. **10 Hrs**

Unit-V

Software for parallel programming: Parallel Program Development and Environments: Parallel Programming Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism: Computer Architecture, Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism, Operand Forwarding, Reorder Buffer, Register Renaming, Tomasulo's Algorithm, Branch

Prediction, Limitations in Exploiting Instruction Level Parallelism, Thread Level Parallelism. **12 Hrs**

Reference Books:

1) Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability", 3/E, McGraw Hill Education, 2015
2) John L. Hennessy and David A. Patterson "Computer Architecture: A quantitative approach" 5/E, Morgan Kaufmann, Elseveir 2013.
3) Richard Y.Kain, "Advanced Computer Architecture: A System's Design Approach", Pearson Publications, 2015
4) John D. Carpinelli, "Computer Systems Organization and Architecture", Pearson Publications, 2001

18UCSE705 Computer Graphics (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course introduces fundamental principles of computer graphics, its architecture and how transformations of objects are carried out. It facilitates students to identify good design principles to solve challenges involved in simulating real world objects/conditions. It also provides the students to learn and apply the aspects of interaction with computer and exposes them to open-source tools like OpenGL.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs(13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the principles of Computer Graphics Architecture used in industry relevant tool like OpenGL.	-	13,14	1,2,12
CO-2	**Explain** the design objectives of APIs used in OpenGL.	-	14,12	1,5
CO-3	**Apply** input interaction techniquesused in graphics environment.	14	2	-

CO-4	**Apply** affine transformations to solve problems relating to object transformations.	13	14	1
CO-5	**Discriminate** the views of objects in parallel and perspective projections under various lighting conditions.	-	13	14
CO-6	**Formulate** mathematical strategies for scan conversion algorithms to realize basic primitives, and **represent** curve and surfaces.	13,14	-	1,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	1.5	-	-	1.0	-	-	-	-	-	-	1.3	2.5	2.1	-	-

Pre-requisites: Knowledge of

- Basic Engineering Graphics
- Linear Algebra (Scalars, Vectors, Matrices)
- Algorithms and C programming.

Contents:

Unit-I

Introduction : Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics. Graphics Programming: The Sierpinski gasket; Programming two dimensional applications

Input and Interaction: Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations. **9 Hrs**

Unit-II

Geometric Objects and Transformations: Scalars, points, and vectors; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling; Transformations in homogeneous coordinates; Concatenation of transformations; Interfaces to three-dimensional applications. **9 Hrs**

Unit-III

Viewing and Lighting : Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL, Hidden surface removal; Parallel-projection matrices; Perspective-projection matrices.
OpenGL: Introduction to OpenGL; Programming two-dimensional Application; The OpenGL API; Primitives and Attributes; Color; Control Functions. **7 Hrs**

Unit-IV

Basic Raster Graphics Algorithms for drawing 2D primitives : Scan converting lines, circles, Filling Rectangles, Polygons; Clipping in a raster world; Clipping lines, polygons; Anti-aliasing **7 Hrs**

Unit-V

Lighting and Shading: Light and matter; Light sources; The Phong lighting model.
Representing Curves and Surfaces: Parametric Cubic Curves – Hermite Curves, Bézier Curves. **7 Hrs**

Conduction of Practical Sessions: Practical Sessions to be held with the focus of learning Open Source Tools like OpenGL and its API features. For the successful completion of the course, students are expected to undertake project to explore advanced features of Open Source Tools like OpenGL.

Reference Books:

1) Edward Angel, “Interactive Computer Graphics A Top-Down Approach with OpenGL”, 5/E, Addison-Wesley, 2008
2) James D Foley, Andries Van Dam, Steven K Feiner & John F Hughes, “Computer Graphics Principles and Practice”, 2/E, Addison-Wesley, 1997.
3) Edward Angel & Dave Shreiner, “Interactive Computer Graphics A Top-Down Approach with Shader-Based OpenGL”, 6/E, Addison-Wesley, 2012
4) F.S. Hill, Jr., “Computer Graphics Using OpenGL”, 2/E, Pearson Education, 2005
5) Donald Hearn and Pauline Baker, “Computer Graphics- OpenGL Version”, 2/E, Pearson Education, 2003

18UCSE706 Software Testing (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course discusses the notations and terminologies used in software testing with Principles of programming, Software

Development Process from the perspective of quality, maintenance, testing, programming style. Further, it focuses on System quality through: requirements, design, coding, verification and validation procedures and applications, case studies, use of tools / programming techniques for design and implementation.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Map** inputs to the expected outputs of the system by understanding the system behavior represented in the form of: requirements and design specifications / Models.	1, 13	-	-
CO-2	**Design** test cases based on requirement specifications.	2, 14	1	-
CO-3	**Design** test cases based on traditional design specifications.	-	3, 13	-
CO-4	**Design** test cases based on Object specifications/Models (UML).	13	3	-
CO-5	**Write** script in any programming Language/Tools to implement test cases designed.	14	15	-
CO-6	**Design** test cases based on various testing strategies to check the correctness of computer program.	-	15, 13	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.5	3.0	2.0	-	-	-	-	-	-	-	-	-	2.5	3.0	2.0	-

Pre-requisites: Knowledge of

- Programming language
- Software Engineering
- Object Oriented System Analysis and Design

Contents:

Unit-I

Programming Practice: A Testing Perspective: Programming Principles & Guidelines, Coding Processes, Refactoring, Verifications & Metrics, Style- Names, Expression and Statements, Consistency and Idioms, Function Macros, Debugging, Performance, Portability

Basics of Software Testing: Human Errors and Testing, Software Quality, Requirements, Behavior and Correctness, Correctness versus Reliability, Testing and Debugging, Test Metrics, Software and Hardware Testing, Testing and Verification, Defect Management, Execution History, Test generation Strategies, Static Testing. Model-Based Testing and Model Checking, Control-Flow Graph, Types of Testing, The Saturation Effect. **9 Hrs**

Unit-II

Test Generation from Requirements: Introduction; The Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis, Category-Partition Method, Cause-Effect Graphing, Test Generation from Predicates. **7 Hrs**

Unit-III

Dependence, Data Flow Models and Data Flow Testing: Definition-Use pairs; Data flow analysis; Classic analysis; From execution to conservative flow analysis; Data flow analysis with arrays and pointers; Inter-procedural analysis; Overview of data flow testing; Definition- Use associations; Data flow testing criteria; Data flow coverage with complex structures; The infeasibility problem. **7 Hrs**

Unit-IV

Structural Testing: Overview; Statement testing; Branch testing; Condition testing, Path testing; Procedure call testing; Comparing structural testing criteria; The infeasibility problem.

