Program: Bachelor of Engineering		
Course Title: **Data Structures and Algorithms**		Course Code: **17ECSC204**
L-T-P: **4-1-0**	Credits: **5**	Contact Hrs: **5 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **62 hrs**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction to Data Structures and Algorithm Analysis** Primitive Data structures in C, Custom Data Types, Arrays, Recursive Definitions, Recursive Functions, Towers of Hanoi, Backtracking, Recursion Vs. Iteration, Model, Running Time Calculations, Space and Time Complexities, Order of an Algorithm	**10 hrs**
2	**Lists, Stacks, Queues** Abstract Data Types, Lists, Stacks, Queues, Applications	**10 hrs**
3	**Hashing** General Idea, Hash Function, Collision Resolution Techniques, Applications in Number Theory	**05 hrs**
Unit –II		
4	**Trees** Introduction to graphs, Trees, Binary Search trees, AVL Trees, Tree Traversals, Applications	**08 hrs**
5	**Sorting** Sorting, Bubble sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort.	**08 hrs**
6	**Graphs and Graph Algorithms** Graphs, Topological sort, Shortest Path Algorithms, Minimum Spanning Tree	**09 hrs**
Unit –III		
7	**Graph Algorithms Continued** Greedy algorithms, DFS, BFS, Application of Graph algorithms	**06 hrs**
8	**File Structures and Storage Management** Files, Random and Direct access, Storage Management with Fixed and Variable Blocks	**06 hrs**

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2010

Reference Books:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", 1st Edition, Addison Wesley Publication, 1983.
1. Aron M. Tenenbaum, et. al, "Data Structures using C", PHI, 2006.
2. Levitin A., "Introduction to the Design and Analysis of Algorithms", 2nd Edition, Pearson

Education, 2008.

Scheme for Semester End Examination (SEE)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2** out of **3**
III	Q.No.-7	7	Solve Any **1** out of **2**
	Q.No.-8	8	

KLE TECH.	Department of Computer Science & Engineering

Program: Bachelor of Engineering		
Course Title: **Engineering Design Practice [Part B]** **[Part A – Central Level]**		Course Code: **17ECSP202**
L-T-P: **0-0-1.5**	Credits: **1.5**	Contact Hrs: **3 hrs/week**
ISA Marks: **40**	ESA Marks: **0**	Total Marks: **40**
Teaching Hrs: **39 hrs**	Exam Duration: **3 hrs**	

Experiments	Lab assignments/experiment
Phase 1 (Plannig)	Introduction to Eclipse –IDE Requirement modeling : • Identifying use cases and actors • Apply UML notations to draw use case diagram
Phase 2 (Conceptual Design)	Behaviour Modeling using DFD • List behavior of system/sub-system • List states, tasks and their dependencies Illustrate DFD : • Identify data flow and processes of a system • Draw data flow diagrams for system/sub-system • Draw system diagram to show interaction of all domain components (Draw state and sequence diagram for identified tasks)
Phase 3(System Design)	Software Architectures: • List components of architecture • List type of architectures Choose appropriate architecture for given system
Phase 4 (Detail Design)	UI Design using GUI wireframe: • Design function prototyping for event diagrams(DFD) • Identify user interface components • Choose appropriate property of component • Use wireframe to design a user interface

Text books:

1. Ian Somerville, Software Engineering, 9th, Pearson Ed, 2015
2. Clive L Dym and Patrick Little, "Engineering Design: A Project Based Introduction", John Wiley & Sons

Reference books:

1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 7th, McGraw, 2007
2. Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering Theory and Practice, 3rd, Pearson Ed, 2006
3. Jalote, P, An Integrated Approach to Software Engineering, 3rd, Narosa Pub, 2005

Program: **Bachelor of Engineering**		
Course Title: **Data Structure and Algorithms Lab**		Course Code: **17ECSP201**
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **4 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs:**56 hrs**	Exam Duration: **3 Hrs**	

Tentative plan of lab implementation

Week No	Lab Assignments
1	03 Programming Assignments on C language Features
2	
3	
4	01 Assignment on List and Stack
5	01 Assignment on List and Queue
6	02 Assignments on Applications of List
7	
8	01 Assignment on Trees
9	01 Assignment on Introduction to Algorithms
10	01 Assignment on Sorting technique and efficiency analysis
11	03 Assignments on Search or Graph algorithms
12	
13	
14	Open Ended Experiment

Program: **Bachelor of Engineering**		
Course Title: **Data Structure and Algorithms Lab**		Course Code: **17ECSP201**
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **4 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs:**56 hrs**	Exam Duration: **3 Hrs**	

Tentative plan of lab implementation

Week No	**Lab Assignments**
1	03 Programming Assignments on C language Features
2	
3	
4	01 Assignment on List and Stack
5	01 Assignment on List and Queue
6	02 Assignments on Applications of List
7	
8	01 Assignment on Trees
9	01 Assignment on Introduction to Algorithms
10	01 Assignment on Sorting technique and efficiency analysis
11	03 Assignments on Search or Graph algorithms
12	
13	
14	Open Ended Experiment

KLE TECH.	Department of Computer Science & Engineering

Program: Bachelor of Engineering		
Course Title: **Engineering Design Practice [Part B]** **[Part A – Central Level]**		Course Code: **17ECSP202**
L-T-P: **0-0-1.5**	Credits: **1.5**	Contact Hrs: **3 hrs/week**
ISA Marks: **40**	ESA Marks: **0**	Total Marks: **40**
Teaching Hrs: **39 hrs**	Exam Duration: **3 hrs**	

Experiments	Lab assignments/experiment
Phase 1 (Plannig)	Introduction to Eclipse –IDE Requirement modeling : • Identifying use cases and actors • Apply UML notations to draw use case diagram
Phase 2 (Conceptual Design)	Behaviour Modeling using DFD • List behavior of system/sub-system • List states, tasks and their dependencies Illustrate DFD : • Identify data flow and processes of a system • Draw data flow diagrams for system/sub-system • Draw system diagram to show interaction of all domain components (Draw state and sequence diagram for identified tasks)
Phase 3(System Design)	Software Architectures: • List components of architecture • List type of architectures Choose appropriate architecture for given system
Phase 4 (Detail Design)	UI Design using GUI wireframe: • Design function prototyping for event diagrams(DFD) • Identify user interface components • Choose appropriate property of component • Use wireframe to design a user interface

Text books:

3. Ian Somerville, Software Engineering, 9th, Pearson Ed, 2015
4. Clive L Dym and Patrick Little, "Engineering Design: A Project Based Introduction", John Wiley & Sons

Reference books:

4. Roger S. Pressman, Software Engineering: A Practitioners Approach, 7th, McGraw, 2007
5. Shari Lawrence Pfleeger and Joanne M. Atlee, Software Engineering Theory and Practice, 3rd, Pearson Ed, 2006
6. Jalote, P, An Integrated Approach to Software Engineering, 3rd, Narosa Pub, 2005

Program: Bachelor of Engineering		
Course Title: **Data Mining & Analysis**		Course Code: **18ECSC301**
L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **5 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3hrs**	

Unit –I		
1	**Data Pre-Preprocessing** Introduction to data mining, Data Warehouse and OLAP Technology for Data mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Major tasks in data preprocessing- data reduction, data transformation and data Discretization, data cleaning and data integration.	**08 hrs**
2	**Frequent Pattern Mining** Frequent item sets and association rules; Item set mining algorithms; Generating association rules; Summarizing item sets: maximal and closed frequent item sets; Interesting patterns: pattern evaluation methods;	**08 hrs**
Unit –II		
3	**Classification Techniques** Probabilistic classification: naïve Bayes classifier, K-nearest neighbours; Decision tree classifier: decision tree induction, tree pruning; Model evaluation and selection: metrics, cross validation, random sampling, ROC curves;	**08 hrs**
4	**Cluster Analysis** Cluster Analysis- Partitioning methods, Hierarchical Methods, Density based methods, Outlier Detection.	**08 hrs**
Unit –III		
5	**Advanced Mining Techniques** Popular data pre-processing techniques: One hot encoding, stacking; Techniques to improve classification accuracy: ensemble methods, random forests, XGBoosting; Bias-variance trade-off; Post processing: Visualization and Interpretation;	**08 hrs**

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd edition, Morgan Kaufmann, 2012.

Reference Books:

1. Ian H. Witten, Eibe Frank, Mark A. Hall and Christopher J. Pal, Data Mining:

Practical Machine Learning Tools and Techniques, Morgan Kaufmann; 4th edition, 2016.

2. Pang-Ning, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson, International edition, 2013.
3. Mohammed J. Zaki and Wagner Meira, Jr., Data Mining and Analysis: Fundamental Concepts and Algorithms, Cambridge University Press, 2014.
4. M. H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education, 1st edition, 2006.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **3** out of **4**
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4,5	Solve Any **3** out of **4**
III	Lab exam	6	Lab exam evaluation

Program: **Bachelor of Engineering**		
Course Title: **Embedded Intelligent Systems**		Course Code: **18ECSE302**
L-T-P: 0-0-3	Credits: 3	Contact Hrs: **6hrs/week**
ISA Marks: 80	ESA Marks: 20	Total Marks: 100
Teaching Hrs: 60	Exam Duration: 3 hrs	

1	**Basics of embedded systems** Linux Application Programming, System V IPC, . Linux Kernel Internals and Architecture , Kernel Core , Linux Device Driver Programming, Interrupts & Timers , Sample shell script, application program, driver source build and execute	**10 hrs**
2	**Heterogeneous computing** Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b.GPU programming (OpenCL) c. Open standards for heterogeneous computing (Openvx) , Basic OpenCL examples - Coding, compilation and execution	**12 hrs**
3	**ML Frameworks lab with the target device** Caffe, tensorflow, TF Lite machine learning frameworks & architecture ,Model parsing, feature support and flexibility ,Supported layers , advantages and disadvantages with each of these frameworks, Android NN architecture overview , Full stack compilation and execution on embedded device	**16 hrs**
4	**Model Development and Optimization** Significance of on device AI ,Quantization , pruning, weight sharing, Distillation ,Various pre-trained networks and design considerations to choose a particular pre-trained model ,Federated Learning , Flexible Inferencing	**8 hrs**
6	**Android Anatomy** Android Architecture ,Linux Kernel , Binder , HAL Native Libraries , Android Runtime, Dalvik Application framework , Applications, IPC	**8 hrs**

Program: **Bachelor of Engineering**		
Course Title: **Algorithmic Problem Solving**		Course Code: **17ECSE309**
L-T-P: **0-0-6**	Credits: **6**	Contact Hrs: 74
ISA Marks: **70**	ESA Marks: 30	Total Marks: **100**
Teaching Hrs: 74	Exam Duration: 2 to 3 days	

Course Content

Unit – 1	
Chapter 0: Building Blocks Understanding coding platforms and tools, Data Structures and Algorithms revisited	**06 hrs**
Chapter 1: Strategies and Performance Warm up problems, Parsing and Formatting text, Code performance analysis and tools	**06 hrs**
Chapter 2: Advanced Data Structures Matrix, Grids, Trees and variants, Lists, Skip lists, Hash, Trie and variants	**10 hrs**
Chapter 3: Dynamic Programming Memory functions, Optimization problems	**08 hrs**
Unit – 2	
Chapter 4: Graph algorithms Traversal Algorithms, Shortest Path Algorithms, Spanning Tree Algorithms and variants	**25 hrs**
Chapter 5: Introduction to Computational Geometry Points, Line Segments, Polygons and Basics of Geometric Problems	**05 hrs**
Unit – 3	
Chapter 6: Problem Solving Assortment of problems and techniques.	**14 hrs**

Text Book

1. Levitin A., "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2017.
2. Levitin A, Levitin M, "Algorithmic Puzzles", First Edition, Oxford University Press, 2011.
3. Online Coding Platforms

References

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2010.

KLE TECH.	Department of Computer Science & Engineering

Program: **Bachelor of Engineering**		
Course Title: **Natural Language Processing**		Course Code: **18ECSE403**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **04 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

	Unit –I	
1	**Introduction to NLP and Deep Learning** Introduction to Natural Language Processing, Applications of Natural Language Processing, Word2vec introduction, Word2vec objective function gradients	**05 hrs**
2	**Dependency Parsing, Recurrent Neural Networks** Dependency Grammar , Neural dependency parsing, Recurrent Neural Networks and Language Models, Vanishing Gradients, Fancy RNNs	**07 hrs**
	Unit –II	
3	**Machine Translation, Seq2Seq and Attention** Machine Translation, Seq2Seq and Attention, Advanced Attention	**06 hrs**
4	**Transformer Networks , Coreference Resolution, Memory Networks** Transformer Networks and CNNs, Tree Recursive Neural Networks and Constituency Parsing , Advanced Architectures and Memory Networks	**06 hrs**
	Unit –III	
5	**Reinforcement Learning** Reinforcement Learning for NLP, Semi-supervised Learning for NLP, Future of NLP Models, Multi-task Learning and QA Systems	**06 hrs**

Text Books:

1. Yoav Goldberg. A Primer on Neural Network Models for Natural Language Processing , 2016.

Reference Books:

Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft).

Ian Goodfellow, YoshuaBengio, and Aaron Courville. *Deep Learning*. MIT Press.