Test Case Selection and Adequacy Test Execution: Overview; Test specification and cases; Adequacy criteria; Comparing criteria; Overview of test execution; From test case specification to test cases; Scaffolding; Generic versus specific scaffolding; Test oracles; Self-checks as oracles; Capture and replay **9 Hrs**

Unit-V

Testing Object Oriented Software: Issues in Testing OO Software, Intra Class Testing, Testing with State Machine Models, Inter-Class Testing, Structural Testing of Class **7 Hrs**

Reference Books:

1) Brain W. Kernighan & Rob Pike, “The Practice of Programming”, Pearson education, 2008.
2) Pankaj Jalote & Narosa, “An Integrated Approach to Software Engineering”, 3/E, Publishing House.
3) Edward Kit, “Software Testing in the Real World”, Pearson Education, 2006

4) Aditya P Mathur, "Foundations of Software Testing", Pearson Education, 2008.
5) Mauro Pezze, Michal Young, John Wiley & Sons, "Software Testing and Analysis: Process, Principles and Techniques", 2008.

18UCSE708 Adhoc Networks (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course covers major aspects of wireless ad hoc networks, from design through performance issues to application requirements. It starts with characteristics features, applications of wireless ad hoc networks, different types of routing protocols and understanding the security issues and various QoS requirements.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the design issues of protocol stack.	-	3,13	-
CO-2	**Compare** the architecture and working of various MAC layer protocols.	-	16	1,14
CO-3	**Apply** the knowledge of different routing mechanisms for the better routing decisions in WANETs.	3,13,16	-	-
CO-4	**Apply** the knowledge of different transport layer protocols for ensuring reliable communication in WANETs.	3,13	16	15
CO-5	**Identify** the challenges in security and QoS issues in WANETs and explain suitable solutions for the same.	-	2	1,16

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	2.0	2.7	-	-	-	-	-	-	-	-	-	2.7	1.0	1.0	1.7

Pre-requisites: Knowledge of

- Data Communications
- Computer Networks
- C programming

Contents:

Unit-I

Adhoc Networks: Introduction, Issues in Adhoc wireless networks, Adhoc wireless internet.

MAC–1: MAC Protocols - Introduction, Issues in designing a MAC protocol, Design goals of a MAC protocol for Adhoc wireless networks. **7 Hrs**

Unit-II

MAC–2: Classification of MAC protocols, Contention based protocols with reservation mechanisms; Contention based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. **7 Hrs**

Unit-III

Routing: Proactive and Reactive Routing Protocols, Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols. **9 Hrs**

Unit-IV

Transport Layer: Protocols - Introduction, Issues in designing a transport layer protocol, Design goals of a transport layer protocol, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols. **9 Hrs**

Unit-V

Security: Introduction, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing.

QoS: Introduction, Issues and challenges in providing QoS, Classification of QoS solutions, MAC layer solutions, network layer solutions. **7 Hrs**

Reference Books:

1) C. Siva Ram Murthy & B. S. Manoj, “Adhoc Wireless Networks”, 2/E, Pearson Education, 2005.

2) Ozan K. Tonguz and Gianguigi Ferrari & John Wiley, “Ad hoc Wireless Networks”, 2006.
3) Xiuzhen Cheng, Xiao Hung, Ding Zhu Du, & Kluwer, “Ad hoc Wireless Networking”, Academic Publishers, 2004.
4) C.K. Toh, “Adhoc Mobile Wireless Networks, Protocols and Systems”, Prentice Hall PTR, 2007.

18UCSE709 Operations Research (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Apply the fundamental techniques (graphical method, simplex method, dual simplex method) of operations research to solve real world problems.
- Estimate the transportation and assignment costs.
- Design, code, test, and debug programs to solve problems in the domain of operations research.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** real-world problems in the form of mathematical model and **solve** using graphical method.	-	2	1
CO-2	**Formulate** real-world problems in the form of mathematical model and **solve** using simplex and artificial variables techniques.	-	1,2,3	-
CO-3	**Solve** LP problems using dual simplex method and **perform** sensitivity analysis.	-	1,2,3	16
CO-4	**Build** Models to **Solve** Transportation and Assignment problems.	-	1,2	5,16
CO-5	**Solve** a given problem using game theory techniques.	-	1,2	5

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.8	2.0	2.0	-	1.0	-	-	-	-	-	-	-	-	-	-	1.0

Pre-requisites: Knowledge of

- Algebra
- Probability

Contents:

Unit-I

Introduction: Definitions and various phases of operations research, Role of computers in operations research, Formulating a problem as a mathematical model in the form of linear programming (LP) problem – Minization and Maximization Types, Solving LP problems using Graphical method. **7 Hrs**

Unit-II

Simplex Method: Canonical and Standard forms of LP problem, The simplex method – examples, Artificial variables Techniques (Big M and Two Phase method) - examples. **7 Hrs**

Unit-III

Advanced Topics in Linear Programming: Duality, Dual Simplex Method, Economic interpretation of duality, Sensitivity analysis, Dynamic Programming. **9 Hrs**

Unit-IV

Transportation Model: Introduction, Formulation, Methods for Initial Basic Feasible solution, Improving the basic feasible solution using Stepping Stone and MODI methods.

Assignment Model: Introduction, Formulation, Comparison with transportation model, Hungarian method. **9 Hrs**

Unit-V

Game Theory: Introduction, Formulation, Strategies – Pure and Mixed, Methods for solving Game theory problems – Saddle point, Rule of Dominance, Arithmetic method, Graphical method. **7 Hrs**

Reference Books:

1) Er. Premakumar Gupta and Dr. D.S.Hira, “Operations Research”, S Chand Publications, 2014.