Scheme for End Semester Assessment(ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5	Solve Any **2** out of **3**
III	Q.No.-7	6	Solve Any **1** out of **2**
	Q.No.-8		

KLE TECH.	Department of Computer Science & Engineering

Program: **Bachelor of Engineering**		
Course Title: **Fuzzy Set Theory**		Course Code: **19ECSE402**
L-T-P: **3-0-0**	Credits: 3	Contact Hrs: 3**hrs/week**
ISA Marks: 50	ESA Marks: 50	Total Marks:100
Teaching Hrs: 40	Exam Duration: 3hrs	

Unit –I		
1	**Introduction** : Introduction to Fuzzy Logic, Fuzzy Membership Functions, Operations on Fuzzy Sets	8hrs
2	**Fuzzy Measures:** Fuzzy Relations,Fuzzy Proposition,Fuzzy Implications,Fuzzy Inferences	8hrs
Unit –II		
3	**Fuzzy Relations and Fuzzy Graphs**: Fuzzy Relations, Compositions of Fuzzy Relations, Properties of the Min-Max Composition, DefuzzificatinTechniques,Lambda-cut method, Weighted average method, Maxima methods, Centroid methods, Output of a Fuzzy System	8 hrs
4	**Uncertainty Modeling:** Application-oriented Modeling of Uncertainty, Causes of Uncertainty, Uncertainty Methods, Possibility Theory	8hrs
Unit –III		
5	**Fuzzy Data Bases and Queries:** Introduction, Fuzzy Relational Databases, Fuzzy Queries in Crisp Databases	4 hrs
6	**Fuzzy Sets and Expert Systems:** Introduction to Expert Systems, Uncertainty Modeling in Expert Systems, Applications	4 hrs

Text Books:

1. H. J. Zimmermann ., Fuzzy Set Theory-and Its Applications, Fourth Edition, 4th Ed., Springer Science Business Media, LLC , 2001
2. Chander Mohan, An Introduction to Fuzzy Set Theory and Fuzzy Logic,2nd ed. Vivo Books pvt ltd , 2015

Reference Books:

1. Timothy J. Ross, Fuzzy Logic With Engineering Applications, 3ed., 2010, A John Wiley and Sons, Ltd., Publication
2. Kumar S. Ray,Soft Computing and Its Applications: Fuzzy Reasoning and Fuzzy Control, 1st Edition, Apple Academic Press 2014
3. Ahmed M. Ibrahim, Fuzzy Logic for Embedded Systems Applications, Elesvier Press, 2004.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**

III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

Program: Bachelor of Engineering		
Course Title: **Wireless Ad Hoc and Sensor Networks**		Course Code: **18ECSE406**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3hrs/week**
CIE Marks: **50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40 hrs**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction:** Fundamentals of wireless communication technology, Characteristics of wireless channel, Multiple Access Techniques, IEEE802.11 Standards, Bluetooth, Cellular Concept, Cellular Architecture.	**07 hrs**
2	**Ad hoc Networks:** Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.	**04 hrs**
3	**MAC Protocols:** Introduction, Issues in Designing MAC protocol, Design goals, Classification, Contention Based Protocols with Reservation Mechanisms. Contention-Based MAC Protocols with Scheduling Mechanism.	**05 hrs**
Unit –II		
4	**Routing Protocols:** Introduction, Issues in designing a routing protocol, classification, Table drive routing protocol, On-demand routing protocol, Hybrid routing protocol, Hierarchical routing protocols, Power aware routing protocols.	**06 hrs**
5	**Energy Management:** Introduction, Need for Energy Management, Classification, Battery Management Scheme, Transmission Power Management Schemes, System Management Scheme.	**05 hrs**
6	**Sensor Networks:** Introduction, Architecture, Data Dissemination, Data Gathering, MAC Protocols (schedule based protocols).	**05 hrs**
Unit –III		
7	**Routing Protocols for Sensor Networks:** Routing Characteristics, Routing Strategies, LEACH, SPIN.	**04 hrs**
8	**Sensor Network Applications:** Case Study: Traffic Control, Health Care, Green House Monitoring.	**04 hrs**

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad hoc Wireless Networks",2nd Edition, Pearson Education, 2006.
2. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley and Sons, 2007.

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari, "Ad hoc Wireless Networks",John Wiley, 2006.
2. C.K. Toh, "Adhoc Mobile Wireless Networks",Protocols and Systems, Prentice-Hall PTR, 2002.

UNIT	**8 Questions to be set of 20 Marks Each**	**Chapter Numbers**	**Instructions**
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5,6	Solve Any **2** out of **3**
III	Q.No.-7	7	Solve Any **1** out of **2**
	Q.No.-8	8	

Program: **Bachelor of Engineering**		
Course Title: **Advanced Parallel Computing**		Course Code:**18ECSE408**
L-T-P:**3-0-0**	Credits: **3**	Contact Hrs: **03 hrs/week**
CIE Marks**: 50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

Unit –I		
1	**Introduction and History** GPUs as Parallel Computers; Architecture of a Modem GPU; Parallel Programming Languages and Models; Overarching Goals; Evolution of Graphics Pipelines; The Era of Fixed- Function ; Graphics Pipelines; Evolution of Programmable Real-Time Graphics; Unified Graphics and Computing Processors; GPGPU; An Intermediate Step; GPU Computing; Scalable GPUs Recent Developments; Future Trends.	**07 hrs**
2	**Introduction to CUDA** Data Parallelism; CUDA Program Structure; A Matrix-Matrix Multiplication Example; Device Memories and Data Transfer; Kernel Functions and Threading; Function declarations; Kernel launch; Predefined variables; Runtime API.CUDA Thread Organization; Using b1ock Id x and thread Id x ; Synchronization and Transparent Scalability; Thread Assignment ; Thread Scheduling and Latency Tolerance.	**09 hrs**
Unit –II		
3	**CUDA Memories** Importance of Memory Access Efficiency; CUDA Device Memory Types; A Strategy for Reducing Global Memory Traffic; Memory as a Limiting Factor to Parallelism; Global Memory Bandwidth; Dynamic Partitioning of SM Resources; Data Perfetching; Instruction Mix; Thread Granularity; Measured Performance.	**07 hrs**
4	**Introduction to OPENCL** Introduction to OPENCL; Background; Data Parallelism Model; Device Architecture; Kernel Functions; Device Management and Kernel Launch; Electrostatic Potential Map in OpenCL.	**09 hrs**
Unit –III		
5.	**Case Study** Concepts of Game Design, Applications like Matrix multiplication, MRI reconstruction Molecular Visualization and Gaming.	**04 hrs**
6.	**Parallel Programming and Computational Thinking** Goals of Parallel Programming, Problem Decomposition, Algorithm Selection, Computational Thinking.	**04 hrs**

Text Books:

2. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors: A Hands on Approach", Morgan Kaufmann/Elsevier India reprint, 2010.

Reference Books:

1. Benedict R Gaster, Lee Howes, David Kaeli, Perhaad Mistry and Dana Schaa, "Heterogeneous Computing with OpenCl", Morgan Kaufmann/Elsevier reprint, 2012.

Scheme for End Semester Assessment(ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	6	

Program: **Bachelor of Engineering**		
Course Title: **Software Architecture and Design Thinking**		Course Code:**18ECSE410**
L-T-P:**3-0-0**	Credits: **3**	Contact Hrs: 3**hrs/week**
CIE Marks**: 50**	SEE Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

Unit –I		
1	**Chapter No. 1 What Is Software Architecture?** What Software Architecture Is and What It Isn't ,Architectural Structures and Views, Architectural Patterns, What Makes a "Good" Architecture?	**5 hrs**
2	**Chapter No. 2 Why Is Software Architecture Important?** Inhibiting or Enabling a System's Quality Attributes, Reasoning About and Managing Change, Predicting System Qualities, Enhancing Communication among Stakeholders, Carrying Early Design Decisions, Defining Constraints on an Implementation, Influencing the Organizational Structure, Enabling Evolutionary Prototyping, Improving Cost and Schedule Estimates, Supplying a Transferable, Reusable Model, Allowing Incorporation of Independently Developed Components, Restricting the Vocabulary of Design Alternatives, Providing a Basis for Training	**6hrs**
3	**Chapter No. 3 The Many Contexts of Software Architecture** Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, How Is Architecture Influenced?,What Do Architectures Influence?	**5 hrs**
Unit –II		
4	**Chapter No. 4. Understanding Quality Attributes** Architecture and Requirements, Functionality, Quality Attribute Considerations, Specifying Quality Attribute Requirements, Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions	**5 hrs**
5	**Chapter No. 5. Quality Attributes** Tactics for Availability, Tactics for Interoperability, Tactics for Modifiability, Tactics for Performance, Tactics for Security, Tactics for Testability, Tactics for Usability,	**6hrs**
6	**Chapter No. 6. Architectural Tactics and Patterns** Architectural Patterns, Overview of the Patterns Catalog, Relationships between Tactics and Patterns, Using Tactics Together	**5 hrs**
Unit –III		
5.	**Chapter No. 7 Architecture and Requirements** Gathering ASRs from Requirements Documents, Gathering ASRs by Interviewing Stakeholders, Gathering ASRs by Understanding the Business Goals, Capturing ASRs in a Utility Tree, Tying the Methods Together	**4 hrs**
6.	**Chapter No. 8 Designing an Architecture, Implementation, Testing and EvaluationDesigning:**	**4 hrs**

	Design Strategy, The Attribute-Driven Design Method, The Steps of ADD, Implementation, and Testing:Architecture and Implementation, Architecture and Testing, Evaluation:Evaluation Factors, The Architecture Tradeoff Analysis Method, Lightweight Architecture Evaluation	

Text Books:

1. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice (3rd Edition), Addison-Wesley Professional; 3 edition

Reference Books:

Scheme for End Semester Assessment(ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	6	

KLE TECH.	Department of Computer Science & Engineering

Course Title: **Model Thinking**	Course Code: **18ECSE411**	
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **30**
CIA Marks: **50**	SEE Marks: 50	Total Marks: **100**
Teaching Hrs: **40**		Exam Duration: **3 hrs**

Content	40 Hrs
Unit – 1	
1. **Why Model** Model Thinking - The need, Advantages and disadvantages, Segregation/Peer Effects, Case study	4 hrs
2.**Modeling People, Tipping Points & Economic Growth** Rational models, Behavioral models, Rule based models, Percolation Models, Growth and its kinds	6 hrs
3. **Special Topics** Standing ovation model, Game of Life, Lyapunov Functions: Equilibrium, A cycle, Randomness or complexity, Coordination and culture. Urn models, Polya process, paths and networks, Prisoners' Dilemma, Collective Action & Mechanism Design	6 hrs
Unit – 2	
4. **Randomness and Learning Models** Luck as randomness, Random Walks & Colonel Blotto, Replicator Dynamics, Fisher's fundamental theorem, Prediction and the Many Model Thinker	8 hrs
5**. Model Checking and Modelling Concurrent Systems** Model Checking, Characteristics of Model Checking, Transition Systems, Parallelism and Communication, The State Space Explosion	8 hrs
Unit – 3	
6**. Linear-Time Properties** Linear-Time behavior, Safety Properties and Invariants, Liveness Properties, Fairness	4 hrs
7. **Regular Properties** Automata on Finite Words, Model-Checking Regular Safety Properties, Automata on Infinite Words, Model Checking with omega-regular properties	4 hrs

Text Books

1. Scott E Page, The Model Thinker, Basic Books Publication, 2018
2. ChristelBaier and Joost-Pieter Katoen, Principles of Model Checking (Representation and Mind Series), The MIT Press, 2008

References

1. Model Thinking Coursera online course from Michigan University.

KLE TECH.	Department of Computer Science & Engineering

Program: **Bachelor of Engineering**		
Course Title **Scripting Languages Lab**		Course Code: **18ECSP201**
L-T-P: **0-0-2**	Credits: **2**	Contact Hrs: **4hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

1	**Introduction to UNIX Utilities** Architecture, Commands, File Attributes, vi Editor, Process, Simple Filter, File System, Handling Files and Basic File Attributes.	**06hrs**
2	**UNIX shell Scripting** Shell Basics, Shell Environment, Shell Script Programming Concepts, Decision Structures, Looping Structures, and Command line arguments, Functions and Arrays, Regular Expression & Filters, Processes.	**06hrs**
3	**Python Scripting** Python: Types, Variables, and Simple I/O, Branching and Looping, String Manipulation,Numbers, Lists and Dictionaries, Regular Expressions, Functions, Files and Exceptions, Programming using numpy and scipy libraries.	**12hrs**
4	**System Administration** Common administrative tasks, creating and mounting file system, File system management, managing users and group accounts, monitoring system performance, accessing system information, backup and restore files, reconfiguration hardware with kudzu, installing and removing packages.	**06 hrs**

Tentative plan of lab implementation

Expt./ Job No.	Lab assignments/experiment	No. of Lab. Slots per batch (estimate)
1-2	Introduction to UNIX Utilities	02
3-4	Shell Script	03
5-10	Python programming	05
11-12	System Administration	02

Text Books

1. Sumitabha Das, UNIX Concepts and Applications", 4th Edition, McGraw-Hill, 2017.
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly, 2010.

Reference Books

1. Noah Gift, Jeremy Jones, Python for Unix and Linux System Administration, 2008.
2. RytisSileikam, Pro Python System Administration, 2nd Edition, 2014
3. Michael Dawson, Python Programing for the Absolute Beginner, Premier Press, 3rd Edition 2010.

KLE TECH.	Department of Computer Science & Engineering

Program: Bachelor of Engineering		
Course Title: **Computer Organization and Architecture**		Course Code: **18ECSC201**
L-T-P: **4-0-0**	Credits: **4**	Contact Hrs: **04 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **50**	Exam Duration: **3hrs**	

	Unit –I	
1	**Fundamentals of Digital Logic** Combinational Circuits: Adders, Mux, De-Mux, Sequential Circuits : Flip-Flops (SR, JK & D), Counters : Synchronous and Asynchronous Counter, Addition and Subtraction of Signed Numbers. Design of Fast Adders. Multiplication of Signed and Unsigned Numbers. Fast Multiplication. Integer Division. Floating-Point Numbers and Operations	**12hrs**
2	**Computer System** Basic operational concepts. Bus structures. Fundamental concepts: Instruction Execution, Hardware Components Control Signals. Hardwired Control CISC-Style Processors. Accessing i/o devices. Interrupts. Bus Structure/Operation, Arbitration.	**08hrs**
	Unit –II	
4	**The Memory System** Basic Concepts. Semiconductor RAM Memories. Read-only Memories. Direct Memory Access. Memory Hierarchy. Cache Memories. Virtual Memory.	**08 hrs**
5	**Architecture** The State of Computing, Elements of Modern Computers, Evolution of computing Architecture, System Attributes to Performance. Multiprocessors and Multi computer: Shared-Memory Multiprocessor, Distributed-Memory Multicomputer. Multi vector and SIMD computers: Vector Supercomputers, SIMD Supercomputers, CISC Scalar Processor, RISC Scalar Processor, SPARC processor, Superscalar and Vector Processor, VLIW Architecture.	**12 hrs**
	Unit –III	
7	**Introduction to Pipelining** Basic Concepts. Pipeline Organization. Pipelining Issues: Data Dependencies, Memory Delays, And Branch Delays: Unconditional branches and Resource Limitations.	**05 hrs**
8	**Advanced features in Pipelining** Performance Evaluation: Effects of stalls and penalties, Number of pipeline stages. Superscalar Operation: Branch and data dependency, out-of- order execution , execution completion, dispatch operation,	**05 hrs**