2) Frederick S. Hillier and Gerald J. Lieberman, "Introduction to Operations Research", 8th Edition, Tata McGraw Hill, 2005.
3) Wayne L. Winston, "Operations Research Applications and Algorithms", 4/E, Thomson Course Technology, 2003.
4) Hamdy A T, "Operations Research: An Introduction", 9/E, Pearson Publishers, 2014

18UCSE710 Multi Core Architecture and Programming (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Basic concepts in multicore architecture.
- Synchronization and coordination mechanisms available on latest multicore machines.
- Effective concurrent program writing to enhance the performance for windows, C# & .net and Linux programming platforms.
- Introductory knowledge in Open MP libraries and pthreads.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the need for multicore architecture for modern day applications	1	2	13
CO-2	**Write** a program using pthread libraries and Open MP features to solve problems that needs thread models.	2	5	13
CO-3	**Write** a program to solve problems using parallel programming constructs.	-	4	5
CO-4	**Design** a solution for the problem using APIs for Win32, MFC and .NET;	-	5	-
CO-5	**Apply** standard solutions to some common parallel programming problems like data Race	2	3	1

	conditions, Dead locks,Live locks, Memory Issues etc.			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.7	2.0	2.0	2.7	-	-	-	-	-	-	-	1.0	-	-	-

Pre-requisites: Knowledge of

- Microprocessor
- Operating Systems
- C programming

Contents:

Unit-I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.

System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **8 Hrs**

Unit-II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. **8 Hrs**

Unit-III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. Threading APIs: Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread

Synchronization, Signaling, Compilation and Linking. **8 Hrs**

Unit-IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance. **8 Hrs**

Unit-V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency. **7 Hrs**

Reference Books:

1) Shameem Akhter & Jason Roberts “Multicore Programming Increased Performance through Software Multi-threading”, Intel Press, 2006
2) The Software Optimization Cookbook – Intel Press 2007
3) M.Shyamala Devi, “Multicore Architectures and Programming”, Sahara Publications, 2016
4) Krishna Sankar P & Shangarnarayanee N P, “Multi-Core Architectures and Programming”, AR Publications, 2016.

18UCSO707	Web Technology	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course emphasizes on practice-based learning. It enables the students to understand the web application architecture and use the state-of-the-art technology to provide web-based solutions.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs(13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Design** and **develop** static web pages using XHTML.	5	2,3,13,14,15	12
CO-2	**Design** and **develop** dynamic web application to validate and store data using markup languages like-XML, DTD & XSD.	5	2,3,13,14,15	12
CO-3	**Design** and **develop** an interactive web application using JavaScript and XHTML with CSS.	5	2,3,13,14,15	12
CO-4	**Design** and **develop** dynamic web application using server-side programming and Database connectivity.	5	2,3,13,14,15	12
CO-5	**Develop** a web service to represent the data in the standard formats for the given requirements.	5	2,3,13,14,15	12
CO-6	**Explain** the future of World Wide Web and its associated trending technologies.	-	5, 13	1,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	2.0	2.0	-	3.0	-	-	-	-	-	-	1.0	2.0	2.0	2.0	-

Pre-requisites: Knowledge of

- Programming language (any)
- Database Management Systems

Contents:

Unit-I

Introduction to Web: WWW1.0, HTML, HTML5, XHTML, XML, XSD, DTD, DOM-XML. **8 Hrs**

Unit-II

Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.
Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **8 Hrs**

Unit-III

Introduction to JavaScript: Basics, Strings, Arrays, Functions, Objects in JavaScript, building simple applications using JavaScript and HTML. **8 Hrs**

Unit-IV

Introduction to PHP: Introduction to PHP, Datatypes, Control Statements, Loops, Functions, Embedding PHP in HTML & MySQL. **8 Hrs**

Unit-V

Introduction to Web 2.0: Overview of WWW 2.0, JSON, Web Services - SOAP & WSDL, RESTful.
Introduction to AJAX: Basics of AJAX, Asynchronous and Synchronous message transformation.
Future of Web: Overview of Semantic Web, Applications of Semantic Web, Virtual Reality, Web OS. **7 Hrs**

Reference Books:

1) Robert W. Sebesta, Programming the World Wide Web, 7/E Pearson Education, 2012.
2) Luke Welling, Laura Thomson, PHP and MySQL Web Development, 5/E, Pearson Education, 2016.
3) Nicholas C Zakas, Professional JavaScript for Web Developers, 3/E, Wrox/Wiley India, 2012.
4) Nicholas C Zakas et al, Professional AJAX, Wrox, 2007.
5) Karin K. Breitman, Marco Antonio Casanova and Walter Truszkowski, Semantic Web: Concepts, Technologies and Applications, Springer International Edition, 2007.

18UCSO711 Internet of Things (2-0-2) 3

Contact Hours: 39 (26T + 13L)

Course Learning Objectives (CLOs): This course provides the basic understanding of IoT technology, communication protocols, sensor networks and its applications. It focuses on setting up IoT ecosystem to implement use cases by applying the key concepts of IoT.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the working of IoT and its enabling technologies.	-	5	1, 12
CO-2	**Explain** the use cases of IoT andthe useof sensors & actuators in IoT ecosystem.	-	5	1, 12
CO-3	**Compare** and **contrast** IoT & M2M and **explain** the generic design methodology for IoT system.	-	5, 13	1, 12
CO-4	**Develop** IoT applications using Arduino by making use of sensors and modules.	13	14	1, 5, 9, 15
CO-5	**Develop** IoT applications using Raspberry Pi microcontroller by making use of sensors and modules.	13	14	1, 5, 9, 15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.0	-	-	-	1.6	-	-	-	1.0	-	-	1.0	2.7	2.0	1.0	-

Pre-requisites: Knowledge of Programming and Basics of Computer Networking

Contents:

Unit-I

Introduction to Internet of Things (IoT): Introduction, Physical and Logical Design of IoT, IoT Enabling Technologies, IoT levels and Deployment templates **7 Hrs**

Unit-II

Domain Specific IoTs: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health &Lifestyle

IoT Sensors and Actuators: Introduction, IoT sensors, RFID, Video Tracking, IoT Actuators **8 Hrs**

Unit-III

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT

IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring **7 Hrs**

Unit-IV

Arduino Programming: Features of Arduino, Arduino UNO, Arduino IDE, Arduino sketch structure, Arduino function libraries, Blinking LED example; Operators, control statements, loops, arrays, string, interrupts, Traffic Control System example

Integration of Sensors, Actuators and modules with Arduino: Sensor Types, Sensor Interface with Arduino, Interfacing DHT, LM35, LDR, Accelerometer and HC-SR04 sensors with Arduino; Actuators, Types of Motor Actuators, Servo motor, Servo library on Arduino; HC05 Bluetooth module, Features, Interfacing HC05 with Arduino, Controlling LED using Bluetooth; ESP8266 wifi module, Features, Send LM35 sensor data to cloud using wifi module **2L + 7P Hrs**