Text Books:

1. Donald D. Givone "Digital Principles and Design" Tata McGraw Hill edition 2003.
2. Hamacher C., Vranesic Z., and Zaky S., Computer Organization, 5ed., McGraw Hill,2002
3. Kai Hwang .Advanced Computer Architecture, McGraw Hill, 2001

Reference Books:

1. John P. Hayes. Computer Architecture and Organization,3rd Edition, McGraw Hill
2. V Rajaraman, C Murthy. Parallel Computers Architecture and programming, PHI 2000.
3. M. Morris Mano and C. R. Kime "Logic and Computer Design Fundamentals" 2nd Edition, Updated Publishers Pearson Education 2005.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, "Digital Systems Principles and Applications" 10th Edition, PHI/Pearson Education, 2007.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3, 4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	6	

KLE TECH.	Department of Computer Science & Engineering

Program: Bachelor of Engineering		
Course Title: Object Oriented Programming with C++		Course Code: 18ECSC207
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3hrs**	

Unit –I		
1	**Chapter No. 1: Introduction:** Introduction to object oriented programming. Characteristics of object oriented languages, Programming Basics, arrays, Functions in C++ (parameter passing techniques.)	**4 hrs**
2	**Chapter No. 2:Classes and Objects:** Introduction to Classes and Objects, encapsulation visibility modifiers, constructor and its types, nested classes, String class. UML diagrams to describe classes and relationships.	**6 hrs**
3	**Chapter No. 3:Inheritance:** Introduction, types of Inheritance, constructors, Abstract class,Aggregation: classes within classes	**6 hrs**
Unit –II		
4	**Chapter No. 4:Virtual Functions and Polymorphism:** Virtual functions, Friend functions, static functions, The 'this' pointer	**6 hrs**
5	**Chapter No. 5:Templates and Exception Handling:** Function and class templates.Introduction to exceptions, Throwing an Exception, Try Block, Exception Handler (Catching an Exception), Multiple exceptions. Exceptions with arguments	**6hrs**
6	**Chapter No. 6:Design Patterns:** Creational, Structural and Behavioural design patterns.	**4 hrs**
Unit –III		
7	**Chapter No. 7:Streams and Files:** Stream classes, File I/O with streams.	**4 hrs**
8	**Chapter No. 8:Standard Template Library:** container classes**:** Sequence and Associative Containers	**4 hrs**

Textbooks

1. Robert Lafore, "Object oriented programming in C++", 4th Edition, Pearson education,

Reference Books

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill

Program: Bachelor of Engineering		
Course Title: **Operating System Principles and Programming**		Course Code: **18ECSC202**
L-T-P: **4-0-1**	Credits: **5**	Contact Hrs: 4+2**hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **74**	Exam Duration: **3 hrs**	

Unit –I		
1	**Chapter No. 1. Introduction and Systems structures** Operating system definition; Operating System operations; Modules of OS **,**Overview of UNIX Operating System,UNIX APIs	04 hrs + 02 hrs (lab)
2	**Chapter No. 2. Process Management** Process concept; Process scheduling; Operations on processes; Inter-process communication (Pipes and FIFOs). Threads, Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms. Process management using UNIX APIs**:** Process Management Functions, User IDs and Group IDs, Creating process, parent child relationship.	10 hrs + 08 hrs (lab)
3	**Chapter No. 3. Process Synchronization** Synchronization: The Critical section problem; Peterson's solution; Semaphores, Classical problems of synchronization, Process synchronization UNIX APIs.	06 hrs + 02 hrs (lab)
Unit –II		
4	**Chapter No. 4. Deadlocks** Deadlocks: System model; Deadlock characterization; Methods	06 hrs + 02

	for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	hrs (lab)
5	**Chapter 5 : File management** File concepts, Directory structure, File Types , File systems , File Attributes, Inodes in UNIX , UNIX Kernel Support for Files, Directory Files, Hard and symbolic names. General File APIs: File and record lock API, Symbolic file API	07 hrs + 04 hrs (lab)
6	**Chapter No. 6. Memory Management** Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement.	07 hrs + 02 hrs (lab)
Unit –III		
7	**Chapter No. 7. Secondary Storage Management** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management.	5hrs
8	**Chapter No. 8. Case study** Architecture of Mobile OS - Introduction. .Overall Architecture, Linux Kernel, various components, Network OS, Applications.	5hrs

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 9th edition, Wiley-India, 2006.
2. W. Richard Stevens, Stephen A. Rago, “Advanced Programming in the UNIX Environment”, 3rd Edition, Addison Wesley Professional, 2013

References

1. William Stallings,"Operating System Internals and Design Principles", 5th edition, Pearson Education, Asia, 2005
2. Gary Nutt," Operating System"3rd edition, Pearson Education,2004
3. Terrence Chan, "Unix System Programming Using C++", 1 ed., Prentice Hall India, 2007
4. Marc J. Rochkind, "Advanced Unix Programming", 2nd Edition, Pearson Education, 2005.

Course Code: 18ECSC206	Course Title: Microcontroller Programming& Interfacing	
L-T-P-SS: 3-0-1	Credits: 4	Contact Hrs: 3+2 hrs
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 40		Exam Duration: 3 hrs

Content	Hrs
Unit – I	
Chapter No. 1.The 8051 Architecture Introduction, 8051 Microcontroller hardware, input/output pins, ports & circuits, External memory,	04 hrs
Chapter No. 2. Assembly Programming Introduction, addressing modes, External Data Moves, Code Memory Read Only Data Moves / Indexed Addressing mode, PUSH and POP opcodes, Data exchanges, assembler directives, example programs. Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Example Programs. The JUMP and CALL Program range, Jumps, Call and Subroutines, Example programs	12hrs +08 hrs (Lab)
Unit – II	
Chapter No. 3. Timer/Counter & Serial Port Programming. C Data Types and Time delay computation in 8051 Counters and Timers, Programming 8051 Timers/counters in different modes, Basics of Serial Communication, RS232 standards, 8051 connection to RS232, 8051 serial port Programming.	12 hrs
Chapter No. 4. Interrupts Programming 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, Interrupt programming.	04 hrs
	4 hrs
Unit – III	
Chapter No. 5. Interfacing to Peripheral Devices Interfacing 8051 to LEDs, DIP switches, BCD Decoder display, 7 Segment Display, LCD, Keypad, DAC, ADC, Stepper Motor and DC Motor	08hrs +12 Hrs (Lab)

Text Books (List of books as mentioned in the approved syllabus)

3. Ayala.K.J, "The 8051 Microcontroller", 3rd.,CENGAGELearning, 2007.
4. Mazidi.M.A, Mazidi.J.G and McKinlay.R.D, "The 8051 Microcontroller and Embedded Systems-using Assembly and C", 2ed, PHI 2006/Pearson, 2006.