Unit-V

Raspberry Pi: Introduction, Specifications, Basic Architecture, Pin configuration, Blinking LED example; Capture image using Raspberry Pi

Implementation of IoT with Raspberry Pi: Temperature dependent auto cooling system; interfacing DHT, LM35, LDR, Accelerometer and HC-SR04 sensors with Raspberry Pi; Send LM35 sensor data to cloud using wifi module. **2L + 6P Hrs**

Conduction of Practical Sessions:

Practical sessions shall include experiments on the following:

1) Use of Arduino board and coding to blink built-in as well as external LEDs
2) Interfacing temperature, humidity, soil moisture, light intensity, accelerometer, ultrasonic and obstacle detection sensors with Arduino and displaying the results
3) Connecting modules like Bluetooth and Wi-Fi to Arduino and sending the sensed data to cloud for storage and analytics.
4) Use of Raspberry Pi as a surveillance system

Reference Books:

1) Arshdeep Bahga, Vijay Madisetti ,"Internet of Things – A Hands-on Approach", Universities Press, 2015
2) Ammar Rayes, Samer Salam, "Internet of Things From Hype to Reality – The Road to Digitalization", Second Edition, , Springer Nature Switzerland AG 2017, 2019

18UCSL702 Artificial Intelligence and Machine Learning Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course is in line with the theory course Artificial Intelligence & Machine Learning (18UCSC700). It focuses on hands on experience on creation of data models, database design, programming using appropriate technology.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs(1-12) / PSOs(13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Represent** the Knowledge for the given scenario using appropriate tools techniques and language.	-	3,4,5	-
CO-2	**Identify** data preprocessing requirement of a given data set for the learning algorithms.	-	3,4,5	-
CO-3	**Demonstrate** of the strengths and weaknesses of regression and classification approaches in machine learning.	-	3,4,5	-
CO-4	**Demonstrate** unsupervised algorithms for clustering requirement on a data set from the real world using python.	-	3,4,5	-
CO-5	**Represent** the Knowledge for the given scenario using appropriate tools techniques and language.	-	3,4,5	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**

Mapping Level	-	-	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

1. Logic
2. Discrete Mathematics
3. Programming Fundamentals

Course Contents

This course is in line with the theory course Artificial Intelligence & Machine Learning (18UCSC700). There will be one problem with the **Knowledge Representation** and four problems on **Machine Learning** (Linear Regression, Multilinear regression, Polynomial regression, Decision Tree, K-means clustering). The problems to be composed by the faculty are announced to the students. The student will analyze the problem, justify the requirement of AI Approach for the solution, choose the platform or technology for implementations and demonstrate all the steps involved like pre-processing the dataset, importing the dataset, Spitting the dataset into the training set and test set, training the model on the training dataset, predicting the test set results, Visualising the Training set results, Visualising the test set results, etc where ever applicable. The students will submit implementation, conduction and observation write up for each problem. An internal examination and 5 problems work will be used to grade the student's performance in this course.

Associated Lab Works (Sample)

1. Represent facts and relationships of any famous epic of your choice using first order logic, implement and demonstrate some queries.
2. Build a decision tree for the case of SDMCET students' performance based on the IA-1, IA-2, IA-3, CTA, Attendance, SEE marks (optional) and classifying them into one of the Grade S, A, B, C, D, E & F. Study of precision of classification by including the 10th, 12th and CET/COMED-K into consideration.
3. Given the features of an email like , Sender's email ID, Number of typos in the email, Occurrence of words like "offer", "prize", "free Gift", classify the email as Spam or not. Use the feature vector to train a Logistic classifier which emits a score in the range 0 to 1. If the score is more than 0.5, we label the email as spam. Otherwise, we don't label it as spam.
   (https://magoosh.com/).
4. Linear or polynomial regression to predict the salary of a person given the designation, no of years of experience, location of work, previous financial years profit etc.

5. A Hospital Care chain wants to open a series of Emergency-Care wards within a region. We assume that the hospital knows the location of all the maximum accident-prone areas in the region. They have to decide the number of the Emergency Units to be opened and the location of these Emergency Units, so that all the accident-prone areas are covered in the vicinity of these Emergency Units. The challenge is to decide the location of these Emergency Units so that the whole region is covered. Here is when K-means Clustering comes to rescue! (https://www.edureka.co/blog/k-means-clustering/)

18UCSL703 Major Project – Phase 1 (0-0-4) 2

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:
Understand the domain through proper modeling and analysis using the state-of-art technology. Then apply relevant Software Engineering Principles to develop modular and robust applications through the use of Standards and tools. At the end build appropriate test cases, verification and validation techniques in order to make the project reliable and maintainable.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the problem and **formulate** the problem statement.	1, 8, 2,12	-	-
CO-2	**Analyze** the problem scenario and **Design** the solutions to complex engineering problem using software engineering principles or appropriate research methodology.	3,5, 8, 13,12	11, 16	6, 7
CO-3	**Identify** and **Implement** a feasible solution using appropriate technology, tools, procedures and techniques.	4,5, 8, 14,12	16	-
CO-4	**Verify** and **Validate** the proposed system for correctness and to demonstrate compliance with the design and hence the stated requirements/ research gap.	5, 8, 15,12	-	-

CO-5	**Prepare** the report and **communicate** effectively through presentation.	8, 9,10	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	3.0	3.0	3.0	3.0	1.0	1.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0

Prerequisites: Different programming languages / tools, Software Engineering Principles

Marks Weightage and Various parameters for project evaluation for both CIE and SEE level @ 7th and 8th Semester:

Sl.No.	Parameter for Assessment	% Weight For CIE and SEE	
		7th Sem	8th Sem
1	**Requirements Analysis (SRS):** Abstract and Detailed.	20	10
2	**Design Specification:** Use of UML diagrams, architecture diagram, ER diagram, Patterns etc. Proper cohesiveness and coupling of various components in the system design.	35	10
4	Use of Tools and standards.	5	5
5	**Implementation:** Code documentation, style, robustness, maintainability, Testability, Usability (User Experience) etc.	10	20
6	**Testing:** for every scenario of all use cases identified.	10	10
7	**Final Oral Presentation** (viva-voce) (IEEE Standards for slides, oral presentation techniques, etc.)	10	10
8	**Project Reports** - Final and Intermediate if any: preparation using LATEX and plagiarism check	10	20

9	**Preparation of Learning Materials** (.doc & .pdf) & **Videos**: Uploading through Department Channel on YouTube. **Knowledge Transfer**: through conduction of workshop and training programs	-	10
10	**Publication of paper / Equivalent Effort** (@IEEE or equivalent or higher)	-	5

References:

1) Grady Booch, "Object-Oriented Analysis and Design with Applications", 2/E, Addison-Wesley Publications.
2) Pankaj Jalote, "An Integrated Approach to Software Engineering", 3/E, Springer Publications.
3) Project Manual, prepared by the CSE Department, S D M College of Engineering and Technology, Dharwad

18UCSL704 Internship 2 Credits

Contact Hours: 4 weeks

Course Learning Objectives (CLOs): Internship provides an opportunity to get industry exposure to real time scenarios that include professional skill development programs and adhere to the professional standards.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs(1-12) / PSOs (13-16)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	**Explore** the domain knowledge	1, 8, 2,12	-	-
CO-2	**Apply** the knowledge and skills in the professional career.	3,5, 8, 13,12	11, 16	6, 7
CO-3	**Prepare** a technical report	4,5, 8, 14,12	16	-
CO-4	**Demonstrate** the knowledge gained through presentation.	5, 8, 15,12	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	3.0	3.0	3.0	3.0	3.0	1.0	1.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0

Prerequisites: Knowledge of both theory and practical courses learnt in all the previos semesters and relevant value-added information.

Internship: The students are to undergo internship in Private industries / R&D organizations / Centres of Excellence / Laboratories of Reputed Institutions / Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get en exposure to the external world for a period of 4 weeks in the summer vacation after VI sem and before start of VII semester. The students are to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award CIE marks. There is a SEE in which the student shall present his work before a panel of examiners consisting of HoD, Guide and one faculty member during VII semester. The performance shall be communicated to the CoE office and the same shall reflect in the VII semester grade card

VIII SEMESTER

18UCSC800 Distributed Systems and Applications (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course is at undergraduate level for 4 credits with emphasis on the principles of distributed systems and to design the solutions for message passing, clock synchronization, consistency and fault tolerance at basic level.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the characteristics and functioning of communication protocols in distributed systems.	-	1,2,13	-
CO-2	**Comprehend** the need for synchronization strategies in a distributed system and **Implement** a synchronization algorithm.	13,14	1,3,5,15	2
CO-3	**Explain** principles of consistency and replication strategies in a distributed system.	-	1,2,13	-
CO-4	**Elucidate** the principles of fault tolerance strategies in a distributed system.	-	1,2,13	-
CO-5	**Explain** the characteristics of distributed file system and **Implement** the file system operations of a distributed operating system.	13,14	1,3,5,15	2

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.0	1.6	2.0	-	2.0	-	-	-	-	-	-	-	2.4	3.0	2.0	-

Pre-requisites: Knowledge of

- Computer Networks
- Operating Systems

Contents:

Unit-I

Introduction: Need for distributed system and applications, process and communication model (in terms of IPCs RPCs, RMIs and software agents), architecture & design patterns. **10 Hrs**

Unit-II

Naming: Terminologies and different types of naming services.

Synchronization : Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, Election Algorithms **12 Hrs**

Unit-III

Consistency and Replication: Introduction, Data-centric Consistency Models, Client-centric Consistency Models, Replica Management. **10 Hrs**

Unit-IV

Fault Tolerance & Security: Introduction, Process Resilience, Reliable Client-Server Communication, Reliable Client-Server Communication, Security and design issues in distributed system. **10 Hrs**

Unit-V

Distributed file systems: client-server architectures, cluster-based distributed file systems, symmetric architectures and processes. **10 Hrs**

Reference Books:

1) Andrew S Tanenbaum & Maarten van Steen, “Distributed Systems Principles and Paradigms”, 2/E, Pearson Prentice Hall, 2007.
2) Tom White, “Hadoop: The Definitive Guide”, 4/E, O’Reilly, 2015,
3) George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair, “Distributed Systems Concepts and Design”, 5/E, Addison-Wesley, 2012.
4) Ghosh, Sukumar. Distributed systems: an algorithmic approach. Chapman and Hall/CRC, 2006.

18UCSE803 Cryptography and Network Security (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Principles of Cryptographic algorithms including secret key cryptography, hashing and public key algorithms.
- Use of cryptographic techniques to establish security in modern information- and communication systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Compare** and **contrast** different symmetric key encryption techniques to achieve data confidentiality.	-	1, 2	-
CO-2	**Apply** different security solutions for a given system using private and public key cryptography.	13	1, 2	-
CO-3	**Identify** the need for key management and message authentication; critically **compare** various key management, and authentication services and mechanisms.	-	3	-
CO-4	**Identify** and **explain** the requirement and usage of security services and mechanisms for various network security applications.	2	-	1
CO-5	Critically **compare** system threats and countermeasures.	-	-	13
CO-6	**Implement** a given cryptographic algorithm using higher level programming languages.	4, 5, 15	14	

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.7	2.3	2.0	3.0	3.0	-	-	-	-	-	-	-	2.0	2.0	3.0	-

Pre-requisites: Knowledge of

- Computer Networks
- Discrete Structures

Contents:

Unit-I

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES. **8 Hrs**

Unit-II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm.

Other Public-Key Cryptosystems: Diffie hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp **8 Hrs**

Unit-III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication.

User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication,remote user Authentication using Symmetric encryption, Mutual Authentication,one-way Authentication,Kerberos, Motivation, Kerberos version 4, Kerberos version 5 **8 Hrs**

Unit-IV

Wireless network security: 802.11i pseudorandom Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview

Transport Level Security: Web Security Considerations, Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Transport Layer Protocol, Connection Protocol. **8 Hrs**

Unit-V

Electronic Mail Security: Pretty good privacy, notation, operational description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality.

IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database. **7 Hrs**

Reference Books:

1) William Stallings, "Cryptography and Network Security", 6/E, Pearson Education, 2014.
2) Atul Kahate, "Cryptography and Network Security", 3/E, McGraw-Hill Education (India) Pvt. Ltd., 2013
3) Bruce Schinner, "Applied Cryptography", 2/E, PHI publication 2007.
4) Radia Perlman, Mike Speciner, & Charlie Kaufman, "Network Security: Private communication in a Public World", 2/E, Pearson Education Asia, 2002.