References

1. Ayala.K.J., Gadre D.V., "The 8051 Microcontroller & Embedded Systems using Assembly and C", 1ed., CENGAGE Learning, 2010
2. V. Udayashankara, M.S. Mallikarajunaswamy, "8051 Microcontroller Hardware, Software and Applications", 1ed., Tata McGraw Hill, 2009.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1 & 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3 &4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	5	

	Q.No.-8	5	

Program: Bachelor of Engineering		
Course Title: **Object Oriented Programming with C++ Lab**		Course Code: **18ECSP203**
L-T-P: **0-0-1.5**	Credits: **1.5**	Contact Hrs: **3 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **39**	Exam Duration: **3hrs**	

UNIT	**8 Questions to be set of 20 Marks Each**	**Chapter Numbers**	**Instructions**
I	Q.No.-1, Q.No.-2, Q.No.-3	1 & 2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3 &4	Solve Any **2** out of **3**
III	Q.No.-7	5	Solve Any **1** out of **2**
	Q.No.-8	5	

Program: Bachelor of Engineering		
Course Title: **Object Oriented Programming with C++ Lab**		Course Code: **18ECSP203**
L-T-P: **0-0-1.5**	Credits: **1.5**	Contact Hrs: **3 hrs/week**
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**
Teaching Hrs: **39**	Exam Duration: **3hrs**	

Experiments	**Lab assignments/experiment**
2-Demonstration	Introduction to Code Blocks IDE (Integrated Development Environment), C++ programming basics.
4–Exercise	Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling
2-Structured Enquiry	Classes and objects, Inheritance, Polymorphism, Templates and Exceptions Handling
1-Open Ended	Data types, Classes and Objects, Inheritance polymorphism, Exception Handling. Design patterns

Text Book:

1. Robert Lafore, "Object oriented programming in C++", 4th Edition, Pearson education.

Reference Books:

1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill

1.

Evaluation :

Students Assessment Through CIE (80%) + SEE (20%)

	Assessment	Weightage in Marks
Continuous Internal Evaluation (80%)	Exercises	40
	Structured Enquiry	20
	Open Ended Experiment	20
Semester End Examination (20%)	Structured Enquiry	**20**
	Total	**100**

KLE TECH.	Department of Computer Science & Engineering

Program: **Bachelor of Engineering**		
Course Title: **Computer Networks - I**		Course Code: **19ECSC302**
L-T-P: **3-1-0**	Credits: **4**	Contact Hrs: 5**hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs.**	

	Unit –I	
1	**Introduction** Internet, The Network Edge and Core, Protocol Layer and Service Models: OSI and TCP/IP, Networks Attacks, History of Computer Network and Internet.	8 hrs
2	**Application Layer** Principles of Network Applications , HTTP , SMTP, DNS,DHCP	8 hrs
	Unit –II	
3	**Transport-Layer Services** Introduction, Connectionless Transport, Principles of Reliable Data Transfer Protocol, Connection-Oriented and Connectionless Transport, Principle of Congestion Control, TCP Congestion Control.	8 hrs
4	**Network Layer: Data plane** Introduction to Data and Control Plane, Virtual Circuit and Datagram Networks, Internet Protocol: Datagram Format, Fragmentation, IP Addressing	8 hrs
	Unit –III	
5	**Network Layer: Data plane** NAT, IPv6, Software Defined Network(SDN)	4 hrs
6	**Network Layer: Control Plane and Network Management** SDN Control Plane, Network Management and SNMP	4 hrs

Text Books

1. J. F. Kurose, K. W. Ross, Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education, 2017.

Reference Books:

1. Peterson, Larry L, Computer networks : A Systems Approach, 5th Edition, The Morgan Kaufmann series in networking, 2012
2. Behrouz A. Forouzan , TCP/IP protocol suite, 4th , McGraw Hill, 2010.

Computer Networks-I Tutorial

Sl. No	Exercise	No of Slots (2 hrs)
1	Demonstration of n/w commands and tools.	2
2	Demonstration of socket programming- Connection oriented/Connectionless.	2
3	Application layer protocol implementation - FTP, Mail server, HTTP.	3
4	Demonstration of NS3 / Qualnet tools.	1
5	Performance analysis of TCP, UDP and SCTP.	1
6	Exercise on congestion control techniques.	1

7	Exercise on flow control techniques.	1
8	Design of network topology with IP addressing scheme.	2

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

Program: Bachelor of Engineering			
Course Title: **JAVA Programming**		Course Code: 19ECSP301	
L-T-P:**1-0-1.5**	Credits: **2.5**	Contact Hrs: 4 Hrs/week	
ISA Marks: **80**	ESA Marks: **20**	Total Marks: **100**	
Teaching Hrs: **52**	Exam Duration: **3hrs**		
Unit –I			
1	**JAVA Language Fundamentals:** Java Features, Programming basics, Arrays and Strings, classes and objects		**4 Hrs**
2	**Inheritance**: Introduction, types of inheritance, static and dynamic polymorphism.		**2 Hrs**
Unit –II			
3	**Interfaces and Exception Handling:** Introduction,Create and implement interfaces, Exception handling,		**2 Hrs**
4	**Generics and Collections Frame work:** Introduction to generic programming, Collections: Interfaces: List, Set, Queue Classes: ArrayList, LinkedList and HashSet, Map		**2 Hrs**
Unit –III			
5	**Lambda Expressions:** Functional programming, Functional interface, Bulk operations on collections		**2hrs**
6	**Java Database Connectivity (JDBC):** Introduction, Drivers, Interfaces and classes to develop data base applications, case study		**2 Hrs**

Text Books:

1. JAVA The Complete Reference, Herbert Schildt, 10th Ed, 2017, McGraw-Hill

Reference Book

1. Kathy Sierra and Bert Bates, Head First Java: A Brain-Friendly Guide, 2nd Edition, O'Reilly Media
2. Introduction to Java Programming, Liang Y D, Pearson, 11th Edition

Program: **Bachelor of Engineering**		
Course Title: **Computer Networks-II**		Course Code: **19ECSC303**
L-T-P: **2-0-1.5**	Credits: **3.5**	Contact Hrs: **5hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **30**	Exam Duration: **3 hrs**	