18UCSE805 Network Management (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course, at under graduate level for 3 credits, explains the issues for network management arising from a range of security threats, including viruses and denial-of-service attacks. Develop a strategy for ensuring appropriate levels of security in a system designed for a particular purpose.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** network communication architecture and goals	2,13	-	-
CO-2	**Explain** and **apply** Management information Tree (MIT)	13,14	3, 4	5
CO-3	**Explain** structure of management through Management Information Base	13	4	3
CO-4	**Explain** Remote Monitoring, and	-	4,5	7

	concept of broadband, security.			
CO-5	**Design** and **develop** network management solutions for the given scenario like Inventory management, fault location and management, performance management, accounting management, report management.	-	10	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	3.0	2.0	2.0	1.5	-	1.0	-	-	2.0	-	-	3.0	3.0	-	-

Pre-requisites: Knowledge of Computer Networks

Contents:

Unit-I

Introduction: Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model –Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1 Terminology, Symbols and Conventions, Objects and Data Types, Object Names, An Example of ASN.1Prere from ISO 8824; Encoding Structure; Macros, Functional Model. **8 Hrs**

Unit-II

SNMPv1 Network Management : Organization and Information Models : Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview,

The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base **8 Hrs**

Unit-III

SNMPv1 Network Management: Communication and Functional Models: The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, and Functional Model.

SNMP Management- RMON: Remote Monitoring, RMON SMI and MIB, RMONI1 RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2. **8 Hrs**

Unit-IV

Broadband Network Management: ATM Networks: Broadband Networks and Services, ATM Technology – Virtual Path Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base, The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface: Customer Network Management of Public Networks, M4 Interface: Public Network Management, Management of LAN Emulation. ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management ADSL Network Management Elements **8 Hrs**

Unit-V

Network Management Tools: Introduction to various network management tools. Server Management: Application Servers, Web Server. Device configuration like Fire wall settings, Hot Spot, Gate Ways, Switches etc. **7 Hrs**

Experiments:

1. Analyze bandwidth throughput etc. for a given network.
2. Analyze different protocols performance like TCP and UDP for a given point-to-point network.
3. Analyze routing protocol performance.

Reference Books:

1) Mani Subramanian, “Network Management Principles and Practice”, 2/E, Pearson Education Publication, 2010.

2) Jianguo Ding, “Advances in Network Management”, 1/E, Auerbach Publications, 2016.

3) Allan Leinwand, Karen Fang Conroy, & Karen Fang, "Network Management: A Practical Perspective", Addison Wesley, 1996
4) Alexander Clemm, "Network Management Fundamentals", Cisco, 1/E, 2016.

18UCSE806 Mobile Applications Development (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Familarize with mobile apps development aspects.
- Design and develop mobile apps, using Android as development platform, with key focus on user experience design, native data handling and background tasks and modifications.
- Appreciation of naunces such as native hardware play, location awareness, graphics, and multimedia.
- Perform testing, signing, packaging and distribution of mobile apps.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the android platform architecture.	5,13	7	3
CO-2	**Acquire** the knowledge of UI components and life cycle of activity with respect to android platform.	5	4	13
CO-3	**Design** and **develop** apps using native data handling on-devices like file I/O, SQLite, and enterprise data access.	14	3,13	7
CO-4	**Design** and **develop** spruce apps to demonstrate the use of various components involved in android platform.	13,14	3,13	7
CO-5	**Explain** and **apply** use of testing tools to test mobile apps.	15	16	5
CO-6	**Explain** the concept of versioning and distributing apps to mobile market place.	14	5	16

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	-	-	1.6	2.0	2.3	-	1.3	-	-	-	-	-	2.2	3.0	3.0	1.5

Pre-requisites: Knowledge of Java (J2SE) and basic RDBMS.

Contents:

Unit-I

Getting started with Mobility: Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development. **7 Hrs**

Unit-II

Building blocks of mobile apps: App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity – states and life cycle, interaction amongst activities, App functionality beyond user interface – Threads, Async task, Services – states and life cycle, Notifications, Broadcast recievers, Telephony and SMS APIs, Native data handling – on device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). **9 Hrs**

Unit-III

Sprucing up mobile apps: Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelorometer and gyroscope) **9 Hrs**

Unit-IV

Testing mobile apps: Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, Junit for Android, Robotium, MonkeyTalk **7 Hrs**

Unit-V

Taking mobile apps to Market: Versioning, signing and packaging mobile apps, distributing apps on mobile market place. **7 Hrs**

Practical / Project work: Students should implement (and learn to use the tools to accomplish this task) the following during Practical hours:

1. Understand the app idea and design user interface/wireframes of mobile app.
2. Set up the mobile app development environment.
3. Develop and debug mobile app components – User Interface, Services, Notifications, Broadcast recievers, data components.

4. Usingemulator to deploy and run mobile apps.

5. Testing mobile app – unit testing, black box testing and test automation.

Reference Books:

1) Donn Felker, Joshua Dobbs, and Barry Burd, “Android Application Development for Dummies”, Wiley Publishing Inc, 2011

2) Reto Meier, “Professional Android 2 Application Development”, Wrox Publisher, 3/E, 2012.

18UCSE807 Ontology & Semantic Web (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on following learning perspectives:

- Theoretical and practical aspects of ontology in semantic web.
- Concepts of RDF and web ontology language.
- Various patterns for developing and reusing ontologies.
- Models for knowledge management architecture in semantic web.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the working principles, architecture of semantic web and the importance of markup languages.	1	-	-
CO-2	**Design** and **analyze** ontologies using web ontology language.	-	3	-
CO-3	**Apply** the logic with web ontology language.	15	-	5
CO-4	**Analyze** scalable architectures and semantic web services.	-	2	-
CO-5	**Explain** the evolution of ontologies with semantic interpretation of information.	-	12	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.0	2.0	-	1.0	-	-	-	-	-	-	2.0		-	3.0	-

Pre-requisites: Knowledge of HTML and Java

Contents:

Unit-I

The semantic web vision: Today's web, Semantic web Technologies, A layered approach, Structured web documents in XML, Introduction to RDF, RDF syntax, RDF schema, Axiomatic statements for RDF and RDF schema, Direct inference system on RDF and RDF schema. **9 Hrs**