	Unit –I	
1	**Network Layer** Address Mapping, Error Reporting, Multicasting: IGMP Group Management, IGMP Messages, Message Format, and IGMP Operation.	06hrs
2	**Network Layer- Routing** Delivery, Forwarding Techniques and Process, Routing Table, Unicast Routing Protocols, Intra and Inter-domain Routing, Distance Vector Routing, Link State Routing, Path Vector Routing, Routing protocols: Unicast, Multicast, and Broadcast Applications.	06hrs
	Unit –II	
3	**Data Link Layer** Error Detection and Correction, Forward Error Correction Versus Retransmission, Coding, Modular Arithmetic, Block coding: Error Detection, Error Correction, Hamming Distance, Minimum Hamming Distance, Cyclic Redundancy Check,Checksum, Framing.	06hrs
4	**Switched Local Area Networks** Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),Multiprotocol Label Switching (MPLS), Data Center Networking, Multiple Access: Aloha , Slotted Aloha, CSMA, CSMA/CD, CSMA/CA.	06hrs
	Unit –III	
5	**Wireless Networks** Wireless Links and Network Characteristics, 802.11 Wireless LANs, Architecture, MAC Protocol, Frame, Mobility, Personal Area Networks: Bluetooth and Zigbee.	03hrs
6	**Cellular Networks and Mobility Management** Cellular Networks and Internet Access, Mobility, Mobile IP, Managing Mobility in Cellular Network.	03hrs

Text Books

1. J. F. Kurose, K. W. Ross, Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education, 2017.
2. Behrouz A. Forouzan , TCP/IP protocol suite, 4th , McGraw Hill, 2010.

Reference Books:

1. Peterson, Larry L, Computer Networks: A Systems Approach, 5th Edition, The Morgan Kaufmann series in networking, 2012.
2. Dimitri P. Bertsekas and Robert G. Gallager, Data Networks (2nd Edition),PHI,2009.

List of Experiments

S.No	Experiments	Number of lab Slots (3 hrs)
1	Demonstration of SDN testbed.	1
2	Traffic measurement and traffic volume control using the POX controller.	1
3	Implementation of load balancing/routing technique.	1
4	Demonstration of Junos.	1
5	Configuration and analysis of VLAN.	1
6	Configuration and analysis of STP, MPLS and VPN.	1
7	Configuration and analysis of OSPF and BGP routing protocols.	2
8	Performance analysis of routing metrics.	1
9	Experimental analysis of the Handover Procedure in a WiFi Network.	1
10	Performance analysis of IEEE 802.11 MAC protocols.	1
11	Network application development using Mojo access points.	2

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

Program: **Bachelor of Engineering**		
Course Title: **Semantic Web**		Course Code:**19ECSE303**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **03 hrs**	

Unit –I		
1	**Introduction to Semantics** History of the Web, Limitations, Vision of Semantic Web, Principles, Data Integration Across Web, Data Modeling Methods, Semantic Relationships, Metadata, Perpetual Data	**4 hrs**
2	**Expressing Meaning** Triple Store, Merging Graphs, Querying: Case Study	**4 hrs**
3	**Using Semantic Data** Query Language, Feed Forward Inference, Searching for Connections, Linked Data, Freebase	**8 hrs**
Unit –II		
4	**Working with Semantics** RDF—The Basis of the Semantic Web, OWL, Metadata with RDF, Metadata Taxonomies, Ontology	**8 hrs**
5	**Reasoning and Social Web** Reasoning types: Approximate Reasoning and Bounded Reasoning, Social Semantic Web, Semantic Crawlers	**8 hrs**
Unit –III		
6	**Semantic Modeling** Semantic Modeling, Semantic Web Applications, Logic for Semantic Web, Case Studies: Dr. Watson, Yahoo! SearchMonkey	**8 hrs**

Text Books

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, A Semantic Web Primer, MIT Press; 3rd edition, 2012.
2. Toby Segaran, Colin Evans, and Jamie Taylor, Programming the Semantic Web: Build Flexible Applications with Graph Data, O'Reilly Media; 2 edition, July 2009.

Reference Books:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, Chapman and Hall; 1st edition, 2009.
2. Dean Allemang, and James Hendler, Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2nd edition, 2011.
3. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike Dean (Foreword), Semantic Web Programming, Wiley Publishers, 1 edition 2009.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions

I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	6	

Course Title: Block Chain Technology		Course ode:19ECSE301
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

	Unit –I	
1	**Introduction** Overview of Blockchain, History: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy	**08 hrs**
2	**Blockchain Architecture and Design** Crypto primitives- Hash, Signature, Hashchain to Blockchain, basic consensus mechanisms, Requirements for the consensus protocols, Proof of Work, Proof of State, Scalability issues of consensus protocols	**08 hrs**
	Unit –II	
3	**Blockchain Contracts** Financial Services, Crowdfunding, Bitcoin Prediction Markets, Smart Property, Smart Contracts, Blockchain Development Platforms and APIs, Blockchain Ecosystem: Decentralized Storage, Communication, and Computation	**08 hrs**
4	**Etherium** Etherium transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage, Etherium scaling	**08 hrs**
	Unit –III	
5	**Blockchain Applications** Blockchain in Financial Software and Systems: Settlements, KYC, InsuranceBlockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system social welfare systems	**08hrs**

Text Books:

1. Melanie Swan, “Blockchain: Blueprint for New Economy", 1st Edition, O'Reilly Media, 2014.

Reference Books:

1. ArshdeepBhaga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", Paperback– January 31, 2017

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7, 8	5	Solve Any **1**

Course Title: The ARM Architecture		Coursecode:19ECSE302
L-T-P: 2-1-0	Credits: 3	Contact Hrs: 3hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 30	Exam Duration: 3 hrs	

	Unit –I	
1	**ARM Embedded Systems and Processor Fundamentals** The RISC Design Philosophy , The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families	06 hrs
2	**Introduction to the ARM Instruction Set & Assembly Programming** Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, Conditional Execution, Thumb instruction set.	06 hrs
	Unit –II	
3	**Efficient C Programming** Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division.	06 hrs
4	**Writing and Optimizing ARM Assembly Code** Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches, Handling Unaligned Data.	06 hrs
	Unit –III	
5	**Introduction to LPC-2148 controller** Input output Ports, Pin select registers, Input output select registers, direction control and control registers, Introduction to interfacing standards	03 hrs
6	**ARM Interfacing** ARM interfacing to peripherals like LED, LCD, Seven segments, Motors, Converters, Keypad.	03 hrs

Text Books

1. Andrew N.Sloss et al, ARM System Developer's Guide- Designing and Optimizing System Software

Reference Books:

1.Marilyn Wolf, Computers as Components: Principles of embedded computing system design, Morgan Ka, 2012

2.Steve Furber, ARM System-on-chip Architecture, 2, Pearson, 2000

Tutorial Plan

Expt./ Job No.	assignments/experiment	No. of Lab. Slots per batch (estimate)
1	ALP on arithmetic instructions set	*01*
2	ALP on logical instructions set	01
3	ALP on loop and branch instructions	01
4	Interface LED and Seven segments to ARM for displaying message.	01
5	Interface LCD to ARM for displaying message.	01
6	Interface Keypad to read the characters	01
7	Rotate DC and stepper motor for variable speed and direction	01
8	Interface DAC to ARM controller	01

Scheme for End Semester Assessment (ESA)

UNIT	**8 Questions to be set of 20 Marks Each**	**Chapter Numbers**	**Instructions**
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2** out of **3**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2** out of **3**
III	Q.No.-7, 8	5	Solve Any **1** out of **2**