Unit-II

Ontology and Web ontology Language: Introducing OWL, Discovering the Various Species of OWL, Exploring the Foundations of OWL Understanding OWL Essentials, Making Simple Assertions, Inconsistency, Examining Property Characteristics, Complex Classes, Understanding Why OWL Is Different, Developing OWL Ontologies. **8 Hrs**

Unit-III

Ontology building and inference by logic: Monotonic rules syntax and semantics, Nonmonotonic rules syntax, Rule markup in XML, Constructing and reusing ontologies, Semantic web knowledge management architecture, Querying using SPARQL, Jena ontology API, Reasoners. **8 Hrs**

Unit-IV

Ontology scalable architectures and Discovering the semantic web services: Discovering the Roles, Creating Semantics for Enterprise Systems, Scaling Semantic Web Tools, Patterns of Architectural Usage and Application development using OWL API. **7 Hrs**

Unit-V

Ontology evolution and Semantic knowledge: Ontology population and enrichment, Semantic representation of multimedia content, Ontology based semantics extraction from text and Images. A survey of semantic image and video annotation tools, Overview of linked data. **7 Hrs**

Reference Books:

1) Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", 2/E, MIT Press, Cambridge, MA 2008

2) Jeffrey T.Pollock, "Semantic Web For Dummies", Wiley Publishing, Inc 2009
3) John Hebeler, Matthew Fisher, Ryan Blace, & Andrew PerezLopez, "Semantic Web Programming", Wiley Publishing, Inc.
4) Georgios Paliouras, Constantine Spyropoulos, & George Tsatsaronis (Eds.) "KnowledgeDriven Multimedia Information Extraction and Ontology Evolution", Springer, 2011

18UCSE808 Data Science (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course is a 3 credit undergraduate course focusing on the data and types, data preprocessing. The details of R language are discussed to enable the students to perform data analytics. It also discusses the supervised and unsupervised learning.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the flow process for processing data science problems and the data types.	-	1, 2	13
CO-2	**Apply** the preprocessing methods to the raw data to make it available for analysis.	1, 2	-	-
CO-3	**Use** the R language to perform the data visualization and the analysis using fundamental statistical technques.	3	-	12
CO-4	Explain the machine learning technques.	-	1, 2	13
CO-5	Explain the unsupervised learning technques.	-	1, 2	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	2.3	2.3	3.0	-	-	-	-	-	-	-	-	1.0	1.0	-	-	-

Pre-requisites: Knowledge of Statistics

Contents:

Unit-I

Introduction: Evolution, Roles, Stages in Data Science Project, Applications, Data Security and Privacy Issues

Data: Data types - Structured and Unstructured, Challenges with Unstructured data, Social media data, Multi modal data, Data Storage and Presentation **7 Hrs**

Unit-II

Data Preprocessing: Cleaning, Integration, Transformation, Reduction, Discretization.

Techniques: Correlation, Regression. Exploratory Analysis. **7 Hrs**

Unit-III

R Language: Basics, Control structures, Functions, Impoting Data.

Graphics and Data Visualization: Installing gglot2, Loading the data, Plotting the Data.

Statistics and Machine Learning: Basic Statistics, Regression, Clustering **9 Hrs**

Unit-IV

Machine Learning: Introduction, Regression, Classification, Gradient Descent. **8 Hrs**

Unit-V

Unsupervised Learning: Introduction, Agglomerative Clustering, Reinforcement Learning **8 Hrs**

Reference Books:

1) Chirag Shah, “A Hands on Introduction to Data Science”, Cambridge University Press, 2020

2) Laura Igual and Santi Segui, “Introduction to Data Science”, Springer International Publications, 2017

3) Richord Cotton “Learning R”, O’Reilly Publications, 2013.

18UCSE809 Blockchain Technology (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on understanding emerging abstract models for Blockchain Technology and familiarizes the functional/operational aspects of the crypto currency ecosystem. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Demonstrate** the basics of Block chain concepts using modern tools/technologies.	-	3, 4, 5	1,13
CO-2	**Analyze** the role of block chain applications in different domains including cyber security.	-	3, 5	-
CO-3	**Evaluate** the usage of Block chain implementation/features for the given scenario.	-	1, 3, 4	14
CO-4	**Exemplify** the usage of bitcoins and its impact on the economy.	3	-	-
CO-5	**Analyze** the application of specific block chain architecture for a given problem.	3	2	6

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	1.0	2.4	1	2	1	-	-	-	-	-	-	-	1.0	1.0	-	-

Pre-requisites: Knowledge of any Object Oriented Programming language and Data Structures.

Contents:

Unit-I

Introduction: Introduction to Blockchain, How Blockchain works, Blockchain vs. Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin. **7 Hrs**

Unit-II

Blockchain Architecture and Types: Architecture, versions, variants, use cases, Life use cases of Blockchain, Blockchain vs. shared Database, Introduction to crypto currencies, Types, Applications. **8 Hrs**

Unit-III

Blockchain Data Structures and Working: Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks. **8 Hrs**

Unit-IV

Bitcoins: Introduction to Bitcoin, key concepts of Bitcoin, Merits and Demerits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency. **8 Hrs**

Unit-V

Ethereum: Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs. Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study. **8 Hrs**

Reference Books:

1) Arshdeep Bikramaditya Signal, Gautam Dhameja, Priyanshu Sekhar Panda “Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions” Apress Publications, 2018.
2) Arshdeep Bahga, Vijay Madisetti, “Blockchain Applications: A Hands-On Approach”, VPT Publications, 2017.

3) Swan Melanie, "Blockchain: Blueprint for New Economy", O'Reilly Publications, 2018.
4) Aravind Narayan, Joseph Bonneau, Edward Felten at al "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
5) Daniel Drescher, "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Apress Publications, 2017.

18UCSO804 Cloud Computing (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning objectives:
Understand the cloud computing paradigm. Recognize its various forms and implement some cloud computing features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** cloud computing philosophy & computing paradigms.	-	1,4	5
CO-2	**Distinguish** and **demonstrate** cloud service models and their risks.	-	2,4,5	-
CO-3	**Explain** and **use** SLA life cycle and agreement structure to build simple applications.	-	4,8	7
CO-4	**Explain** and **build** simple security models using cloud security principles.	-	1,2,4	5
CO-5	**Develop** and **deploy** cloud solution for the given application scenario.	1, 2, 3	4, 5	7

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.3	2.3	3.0	2.0	1.5	-	1.0	2.0	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of

- Operating Systems, Computer Architecture, Computer Networks & Web Technologies.
- Programming languages- Java, Web programming

Contents:

Unit-I

Introduction: Paradigms in Computing, Parallel Computing, Distributed Computing, Grid Computing, Service Computing; Service Oriented Architecture (SOA), Web Services. **7 Hrs**

Unit-II

Basics of Cloud Computing: Definition, Characteristics, Architecture, Components, Service Models, and Deployment Models.
Virtualization: Server, Storage, Network, Desktop Hypervisor, Virtual Machine, Multi-tenancy, Opportunities and Risks.
7 Hrs

Unit-III

Service Level Agreement (SLA): Definition, Types of SLA, SLA Life Cycle, Issues Related to Cloud SLA, SLA Frameworks: WS-Agreement, WSLA, WSOL, Slang, Bilateral Protocol; Translation of SLAs into Monitoring Specifications, Dynamic Creation of Monitoring Infrastructures, Penalty Management, Runtime Prediction.

7 Hrs

Unit-IV

Cloud Security: Cloud Security Fundamentals, Vulnerability Assessment, Security and Privacy in Cloud.

Cloud Computing Security Architecture: Identity Management and Access Control, Autonomic Security; VM Specific Security Techniques. **9 Hrs**

Unit-V

Cloud Application Programming Models: Cloud File Systems: GFS and HDFS, BigTable, HBase and Dynamo; Map Reduce Programming Model, Hadoop: Hadoop Fundamentals, Hama and other Hadoop Related Services. Cloud Application Development Platforms: Xen Hypervisor, Amazon Web Service, Windows Azure, Google App Engine, Eucalyptus, Open Stack, Open Nebula. **9 Hrs**

Experiments

1. Use of Cloud Web Services
2. Experiment on Cloud Storage using mobile
3. Explore Cloud platform like Amazon Web Service, Windows Azure, Google App Engine etc.

Reference Books:

1) A. T. Velte, “Cloud Computing - A Practical Approach”, McGraw Hills 2010
2) Tanenbaum & V. Steen, “Distributed Systems: Principles and Paradigms”, 2/E, Pearson, 2015
3) David E.Y. Sarna, “Implementing and Developing Cloud Computing Applications”, CRC Press, 2011
4) R. Krutz & R. D. Vines, “Cloud Security”, Wiley-India, 2010
5) T. White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Media, 2015
6) Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, “Cloud Computing for Dummies”, Wiley India Edition
7) Rajkumar Buyya, James Broberg & Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, Willey 2014.
8) Dan C Marinescu, “Cloud Computing Theory and Practice”, Elsevier (MK), 2013.

18UCSL801	Independent Study	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course is a one credit self-learning based research / Development oriented activity leading to publication or a study of subjects outside regular UG course offerings; enabling the students to engage in independent and life-long learning in the broadest context of trends of technological change and communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Learn** a technical report independently through self learning mode.	12	2,3,5,8	-
CO-2	**Prepare** a technical report with a given specification and standards.	10	5	-
CO-3	**Present** effectively the knowledge through verbal and written communication mode.	10	5	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	2.0	2.0	-	2.0	-	-	2.0	-	3.0	-	3.0	-	-	-	-

Course Guidelines:

Students are expected to pick a research oriented activities or study of subjects outside current Body-of-Knowledge of Computer Science & Engineering at SDMCET. Prior to registration, a detailed plan of work should be submitted by the student to the

committee appointed by DUGC for approval. The various rules to be followed are listed below:

1. This course is offered at 7th semester. Student from 5th and 6th semester can also register only if their CGPA is 9 and above. Duration may be spread across two semesters. But, physically this course will be reflected in the 8th semester scheme and grade sheet.
2. Guide for this course is must and will be chosen by students by interacting with faculty.
3. In consultation with Guide, Students will prepare the courses description and its outcomes, which he/she promises to accomplish and is to be finally approved by DUGC.
4. Grading is done by the Guide based on the seminar and the report submitted by the students; which are to be in line with the policy established by DUGC's Grade Committee from time to time. Other assessment tool may include demonstration, seminar, quiz, tests, Viva-Voce, publications etc. as the case is. If the Guide wishes, they can form their own examination body for evaluation with the approval of the committee on the behalf of DUGC.
5. Work worth of minimum of 26-30 Hrs spread across 10 to 12 weeks starting from the date of registration is to be ensured by the Guide.
6. Course content should belong to the Body-of-Knowledge (As per ACM, 2008 or its extensions).

Department of CSE will encourage the students to publish a paper in a reputed journal/conference or get certification through the use of well recognized MOOCS like NPTEL, Coursera, Swayam. Udacity etc…for their self-study and demonstrate highest level of ethics and professional practices.

18UCSL802	Major Project Phase – 2	(0-0-14) 7

Contact Hours: 78

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

Understand the domain through proper modeling and analysis using the state-of-art technology. Then apply relevant Software Engineering Principles to develop modular and robust applications through the use of Standards and tools. At the end build appropriate test cases, verification and validation techniques in order to make the project reliable and maintainable.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the problem and **formulate** the problem statement.	1, 8, 2,12	-	-
CO-2	**Analyze** the problem scenario and **Design** the solutions to complex engineering problem using software engineering principles or appropriate research methodology.	3,5, 8, 13,12	11, 16	6, 7
CO-3	**Identify** and **Implement** a feasible solution using appropriate technology, tools, procedures and techniques.	4,5, 8, 14,12	16	-
CO-4	**Verify** and **Validate** the proposed system for correctness and to demonstrate compliance with the design and hence the stated requirements/ research gap.	5, 8, 15,12	-	-
CO-5	**Prepare** the report and **communicate** effectively through presentation.	8, 9,10	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	3.0	3.0	3.0	3.0	3.0	1.0	1.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0

For details, refer the contents related to **Major Project – Phase 1** (**18UCSL703**).

CIE and SEE Evaluation (from 2023-24 batch)

Courses with LTP 3-0-0 and 4-0-0:

Continuous Internal Evaluation (CIE):

- Two Internal Assessments and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course each of 5marks. Total CTA marks-10
- CIE=40 (from tests)+10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.

- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.