Program: Bachelor of Engineering		
Course Title: **Discrete Mathematical Structures**		Course Code:**19ECSC202**
L-T-P:**3-1-0**	Credits: **3**	Contact Hrs: **3hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **3 hrs**	

Unit –I		
1	**Logic and Proofs**: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Rules of Inference. Introduction to Proofs, Mathematical Induction and Well-Ordering	**8hrs**
2	**Functions and Relations:** Types of sets, Functions, Relations, Equivalence relations partial ordering (Poset), HasseDiagram, Counting	**8hrs**
Unit –II		
3	**Recurrence Relations:** Introduction, Applications of Recurrence Relations, Solving Recurrence Relations, Formulating Recurrence relations, Generating Functions, Inclusion–Exclusion, Applications of Inclusion–Exclusion	**8 hrs**
4	**Groups:** Binary Operations, Semi groups, Products and Quotients of Semi Groups, Groups, Product and Quotients of Groups	**8 hrs**
Unit –III		
5	**Cryptography:** Cryptography and Modular Arithmetic, Introduction to Cryptography, Private Key Cryptography, Public-key Cryptosystems. Arithmetic modulo n, Cryptography using multiplication mod n	**4hrs**
6	**RSA Cryptosystem:** The RSA Cryptosystem; RSA Encryption, RSA Decryption, RSA as a Public Key System, Cryptographic Protocols	**4 hrs**

Text Books:

1. Rosen K.H., Discrete Mathematics and its Applications with Combinatorics and graph theory, 7th Ed, Tata Mc-GrawHill Publications, 2012

Reference Books:

1. Kolman, Busby and Ross, Discrete Mathematical Structures, 5Ed., PHI, 2004
2. Grimaldi R.P. and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, 5Ed., Pearson Education, 2007

Tentative tutorial Plan

Sl.No	Topic	Number of slots
1	Logic and Proofs	3
2	Functions and Relations	2
3	Recurrence Relations	3
4	Group	2
5	Cryptography	2

6	RSA Cryptosystem	1

Scheme for Semester End Examination (ESA)

UNIT	**8 Questions to be set of 20 Marks Each**	**Chapter Numbers**	**Instructions**
I	Q.No.-1, Q.No.-2, Q.No.-3	1,2	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	3,4	Solve Any **2**
III	Q.No.-7	5	Solve Any **1**
	Q.No.-8	6	

Program: Bachelor of Engineering		
Course Title: **Principles of Compiler Design**		Course Code:**19ECSC203**
L-T-P:**3-1-0**	Credits: **3**	Contact Hrs: **03 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **40**	Exam Duration: **03 hrs**	

Unit –I		
1	**Introduction to compilers:** Brief History Of Compilers, Translation Process, Major Data Structures In Compilers, Chomsky Hierarchy, Lexical Analysis: Scanning Process, Regular Expressions For Tokens, Lexical Errors, ApplicationsOf Regular Expressions.	**06hrs**
2	**Finite Automata:** Introduction: Language, Automata, From Regular Expressions To Deterministic Finite Automata (DFA): Є-Nondeterministic Finite Automata (Є-NFA), NFA, DFA, DFA Optimization, Finite Automata As Recognizer, Implementation Of Finite Automata	**06hrs**
3	**Introduction to Syntax Analysis:** Introduction To Grammars, Context-Free Grammars (Cfgs), Ambiguity In Grammars And Languages, Role Of Parsing.	**04 hrs**
Unit –II		
4	**Top Down Parsing:** Introduction, Left Recursion, Left Factoring, LL (1) Parsing, FIRST And FOLLOW Sets, Error Recovery In Top Down Parsing.	**08 hrs**
5	**Bottom up Parsing:** Introduction, SLR (1) Parsing, General LR (1) And LALR (1) Parsing, Error Recovery In Bottom Up Parsing.	**08 hrs**
Unit –III		
6	**Semantic Analysis:** Attributes And Attributes Grammars, Algorithm For Attribute Computation, Symbol Table, Data Types And Data Checking.	**04 hrs**
7	**Intermediate Code Generation:** Intermediate Code And Data Structure For Code Generation, Code Generation Of Data Structure References, Code Generation Of Control Statements.	**04 hrs**

Text Book:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers - Principles, Techniques and Tools, 2nd Edition, Pearson, 2011.
2. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 1997.

References:

1. Andrew W Apple, Modern Compiler Implementation in C, Cambridge University Press, 1999.
2. Charles N. Fischer, Richard J. leBlanc, Jr, Crafting a Compiler with C, Pearson, 2011.
3. Peter Linz, An Introduction to formal languages and Automata, IV edition, Narosa, 2016.
4. Basavaraj S Anami, Karibasappa K.G, Formal Languages and Automata Theory, First, Wiley India, 2011.

Tutorial tentative plan

Expt/Job No	Brief description of experiments	No of slots 1 slot = 2hrs
1	Regular expressions.	01
2	NFA, DFA and DFA optimization.	02
3	Regular and Context free grammars.	01
4	Top down parsing.	01
5	Bottom up parsing.	02
6	Implementation of lexical & syntax analyzer using LEX and YACC tools.	02
7	Design of CFG for validating Natural languages and implement the same.	02

Scheme for End Semester Assessment (ESA)

	8 Questions to be set of 20 Marks Each	Chapter Numbers	Instructions
I	Q.No.-1, Q.No.-2, Q.No.-3	1, 2 ,3	Solve Any **2**
II	Q.No.-4, Q.No.-5, Q.No.-6	4 ,5	Solve Any **2**
III	Q.No.-7	6	Solve Any **1**
	Q.No.-8	7	

Course Content

Program: **Bachelor of Engineering**		
Course Title: **Senior Design Project**		Course Code: 20ECSW401
L-T-P: **0-0-6**	Credits: **6**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **39**	Exam Duration: **3hrs**	

Seventh semester senior design project theme: Usage of Design Principles in building the solution.

SDP aims to design and develop a solution using software design principles:- design patterns (creational, behavioral & structural) , User experience (UX) design and API (application programming interface) that are generally followed in industries.

Project domains:

Networking	Data Engineering	System Engineering
• Internet of Things • Cloud Computing • SDN(Software Defined Network) • SNA(Social Network Analysis)	• Data Analytics *Data Processing:* • Image and video processing • Computer Vision and Graphics • NLP(Natural Language Processing)	• Parallel Computing • HPC(High Performance Computing) • Parallel system design

Student Evaluation Matrix:
Project will have 3 internal reviews as follows:

Continuous internal Evaluation	Review Expectation
Review-1	Literature Survey, Problem Analysis and Problem formulation
Review-2	Requirements, Design, design principles adopted in modules/components and Algorithms.
Review-3	Implementation and Testing.

Scheme for End Semester Assessment (ESA)

Sl.No	Expectation	Marks

1	Write up 1. Problem Statement and Objectives. 2. System design with brief description. 3. Concluding remarks.	05
2	Presentation: Prepare minimum of 15-18 slides of presentation with consultation of your respective guides.	05
3	Demo (Complete execution of the project with results) and Viva voce.	30
4.	Project Report.	10